



Adaptation of the Neuropsychological Section of the HUMANS into Portuguese

Adaptação da Seção Neuropsicológica da HUMANS para a língua Portuguesa

**Flávia Heloísa Santos, Karl Goodkin, Bruna Andrade Rocha, Maria Clara Estevam
Vilas-Boas, Natalia Sayuri Benites Aoki, Heloisa Martinez Furniel, Bianca Monção
Alves, Paulo Adilson Silva, Enrique Lopez.**

Santos, F.H.^{1,2}, Goodkin, K.³, Rocha, B.A.², Vilas-Boas, M.C.E.², Aoki, N.S.B.², Furniel, H.M.², Alves, B.M.²,
Silva, P.A.², López, E³

1. University of Minho, Braga, Portugal

2 UNESP, São Paulo State University, Brazil

3 AHF, AIDS Healthcare Foundation, Los Angeles, United States

4 Cedars-Sinai Medical Center, Los Angeles, United States

Correspondent: Dr^a. Flávia Heloísa Santos. University of Minho. School of Psychology
(CIPsi). Gabinete 1098. Campus de Gualtar, 4710-057, Braga, Portugal. Tel. + [351 253 601
387](tel:+351253601387), E-mail: flaviahs@psi.uminho.pt

Abstract

The HUMANS (HIV / University of Miami Annotated Neuropsychological Test Battery in Spanish) was developed in three sections: neuropsychological, psychiatric and medical instruments. It is recommended by the National Institute of Mental Health of the United States for the assessment of HAND (HIV-associated neurocognitive disorders). There is a lack of a standardized neuropsychological battery in Portuguese for assessing HAND. The aim of this study was to describe the methodology used to adapt the HUMANS - Neuropsychological Section into Portuguese. For this purpose all work was done by a multilingual expert team, which carried out the process of adaptation to Brazilian culture in Portuguese language. To ensure the faithful translation and the most accurate adaptation, so as to maintain reliability as the content of tests, were used, among other procedures, the technique of back-translation, in pairs, followed by consigns on team for final considerations needed for each test. The instruments have accessible language, demonstrating its pertinence and relevance either nationally and possibly for other Portuguese-speaking countries. Finally, the adapted instruments respected and preserved a scientific methodology proper to neuropsychological assessment of HAND, and it is ready for use in pilot studies. In order to facilitate its usage hereby it is named as HUMAN-P.

Keywords: AIDS, HIV, HIV-associated neurocognitive disorders, HIV-associated dementia

Resumo

O HUMANS (HIV / University of Miami Annotated Neuropsychological Test Battery) foi desenvolvido em 3 secções: neuropsicológica, psiquiátrica e instrumentos médicos. Está recomendada pelo Instituto Nacional de Saúde Mental dos Estados Unidos para a avaliação da HAND (HIV- associated neurocognitive disorders). Há uma falta de instrumentos neuropsicológicos estandardizados em português para a avaliação HAND. O objetivo deste estudo é descrever a metodologia usada para adaptar a secção neuropsicológica da HUMANS para português. Para este objetivo, todo o trabalho foi desenvolvido por uma equipa de especialistas multilingue que levaram a cabo o processo de adaptação para a cultura brasileira em língua portuguesa. Para assegurar uma tradução fidedigna e o mais exata possível, procurando manter ao mesmo tempo a fiabilidade enquanto o conteúdo dos testes era usado, de entre outros procedimentos, a técnica da contra-tradução, em pares, seguido de envios para a equipa para considerações finais necessárias para cada teste. Os instrumentos têm linguagem acessível, demonstrando a sua pertinência e relevância tanto nacional como, possivelmente, para outros países de língua Portuguesa. Por fim, a adaptação do instrumento respeitou e preservou a metodologia científica adequada para a avaliação neuropsicológica da HAND, bem como está também preparada para ser usada em estudos pilotos. Para facilitar o seu uso, será doravante designada como HUMAN-P.

Palavras-chave: SIDA, HIV-associado a transtornos neurocognitivos, neuropsicologia

Introduction

The Central Nervous System can be invaded early during the Human Immunodeficiency Virus (HIV) infection, which consequently produces changes in cognitive functioning, named as HAND, i. e., HIV-associated neurocognitive disorders (Alfahad & Nath, 2013). The HAND may occur in both asymptomatic and symptomatic states (Rappaport & Voslky, 2015), and are classified in three conditions HIV-Associated Dementia (HAD), Mild neurocognitive disorder (MND) and Asymptomatic neurocognitive impairment (ANI) (Woods, Moore, Weber & Grant, 2009; Antinori et al., 2007; Goodkin et al., 2011).

HAD is one of the most disabling neurological manifestations of HIV (Ardila-Ardila et al., 2003; Sacktor, 2002). It is typically characterized by slowness, forgetfulness, poor concentration, and difficulties with problem solving. Behavioural manifestations most commonly include apathy, lethargy, and

social withdrawal, and occasionally it may be accompanied by psychiatric symptoms. In order to meet criteria for a diagnosis of HAD the patient must present an acquired deficit in two cognitive domains that is greater than or equal to two standard deviations below the mean score (standardized for specific populations), or impairment within at least one cognitive domain that is greater than or equal to one standard deviation below the mean and impairment within one other domain that is greater than or equal to 2.5 standard deviations below the norm. The MND criteria require neurocognitive impairment at least one standard deviation below the mean score in at least two neurocognitive domains (Forstein et. al, 2006; Woods et al., 2009). By contrast, the ANI occurs without any associated decrement in functional status, contrasting with premorbid status (Robertson & Yosief, 2014). Detailed and critical description were presented by Heaton et al. (2010).

For a recent review see Harding & Robertson (2015).

There is evidence that neurocognitive deficits may present even in acute HIV infection (Liner, Ro, & Robertson, 2010). Since combined antiretroviral therapy (CART) the incidence of HAD has decreased, however, MND and ANI continue to persist (Grant et al., 2014; Etherton, Lyons, & Ard, 2015), and increase mortality risk (Gelman, 2015). The presence of HAND is associated with reduced adherence to the CART, consequently to the worsening in the general state of the patient, therefore, the early diagnosis of HAND is important to keep a general health state of the patients and to prevent deterioration (Woods et al., 2009).

Diagnosis for HAND is done by clinical assessment and neurological examination corroborated by neuropsychological assessment (Ellis, Joseph, & Almeida, 2007; Doyle et al., 2015). It requires prioritization of deficits

observed in the neurocognitive sphere that are determined by specific neuropsychological tests over those observed in the motor and behavioural spheres (Forstein, 2006). Brazilian Health System (in Portuguese SUS, Sistema Único de Saúde) has been given singular attention to the treatment of HIV subjects since the beginning of the epidemiology in the country; for instance, by providing - free of charge - the CART and the plastic surgery for patients with HIV who develop lipodystrophy. Despite of it, there is a lack of a standardized neuropsychological battery in Portuguese for assessing HAND (Brasil, 2008a; Pacheco Filho & Santos, 2008; Kalil, Alvarenga, Almeida, & Morais de Sá, 2009). This is particularly important in for a country with 734 thousands of people living with HIV/AIDS (Brasil, 2014), in that there are very few neuropsychological studies of HAND (Santos, Vilas-Boas, Goodkin, Moreira, *in press*; Santos, Aoki, Konkiewitz, Ziff, *submitted*).

In 1990, the United States National Institute of Mental Health (NIMH) recommended a battery of neuropsychological tests for cognitive assessment of HIV-1 patients, ranging cognitive, functional, and psychiatric domains (Butters et al., 1990). Considering the number of Spanish speaking people living in US, the battery was carefully adapted into Spanish, and became known as HUMANS (HIV/University of Miami Annotated Neuropsychological test battery in Spanish; Ardila-Ardila et al., 2003).

The HUMANS/Neuropsychological section is presented as a possible and greatly qualified instrument for assessment of the three types of HAND and cognitive deficits due to opportunistic neurological disorders. The existence of a battery of this extent creates the possibility of scientific advances in research, because it sets a universal standard, qualifies, and expands possibilities of randomized controlled trials in this area. Moreover, the HUMANS corroborates laboratorial, and

clinical examination through diagnosis of the functional, psychiatric, and cognitive changes in patients with HIV, making possible to study associations between HIV progression and characterization of psychiatric and neuropsychological deficits (Wilkie et al., 2004).

The use of a neuropsychological battery suitable to dissimilar cultures would facilitate the comparison in various countries and also to identify sociocultural features associated with cognitive functioning (Pacheco Filho & Santos, 2008). Portuguese is one of the most widely spoken languages in the world, it is written and spoken in seven countries which constitute the CPLP (Community of Portuguese Language Countries: Portugal, Brazil, Angola, Cape Verde, Guinea-Bissau, Mozambique, São Tomé e Príncipe, and Timor Leste) (Brasil, 2010). The adaptation of the HUMANS/Neuropsychological section into Brazilian Portuguese is an important

step to improve crosscultural studies between Portuguese speaker countries.

In order to carry out an adaptation is necessary to take into account the dimensions and boundaries of subject's symbolisms, influenced by creeds, attitudes, habits, behaviours and social values specific for each society (Pedroso, Oliveira, Araújo, & Moraes, 2004). During the work, the validation of the adaptation process was obtained by the extent of the implication of cultural and linguistic mechanisms and their branches in interpretation and production of specific meanings. The present study describes the adaptation process of the HUMANS/Neuropsychological section into Portuguese idiom and Brazilian sociocultural context, considering the necessity of developing a proper and specialized battery for assessment of HIV/AIDS subjects.

Method

Materials

The HUMANS is a battery for assessment of HIV associated neurocognitive impairments currently based on three large areas for participant's evaluation: the first area consists on neuropsychological assessment, ranging cognitive domains of attention, memory, speed of processing information, abstraction, executive function, language, visuospatial abilities, visuoconstructional abilities, motor abilities; the second area consists on psychiatric assessment and the third section is the medical assessment, however the last two are not included in the present article. Authors from this manuscript are glad to share with Brazilian researchers the adapted final version of the pencil and paper tasks that has not copyrights signed in Brazil in order to optimize its use in scientific studies. Nevertheless, material is not yet recommended for clinical usage before standardization. Requests will be analysed by the correspondent author. Hereby, only

procedures, and discrepancies from the original material will be pointed.

Procedures

The Ethics Committee of Regional Hospital “Dr. Joelson Leal Lisboa” approved the study, case n° 0095/2005. The authors had neither conflict of interest nor specific financial support to the adaptation study.

The panel was composed by nine members - seven in Brazil and two in US – that worked together during the period of 30 months (from June/2008 to Nov/2010). The Lab team (Laboratory of Neuropsychology at São Paulo State University, UNESP) included five undergraduate granted students, a postgraduate, and a professor. The US collaborators were researchers in this field, fluent in English and Spanish, one participated to the HUMANS development and the other worked as a clinical neuropsychologist using the battery regularly in Los Angeles. The US

researchers were usually consulted by emails, and eventually by videoconferences, they also visited the campus in this period.

The adaptation process was divided in four steps: (a) bibliographic search and verification of existing instruments in Portuguese, preferably in a Brazilian version; (b) comparison between existent versions and those used in English and in HUMANS; (c) translation and adaptation of instruments not found in Portuguese language; and (d) checking both, pre-existent and translated/adapted versions by our team in comparison to the original.

First of all, a survey of Brazilian versions for battery instruments was performed. For existing ones, they were consulted and compared to the original in English or Spanish, or both; if trustworthy, the pre-existing instruments were included in the protocol.

For non-Portuguese instruments, the translation/adaptation of each instrument from English and/or Spanish

version was performed. Both English and Spanish versions of the tests were utilized, when available, for guidance and verification. However, in case of doubts or possible contradictions or divergences between translations, the English version was chosen over HUMANS. In some specific cases, only the Spanish version was used to proceed with the translations.

The Lab meetings were once a week regularly and the activities in the adaptation process were performed in duos or trios, never individually. The translation of any instrument was performed integrally by a twosome, and other independent pair reviewed the translation performed, and converting it to the original language, a procedure known as “back translation”. However, the process involved the entire Lab team: In the face of any question or doubt, the Lab’s panel was consulted, and all the participants expressed his/her opinion regarding the aim of divergence – in addition to consulting other resources, like

dictionaries, articles, test or scale handbooks or even the authors. In all cases, decisions were made by consensus. Therefore, in the final composition were included only contents originated from Lab team agreement.

In the whole translation and adaptation process, socioeconomic, cultural, regional, age-based, and word formality issues were considered, in order to assure effective comprehension for examiner and participant. Thus, the purpose was to constitute a comprehensive and trustworthy instrument comparing to the original.

Methodological Resources

Use of bilingual dictionaries:

During the process, bilingual dictionaries – English/Portuguese (Houaiss & Cardim, 1985) and Spanish/Portuguese (Cavero, 1995) – and monolingual dictionaries – Novo Aurélio. Dicionário da língua portuguesa: século XXI (Ferreira, 1986); Collins (Ferreira, 1999), also English,

Portuguese, and Spanish dictionaries were used, as well as online searches. Dictionaries were used not only for translation, but also for strict sense meaning search, i.e., to reach the exact original proposal of the words. The dictionary offered a larger word collection, and, consequently, synonyms for word translation.

Bibliographic search: For surveying the pre-existing Portuguese instruments were consulted in databases like Scielo, Medline, and COMUT in order to get available the articles, and thesis in that its adaptation process should be described. Furthermore, as for some tests or scales the authors were contacted to obtain copies of the instruments or even to solve doubts related to differences between tests or scales versions.

Use of word frequency list: There are cultural differences across different languages (English, Spanish, and Portuguese) in regards to the degree of difficult to word use (familiarity and

context) or even distinct word structure in written language (single or composed terms). Therefore, for some memory and vocabulary tests, a word frequency list was adopted through word use search in the Brazilian Portuguese print media (255,035 items), provided by Sardinha (2001).

Free search with randomly-chosen volunteers: In some cases the panel considered the necessity of performing surveys with randomly-chosen people were asked about their understanding on a given word (its popular meaning), to assure meanings compatible with usage, because in many cases the dictionary meaning was not the same use for a given word or expression, indicating a disparity according to the circumstance.

Image searches at Internet: In tests with verbal tasks, visual stimulations – images – were used to investigate possible associations of names and meanings with them, in order to verify the understanding, in the Brazilian Portuguese, on denotations of words and images, considering the

ability to memorize words through mental associations with familiar images (Miranda, Pompeia, & Bueno, 2004).

Back translation procedure: The methodological procedure was originally proposed by Brislin (1970) in order to assure translation quality and equivalence between versions. It is composed by steps that may suffer changes to be adjusted to the research project. The steps performed were: 1) one bilingual pair has translated the material to Portuguese utilizing English and Spanish versions (in case both versions were found); 2) another bilingual pair performed back translation from Portuguese to English and Spanish (if two versions were found), preference always for the best adapted-to-Portuguese version comprising cultural word differences between languages; 3) Lab team review for the translated material into Portuguese contrasting with the back translation, to identify check eventual meaning differences and, mainly deviation from the original test objectives, considering the

accuracy to set neuropsychological items; 4) in case of discrepancy in translations, first step was resumed and, in some cases, “custom surveys” were utilized to guide the Lab team decisions. The procedure was utilized based on criteria described by Guillemin, Bombardier, and Beaton (1993) for transcultural adaptation, like semantic, idiomatic, experience-based, cultural or concept-based equivalence. Discussions about cultural adaptation were always considered until a consensus by Lab team was reached.

Consultancy: For all the adaptations through methodological resources, when questions were reported to Dr. Karl Goodkin and his colleagues at Cedars-Sinai Medical Centre and UCLA, in order to solve specific doubts related to HUMANS.

Results

The battery adaptation work (including psychiatric and neuropsychological sections) was performed from June 2008 to June 2010, at approximately weekly four-hour sessions, resulting in a total of 200 hours to adapt 33 instruments, eighteen of which being neuropsychological, eleven psychiatric and six Ad-Hoc instruments. In addition to the results of each test, a CVLT pilot adaptation study was performed.

Specific procedures used in the organization and translation of the Neuropsychological section of HUMANS into Portuguese are described below per domain and section, which are described below.

Neuropsychological Domain

Indicator of pre-morbid intelligence

Vocabulary (WAIS-III) –
(Wechsler, 1999)

Instructions for subject: Brazilian version of the test was utilized (Nascimento, 2005).

Item Content: In the Portuguese version two words without corresponding terms in the Spanish battery were found, “balada” (frequency in Portuguese is 132) and “obstruir” (frequency in Portuguese is 119) (“ballad” and “Obstruct”) while in the Spanish battery two items without correspondent terms in Portuguese were found: “moroso” (“fraco” in Portuguese or weak), “perímetro” (perimeter). Lab team decided in consensus that the words “balada” and “obstruir”, presented in “WAIS-III” should be maintained, since it is referring to a material already standardized in Portuguese for use in Brazil.

Since there is difference among languages in terms of degree of difficulty of words, the order of presentation for words contained at “WAIS-III” (Nascimento, 2005) was slightly changed by Lab’s consensus for the HUMANS

adaptation, it was done by taking into account the word frequency list and familiarity. Items are shown in conformity with its frequency list of 255,035 items in the Brazilian Portuguese print media (Sardinha, 2001).

The final order of presentation in the Portuguese version with the frequency of each words was: 1)"ontem" - 48037 (yesterday), 2)"inverno" - 1936 (winter), 3)"almoço" - 1648 (lunch), 4)"cama" - 1197 (bed), 5)"reunir" - 1164 (assemble), 6)"navio" - 1077 (ship), 7)"gerar" - 1074 (generate), 8)"sentença" - 963 (sentence), 9)"terminar" - 893 (terminate), 10)"colônia" - 574 (colony), 11)"tranquilo" - 544 (tranquil), 12)"consumir" - 230 (consume), 13)"consertar" - 88 (repair), 14)"centavo" - 182 (cent), 15)"épico" - 177 (epic), 16)"santuário" - 160 (sanctuary), 17)"designar" - 148 (designate), 18)"balada" - 132 (music balad), 19)"obstruir" - 119 (obstruct), 20)"evoluir" - 103 (develop), 21)"compaixão" - 88

(compassion), 22)"diverso" - 80 (various), 23)"remorso" - 73 (remorse), 24)"ponderar" - 36 (ponder), 25)"audacioso" - 35 (audacious), 26)"nefasto" - 27 (ominous), 27)"tangível" - 25 (tangible), 28)"relutante" - 23 (reluctant), 29)"confidência" - 22 (confidence), 30)"plagiar" - 12 (plagiarize), 31)"amuado" - 10 (pouted), 32)"intrepidez" - 10 (fortitude), 33)"invectiva" - 4 (diatribe).

Scoring Instructions: No change in scoring instructions was required.

Attention

Digit Span (WAIS-III) – (Wechsler, 1999) (Computer adapted)

Instructions for subject: Portuguese and Spanish battery were compared, content trustworthiness was observed, having been used, thus, the instruction guide in Spanish, "WAIS-R" (Wechsler, 1981), and in Portuguese, "WAIS-III" (Wechsler, 1999). Following back translation, the word "ENSAYO" (test)

was replaced by “SÉRIE” (series), according to Wechsler Scale official Brazilian versions.

Item Content: No change was performed in the item content.

Scoring Instructions: Scoring instructions are the same as in the U.S.A. version, referred in the Portuguese instruction guide (Nascimento, 2005).

Variable Interval Trial Reaction Time – (Wilkie, Eisdorfer, Morgan, Loewenstein, & Szapocznik, 1990) (Computer adapted)

Instructions for subject: Brazilian version was based on Spanish battery, requiring back translation. Changes in instructions for software application were required, since the examiner must read the instructions for the participant on the computer screen.

Item Content: The only translated word was “LISTO”. The only necessary change in the software is that the word “PRONTO” (ready) will be displayed on

the computer screen, and it will replace the word “LISTO” in Spanish and “READY” in English.

Scoring Instructions: The software performs all required calculations so that scoring instructions are not required.

Speed of processing information

Simple & Choice Reaction Time (“GO”/ “NO GO” RT Paradigm) – (Martin et al., 1992) (Computer adapted)

Exactly the same procedures and changes proposed to Variable Interval Trial Reaction Time were demanded for Simple & Choice Reaction Time.

Posner Letter Matching Test (Posner & Mitchell, 1967) (Computer adapted)

Exactly the same procedures and changes proposed to Variable Interval Trial Reaction Time were demanded for Posner Letter Matching Test.

Figural Visual Scanning and Discrimination Test (Ekstrom, French, Harman, & Dermen, 1990.)

Instructions for subject: The word “en fila”, from Spanish (“fileira” in Portuguese or row) was replaced by “linha” (line). The second sentence of the instructions was modified to assure understanding of the meaning in Portuguese. The sentence “una figura a la izquierda de la linea oscura”, from Spanish (a figure in the left side of the dark line), was replaced by “a primeira figura à esquerda será o modelo” (the first figure to the left will be the model). To refer the “linea oscura” in Spanish (dark line), “linha vertical” (vertical line) was used in Portuguese. In the presentation of the example, the sentence was modified to: “neste exemplo você deveria ter marcado a terceira figura após a linha vertical” (in this example you should have marked the third figure after the vertical line).

Item Content: No change was performed in item content.

Scoring instructions: No change was required in the scoring instructions.

Memory

Logical Memory (WMS-R) – (Wechsler, 1987)

Instructions for subject: A bibliographic search was performed, in which the existence of at least three free adaptations of the referred test were found. The first adaptation was done by Dr. Cândida Pires de Camargo (HC/FMUSP), the second one was made for use in indigenous population by Dr. Vivian Maria Andrade (UFS), and the third one was performed by Dr. Joana Maria Mader (UFPR). In addition to these versions, Casa do Psicólogo publisher has edited an official version (Casa do Psicólogo, 1993). Eleven (11) publications were encountered in the literature (articles and book chapters), five of which utilized Dr. Camargo’s version, which is also used in clinical context. Therefore, her version was selected, since it is the free adaptation most frequently used in Brazil.

Item Content: No changes were required in the content of the stimuli utilized in the referred test.

Scoring Instructions: Logical Memory subtest scoring instructions followed the same rules at the Brazilian version used by the Lab team.

Visual Reproduction (WMS-R) (Wechsler, 1987)

Instructions for subject: Portuguese version was based on Spanish battery, requiring back translation.

Item Content: No change was performed in item content.

Scoring Instructions: Logical Visual Reproduction subtest scoring instructions followed the same rules of the Spanish battery.

California Verbal Learning Test (CVLT Delis, Kaplan, Kramer, & Ober, 2000).

Instructions for subject: Portuguese version was based on Spanish battery, requiring back translation.

Item Content: Here we had a question about the meanings of the words “Abrigo” (coat) and “Suéter” (sweater). A research was done on dictionaries (Ferreira, 1999; Cavero, 1995; Houaiss & Cardim, 1985) and the “suéter” (sweater) is a wool pullover, closed, and “abrigo” (coat) is generally used on occasions of bad weather. There was also did an internet search for images to establish correspondence between words and images in different languages. It was observed that there is no right correspondence between the words "bag", "sports jacket" and "sweater" in Portuguese. Thus, we chose to replace the word sweater to “suéter”. At first the word “abrigo” (coat) would be more appropriate to be replace for "Sports Jacket" (or "chaqueta" in Spanish, which corresponds to coat), however the word “abrigo” in Portuguese has several unrelated meanings (refuge, shelter, home care, asylum, etc.). For this reason, Lab’s panel decided replace the word “abrigo” (coat) by “jaqueta” (jacket).

The word “serrote” (handsaw) was replaced by “martelo” (hammer) because they belong to the same semantic category, to avoid confusion since “serrote” is an image used for the BNT test (Kaplan, Goodglass, & Weintraub, 1983). In herb list, “canela” (cinnamon) was replaced by “coentro” (“coriander” in English, and “cilantro” in Spanish). For composed words, like “noz-moscada” (nutmeg) and “chave inglesa” (screwdriver), a word in the same category and with equivalent frequency was searched, resulting in “orégano” (oregano) and “martelo” (hammer), respectively.

On Tuesday list, on the other hand, the spices were substituted by other more popular condiments in the Brazilian culture: “sarten” (frying pan; “frigideira” in Portuguese) was changed by “panela” (pan). In fruit, lemon, as a popular fruit, was replaced by “maracujá” (passion fruit), which has a medium frequency, excluding bias. All fishes were replaced by fishes more commonly found in the

Brazilian culture – “atum” (tuna), “bacalhau” (cod), “sardinha” (sardine), and “tilápia” (tilapia). Only “canela” (cinnamon) and “gengibre” (ginger) were maintained from English list, and “alho” (garlic) and “cebola” (onion) were included, because they are more common items in the Brazilian culture.

On the recognition list, performing comparison between English and Spanish lists, the following substitutions were done: 1) “recipientes cilíndricos para líquidos” (cylindrical containers for liquids) or “tambores” (Drums), in Portuguese the word “tambores” (drums) was not used due to conceptual ambiguity, because it is also a musical instrument, and was replaced by “baldes” (bucket), which can correspond in the Brazilian culture to that; 2) “pimenta” (pepper) for “pimentão” (sweet pepper), since the first was utilized in Monday list; 3) “pastelaria” (pastry) was replaced by “ferradura” (horseshoe), because in the instructions of this test it is asked to recall products and pastry

correspond to a place; 4) “chave inglesa” (wrench) by “marreta” (mallet), since the first is a composed word, what isn’t possible to exists at this test, the changed were based at the category of the first word, to keep the objective of the instrument; 5) “martelo” (hammer) by “rastelo” (rake), because the first was used in Monday list, and was replaced by rake for correspondence with the category (tools) and it is popularly known in Brazilian context and; 6) “pasta de papéis” (briefcase) by “maleta” (small briefcase), because folder in Portuguese has several meanings, and has therefore to be replaced by another one that would better translate in function the original.

Scoring Instructions: No change was required in scoring instructions.

CVLT (California Verbal Learning Test) Pilot Study

At first, a national literature search was performed, and no official Brazilian CVLT test (an episodic memory measure

consisting of two lists with 16 words each) adaptation was found. Only one version from an article that utilized a CVLT free Portuguese adaptation was found (Selaimen, Brilhante, Grossil, & Grossi, 2007). This adaptation is described in the thesis of Dr. Selaimen with instructions and items for Monday buying list: “furadeira” (drill), “ameixa” (plum), “colete” (vest), “salsa” (parsley), “uva” (grape), “pimentão” (sweet pepper), “suéter” (sweater), “chave inglesa” (wrench), “cebolinha” (scallion), “tangerina” (tangerine), “cinzel” (chisel), “jaqueta” (jacket), “noz-moscada” (nutmeg), “pêssego” (peach), “alicate” (pliers), “calça” (pants).

However, the study did not use Tuesday list. Because of that the Lab team decided to perform its adaptation from the original. Regarding the original version of the test, the following changes were performed:

1) in the tool list, the word “serrote” (handsaw; frequency in

Portuguese is 12) was replaced by “martelo” (hammer; frequency in Portuguese is 181), as we explained in the “item content”.

2) in the herb list, “canela” (cinnamon) is more utilized for sweet food in the Brazilian culture, and the remaining items in the category were typically used for salt food. Thus, at first, the term was substituted by “alecrim” (rosemary, in English, and “romero”, in Spanish). However, a free survey with 16 randomly-chosen individuals at the campus was performed, and different meanings are associated with the term alecrim: flower, music, teas, and, scents. Therefore, “coentro” (“coriander”, in English, and “cilantro”, in Spanish) was selected.

3) for composed words, like “noz-moscada” (nutmeg), “chave inglesa” (screwdriver), a word in the same category and with equivalent frequency was searched. For substitution, “orégano” (oregano; frequency in Portuguese is 17) and “martelo” (hammer; frequency in

Portuguese is 181) were utilized, respectively. Replacement was done since remembering composed words would be an extra load on memory capacity (more syllables) or represent a distinctiveness for the memory trace, in any case interfering on the memory processing (Santos, Bueno, & Gathercole, 2006).

4) Clothes category had one subcategory (winter clothes: sweater and jacket). In addition, the term “jaleco” in Portuguese is more associated with a uniform (work cloth), for this reason it was adequate to replace the term “jaleco” by “camisa” (shirt). Although the word “suéter” (frequency in Portuguese is 23) already exists in Portuguese, its use is less frequent, being replaced by “blusa” (frequency in Portuguese is 124).

5) In the Spanish battery, some items were improperly in plural; thus, Lab’s consensus decided to keep all words in singular.

To verify if adapted items maintained purpose and efficacy, a pilot

test of Monday list were done for the following word-list: “furadeira” (drill), “ameixa” (plum), “camisa” (shirt), “salsa” (parsley), “morango” (strawberry), “pimentão” (sweet pepper), “blusa” (sweater), “martelo” (hammer), “coentro” (coriander), “tangerina” (tangerine), “machado” (axe), “jaqueta” (jacket), “orégano” (oregano), “pêssego” (peach), “alicate” (pliers), and “calça” (pants).

CVLT Pilot study.

Volunteers signed Informed Consent Form and received instructions related to CVLT performance. Each word was spoken by the examiner at a one per second rate. Fifty participants aged between 18 and 30 years were assessed, both gender, with educational level from high school to college. The assessment was performed in a quiet environment, without presence of other people. After performing the task participants were encouraged to comment about the items. Participants considered incorrect to

classify the word “pimentão” (chilli) in the category “herbs and condiments”. This item was substituted by “pimenta” (pepper) due to category similarity and number of syllables.

The employment of the words was analyzed through the plot in the graphic, based on frequency/percentage of its immediate recall. The serial position curve generated by the items indicated the necessity of a final word replacement to the words: “pimentão” (chilli) by “pimenta” (pepper), and “coentro” by “manjericão” (basil), because these words interfered with the expected curve, i.e., a “U” shape in which there is a recollection peak for first items and the last items, respectively by primacy and recency effects. Another change occurred in word order in Monday list in order to arrange words so that its arrangement was homogenous for category. Furthermore, necessity for changing the category name “Herbs and condiments” to “Temperos” (spices) was observed, because list items

are better associated with this second world.

Abstraction and executive function

Trail Making Test – (Lezak, 1995)

Instructions for subject: Brazilian version was based on HUMANS and English batteries, requiring back translation.

Item Content: We found an automated Brazilian version (Capovilla, Montiel, Macedo, & Charin, 2005), consequently, Portuguese version was based on original instruments in English and Spanish batteries. The words start and end or “inicio” and “fin” in Spanish were translated to Portuguese to “início” and “fim” for both, instruction and test application forms.

Scoring Instructions: No change in item content was performed.

Wisconsin Card Sorting Task (WCST) - (Heaton, 1981)

Instructions for subject: Brazilian version was translated from HUMANS

and English batteries, and confirmed by back translation.

Item Content: The WCST has an existent Brazilian adaptation and standardization (Heaton, Chelune, Talley, Kay & Curtiss, 2005), created with approval of PAR, Psychological Assessment Resources, Inc., because HUMANS has an automated version, it was necessary to translate the test from the original.

Scoring Instructions: Instructions were not required, since the software perform all required calculations.

Stroop Color-Word Test - (Stroop, 1935)

Instructions for subject: We found instruction on a Brazilian automated version of the Stroop (Capovilla et al., 2005); nevertheless, it was slightly different from HUMANS and English batteries. Then, it was necessary to translate and back translate it. As for the final version, the word “blocos” (blocks)

was excluded while the word “retângulo” (rectangle) was replaced by “item” (item).

Item Content: Respecting the Brazilian computed Stroop test version (Capovilla et al., 2005) no changes in item content were required.

Scoring Instructions: Instructions were taken from English battery (Ardila-Ardila et al., 2003; Wilkie et al., 2004). Additionally to the number of positive answers in the Brazilian version (Capovilla et al., 2005) reaction time is computed.

Language

Boston Naming Test - (Kaplan et al., 1983)

Instructions for subject: Brazilian test version was based in current Spanish battery, requiring back translation.

Item Content: Some changes in the items and its order were necessary. The items were excluded or modified if: a) Items in Portuguese were composed words, because the English version requires and accepts only singular

responses (example: Seahorse – “Caballito del Mar” in Spanish – “Cavalo-Marinho” in Portuguese). b) Items that have multiple nominations (example: Mushroom – “Hongo”; “Champiñon” in Spanish - “Champignon”, “Mushroom” as “cogumelos” in Portuguese). c) Items that had no equivalent in Portuguese (example: pretzels).

Two words on the original test were composed words in Portuguese, “perna de pau” (stilts) and “chave de fenda” (screwdriver), words that don’t even have their frequency in Portuguese list frequency. Stilts could be better replaced by “pernalta” (in English, straddle) that frequency in Portuguese it’s 3 or “perneta” (in English, one-legged), that has the same frequency of the first one. However, in Portuguese “pernalta” (in English, straddle) its associated to long legs and “perneta” (one-legged) to small leg or leg with physical defect (Houaiss & Cardim, 1985). In Spanish, the word “zanca” (stilts) means long legs made of wood,

indicating more appropriate association with the term "pernalta" (straddle). However this word is rarely used in the Brazilian cultural context, a fact strengthened by its low frequency in the language (3). For this reason the Lab team decided to add at the list the word "saci" (a man without a leg) which is a cultural Brazilian symbol to be used in a Pilot test, if stilts were recall as "perna de pau" the composed word instead of "pernalta" (straddle) the word that would replace with a similar meaning, related to a legs off its "saci".

To the word "chave de fenda" (screwdriver) were asked to 26 people aged between 20 and 30 years with high school or college: "qual a palavra que vem à mente após ouvir chave de fenda?" (which word comes to your mind after hear the word screwdriver?), the answers varied being 6 "parafusos" (screws), 4 "martelo" (hammer), 4 consertos (repairs), 3 "ferramentas" (tools), 2 "mecânico" (mechanic), 2 "obras" (workmanships)

and 2 "nada" (nothing), 1 "porta" (door), 1 "peça" (part) and 1 "rosto" (face). It was verified the frequency of the words "parafuso" (screw, position 30756, frequency 44) and hammer (hammer, position 12812, frequency 181), thus evidenced the higher frequency of the word hammer, however, this constitutes a stimulus of another present test in the battery, thus the Lab team decided to use the word screw, since it had greater mandate in the survey.

A first pilot study was carried out in order to check the response to the quality of the visual stimuli. For this purpose 68 people, both genders aged 20 to 50 years old, balanced from 1 to 16 years of schooling named the stimuli. The participants saw each stimulus of BNT and other 6 complementary stimuli. The reasons and criteria to select the complementary stimuli are described below. Some figures in the present test does not match the reality of Brazilian culture, for instance the design of the

original “casa” (house) was named as ‘school’ due the architectural style; similar problem was observed with the “cadeado” (padlock), so for these cases, other figures with same meaning were used in order to make sure the identification of the figure.

The figure “escada” (stairs) should be named in Portuguese as “escada rolante” (automatic stairs), which characterizes a composed reply. Thus, this figure has been replaced to a simple stairs, which was then visually confused with a “trilho” (rail), which characterizes an inappropriate figure for the test.

The word “acordeão” (“acordeón” in Spanish; “accordion” in English) it is also known in Brazil as “Sanfona”, which characterizes a stimulus capable of double nominations, so we added a picture of a guitar in the pilot study. To verify how this item is usually named.

The figure of the “canoa” (canoe) can also be named as a “barco” (boat), and, therefore, has a double nomination. We

added a figure of “navio” (ship), if were verified the dual appointment, that figure could be replaced.

The figure of the “caranguejo” (sea crab) may be named as “siri” (sand crab), therefore word probably has double nomination in Portuguese. We added the figure of a fish in the pilot study to replace the figure of the crab if it was needed.

The figure of the “caracol” (snail) can be named as “caramujo” (snail), therefore, it corresponds to a double nomination. We added the figure of the “lesma” (slug) in order to verify the need of replacement to the figure of the snail.

Given the low prevalence of the “pelicano” (pelican) in Brazil, so his little reminder, it was decided to replace this figure by the figure of a “tucano” (toucan), being more common in Brazilian culture and maintain the category of birds. This was the same figure used in Romero (2000).

The order defined considering the level of familiarity of the stimuli,

including the complementary stimuli was:
 “Cama” (bed); “Árvore” (tree); “Lápis” (pencil); “Casa” (House); “Relógio” (clock); “Tesoura” (scissors); “Pente” (comb); “Flor” (flower); “Serrote” (saw); “Telefone” (telephone); “Helicóptero” (Helicopter); “Vassoura” (broom); “Escada” (stairs); “Cenoura” (carrot); “Bicicleta” (bicycle); “Termômetro” (thermometer); “Coco” (coconut); Cadeado (padlock); “Torta” (pie); “Banco” (bench); “Caracol” (snail); “Vulcão” (volcano); “Caranguejo” (crab); “Dominó” (domino); “Canoa” (canoe); “Funil” (funnel); “Coroa” (crown); “Regador” (watering can); “Pingüim” (penguin); “Flauta” (Flute); “Parafuso” (screw); “Camelo” (camel); “Perna de pau” (stilts); “Cacto” (cactus); “Harpa” (harp); “Rede” (hammock); “Tucano” (toucan); “Seringa” (syringe); “Pirâmide” (pyramid); “Focinheira” (muzzle); “Acordeão” (accordiann);” Raquete” (racquet); “Rastelo” (rake); “Dobradiça” (hinge); “Compasso” (compass); “Tripé” (tripod);

“Leque” (fan); “Esfinge” (sphinx); “Jugo” (yoke); “Forca” (gallows); “Polvo” (octopus); “Balão” (balloon); “Dardo” (dart); “Rinoceronte” (rhinoceros); “Unicórnio” (unicorn); “Iglu” (igloo); “Pergaminho” (scroll); “Palheta” (palette); “Transferidor” (protractor); “Ábaco” (abacus).

After these steps another pilot study was necessary in order to define the items that should be kept in the Portuguese version of the Boston Naming Test, this study is in progress and its result will be described in the future.

Scoring Instructions: Instructions were extracted from English battery (Kaplan et al., 1983).

Letter Fluency (F, A and S Letters) – (COWA) - (Benton & Hamsher, 1976)

Instructions for subject: Brazilian version was based on HUMANS and English batteries, requiring back translation.

Item Content: No change was performed in item content.

Scoring Instructions: Considering that in Portuguese “C” and “S” sound are phonetically similar, the test will be scored by two ways: one including only orthographically correct answers; and other including all phonologically correct answers.

Category Fluency (“Animals and Vegetables” Category) - (Benton & Hamser, 1976)

Instructions for subject: The Portuguese version was based on the Brazilian normative studies (Brucki, Malheiros, Okamoto, & Bertolucci, 1997) and on the Spanish battery, requiring back translation.

Item Content: The instruction is the same for “animals” category. As in the Spanish battery, the word “vegetales” refers to every live plant. Thus, Lab team decided to include in the instructions “vegetais para comer” (vegetables to eat).

Scoring instructions: Scoring instructions were extracted from English version (Benton & Hamsher, 1976).

Visuospatial

Digit Symbol (WAIS-R) (Wechsler, 1981)

Instructions for subject: Test translation was not necessary, since the “WAIS-III” (Nascimento, 2005) has Brazilian adaptation and standardization, performed with approval of (PAR), Psychological Assessment Resources, Inc.

Item Content: No change was performed in item content.

Scoring instructions: Scoring instructions were extracted from the “WAIS-III”, Brazilian version (Nascimento, 2005).

Construction abilities

Block Design (WAIS-R) – (Wechsler, 1981)

Instructions for subject: The translation for “Block Design” task was taken from, since “WAIS-III” (Nascimento, 2005) already adapted and standardizaed with permission PAR

Psychological Assessment Resources, Inc. approval.

Item Content: No change was performed in item content.

Scoring instructions: Scoring instructions were extracted from the “WAIS-III”, Brazilian version (Nascimento, 2005).

Motor abilities

Grooved Pegboard - (Klove, 1963)

Instructions for subject: The Portuguese version was based in the Spanish battery, requiring back translation.

Item Content: No change was performed in item content.

Scoring instructions: Scoring instructions were extracted from the English battery (Klove, 1963).

Discussion

This study has aimed to present the methodology and main changes necessary to adapt the Neuropsychological Section of HUMANS into Portuguese, preserving the

procedures and prerogatives of its original purposes. To assure efficacy and accuracy of translated neuropsychological instruments, peculiarities inherent to the words and images were carefully controlled, making the result suitable for use in researches involved in a Brazilian linguistic and sociocultural context.

During the adaptation process, is common to find some instruments with excellent adaptation procedures and a few others, which do not have a national criteria-based adapted version neither take into account the environment, subject's culture and social reality underlying the instruments (Ardila, 2005).

Free translations, i.e., when each investigator performs his/her personal translation for the test, task or scale may generate hazardous outcomes and make difficult to explain the findings, since the criteria adopted were unknown or different from the original. Therefore, free translations should be avoided, since it prevents comparisons across studies,

besides affecting reliability. Thus, the absence of a criteria-based methodology and standardization affects the sustainability of test validation and, hence, of the research (Pasquali, 1998).

The pilot studies performed has served to illustrate and emphasize the danger of literal translation rather than an adaptation for the test, task or scale. Literal translations affect the trustworthiness of assessment process. For instance, the presence of dissonant words in the CVLT can be noted, found to be obstacles for the results because they were not usually known, or have a modified meaning, making its allusions or recognition within its category difficult, or in other cases easier (Pasquali, 1998).

In the present study, when current and reliable, existing national versions of instruments were always preferred. For some measures these national publications had more current versions, so that Brazilian versions were selected for use. It remarks the positive developing of

Brazilian scientific studies in the field of Psychology, fortunately a growing tendency. However, as a standard procedure, to develop the final version of every instrument, the contrast between the existing adaptations with the original was performed in all cases. As for the new translations and back translations, a word frequency list was utilized in order to keep difficulty level of the stimuli and relevance intended in the test. This was necessary because following process translation, it was observed that some items did not matched to the original purpose of the test. Some of these items were idiomatic expressions, composed words, or even were not significant in the Brazilian sociocultural context comparing with that in original version. Thus, when variations were identified, Lab team decided to replace them by a correspondent item in the word frequency list, in order to guarantee its purpose.

Methodological resources used were procedures that strengthened and

corroborated the whole process. It allowed us to observe different interpretations and denotations of each item and, hence, of the battery. By this procedure, the understanding of items, and correction and identification of semantically wrong and culturally improper contents were assured. Therefore, the boundaries and articulations of words and linguistic codes are preserved, as specific for each language and singular cultural groups (Ardila, 1995). Finally, this is a reflective process on various nuances inherent to concepts of a Brazilian linguistic and cultural context. From now onward we would like to mention the generated adaption as HUMAN-P. After that, the Laboratory of Neuropsychology of UNESP, São Paulo State University has carried out studies about HAND in different cities in the countryside of São Paulo State. Some results of these NP studies were briefly mentioned in a narrative HAND review (Konkiewitz & Santos, 2015).

Conclusion

The methodology was suitable to develop reliable and equivalent adaptation of neuropsychological section of HUMANS into Portuguese. The adapted instruments are adequate to Brazilian culture and Portuguese language, and they are ready to be used in pilot studies. The instruments have accessible language, demonstrating its coherence and relevance either nationally or for other Portuguese-speaking countries. Therefore, a qualified tool is available, whose composition has respected and preserved a scientific methodology proper to neuropsychological assessment of HIV subjects.

Acknowledgements. To Dr. Guadalupe Morales from Cedars Sinai Medical Center that provided technical information regarding some of the instruments. To the undergraduate students Francis Vinícius Portes Virgínio, Flávia Mendes, and Marina Coimbra Casadei that collaborated

in some meetings as part of their academic activities.

Funding. Fundação de Amparo à Pesquisa do Estado de São Paulo and CNPq, Conselho Nacional de Ciência e Tecnologia that awarded co-authors with grants: Bruna Andrade Rocha (CNPq, 119.285/2010-0), Bianca (FAPESP 2011/02502-8), Maria Clara Estevam Vilas-Boas (FAPESP case: 2011/11266-6), Heloísa Martinez Furniel (CNPq, 103.717/2012-9), Natalia Sayuri Benites Aoki (CNPq, 123132/2012-6).

References

- Alfahad, T. B., & Nath, A. (2013). Update on HIV-Associated Neurocognitive Disorders. *Current Neurology and Neuroscience Reports*, 13(10), 1–8. <http://doi.org/10.1007/s11910-013-0387-7>
- Antinori, A, Arendt, G, Becker, J.T., Brew, B.J., Byrd, D.A., et al. (2007) Updated research nosology for HIV-associated neurocognitive disorders. *Neurology* 69: 1789–1799.
- American Psychiatric Association. (2000). *Diagnostic and statistical manual of mental disorders* (4th ed., text revision). Washington, DC: Author.
- Ardila-Ardila, A., Goodkin, K., Concha-Bartolini, M., Lecusay-Ruiz, R., O'Mellan-Fajardo, S., Suarez-Bustamante, P., Molina-Vasquez, R., Lee, D., Chayeb, G., & Wilkie, F. L. (2003). HUMANS: Una batería neuropsicológica para la evaluación de pacientes infectados con VIH-1. *Review in Neurology*, 36(8), 756-762.
- Ardila, A. (1995). Directions of research in cross-cultural neuropsychology. *Journal of Clinical and Experimental Neuropsychology*, 17, 143-150.
- Ardila, A. (2005). Cultural values underlying cognitive psychometric testing. *Neuropsychology Review*, 15, 185-195.
- Benton, A. L., & Hamsher, K. (1976). *Multilingual Aphasia Examination*. Iowa City: Department of Neurology, University of Iowa.
- Brasil. Ministério da Saúde / Departamento de DST, Aids e Hepatites Virais/SVS/MS (2014) *Aids no Brasil*. Boletim Epidemiológico. Retrived from <http://www.aids.gov.br/pagina/aids-no-brasil>
- Brasil. Ministério da Saúde. (2010). *Boletim Epidemiológico AIDS Ano VII - julho a dezembro de 2009/janeiro a junho de 2010*. Retrieved from http://www.aids.gov.br/sites/default/files/publicacao/2010/boletim2010_preliminar_pdf_34434.pdf

- Brasil. CPLP. (2010). *Comunidade dos Países de Língua Portuguesa*. Retrieved from <http://www.cplp.org/id-22.aspx>
- Brasil. Ministério da Saúde/ Secretaria de Vigilância em Saúde/ Programa Nacional de DST e Aids. (2008). *Recomendações para Terapia Anti-retroviral em Adultos Infectados pelo HIV*. Retrieved from http://www.saude.rio.rj.gov.br/media/ds_t aids_consenso_adulto_2008.pdf
- Brislin, R. N. (1970). Back-translation for cross-cultural research. *Journal of Cross-Cultural Psychology*, 1(3), 185-216.
- Brucki, S. M., Malheiros, S. M., Okamoto, I. H., & Bertolucci, P. H. (1997). Dados Normativos para o Teste de Fluência Verbal Categoria Animais em Nosso Meio. *Arquivos de Neuropsiquiatria*, 55, 56-61.
- Butters, N., Grant, I., Haxby, J., Judd, L. L., Martin, A., McClelland, J., Pequegnat, W., Schacter, D., & Stover, E. (1990). Special presentation: Assessment of AIDS-related cognitive changes: Recommendations of the NIMH workshop on neuropsychological assessment approaches. *Journal of Clinical and Experimental Neuropsychology*, 12, 963-978.
- Capovilla, A. G. S., Montiel, J. M., Macedo, E. C., & Charin, S. (2005). *Teste de Stroop Computadorizado*. Programa de computador. Itatiba: Universidade São Francisco.
- Cavero, D. O. (1995). *Dicionário Português-Espanhol, Espanhol-Português*. Barcelona: Ed. Ramon Sopena, S.A.
- Delis, D., Kaplan, E., Kramer, J., & Ober, B. (2000). *California Verbal Learning Test-II*. San Antonio, TX: The Psychological Corporation.
- Doyle KL, Morgan EE, Weber E, Woods SP; HIV Neurobehavioral Research Program (HNRP) Group. Time estimation and production in HIV-associated neurocognitive disorders (HAND). *J Int Neuropsychol Soc*. 2015 Feb;21(2):175-81. doi: 10.1017/S1355617715000089.
- Ellis, R. J., Joseph, J., & de Almeida, S. M. (2007). NeuroAIDS in Brazil. *Journal of Neurovirology*, 13, 89-96.
- Ekstrom, R. B., French, J. W., Harman, H. H., & Dermen, D. (1990). *Manual for kit of factor-referenced cognitive tests*. Princeton, NJ: Educational Testing Service.
- Etherton MR, Lyon JL, Ard KL. HIV-associated Neurocognitive Disorders and Antiretroviral Therapy: Current Concepts and Controversies. *Curr Infect Dis Rep* (2015) 17: 28. doi:10.1007/s11908-015-0485-6.
- Ferreira, A. B. de H. (1986). *Novo Dicionário da Língua Portuguesa*. (2ª. Ed). Rio de Janeiro: Nova Fronteira.
- Ferreira, A. B. H. (1999). *Novo Aurélio Século XXI: O dicionário da língua portuguesa*. Rio de Janeiro: Nova Fronteira.
- Forstein, M., Cournos, F., Douaihy, A., Goodkin, K., Wainberg, M. L., &

- Wapenyi, K. H. (2006). *Guideline Watch: Practice Guideline for the Treatment of Patients With HIV/AIDS*. Arlington, VA: American Psychiatric Association.
- Gelman BB: Neuropathology of HAND With Suppressive Antiretroviral Therapy: Encephalitis and Neurodegeneration Reconsidered. *Curr HIV/AIDS Rep* (2015) 12:272–279
- Grant I, Franklin DR Jr, Deutsch R, Woods SP, Vaida F, Ellis RJ, Letendre SL, Marcotte TD, Atkinson JH, Collier AC, Marra CM, Clifford DB, Gelman BB, McArthur JC, Morgello S, Simpson DM, McCutchan JA, Abramson I, Gamst A, Fennema-Notestine C, Smith DM, Heaton RK; CHARTER Group. (2014). Asymptomatic HIV-associated neurocognitive impairment increases risk for symptomatic decline. *Neurology*. Jun 10;82(23):2055-62. doi: 10.1212/WNL.0000000000000492. Epub 2014 May 9.
- Goodkin, K., Fernandez, F., Forstein, M., Miller, E.N., Becker, J.T., Douaihy, A., Cubano, L., Santos, F.H., Silva-Filho, N., Zirulnik, J. and Singh, D. A perspective on the proposal for neurocognitive disorder criteria in DSM-5 as applied to HIV-associated neurocognitive disorders. *Neuropsychiatry* (London). 2011 Oct 1; 1(5): 431–440.
- Guillemin, F., Bombardier, C., & Beaton, D. (1993). Cross-Cultural adaptation of health related quality of life measures: Literature review and proposed guidelines. *Journal of Clinical Epidemiology*, 46, 1417-1432.
- Heaton, R. K. (1981). *Wisconsin Card Sorting Test Manual*. Odessa, Florida: Psychological Assessment Resources Inc.
- Heaton, R. K., Chelune, G. J., Talley, J. L., Kay, G. G., & Curtiss, G. (2005). *Teste Wisconsin de Classificação de Cartas*. São Paulo: Casa do Psicólogo.
- Heaton, R.K., Clifford, D.B., Franklin, D.R.Jr., Woods, S.P., Ake, C., Vaida, F., Ellis, R.J., Letendre, S.L., Marcotte, T.D., Atkinson, J.H., Rivera-Mindt, M., Vigil, O.R., Taylor, M.J., Collier, A.C., Marra, C.M., Gelman, B.B., McArthur, J.C., Morgello, S., Simpson, D.M., McCutchan, J.A., Abramson, I., Gamst, A., Fennema-Notestine, C., Jernigan, T.L., Wong, J., Grant, I.; CHARTER Group. HIV-associated neurocognitive disorders persist in the era of potent antiretroviral therapy: CHARTER Study. *Neurology*. Dec 7;75(23):2087-96. doi: 10.1212/WNL.0b013e318200d727.
- Harding KE, Robertson NP. (2015) HIV-associated neurocognitive disorders. *J Neurol*. May 23. [Epub ahead of print]
- Houaiss, A., & Cardim, I. (1985). *Novo dicionário Folha Webster's*. São Paulo: Ed. Folha de São Paulo.
- Kalil, R. S., Alvarenga, R. M. P., Almeida, A. J de., & Morais-De-Sá, A. A. (2009). Estudo dos transtornos cognitivos decorrentes da infecção pelo HIV-1.

- Estudos de Psicologia I Campinas*, 26(4), 465-473.
- Kaplan, E., Goodglass, H., & Weintraub, S. (1983). *The Boston Naming Test*. Philadelphia, PA: Lea & Febiger.
- Klove, H. (1963). Clinical neuropsychology. *Medical Clinics of North America*, 46, 1647-1658.
- Knippels, H. M. A., Goodkin, K., Weiss, J. J., Wilkie, F. L., & Antoni, M. H. (2002). The importance of cognitive self-report in early HIV-1 infection: Validation of a cognitive functional status subscale. *AIDS*, 16(2), 259-267.
- Konkiewitz, E. C. ; Santos, F.H. (2015). Transtornos Neurocognitivos Associados ao HIV. In: Flávia Heloísa Dos Santos; Vivian Maria Andrade; Orlando Francisco Amodeo Bueno. (Org.). *Neuropsicologia Hoje*. 2ed. Porto Alegre: ARTMED, v. 1, p. 214-221.
- Lezak, M. D. (1995). *Neuropsychological assesment*. New York: Oxford Universisty Press.
- Liner, K. J. 2nd., Ro, M. J., & Robertson K. R. (2010). HIV, antiretroviral therapies, and the brains. *Curr HIV/AIDS Rep. May*;7(2), 85-91.
- Marcotte, T. D., Wolfson, T., Rosenthal, T. J., Heaton, R. K., Gonzalez, R., Ellis, R. J., Grant, I., & the HIV Neurobehavioral Research Center Group. (2004). A multimodal assessment of driving performance in HIV infection. *Neurology*, 63, 1417-1422.
- Martin, A., Heyes, M. P., Salazar, A. M., Kampen, D. L., Williams J., Law , W. A., Coats, M. E., & Markey, S. P. (1992). Progressive slowing of reaction time and increasing cerebrospinal fluid concentrations of quinolinic acid in HIV-infected individuals. *Journal of Neuropsychiatry and Clinical Neurosciences*, 4, 270-279.
- Miranda, M. C., Pompeia, S., & Bueno, O. F. A. (2004). Um estudo comparativo das normas de um conjunto de 400 figuras entre crianças brasileiras e americanas. *Revista Brasileira de Psiquiatria* , 26 (4), 226-233.
- Nascimento, E. (2005). *WAIS-III: Escala de Inteligência Wechsler para Adultos – manual técnico*. São Paulo: Casa do Psicólogo.
- Pacheto Filho, J. R. P., & Santos, F. H. (2008). Estudos Brasileiros Sobre Demência Associada ao HIV. *DST - Jornal Brasileiro de Doenças Sexualmente Transmissíveis*, 20(3-4), 196-203.
- Pasquali, L. (1998). Principios de elaboracao de escalas psicologicas / Principles of elaboration of psychological scales. *Revista Psiquiatria Clínica*, 25(5), 206-213.
- Pedroso, R. S., Oliveira, M. S., Araujo, R. B., & Moraes, J. F. D. (2004). Tradução, Equivalência Semântica E Adaptação Cultural Do Marijuana Expectancy Questionnaire (MEQ). *Psico-USF*, 9, 129-136.
- Posner, M. I., & Mitchell, R. F. (1967). Chronometric analysis of classification. *Psychological Review*, 74, 392-409.

- Rappaport J & Volsky DJ. Role of the macrophage in HIV-associated neurocognitive disorders and other comorbidities in patients on effective antiretroviral treatment. *J. Neurovirol.* (2015) 21:235–241. doi: 10.1007/s13365-015-0346-y
- Romero, S. B. (2000). *Desempenho de uma amostra brasileira no teste de nomeação de Boston*. [Performance of a Brazilian population sample in the Boston naming test]. 193 f. Dissertação (Mestrado em Neurociências) – Universidade Federal de São Paulo, São Paulo.
- Robertson K, Yosief S. (2014). Neurocognitive Assessment in the Diagnosis of HIV-Associated Neurocognitive Disorders. *Seminars in Neurology*;34:21–26.
- Sacktor, N. (2002). The epidemiology of human immunodeficiency virus-associated neurological disease in the era of highly active antiretroviral therapy. *Journal of Neurovirology*, 8, 115–121.
- Santos, F. H., Bueno, O. F., & Gathercole, S. E. (2006). Errors in nonword repetition: bridging short- and long-term memory. *Braz J Med Biol Res.* 39(3):371-85.
- Santos, F.H., Vilas-Boas, M.C., Goodkin, K., Moreira, T. HIV-Associated Neurocognitive Disorders in Poly-Substance Users in Southeastern Brazil. *Aids and Behavior*
- Santos, F.H., Aoki, N.S.B., Konkiewitz, E.C., Ziff, E.B. HIV-associated neurocognitive disorders in polydrug users.
- Sardinha, T. B. (2001). The bank of Portuguese. A multi - million word monitor corpus of Brazilian Portuguese. Paper presented at 4th Corpus Linguistics Symposium, *InPLA* , PUC/SP, Brazil.
- Selaimen, C., Brilhante, D. P., Grossi, M. L., & Grossi, P. K. I. (2007). Avaliação da depressão e de testes neuropsicológicos em pacientes com desordens temporomandibulares. *Ciência & Saúde Coletiva* , Rio de Janeiro, 12(6).
- Stroop, J. R. (1935). Studies of interference in serial verbal reactions. *Journal of Experimental Psychology*, 18, 643-662.
- Wechsler, D. (1981). *Manual for the Wechsler Adult Intelligence Scale—Revised*. Psychological Corporation, New York.
- Wechsler, D. (1999). *WAIS-III: Escala de inteligência de Wechsler para adultos – III*. Spain TEA Ediciones.
- Wechsler, D. (1987). *Wechsler Memory Scale-Revised Manual*. New York: The Psychological Corporation.
- Wilkie, F. L., Eisdorfer, C., Morgan, R., Loewenstein, D.A., & Szapocznik, J. (1990). Cognition in early human immunodeficiency virus infection. *Archives of Neurology*, 47, 433-440.

- Wilkie, F. L., Goodkin, K., Ardila, A., Concha, M., Lee, D., Lecuray, R., Suarez, P., Van Zuilen, M. H., Molina, R., & O'Mellan, S. (2004). HUMANS: An English and Spanish neuropsychological test battery for assessing HIV-1-infected individuals – initial report. *Applied neuropsychology*, *11*(3), 121-133.
- Woods, S. P., Moore, D. J., Weber, E., & Grant, I. (2009). Cognitive neuropsychology of HIV-associated neurocognitive disorders. *Neuropsychol Rev* *19*(2),152-168.