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TRANSCULTURAL ADAPTATION DESIGN OF MONTREAL COGNITIVE ASSESSMENT (MOCA) IN BRAZIL

Neurology

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ABSTRACT

Introduction: Montreal Cognitive Assessment (MoCA) is the most common cognitive screening instrument for Mild Cognitive Impairment detection. Although the current Brazilian version (MoCA-BR) has been validated, in clinical practice, it is observed that adults with normal cognitive function, especially those less educated, rarely reaches the maximum score of 30 points on the test. **Objective:** Introduce a methodology to adjust the Brazilian version according to the Brazilian culture. **Methods:** A cross-sectional observational study was conducted with 294 participants. In the Memory section, we used the free listing technique to replace words. In the Naming section, an epidemiological survey of the most pinpointed figures was conducted. Replication of Sentence section was modified based on meetings between researchers and Portuguese teachers fluent in English. **Results:** The alternative version of MoCA-BR was composed by: "azul" (blue), "braço" (arm), "orquídea" (orchid), "seda" (silk) and "igreja" (church) in Memory Section; giraffe, elephant, and lion in the Naming section; "Eu só sei que é João quem será ajudado hoje" and "O gato sempre se esconde embaixo do sofá quando o cachorro está na sala" in the Replication of Sentence section. **Conclusions:** Our data reinforce the need to adapt the MoCA-BR. We present an alternative version of MoCA-BR, which contemplates the linguistic and cultural requirements of the transcultural adaptation process. The next step is to apply this version to obtain its validation. We believe that this adaptation may allow a future better applicability of the MoCA-BR, especially in less educated people, without underestimating the scores of cognitively normal individuals

KEYWORDS

Mild Cognitive Impairment, Montreal Cognitive Assessment, Transcultural Studies, Validation Studies.

INTRODUCTION

Mild Cognitive Impairment (MCI) is an intermediate state between normal aging and dementia. It is a clinical term which describes individual who has more severe memory loss for his age range but keeps his basic activities of daily living[1].

For the diagnosis of MCI, the application of neuropsychometric tests is extremely important, and the Montreal Cognitive Assessment (MoCA) seems to be the most promising instrument both in clinical testing and in population screening for MCI. The sensitivity of MoCA for the detection of MCI and of Alzheimer's Disease (AD) is 82.6% and 96.6%, respectively, while the specificity for the detection of MCI is 85.6% and of AD is 81.8%[2].

MoCA is a widely used test, translated, and validated in more than 50 languages. The test has one page and a maximum score of 30 points, evaluates several cognitive functions: executive functions, visuospatial skills, naming, attention, delayed evocation, language, abstract reasoning, and orientation[3].

The Brazilian version, entitled MoCA-BR (Figure 1), was developed by Sarmento (2009)[4], but not validated by the author due to a low internal consistency. However, the validation was obtained by Memoria et al. (2013)[5] with high accuracy for MCI (82%) and DA (95%).

Sarmento (2009)[4] demonstrates that the psychometric characteristics of the MoCA-BR were not maintained when applied to older adults with less than 4 years of education.

To correct the educational effects found in the original study, Memoria et al. (2013)[5] gave an additional point to subjects with 12 or fewer years of education, and the cut-off was 25 points. However, the study's sample was not representative of older Brazilian adults, whereas the mean education was 11.42 years.

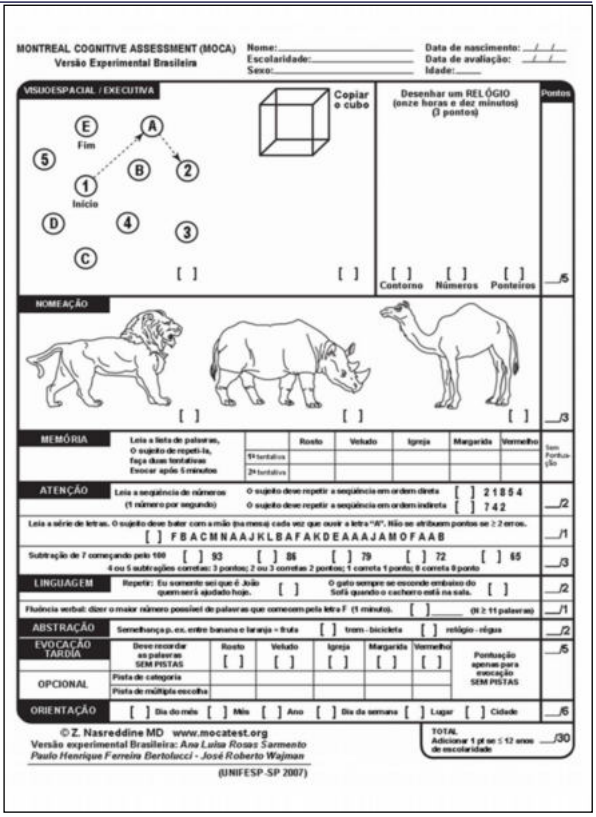

Figure 1 - MoCA-BR (Sarmento, 2009)

Apolinario et al. (2018)[6] argued that MoCA has been validated in Brazil, a country with a large population of older adults with heterogeneous educational backgrounds, but no local norms were available for the Brazilian version. They applied the MoCA-BR in 597 cognitively healthy Brazilians aged 50 to 90 years. The objective was to provide age-corrected and education-corrected norms for the test. The results of the study show that, in the original proposed cutoff (≤25 points), 87% of their sample would be considered impaired. Even using a more conservative suggestion (≤22 points), 67% of their normative sample would be regarded as impaired. These data evidence that the test may underestimate the scores among healthy individuals, and cannot differentiate them from MCI patients.

Furthermore, studies conducted in populations with heterogeneous socioeconomic backgrounds have shown that several items of the MoCA suffer influence of demographic, cultural, and linguistic factors, thus implying the need of local norms to maximize accuracy. These studies raised concerns regarding the cross-cultural suitability and the psychometric properties of the MoCA in samples with very low levels of education[7,8,9].

Cesar et al. (2019)[10] notes that MoCA-BR is highly reliant on abilities learned at school and that low scores may suggest educational limitations or pathology. In this context, the test did not have a high accuracy for detecting cognitive impairments in populations with a low educational level.

Gomez et al. (2013)[8] show that the Spanish version of MoCA is reliable, but it is strongly associated with education level even in the non-demented portion of the Colombian population.

The study reaffirms the need of using common objects of daily life and how it may help registration under the stressful conditions of a cognitive test, for example in categories of Memory and Late Evocation. The author suggests the use of other objects more proximate to Andean, such as bottle or truck, instead of the words present in Spanish MoCA version.

Cross-cultural aspects were discussed in the elaboration of MoCA in Portugal. The literal translation from the original test for the validation of the Portuguese version of MoCA was considered inadequate. Linguistic aspects such as extension of words, phonological repetition, and identical syllables of the Memory section of the test were considered decisive for the elaboration of the Portuguese version[11].

Del Brutto et al. shows an example of the importance of cross-cultural adaptation. In the study, than 70% of the participants could not name 'rinoceronte' (Rhino) in the naming subtest, believing it was a "vaca" (Cow), a more common animal in the Ecuadorian rural environment[12].

During the process of validating neuropsychometric tests, the cross-cultural adaptation, although complex, is extremely necessary, since specific linguistic problems can affect the interpretation and, therefore, the effectiveness of the test[13]. The structural equivalence precept, according to which the neuropsychological aspects evaluated in the test must be the same in all cultures, must be respected[14]. The absence of semantically identical words in different languages, the use of expressions of discordant meanings in different cultural contexts and discordant thoughts in different cultures are just some examples of important aspects that must be considered[13].

Comparing the MoCA-BR with the original Canadian version, it's remarkable that the test was poorly adapted. Despite reinforcing the need to adapt the cutoff points, Brazilian studies poorly discuss the cross-cultural adaptation of MoCA-BR. The test is still highly influenced by socioeconomic aspects[5,6,10].

We hypothesized that the lack of cross-cultural adaptation during the development of MoCA-BR may contribute to underestimating the score of healthy individuals, especially those with less education. The aim of this article is to verify if the current Brazilian MoCA version has aspects similar to the Brazilian culture. In that way, we present a study design used to adapt and develop an alternative version of MoCA-BR, considering the complex cultural, social, and linguistic aspects.

METHODS

This is a cross-sectional observational study. Initially, consensus meetings between linguists and the researchers' team, composed by Neuropsychologist and Neurologists experienced in the test application, were held. The aim was to determine the sections of MoCA-BR directly influenced by the translation which should be adapted to the Brazilian culture. Based on information derived from clinical experience and retrospective evaluation of previously applied tests by the researchers, Memory, Late Evocation, Naming and Sentence Replication were the categories selected to the cross-cultural adaptation. The proposed design of the process will be described below.

All the participants (patients and their companions) were invited to the research while waiting for consults in the corridors of Hospital de Clínicas - UFPR. After comprehending and signing the consent form, each participant was invited to a separate room. The goal was to screen and select cognitively healthy participants with no cognitive complaints. The Psychiatry, Endocrinology and Neurology outpatient clinics were not included in the research, considering the cognitive morbidity of these specialties.

The study included individuals over 18 years of age with no cognitive complaints. Illiterate individuals (less than one year of schooling) were excluded. Of the 326 invited participants, 32 were excluded, resulting in 294 included. For the categories of Memory/Delayed Recall and Naming, we adopt screening exclusion criteria for possible cognitive impairment. These criteria are discussed below.

For descriptive analysis, participants were categorized according to sex, age range and education. Regarding gender, the participants were divided between male and female. Regarding the age range, they were divided into three groups: 18 to 49 years, 50 to 64 years and 65 years and over. As for education, they were divided into Low (1 to 4 years), Average (5 to 8 years) and High Education (over 8 years). For statistical analysis, Pearson's chi-square test ($\chi 2$) was used, by GraphPad Prism 7.0 program. The confidence interval adopted was 95%.

The study was conducted in accordance with Resolution No. 466/12 of the National Health Council (2012), which deals with the participation of human subjects in research, and was approved by the Research Ethics Committee of Hospital de Clínicas of the Federal University of Paraná, Curitiba – PR (CAAE 79897317.0.0000.0096).

Methods: Memory And Delayed Recall

After initial analysis, the adaptation of Memory and Delayed Recall sections was based on retrospective analysis of the clinical experience of the researchers' team.

The objective of this step was to find words more present in the Brazilian culture. In addition to verifying whether the words present in MoCA-BR were prevalent in the participants citations, those words should be equally distributed according to sex, age group and education.

The words "Rosto" (face), "Veludo". (velvet), "Margarida" (daisy) and "Vermelho" (red) of MoCA-BR were selected for replacement.

According to Bernard's free listing technique[15], the individuals were instructed to verbalize as many words as possible in the semantic domains selected for the substitution: body part, fabric, flower and color.

For cognitive screening, we excluded those who were unable to list at least three words in each domain. 235 participants were invited, of whom 32 participants were excluded - 14 of them for being illiterate and the other 18 for not being able to list at least three words in each domain. For the statistical analysis, only the first word listed within each domain was considered.

Methods: Naming

For the adaptation of this section, in order to select a recognized and correctly named animal among the participants, we selected 10 animals from other MoCA versions around the world, including the MoCA-BR, and randomized them in two versions (Figure 3).

To prevent the order of animals from influencing the naming sequence, the sheets were equally and randomly applied to the participants.

The participants were instructed to point out and name 5 among 10 animals displayed on the sheet. We adopted that the first named animals were the most familiar to the participants.

The objective of this stage was to verify which animals were more striking in Brazilian culture, in all categories of sex, education and age groups. In addition, we aimed to confirm if the animals present in MoCA-BR were highly pointed and named correct.

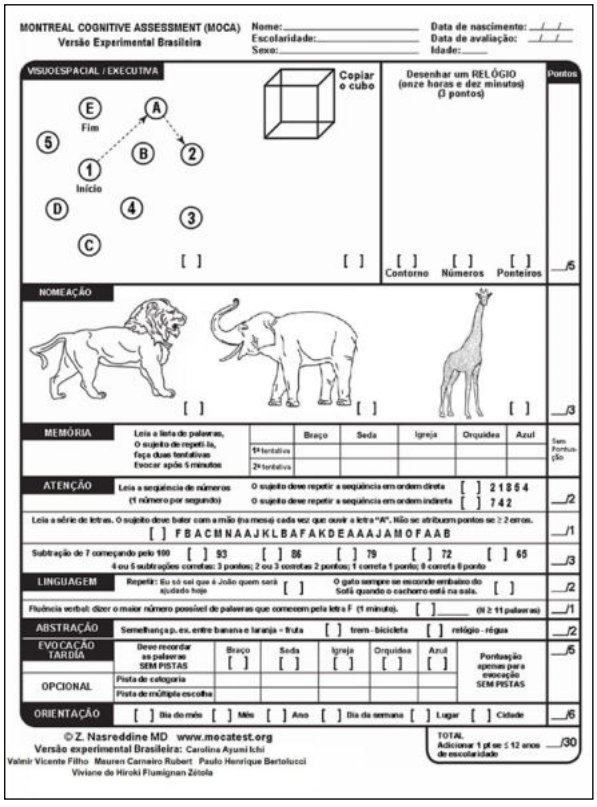

Figure 2 - Alternative version of MoCA-BR

For cognitive screening, we excluded individuals who named more than one animal incorrectly or did not name at least 5 animals. 91 volunteers were invited to participate, 4 of them were excluded, 1 for being illiterate and 3 for incorrectly naming more than one animal.

We analyzed the order of nominations, whether the nomination was correct or incorrect and, if incorrect, the word used to nominate the specific animal. For statistical analysis, the first three animals identified by each participant were considered.

Methods: Language

For adaptation of the Language section, critical debates between the researchers and three Portuguese-speaking teachers fluent in the English language were held to discuss the sentences presented in MoCA-BR: "Eu somente sei que é João quem será ajudado hoje" and "O gato sempre se esconde embaixo do sofá quando o cachorro está na sala".

For the adaptation of the section, translation options of the sentences present into the original English MoCA version - "I only know that John is the one to help today" - and - "The cat always hides under the couch when the dog is in the room" - were developed.

Subsequently, to back-translate the selected phrases from Portuguese do English, the selected phrases were sent to a native English teacher. At the end of this process, the appropriate phrase was chosen to compose the alternative version of MoCA-BR.

The objective was to select a phrase that was better translated and coherent with Brazilian Portuguese, while maintaining the same difficulty required in the original test. The cross-cultural aspects were also discussed.

Results: Memory And Delayed Recall

Among the participants included in this research stage, 58.62% (n = 119) were female and 41.38% (n = 84) male; 14.78% (n = 30) were low, 16.26% (n = 33) were average and 68.96% (n = 140) were highly educated; 46.80% (n = 95) were between 18 and 49 years old, 33.50% (n = 68) were between 50 and 64 years old and 19.70% (n = 40) were 65 years old or more.

Within the domain of body parts (Table 2), the word "cabeça" was the most cited, being listed first by 27.58% of participants (n = 56), followed by "braço" by 18.22% (n = 37) and "mão" and "perna", both cited by 6.89% (n = 14; n = 14). When analyzed between the groups, the words "cabeça" and "braço" did not show a statistically significant difference, with the respective p values for sex (p = 0.7085 and p = 0.7991), education (p = 0.4826 and p = 0.1552) and age group (p = 0.6802 and p = 0.9153). The words "mão" and "perna" also did not show a statistically significant difference in any of the groups.

Within the domain of fabrics (Table 2), the word "algodão" was the most cited, being listed first by 22.66% of participants (n = 46), followed by "seda" in 17.73% (n = 36) and "jeans" in 12.80% (n = 26). When compared between groups, the word "algodão" showed no statistically significant difference at all. The word "jeans" showed a statistically significant difference between sex (p = 0.002) and was more prevalent among men (21.43%; n = 18) compared to women (6.72%; n = 26). In contrast, the word "seda" was more often mentioned by women (23.53%; n = 28) compared to men (9.52%; n = 8), with statistical significance (p = 0.0101). For "seda", there was no statistically significant difference for education (p = 0.8476) and age group (p = 0.6277).

Within the domain of flowers (Table 2), the word "rosa" was the most cited, being listed first by 43.84% of participants (n = 89), followed by "orquídea" in 16.25% (n = 33) and "margarida" by 15.27% (n = 31). When compared within the groups, the word "rosa" showed a statistically significant difference only in relation to education (p = 0.0317), being cited by 53.33% of the participants with low education (n = 16), by 60.61% with medium (n = 20) and by 37.86% (n = 53) of those with high education.

The word "orquídea" showed no statistically significant difference in any of the variables of sex (p = 0.8002), education (p = 0.2131) and age group (0.3012). The word "margarida" also did not show a statistically significant difference in any groups.

Within the color domain (Table 2), the word "azul" was the most cited, being listed first by 31.03% of participants (n = 63), followed by "verde" in 17.24% (n = 35), and "vermelho" by 14.77% (n = 30). When compared between the groups, the word "azul" did not show a statistically significant difference according to sex (p = 0.5239), education (p = 0.0989) and age group (p = 0.069).

The word "verde" showed a statistically significant difference only in the sex variable (p = 0.003), being more cited by men (28.57%; n = 24) compared to women (9.24%; n = 11). In addition, "vermelho" showed no statistically significant difference in any of the groups.

Results: Naming

Among the participants included in this research stage, 64.36% (n = 56) were female and 35.64% (n = 31) male; 8.05% (n = 7) were low, 18.39% (n = 16) average and 73.56% (n = 64) highly educated; 47.12% (n = 41) were between 18 and 49 years old, 34.48% (n = 30) were between 50 and 64 years old and 18.40% (n = 16) were 65 years old or more.

The five most nominated animals were "girafa" by 45.97% (n = 40) of the participants, followed by "elefante" (43.67%; n = 38), "leão" (40.22%; n = 35), "porco" (39.07%; n = 34) and "urso" 29.88% (n = 26). When compared within the groups, there was no statistical difference in any of the animals, except "urso" in the sex variable (p = 0.0370) (Table 2).

Of the 87 participants, 11 of them incorrectly named at least one of the five animals pointed out. The animal that showed more errors was the "mula/burro", being mistaken for "cavalo" six times, corresponding to more than half (54.54%) of mistakes made. Second, the "rinoceronte" was identified as "hipopótamo" three times, corresponding to 27.27% of the mistakes made.

Third, the "hipopótamo" was pointed out once as "rinoceronte" and once as "capivara", totaling two errors, corresponding to 18.18% of the mistakes made. Finally, "urso" was pointed out as "lobo" once, corresponding to 9.9% of errors.

TABLE 2 - Comparative descriptive analysis of the study in relation to the variables of sex, education and age range.

	Body Parts				Fabrics			Flowers			Colors			Animals				
Variable	**Cabeça**	**Braço**	**Perna**	**Mão**	**Algodão**	**Seda**	**Jeans**	**Rosa**	**Orquídea**	**Margarida**	**Azul**	**Verde**	**Vermelho**	**Giraffa**	**Elefante**	**Leão**	**Porco**	**Urso**
Sex+																		
Male	26,19 % (22)	19,05 % (16)	10,71 % (9)	9,52% (8)	21,43 % (18)	9,52 % (8)*	21,43 % (18)**	50,00 % (42)	15,48 % (13)	16,67 % (14)	28,57 % (24)	28.57 % (24)*	11,90 % (10)	41,94 % (13)	45,16 % (14)	41,94 % (13)	38,71 % (12)	16,13 % (5)*
Female	28,57 % (34)	17,65 % (21)	4,20% (5)	5,04% (6)	23,53 % (28)	23,53 % (28)*	6,72% (8)**	39,50 % (47)	16,81 % (20)	14,29 % (17)	32,77 % (39)	9,24 % (11)*	16.81 % (20)	48,21 % (27)	42,86 % (27)	39,29 % (22)	39,29 % (22)	37,50 % (21)*
Education+																		
Low	20,00 % (6)	30,00 % (9)	10,00 % (3)	3,33% (1)	23,33 % (7)	16,67 % (5)	23,33 % (7)	53,33 % (16)*	20,00 % (6)	6,67 % (2)	20,00 % (6)	16,67 % (5)	23,33 % (7)	71,43 % (5)	42,86 % (3)	14,29 % (1)	57,16 % (4)	14,29 % (1)
Average	24,24 (8)	12,12 % (4)	9,09% (3)	12,12 % (4)	27,27 % (9)	21,21 % (7)	12,12 % (4)	60,61 % (2)*	6,06% (2)	9,09 % (3)	21,21 % (7)	21,21 % (7)	24,24 % (8)	62,50 % (10)	68,75 % (11)	31,25 % (5)	31,25 % (5)	12,50 % (2)
High	30,00 % (42)	17,14 % (24)	5,71% (8)	6,43% (9)	21,43 % (30)	17,14 % (24)	10,71 % (15)	37,86 % (53)*	17,86 % (25)	18,57 % (25)	35,71 % (50)	16,43 % (23)	10,71 % (15)	39,06 % (25)	35,94 % (23)	45,31 % (29)	39,06 % (25)	35,94 % (23)
Age range +																		
18-49 years	27,55 % (27)	19,39 % (19)	6,12% (6)	9,18% (9)	26,53 % (26)	20,41 % (20)	11,22 % (11)	35,71 % (35)	20,41 % (20)	15,31 % (15)	38,78 % (38)	14,29 % (14)	12,24 % (14)	53,66 % (22)	36,59 % (15)	29,27 % (12)	43,90 % (18)	31,71 % (13)
50-64 yeas	24,62 % (16)	16,92 % (11)	10,77 % (7)	4,62% (3)	20,41 % (20)	15,38 % (10)	15,00 % (6)	49,23 % (32)	12,31 % (8)	21,54 % (14)	23,08 % (15)	13,85 % (9)	18,46 % (18)	43,33 % (13)	50,00 % (15)	50,00 % (15)	30,00 % (9)	33,33 % (10)
More than 65 years	32,50 % (13)	17,50 % (7)	2,50% (1)	5,00% (2)	11,22 % (11)	20,00 % (13)	5,00% (2)	55,00 % (22)	12,50 % (5)	5,00 % (2)	25,00 % (10)	30,00 % (12)	15,00 % (6)	31,25 % (5)	50,00 % (8)	56,25 % (9)	43,75 % (7)	18,75 % (3)
Total	27,58 % (56)	18,22 % (37)	6,89% (14)	6,89% (14)	22,66 % (46)	17,73 % (36)	12,80 % (26)	43,84 % (89)	16,25 % (33)	15,27 % (31)	31,03 % (63)	17,24 % (35)	14,77 % (30)	45,97 % (40)	43,67 % (38)	40,22 % (35)	39,07 % (34)	29,88 % (26)

Subtitle: + = Relative frequency (Absolute frequency); * = $p < 0,05$; ** = $p < 0,001$.

Results: Language

For the adaptation of the Language Section, after evaluating the back-translation of Portuguese teachers fluent in English and the review of a native English teacher, the consensus was reached that the most appropriate phrase would be "eu só sei que é João quem será ajudado hoje".

Despite the literal translation of the relative pronoun "quem", present in the original MoCA, we believe that the use of "que", as a connective, has a greater use in Brazilian language. That sentence is more consistent with the proposition of the original MoCA in English, obeying the semantic-syntactic aspects of Brazilian Portuguese.

The phrase "O gato sempre se esconde embaixo do sofá quando o cachorro está na sala", according to the Portuguese linguists, already has a semantic structure consistent with the Brazilian Portuguese. Therefore, by respecting the linguistic aspects of the Brazilian culture, this original phrase could be kept in the adapted version.

DISCUSSION

The cross-cultural adaptation of MoCA-BR was based on script proposed by Herdman, Fox-Rushby & Badia (1998)[16]. According to the authors, the cross-cultural equivalence of neuropsychometric instruments should include conceptual, item, semantics, operational, measurement and functional equivalences.

The authors emphasize that, during the test translation process, the neuropsychometric capacity must be preserved and equally evaluated in the translated language.

For this, the adaptation of the test is essential, so that the items evaluated remain equivalent and semantically comparable in both languages[16].

The adaptation of the original version, to compensate for the educational and cultural bias in low and middle-income countries, implies not only a change of cut-off point, but also linguistic and cultural changes that allow a more reliable evaluation[17].

Discussion: Memory And Delayed Recall

Our results suggest that in the Memory and Delayed Recall section, constructed from the literal translation of the words of the original English version ("face", "velvet", "church", "daisy" and "red" to "rosto", "veludo", "igreja", "margarida" e "vermelho"), the relevance of the terms in the Brazilian cultural context was not fully considered.

After initial analysis, the adaptation of Memory and Delayed Recall sections was based on retrospective analysis of the clinical experience of the researchers' team. It was proposed that the length of the words and, possibly, their rare presence in the daily life of the Brazilian dialect could contribute to the difficulty of memorization and delayed evocation in healthy people.

The aim of this step was to find words more present in the Brazilian culture, and to verifying whether the words present in MoCA-BR were prevalent in the participants citations. Those words should be equally distributed according to sex, age group and education.

The words "Rosto", "Veludo", "Margarida" and "Vermelho" of MoCA-BR were selected for replacement because, in pre-analysis conducted by the researchers based on the clinical application of the test, those words appeared to be the most forgotten words by adults with normal cognitive function. It was not proposed to change the word "Igreja" because, in the pre-analysis, it appeared to be a well-known and culturally adequate word for evocation. Furthermore, as the survey was conducted at the hospital, this location was easily cited, setting up a bias.

One of the techniques used in the assembly of neuropsychometric instruments that seek to assess memory is the free listing[18], which consists of the rapid and affluent verbalization of words from the same conceptual sphere and the determination of the order in which each item is cited. This strategy is useful in indicating linguistic and semantic problems present in the literal translation of neuropsychometric tests, because it allows the selection of concepts and nominations consistent with the context of each population[15].

Thus, for the elaboration of the alternative version of MoCA in Brazil, in order to select concepts and nominations consistent with the context of the Brazilian population, the free listing of words within the domains “colors”, “parts of the human body”, “flowers" and “fabrics” was evocated. We sought, among these words, one that was prevalent and equally distributed, that is, with adequate constancy according to the variables of sex, age and education, identified as determinants[19].

For the domain of “human body parts”, both “cabeça” (head) and “braço” (arm) were prevalent, being cited by 27% and 18% of participants, respectively. In addition, both showed adequate constancy, marked by the absence of a statistically significant difference in the adopted variables.

However, it was considered that the choice of the word “braço” (arm) would be more appropriate to compose the alternative version of MoCA-BR. Since the word "cabeça" (head) could easily be confused by synonyms such as "face" and "rosto" (face), which could mislead respondents.

For fabrics, the word "algodão" (cotton) was the most cited (22.66% of the time) and demonstrated adequate constancy within the adopted variables. However, the word also has a linguistic divergence because it is a namesake of "plant" and "fabric". The second and third most prevalent words, “seda” (silk) and “jeans” (jeans), respectively, showed variable constancy within the sex category, represented by the statistically significant difference obtained, they were, therefore, considered inadequate to compose the alternative version.

After consensus meetings, in agreement with the team of Neurologists and Neuropsychologist, we considered that the use of anglicisms, as well as homonymous terms, would be inappropriate for the composition of an adapted neuropsychometric test. Therefore, it was decided that the word “seda” (silk) was appropriate to compose the adapted version of the test due to its high prevalence in relation to other fabrics, in addition to the absence of a statistically significant difference of this word in the variables of education ($p = 0.8476$) and age group ($p = 0.6277$).

For the domain of flowers, although “rosa” (pink) was prevalent in 43.84% of the citations, there was no constancy within the education variable, demonstrated by the statistically significant difference. There was a tendency for the word to be cited by people with less education, with a prevalence of more than 50% in individuals with up to eight years of schooling, compared to about 37% in highly educated individuals.

In addition, the word “rosa” (pink) is not exclusive to a single domain among those surveyed (it is a color and a flower), so its use has been discarded.

The second most prevalent word was “orquídea” (orchid), cited by 16.25% of participants. Its distribution was constant across all variables, represented by the absence of a statistically significant difference. This was, therefore, the word selected to compose the alternative version.

For the “colors” domain, the most prevalent word was “azul” (blue), being cited by approximately 30% of the participants. In addition, no statistically significant difference was found between the variables, which indicates adequate constancy. "Azul" (blue) was, therefore, the word selected to compose the alternative version.

In summary, using the free listing technique and the evaluation of constancy and prevalence in the domains surveyed, the words "azul", "braço", "orquídea" and "seda" (blue, arm, orchid, and silk) were listed for the composition of the alternative version MoCA-BR, being the word “igreja” kept. Our results shows that only the words "vermelho" and "margarida" from MoCA-BR were prevalent on the study sample.

Discussion: Naming

Memória et. al[5], demonstrate that the Naming section was the only subtest of MoCA-BR unable to discriminate Alzheimer's Disease, the MCI and the normal cognitive functioning groups.

The animals present in the current Naming Section (lion, camel and hippopotamus) present similar phenotypic characteristics to other animals (eg. rhinoceros and hippopotamus, camel and dromedary), which can be a confounding factor even to the normal cognitive functioning population. We investigated which figures were the most quickly and correctly identified by the population in the sheets (Figure 3), considering that people usually name first the most familiar figures presented.

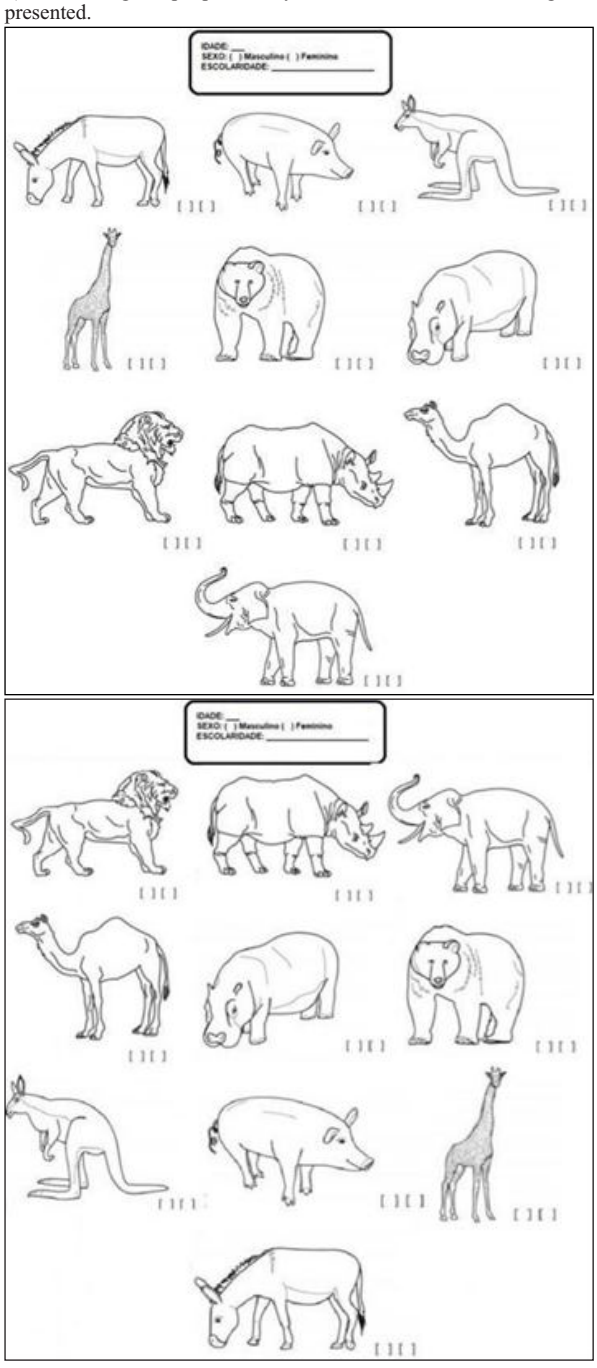

Figure 3 - Naming sheets

From the results, it is interesting to notice that the rhinoceros' figure was named as “hippopotamus” by one third of participants who had mistaken any of the pointed-out animals. In addition, 15% of the people who pointed out the rhinoceros missed the nomination. The camel, on the other hand, was poorly mentioned and was not among the five animals most pointed by the population, which suggests that the

figure is irrelevant in the studied sample. The rhinoceros is an unremarkable animal in Brazilian culture, and the detail of the horn may go unnoticed by the interviewee, who can easily confuse it with a hippopotamus.

These data corroborate that the Naming section may underestimate the scores of the healthy people due to cross-cultural aspects. Giraffe, Elephant, and Lion were the most cited figures, which nominations did not present any error rate. Therefore, they were selected to compose the Naming section in the alternative version.

Even though these animals do not belong to the Brazilian fauna, they are very present in the daily life of Brazilians, whether in zoos or in cartoons, films, and advertisements. Furthermore, the singular characteristics such as the long neck of the giraffe, the trunk of the elephant and the mane of the lion may contribute to the more precise naming of these animals.

Discussion: Language

In the Language section, the sentence construction of the first statement presents at MoCA-BR "Eu somente sei que é João quem será ajudado hoje" was far from the standard Brazilian Portuguese. As MoCA responders need to repeat the sentence in its exact form to score (without omissions, substitutions and / or word additions), a portion of interviewees did not get the full score, as they tended to transform the sentence into a construction closer to Brazilian Portuguese, replacing, for example "somente sei" for "só sei".

Respecting the maintenance of the complexity of the sentence presented in the MoCA-BR, but considering a more culturally accepted phrase construction, the phrases "eu só sei que João é a pessoa para ajudar hoje" e "eu só sei que é João quem será ajudado hoje" were considered to adapt the version present at MoCA-BR.

After discussion between experts and language specialists, it was concluded that the phrase "eu só sei que é João quem será ajudado hoje" would be the option that would best meet the criteria established by the authors. It was pointed out that the relative pronoun "quem" is poorly used as a connective in the language of Brazilian.

The second sentence - "O gato sempre se esconde embaixo do sofá quando o cachorro está na sala" - was maintained, because it already has a semantic structure consistent with the Brazilian Portuguese and respects linguistic aspects of the Brazilian culture. Moreover, based on clinical experience in the application of the test, this sentence does not present a relevant error rate among normal cognitive function patients.

CONCLUSION

Neuropsychometric tests are of great importance in the early diagnosis and monitoring of dementia, directly influencing its prognosis. The rapid increase in the number of elderly people in the Brazilian population, added to the high accuracy MoCA-BR for tracking MCI - known to be a precursor of dementia, corroborates the need for a rigorous process of cross-cultural adaptation of the test for its correct applicability in Brazilian people.

There is no consensus regarding strategies for cross-cultural adaptation after translation of neuropsychometric tests. However, the search for semantic and conceptual equivalence between different versions is essential for maintaining the effectiveness of these instruments. The present study is the presentation of a methodological design that allows the development of an alternative version of MoCA-BR (Figure 3), which values linguistic, psychological, and cultural differences between the Canadian population (target audience of the original version of MoCA) and the Brazilian population.

It is observed that the translation techniques of neuropsychometric tests and their validation in different languages is well consolidated by protocols. However, semantic adaptation processes that contemplate the uniqueness of different sociocultural contexts still lack more specific methodological plans.

In view to guide this cross-cultural adaptation, the lack of knowledge of the error rate obtained in each section of the MoCA-BR in a cognitively healthy population represents a limitation of this study. Furthermore, since Brazil is a country with a large territorial dimension and has varied and distinct sociocultural contexts, basing the cross-cultural adaptation of the test on data obtained in a single center results in selection bias.

We believe that this adaptation may allow a better applicability of MoCA-BR in the future, especially in people less educated, without underestimating the scores of healthy individuals.

The subsequent stage of the study, which is already underway, will consist of applying the MoCA-BR and its alternative version to a population with normal cognitive function and, later, to patients with MCI and other dementias to get youtr validation. In this way, it will be possible to compare the instruments and verify the one with the best applicability.

Table 1 - Animals Selected To Compose The Naming Sheets.

Animal	Traslate	MoCA+	Namings*
Burro	Donkey	English (Additional version 3)	Burro/Mula
Camelo	Camel	English (Original)	Camelo/Dromedário
Canguru	Kangaroo	English (Additional version 3)	Canguru
Elefante	Elephant	Chinese (Singapore)	Elefante
Girafa	Giraffe	English (Additional version 2)	Girafa
Hipopótomo	Hipoppotamus	English (Additional version 2)	Hipopótomo
Leão	Lion	English (Original)	Leão
Porco	Pig	English (Additional version 3)	Porco/Suíno
Rinoceronte	Rhinoceros	English (Original)	Rinoceronte
Urso	Bear	English (Additional version 2)	Urso

Legend: * = Namings given as corrects according to intruction manuals in Portuguese version (Original, Additional version 2, Additional version 3). + = MoCA Version which the figure was removed

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