MESTRADO INTEGRADO EM MEDICINA – TRABALHO FINAL

JOÃO PEDRO GERALDES FREIRE FOJA DE OLIVEIRA

The Brief Cognitive Assessment Tool for Schizophrenia: Exploratory study in a sample of Portuguese patients

ARTIGO CIENTÍFICO ORIGINAL

ÁREA CIENTÍFICA DE PSIQUIATRIA

Trabalho realizado sob a orientação de:

DOUTORA ANA TELMA PEREIRA

DR. DAVID MOTA

ABRIL/2021

THE BRIEF COGNITIVE ASSESSMENT TOOL FOR SCHIZOPHRENIA: EXPLORATORY STUDY IN A SAMPLE OF PORTUGUESE PATIENTS

Artigo Científico Original

João Geraldes Freire[1], David Mota[1,2], Ana Telma Pereira[1,3]

[1]Faculdade de Medicina, Universidade de Coimbra, Portugal

[2]Serviço de Psiquiatria do Centro Hospitalar e Universitário de Coimbra, Portugal

[3]Instituto de Psicologia Médica - Faculdade de Medicina, Universidade de Coimbra, Portugal

Contacto: jojogf.uno@gmail.com

Trabalho final do 6º ano médico com vista à atribuição do grau de mestre no âmbito do ciclo de estudos do Mestrado Integrado em Medicina.

Index

Abstract 4

Resumo 5

Keywords 6

Palavras-chave 6

1. Introduction 7

2. Methods 9

2.1. Subjects 9

2.2. Assessment procedures 10

2.2.1. Trail Making Test Part A: 10

2.2.2. Trail Making Test Part B: 10

2.2.3. Digit Symbol Substitution Test: 10

2.2.4. Animal Fluency: 10

2.3. Statistical analysis 10

3. Results 12

3.1. Temporal Stability 12

3.2. Internal Consistency 12

3.3. Differences by demographic and clinical data 13

4. Discussion 14

5. Conclusion 18

References 19

Annex 22

I: Informed Consent 22

II: Sociodemographic questionnaire 23

III: B-CATS test sheets 24

Abstract

Introduction: Cognitive deficits are a core feature of schizophrenia, being the generalized deficit highly related to functional outcome. As several cognitive remediation strategies have shown improvements in cognition and functioning, with durability over time, it is necessary to provide clinicians with easily administered instruments to properly assess cognition, so that they can offer their patients adequate treatment. The Brief Cognitive Assessment Tool for Schizophrenia (B-CATS) was developed to address this need and gives clinicians a measure of global cognition. It can be administered in about 10 min and, unlike other brief batteries developed, does not require specialized training for administration. Our goal is to perform an exploratory psychometric and descriptive study to analyse the psychometric properties (internal consistency and temporal stability) and mean scores of the B-CATS in a sample of Portuguese patients with the diagnosis of schizophrenia.

Methods: We assembled a B-CATS battery by joining the Portuguese version of each individual test that compose it. Nineteen patients with schizophrenia (N = 19) were administered the B-CATS at two time points separated by 4-8 weeks. We analysed the internal consistency by calculating Cronbach's alpha coefficients, and determined Cronbach's alpha coefficients excluding each test and The Corrected Item-Total Correlations. To assess temporal stability, we calculated the Pearson's correlation coefficient *(r)* between the scores in the test and in the retest. To compare the mean scores by sociodemographic and clinical variables, we used Student's t-test for independent groups.

Results: The administration time of the B-CATS ranged between 4.23 and 12.53 min. The B-CATS showed good temporal stability (r = 0.84) and the internal consistency was high (Cronbach’s alpha = 0.83). All B-CATS components presented high correlations with the total corrected (0.59-0.78) and none of the Cronbach’s Alpha coefficients excluding each test was higher than the global alpha of the battery. We found no significant differences in the B-CATS global scores by any of the clinical and demographic variables evaluated.

Conclusion: As far as we know, it was the first time the B-CATS was assembled in Portugal, by joining the Portuguese versions of the tests composing it. The B-CATS demonstrated to be an easy-to-use tool to obtain a fast and reliable estimate of patients’ global cognitive impairment, largely related with their functioning, without the need of specialized training. Ultimately, it will help more patients with schizophrenia in Portugal to receive a treatment that is suited to their needs.

Resumo

Introdução: Os défices cognitivos são uma característica central da esquizofrenia, estando o défice generalizado altamente relacionado com o resultado funcional. Como várias estratégias de remediação cognitiva mostraram melhorias na cognição e funcionalidade, com durabilidade ao longo do tempo, é necessário fornecer aos médicos instrumentos de fácil administração para avaliar corretamente a cognição, de modo a que possam oferecer aos seus pacientes um tratamento adequado. A *Brief Cognitive Assessment Tool for Schizophrenia* (B-CATS) foi desenvolvida para responder a esta necessidade, dando aos médicos uma medida da cognição global. Pode ser administrada em cerca de 10 min e, ao contrário de outras baterias breves desenvolvidas, não requer formação especializada para a administração. O nosso objetivo é realizar um estudo exploratório psicométrico e descritivo para analisar as propriedades psicométricas (consistência interna e estabilidade temporal) e as pontuações médias da B-CATS numa amostra de doentes portugueses com o diagnóstico de esquizofrenia.

Métodos: Construímos uma bateria B-CATS juntando a versão portuguesa de cada teste que a compõe. A B-CATS foi administrada a dezanove pacientes com esquizofrenia (N = 19) em dois momentos separados por 4-8 semanas. Analisámos a consistência interna calculando os coeficientes alfa de Cronbach, e determinámos os coeficientes alfa de Cronbach excluindo cada teste e as Correlações Item-Total Corrigidas. Para avaliar a estabilidade temporal, calculámos o coeficiente de correlação de Pearson *(r)* entre as pontuações no teste e no reteste. Para comparar as pontuações médias por variáveis sociodemográficas e clínicas, utilizámos testes t de Student para grupos independentes.

Resultados: O tempo de administração da B-CATS variou entre 4,23 e 12,53 min. A B-CATS mostrou boa estabilidade temporal (r = 0,84) e a consistência interna foi elevada (alfa de Cronbach = 0,83). Todos os componentes da B-CATS apresentaram correlações elevadas com o total corrigido (0,59-0,78) e nenhum dos coeficientes alfa de Cronbach excluindo cada teste foi maior do que o alfa global da bateria. Não encontramos diferenças significativas na pontuação global da B-CATS por nenhuma das variáveis clínicas e demográficas avaliadas.

Conclusão: Tanto quanto sabemos, foi a primeira vez que a B-CATS foi compilada em Portugal, juntando as versões portuguesas dos testes que a compõem. A B-CATS demonstrou ser uma ferramenta fácil de usar para obter uma estimativa rápida e fiável do comprometimento cognitivo global dos pacientes, em grande parte relacionado com a funcionalidade dos mesmos, sem a necessidade de formação especializada. Em última análise, ajudará mais pacientes com esquizofrenia em Portugal a receber um tratamento adequado às suas necessidades.

Keywords

Schizophrenia, Cognition, Portugal, Neuropsychological Tests, Psychometrics

Palavras-chave

Esquizofrenia, Cognição, Portugal, Testes Neuropsicológicos, Psicometria

1. Introduction

Schizophrenia is a psychiatric disorder affecting about 1% of the world population, which makes it the most common psychotic disorder. It is a complex disorder characterized by a loss of contact with reality, with a myriad of signs and symptoms conditioning an important functional impairment.(1)

Cognitive deficits are a core feature of schizophrenia – they are not a result of the symptoms nor the treatment of the illness.(2) These deficits are sometimes present at the first episode(3,4), are relatively stable over time, with progressive deterioration occurring in some patients, and persist despite the remission of psychotic symptoms.(4,5) The generalized deficit is about 1.5 to 2 standard deviations (SD) compared to the normal population.

Cognitive deficits in schizophrenia are more important than positive and negative symptoms in predicting functional outcome.(5,6) On the other hand, patients with schizophrenia with deeper cognitive deficits are those who benefit the least from psychosocial rehabilitation programs, since these programs are based in learning models which place substantial cognitive demands on the patients. These relations with functional outcome and, more specifically, with the effectiveness of psychosocial rehabilitation strategies make cognitive deficits a target of most importance for intervention in patients with schizophrenia.(1,5)

Several cognitive remediation strategies have shown improvements in cognition and functioning, with durability over time.(7,8)

However, most clinicians are unable to adequately detect neurocognitive deficits indicated by neurocognitive test performances, frequently underestimating the degree of the deficit.(9) If the clinicians cannot adequately detect neurocognitive deficits, they will not offer patients adequate cognitive treatment.

The National Institute of Mental Health (NIMH) established the Measurement and Treatment Research to Improve Cognition in Schizophrenia (MATRICS) initiative, from which arose the MATRICS Consensus Cognitive Battery (MCCB). The MCCB was designed to be the standard cognitive performance battery to be used in clinical trials of cognitive-enhancing interventions and is a reference battery to assess cognitive changes in schizophrenia.(2,10) In this battery are represented seven cognitive domains identified as the major relatively independent dimensions of cognitive performance impaired in schizophrenia.(11) However, the MCCB takes 60-70 minutes to administer and requires specialized training in administration and interpretation, which makes its application in the average psychiatric setting impracticable.

In response to these limitations, several briefer batteries have been developed or adapted for schizophrenia populations, such as the Brief Assessment of Cognition in Schizophrenia

(BACS, originally developed specifically for schizophrenia populations)(12) and the Repeatable Battery for the Assessment of Neuropsychological Status (RBANS, adapted for schizophrenia populations)(13,14). These batteries' composite scores highly correlated with the composite scores of longer complete neuropsychological batteries. However, the BACS takes about 34 minutes to administer, and the RBANS approximately 25 minutes. The administration times, despite being considerably reduced when compared to those of complete neuropsychological batteries, still bring a limitation for average clinical settings' application.

With application in everyday clinical practice in mind, the Brief Cognitive Assessment Tool for Schizophrenia (B-CATS) was developed. It is a short and easy to administer and interpret battery which can be administered by non-psychometrically trained clinicians and only requires 10 minutes for administration. The B-CATS provides a measure of global cognition that highly correlates with a much longer reference neurocognitive battery such as the MCCB.(15,16) It is important to note that the relations with functional outcome may be larger when considering global measures of cognition rather than specific neurocognitive constructs.(6)

The B-CATS is composed by the following tests: Trail-Making Test (TMT) A, TMT B, Digit Symbol Substitution Test (DSST), and Animal Fluency. These tests have already been properly translated, adapted and validated for the Portuguese population.(17)(18)(19)

In this paper, we want to perform an exploratory psychometric and descriptive study to analyse the psychometric properties (internal consistency and temporal stability) and mean scores of the B-CATS in a sample of Portuguese patients with the diagnosis of schizophrenia.

2. Methods

2.1. Subjects

Nineteen patients diagnosed with schizophrenia, six of whom with treatment-resistant schizophrenia, took part in this study. Patients were recruited from different units of the inpatient and outpatient facilities at the Psychiatry department of the Centro Hospitalar e Universitário de Coimbra (CHUC).

Patients were required to have the diagnosis of schizophrenia according to the DSM-5 criteria; have ≥18 years of age; have ≥3 years of education; speak fluent Portuguese; have no significant motor, auditory or visual deficits after correction. There were no specific medication criteria for inclusion in the study.

All the 19 participants completed the first test session and 17 of them completed both test sessions. Due to COVID-19 related restrictions, two of the patients did not perform the second test session. We perceived that the missing of the letter "K" from the test sheet on TMT B greatly conditioned the result of the first patient assessed with the B-CATS in such test, at testing time 1. Therefore, we decided not to consider this result in further analyses and set it to "missing" in the data set. This issue was then targeted in the subsequent assessments.

The demographic data for all patients are described in **Table 1**. All the participants were males. The data relative to the duration of illness of six patients and to the number of hospitalizations of five patients was missing from the patients' files and we did not find any other credible sources.

This study was approved by the Ethics Committee of the CHUC and by the Ethics Committee of the Faculty of Medicine, University of Coimbra. All participants were informed about the purpose of the study and gave their written informed consent.

Table 1: Demographics of the sample

	N	Mean	Median	SD	Minimum	Maximum
Age	19	41.84	43.00	11.24	25	67
Years of education[a]	19	9.89	9.00	2.92	5	17
Duration of illness (years)[b]	13	16.15	15.00	7.21	6	26
Number of hospitalizations	14	5.57	4.50	4.62	1	16

[a] Formal schooling completed with success

[b] Since first psychotic episode

2.2. Assessment procedures

Each participant was tested on two distinct occasions, separated by a period of 4-8 weeks, to assess temporal stability. Mean value for the time between the test and the retest was 7 weeks (SD = 0.66).

We assembled a B-CATS battery by joining the Portuguese version of each individual test. On both test sessions, the patients received the tests that compose the B-CATS in the following order:

2.2.1. Trail-Making Test Part A: the patients were presented with a sheet with scattered circles containing numbers. The task of each patient was to connect the circles from number to number (1-2-3, etc.) to number 25. The time of task completion constituted the result – the lower the score, the better the cognitive ability of the patient.(18)

2.2.2. Trail-Making Test Part B: the patients were presented with a sheet with scattered circles containing letters or numbers. The task of each patient was to connect the circles from number to letter (1-A-2-B, etc.) to number 13. The time of task completion constituted the result – the lower the score, the better the cognitive ability of the patient.(18)

2.2.3. Digit Symbol Substitution Test: the patients were given a sheet with a key on the top pairing digit 1-9 with a unique symbol, and below with rows of numbers with blank squares beneath. The patients were then asked to draw as many unique symbols beneath their corresponding numbers as possible in 120 s. The number of correctly matched symbols constituted the result – the higher the score, the better the cognitive ability of the patient.(17)

2.2.4. Animal Fluency: the participants were asked to orally list as many different animals as they could in 60 s. The number of different animals listed constituted the result – the higher the score, the better the cognitive ability of the patient.(19)

2.3. Statistical analysis

All analyses were carried out using IBM SPSS Statistics version 26 software for Windows.

We obtained TMT A, TMT B and Animal Fluency adjusted scores (standardized Z scores) for the Portuguese population and respective scaled scores (i.e., mean = 10 and SD = 3) using a program developed by Cavaco et al., available online at http://neuropsi.up.pt/.(18,19) However, this program does not discriminate scaled scores 1 and 2, displaying them as a single category – <3. For the patients who had an adjusted score correspondent to a scaled score minor than 3, we found the corresponding scaled score using the Norm Scale Calculator, available online at https://www.psychometrica.de/normwertrechner_en.html(20) This could only be done with the scores from TMT A and TMT B. For the Animal Fluency test, we deduced the progression in adjusted scores from the table from Cavaco et al.'s paper(19) and made the

best possible approximation to find the corresponding scaled scores. For the DSST, we converted the raw scores into scaled scores consulting the normative tables for the Portuguese population in the Portuguese Wechsler Adult Intelligence Scale III (WAIS-III)(17). To calculate the B-CATS global score, we took the mean of the scaled scores of the four tests.

We began the data processing by determining descriptive statistics (namely for sociodemographic characterization), measures of central tendency and dispersion. The Kolmogorov-Smirnov adjustment test showed that all variables had a distribution close to normal. So, despite the small sample size, we used parametric measurements and tests.(21,22) Thus, to compare the mean scores by sociodemographic and clinical variables, we used Student's t-test for independent groups.

We used scaled scores on test session 1 for comparisons by sociodemographic and clinical variables and for internal consistency analysis.

We analysed the internal consistency using Cronbach's alpha coefficients. To determine the particular contribution of each test to the internal consistency of the dimension, we determined Cronbach's alpha coefficients excluding the respective tests, to then compare them with the global alpha of the battery. To ascertain the discriminatory power or internal validity of each test, we analysed the correlation coefficients between each test and the total (excluding the item).

We calculated the Pearson's correlation coefficient between the scores in the test and in the retest to assess temporal stability. To classify the magnitude of Pearson's correlation coefficients, we followed Cohen's criterion: up to 0.20 – low, approximately 0.30 – moderate, and greater than or equal to 0.50 – high.

3. Results

3.1. Temporal Stability

We obtained a Pearson correlation coefficient between B-CATS global scores in the test and in the retest of 0.84 ($p < 0.001$) (**Table 2**). The mean global scores obtained by the patients in the test and in the retest were 5.61 and 6.79, respectively. The mean scores obtained in the B-CATS and in each of its components and the correlation coefficient between the scores in the test and in the retest are shown in **Table 2**.

Table 2: Scaled scores of B-CATS tests in test sessions 1 and 2

	Test session 1			Test session 2			N	Correlation Coefficient	p
	N	Mean	SD	N	Mean	SD			
TMT A	19	4.26	2.58	17	5.88	3.06	17	0.55	0.02
TMT B	18	3.89	2.61	17	5.12	3.44	16	0.42	0.10
DSST	19	6.89	3.45	17	7.65	3.71	17	0.97	< 0.001
Animal Fluency	19	8.11	3.35	17	8.53	3.86	17	0.83	< 0.001
B-CATS global score	18	5.61	2.39	17	6.79	2.81	16	0.84	< 0.001

3.2. Internal Consistency

The Cronbach's Alpha of the B-CATS battery was 0.83.

The Corrected Item-Total Correlations and Cronbach's Alpha coefficients excluding each test are shown in **Table 3**. The Corrected Item-Total Correlations varied from 0.59 (DSST) to 0.78 (TMT B), and the Cronbach's Alpha coefficients excluding each test varied from 0.74 (TMT B) to 0.83 (DSST).

Table 3: Corrected Item-Total Correlations and Cronbach's Alpha if Item Deleted (n = 18)

Tests	Corrected Item-Total Correlation	Cronbach's Alpha if test excluded
TMT A	0.72	0.78
TMT B	0.78	0.74
DSST	0.59	0.83
Animal Fluency	0.64	0.80

3.3. Differences by demographic and clinical data

We did not find any significant differences in the B-CATS global score by age, years of education, duration of illness or number of hospitalizations. Looking at the individual tests' scores, we found significant differences in performance in DSST by duration of illness – patients with schizophrenia for 15 years or more obtained better scores than those with less than 15 years of illness (7.83 ± 1.94 vs. 4.29 ± 2.81; t = - 2.598, p = 0.025).

There were no meaningful differences between the patients with treatment-resistant schizophrenia and the rest of the patients, in terms of mean B-CATS global scores. However, we found a significant difference in TMT A performances – patients with treatment-resistant schizophrenia obtained better scores than the rest of the patients (6.00 ± 3.35 vs. 3.46 ± 1.76; t = - 2.196, p = 0.042).

The administration time of the B-CATS ranged between 4.23 and 12.53 min.

4. Discussion

The Brief Cognitive Assessment Tool for Schizophrenia is a brief and easily administered pen and paper battery of neurocognitive tests. The administration times in the current study (4.23-12.53 min) were similar to those reported in the original validation study.(16)

The Kolmogorov-Smirnov adjustment test performed showed that all variables and test results presented a distribution close to normal, which allowed us to use parametric tests and is indicative of the almost homogeneous distribution of the sample. This almost homogeneous distribution in terms of variables and results supports the quality of our sample, despite its small size, and, consequently, the reliability of the results of this study.

The B-CATS showed a high degree of internal consistency, evinced by the high value of the Cronbach's Alpha. This value can be considered "very good",(23) which points towards the uniformity and coherence between the subjects' responses to each of the tests. Looking at the Corrected Item-Total Correlations, we verify that all the tests composing the B-CATS fulfill the most demanding criterion, with coefficients > 0.30,(23) and even that all have high correlations (> 0.50)(24) with the total corrected. These high correlations presented by every test with the total corrected demonstrate the elevated discriminatory power or internal validity of each test, that is, the degree to which the test differentiates in the same way as the global test.(25) At last, we can see that none of the Cronbach's Alpha coefficients excluding each test is higher than the global alpha of the battery. This attests that all the tests composing the B-CATS contribute to the internal consistency, which means that if any of them was removed from the battery, the global alpha would decrease.

The high Pearson correlation coefficient obtained between B-CATS global scores in the test and in the retest, according to Cohen's criterion, indicates a good test-retest reliability of the B-CATS, which means that the B-CATS scores seem to be stable over time. All the B-CATS tests also presented a good temporal stability, except for the TMT B. For this particular test, there was no significant correlation between the test and the retest. We hypothesize that the small size of the sample, being even smaller precisely for the analysis of temporal stability of the TMT B, caused variations in each individual result to have greater impact on the means, therefore causing this instability. However, our main goal was to assess the temporal stability of the B-CATS battery as a whole, which we found to be very good.

The results from the internal consistency and temporal stability analysis of the B-CATS scores are consistent with those obtained by Hurford et al. in the original B-CATS validation study.(16)

One limitation of our study was the absence of a healthy control group. The severity of global cognitive impairment in the patients in our study was determined by comparing their performance to that of healthy individuals of the Portuguese population in the B-CATS tests, whose normative data were already published. The magnitude of the generalized deficit was between 1 and 1.5 SD when compared to the normal population, which is consistent with estimates from several studies.(4,5,12)

Our study showed no significant differences in the B-CATS global score by age, years of education, duration of illness or number of hospitalizations. There were also no meaningful differences between patients with treatment-resistant schizophrenia and the rest of the patients, in terms of B-CATS global scores. However, we found a difference in DSST performances related to the duration of illness, as patients with a longer duration of illness obtained better scores in the DSST. We also found that patients with treatment-resistant schizophrenia performed better in the TMT A than the rest of the patients.

These two relations seem to contradict what we know about the illness, although we can partially explain them. The patients with treatment-resistant schizophrenia recruited integrate a specialized treatment unit, where they receive structured cognitive training and rehabilitation from a multidisciplinary team. The structured cognitive training and rehabilitation these patients undergo could explain, to some extent, why they had better performances in one of the tests.

Regarding the patients with longer duration of illness obtaining better scores in the DSST, we propose several possible explanations. A considerable proportion of the patients with longer duration of illness were recruited either from the treatment-resistant schizophrenia unit or from a Forensic Psychiatry unit. In both of these units, patients undergo generally long hospitalization periods, during which the compliance with therapeutic regimens is warranted, thus leading to the stabilization of the patients. In these controlled environments, with patients taking the same medication for long periods of time, we can imply that the patients have less relapses, which are a known cause of cognitive deterioration *per se*. In addition, hospitalization in any of these units brings another protective factor on cognition: we have already addressed the advantages of the cognitive stimulation patients receive in the treatment-resistant unit, but patients from the Forensic Psychiatry unit, although in an unstructured manner, also get some kind of cognitive stimuli from the staff.

The different therapeutic regimens of the patients, which were heterogeneous, along with the clinical instability of some patients, could also induce differences in their cognitive performances, regardless of the duration of illness. The therapeutic regimens were not controlled for and clinically unstable patients were not excluded from the study because the B-CATS is a tool developed for the use in the everyday clinical setting, where clinicians can encounter patients with a wide range of clinical presentations and therapeutic regimens.

Finally, we can hypothesize that the patients with longer duration of illness were also those who possessed greater premorbid cognitive reserve. Even if the decay of their cognitive abilities was proportionally bigger when compared to that of patients with a shorter duration of illness but worst premorbid cognitive reserve, their absolute scores would still be better. In fact, looking at the patients with longer duration of illness, we could verify that most of them also detained the highest degrees of education amongst the entire sample, which supports this hypothesis.

Although a meta-analysis by Heinrichs and Zakzanis could not find enough evidence to strongly support the association between chronicity of illness or frequent hospitalization and neurocognitive deficit,(26) large clinical trials showed significative relations between a neurocognitive composite score and the demographic and clinical characteristics analysed. For instance, the Clinical Antipsychotic Trials of Intervention Effectiveness (CATIE) schizophrenia trial revealed that the overall cognition, as measured by the composite score, correlated positively with the years of education, and negatively with the age and the duration of illness of the participants.(27) The co-norming and standardization study of the MCCB showed that younger patients, when compared to elderly ones, and patients with a higher degree of education, when compared to those less educated obtained a better overall composite score.(28) It is important to note, however, and without prejudice for the quality of our sample, that both of these studies used samples significantly larger than ours, thus having greater representativity and external validity. Future studies with the B-CATS using larger sample sizes could replicate the relations found in the mentioned studies in different populations, like the Portuguese.

The sample used in this study did not include any patients from the feminine sex. This bias in sample selection was only due to limitations in the access to the facilities imposed by the pandemic context. However, the evidence on sex differences in neuropsychological test performances in patients with schizophrenia shows conflicting results,(29) for what it would be interesting to verify in further studies if any differences would be seen with the B-CATS.

One limitation of the B-CATS is that it does not assess cognitive impairment at the domain level, rather giving clinicians a measure of the global deficit of the patient. However, several large studies have suggested that a single dimension of cognitive performance is the preferred way to resume cognitive impairment in schizophrenia.(27,30) In addition, obtaining global measures of cognition has functional significance as well, since the relations with functional outcome seem to be larger when considering these measures instead of specific neurocognitive constructs.(6) Although the standard for assessment of cognitive impairment in schizophrenia remains the administration of a complete neurocognitive battery like the MCCB

and its interpretation by a neuropsychologist, a brief battery like the B-CATS can give clinicians a fast estimate of patients global cognitive impairment, largely related with their functioning.

Another potential limitation to the use of the B-CATS in Portuguese patients is the absence of normative scores for the battery as a whole. Currently, B-CATS users must convert the raw scores from each of the already translated tests that compose it into adjusted scores for the Portuguese population, consulting normative tables for the individual tests. Then, the B-CATS global score is given by the mean of the four adjusted scores. To address a similar inconvenient, Hurford et al. are developing a website where a normed score could be generated by entering the patient's age, sex and B-CATS score.(16) In the future, the development of such work for the Portuguese population could bridge these limitations and contribute to a more practical interpretation of results.

The lack of the letter "K" from the TMT B sheet caused an impairment on the score of the first patient we assessed, so we decided to exclude his result in this particular test from our analyses. The lack of the letter "K" from the test sheet can be explained by the fact that only recently letters "K", "W" and "Y" entered the Portuguese alphabet. For most of the twentieth century, these letters were not part of the alphabet taught in Portuguese schools, although the current teaching includes this set of letters, and foreign words integrating them are now a part of current speech. However, the TMT B test sheet does not yet include the letter "K", which may lead to confusion, especially among younger patients. We addressed this problem by asking the patients, prior to the evaluation with the TMT B, which version of the alphabet had they learned – with or without the letter "K". Then, we pointed out to those who had learned the alphabet with the "K" that it was not in the sheet, so they should look up for the next letter in the alphabet instead. This explanation, however, was sometimes difficult to assimilate for some patients, and it is possible that their performance would still be biased. For the proper assessment of these patients, it is important that an updated version of the TMT B including the "K" is designed and validated, in order to ensure a bigger reliability of the results.

5. Conclusion

As far as we know, it was the first time the B-CATS was assembled in Portugal, by joining the Portuguese versions of the tests composing it. Our exploratory study on the psychometric properties of the battery performed in a sample of Portuguese patients with the diagnosis of schizophrenia showed a good internal consistency and temporal stability. The B-CATS demonstrated to be an easy-to-use tool to obtain a fast and reliable estimate of patients' global cognitive impairment, largely related with their functioning, without the need of specialized training. Further research, using larger samples, ought to continue the validation process of the B-CATS in Portuguese patients. We hope that, in the near future, the B-CATS will give clinicians a more realistic understanding of their patients' cognitive impairment, so that more patients with schizophrenia in Portugal can receive a treatment that is suited to their needs.

References

1. Braz Saraiva C, Cerejeira J. Psiquiatria Fundamental. 1ª Edição. Lisboa: Lidel; 2014.
2. Green MF, Nuechterlein KH, Gold JM, Barch DM, Cohen J, Essock S, et al. Approaching a consensus cognitive battery for clinical trials in schizophrenia: The NIMH-MATRICS conference to select cognitive domains and test criteria. Biol Psychiatry. 2004;56(5):301–7.
3. Harrison P, Cowen P, Burns T, Fazel M. Shorter Oxford Textbook of Psychiatry. 7th ed. Oxford University Press; 2017.
4. Bilder RM, Goldman RS, Robinson D, Reiter G, Bell L, Bates JA, et al. Neuropsychology of first-episode schizophrenia: Initial characterization and clinical correlates. Am J Psychiatry. 2000;157(4):549–59.
5. Sharma T, Antonova L. Cognitive function in schizophrenia deficits, functional consequences, and future treatment. Psychiatr Clin North Am. 2003;26(1):25–40.
6. Green MF, Kern RS, Braff DL, Mintz J. Neurocognitive deficits and functional outcome in schizophrenia: Are we measuring the “right stuff”? Schizophr Bull. 2000;26(1):119–36.
7. Krupnick JL. A Meta-Analysis of Cognitive Remediation for Schizophrenia: Methodology and Effect Sizes. Yearb Psychiatry Appl Ment Heal. 2012;2012(May):75–6.
8. Vieira J. Reabilitação Cognitiva na Esquizofrenia [Cognitive Remediation in Schizophrenia]. PsiLogos. 2013;11(2):22–42.
9. Moritz S, Ferahli S, Naber D. Memory and attention performance in psychiatric patients: Lack of correspondence between clinician-rated and patient-rated functioning with neuropsychological test results. J Int Neuropsychol Soc. 2004;10(4):623–33.
10. Nuechterlein KH, Green MF, Kern RS, Baade LE, Barch DM, Cohen JD, et al. The MATRICS consensus cognitive battery, part 1: Test selection, reliability, and validity. Am J Psychiatry. 2008;165(2):203–13.
11. Nuechterlein KH, Barch DM, Gold JM, Goldberg TE, Green MF, Heaton RK. Identification of separable cognitive factors in schizophrenia. Schizophr Res. 2004;72(1):29–39.
12. Keefe RSE, Goldberg TE, Harvey PD, Gold JM, Poe MP, Coughenour L. The Brief Assessment of Cognition in Schizophrenia: Reliability, sensitivity, and comparison with

a standard neurocognitive battery. Schizophr Res. 2004;68(2–3):283–97.

13. Gold JM, Queern C, Iannone VN, Buchanan RW. Repeatable Battery for the Assessment of Neuropsychological Status as a Screening Test in Schizophrenia, I: Sensitivity, Reliability, and Validity. Am J Psychiatry. 1999;156(12):1944–50.

14. Hobart MP, Goldberg R, Bartko JJ, Gold JM. Repeatable battery for the assessment of neuropsychological status as a screening test in schizophrenia, II: Convergent/discriminant validity and diagnostic group comparisons. Am J Psychiatry. 1999;156(12):1951–7.

15. Hurford IM, Marder SR, Keefe RSE, Reise SP, Bilder RM. A brief cognitive assessment tool for schizophrenia: Construction of a tool for clinicians. Schizophr Bull. 2011;37(3):538–45.

16. Hurford IM, Ventura J, Marder SR, Reise SP, Bilder RM. A 10-minute measure of global cognition: Validation of the Brief Cognitive Assessment Tool for Schizophrenia (B-CATS). Schizophr Res [Internet]. 2018;195:327–33. Available from: https://doi.org/10.1016/j.schres.2017.08.033

17. Wechsler D. WAIS-III: Escala de Inteligência de Wechlser para Adultos–3ª edição: Manual. Lisboa: Cegoc; 2008.

18. Cavaco S, Gonçalves A, Pinto C, Almeida E, Gomes F, Moreira I, et al. Trail making test: Regression-based norms for the portuguese population. Arch Clin Neuropsychol. 2013;28(2):189–98.

19. Cavaco S, Gonçalves A, Pinto C, Almeida E, Gomes F, Moreira I, et al. Semantic fluency and phonemic fluency: Regression-based norms for the portuguese population. Arch Clin Neuropsychol. 2013;28(3):262–71.

20. Lenhard, W. Lenhard A. Norm Scale Calculator [Internet]. Bibergau (Germany): Psychometrica. 2014 [cited 2021 Mar 26]. Available from: https://www.psychometrica.de/normwertrechner_en.html

21. Marôco J. Análise de Equações Estruturais: Fundamentos teóricos, Software & Aplicações [Internet]. 2nd ed. ReportNumber Lda; 2014. 400 p. Available from: http://www.reportnumber.pt/aee/

22. Field A. Discovering Statistics using IBM SPSS Statistics. 4th ed. Sage Publications Ltd.; 2013. 952 p.

23. Kline P. The Handbook of Psychological Testing. Psychology Press; 2000. 744 p.

24. Cohen J. Statistical Power Analysis for the Behavioral Sciences. 2nd ed. Hillsdale, N.J. : L. Erlbaum Associates; 1988.

25. Almeida L, Freire T. A investigação em psicologia e educação. In: Metodologia da investigação em psicologia e educação. 3rd ed. Braga: Psiquilíbrios; 2003. p. 18–34.

26. Heinrichs RW, Zakzanis KK. Neurocognitive deficit in schizophrenia: A quantitative review of the evidence. Neuropsychology. 1998;12(3):426–45.

27. Keefe RSE, Bilder RM, Harvey PD, Davis SM, Palmer BW, Gold JM, et al. Baseline neurocognitive deficits in the CATIE schizophrenia trial. Neuropsychopharmacology. 2006;31(9):2033–46.

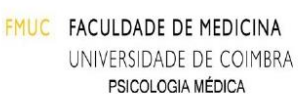
28. Kern RS, Nuechterlein KH, Green MF, Baade LE, Fenton WS, Gold JM, et al. The MATRICS Consensus Cognitive Battery, Part 2: Co-Norming and Standardization. Am J Psychiatry [Internet]. 2008 Feb;165(2):214–20. Available from: http://psychiatryonline.org/doi/abs/10.1176/appi.ajp.2007.07010043

29. Canuso CM, Pandina G. Gender and schizophrenia. Psychopharmacol Bull. 2007;40(4):178–90.

30. Dickinson D, Ragland JD, Gold JM, Gur RC. General and Specific Cognitive Deficits in Schizophrenia: Goliath Defeats David? Biol Psychiatry. 2008;64(9):823–7.

Annex

I: Informed Consent



Exmo. Senhor,

Convidamo-lo a participar num estudo sobre alterações neurocognitivas na Esquizofrenia. A sua participação envolve a resposta a um conjunto de perguntas e de testes que lhe serão colocados. Será garantida completa confidencialidade quanto à informação recolhida.

A sua participação implica o seu consentimento informado para a utilização destes dados para fins de investigação.

A participação é voluntária e tem toda a liberdade de recusar ou de a abandonar. Se estiver interessado em participar, pedimos que responda a todas as questões e responda segundo as instruções que lhe forem dadas. Não há respostas certas ou erradas. O que interessa é que cada um responda como de facto se aplica a si. As suas respostas não serão analisadas individualmente.

Desde já agradecemos a sua colaboração,

Os Investigadoras Responsáveis,
João Geraldes Freire
Dr. David Gomes Mota
Doutora Ana Telma Pereira

Caso tenha alguma dúvida sobre o estudo pode contactar-me.
E-mail: jojogf.uno@gmail.com
Telemóvel: +351910708913 (João Geraldes Freire)

☐ Declaro que li e aceito participar no estudo sobre alterações neurocognitivas na Esquizofrenia

II: Sociodemographic questionnaire

Por favor responda às seguintes questões. Pedimos que seja o mais honesto possível nas suas respostas.

Relembramos que o questionário é anónimo e confidencial.

1. Qual é a sua idade?

_____

2. Qual é o seu sexo?

Masculino

Feminino

3. Qual o último ano de escolaridade que completou?

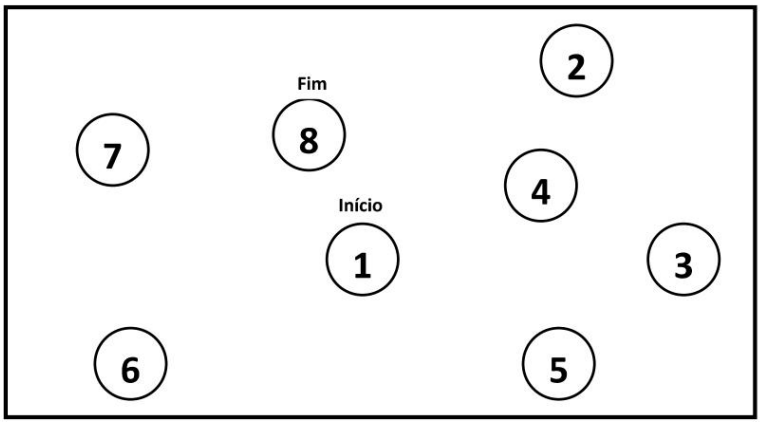
_____

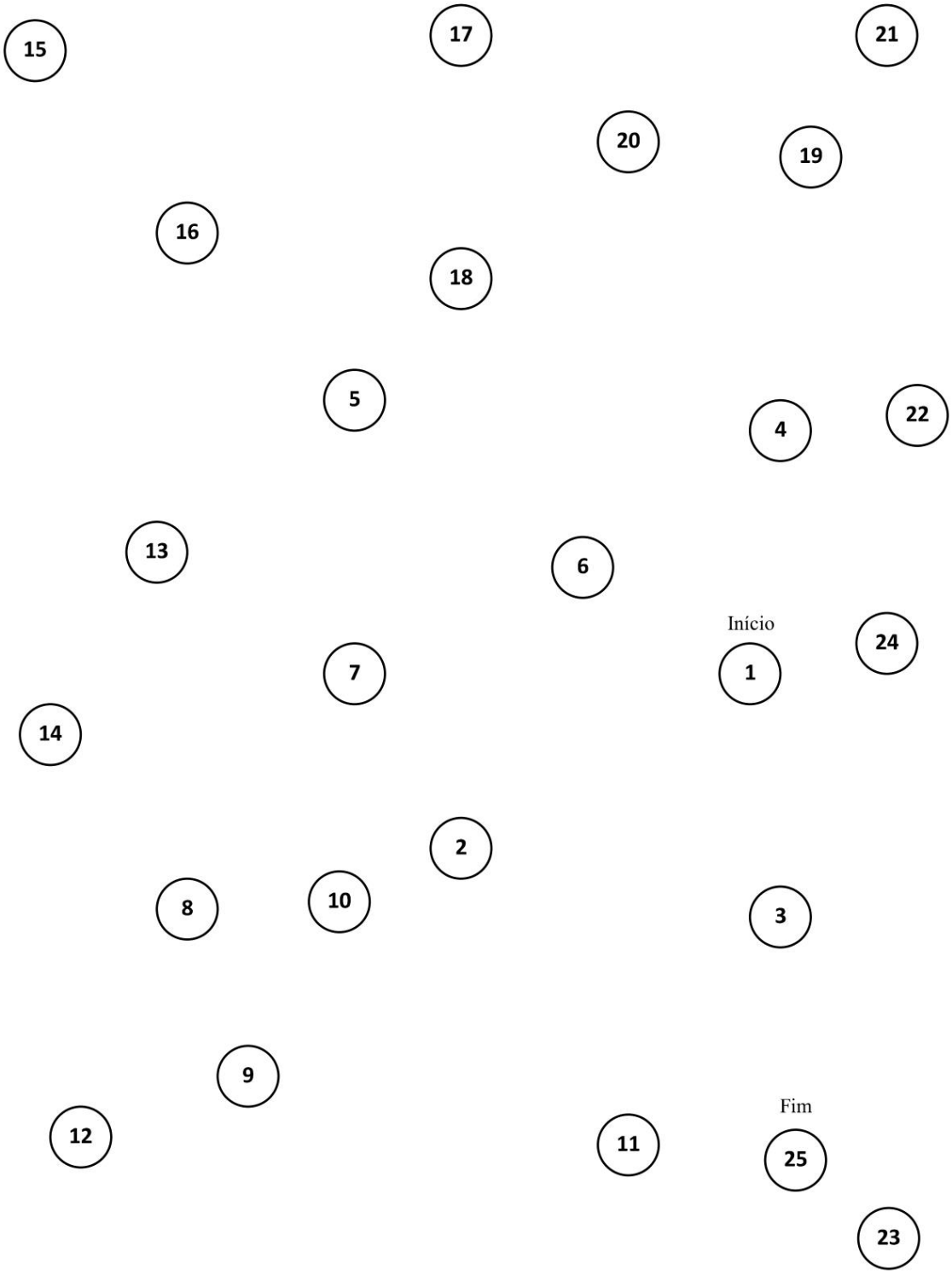
III: B-CATS test sheets

Trail-Making Test Part A

Trail Making Test - Parte A

Exemplo:

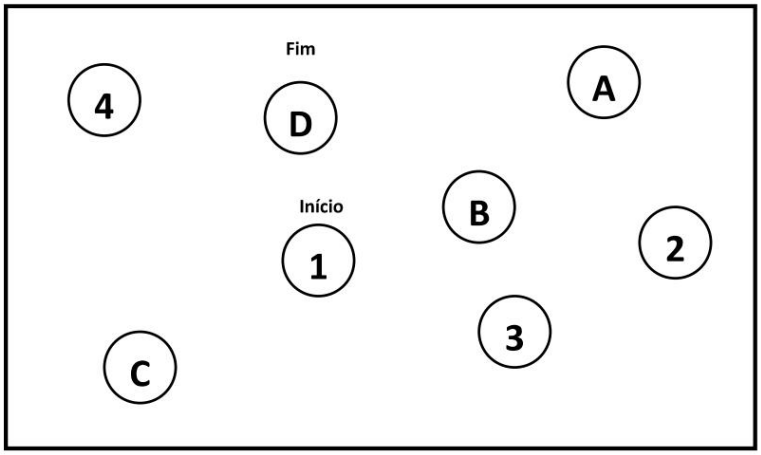


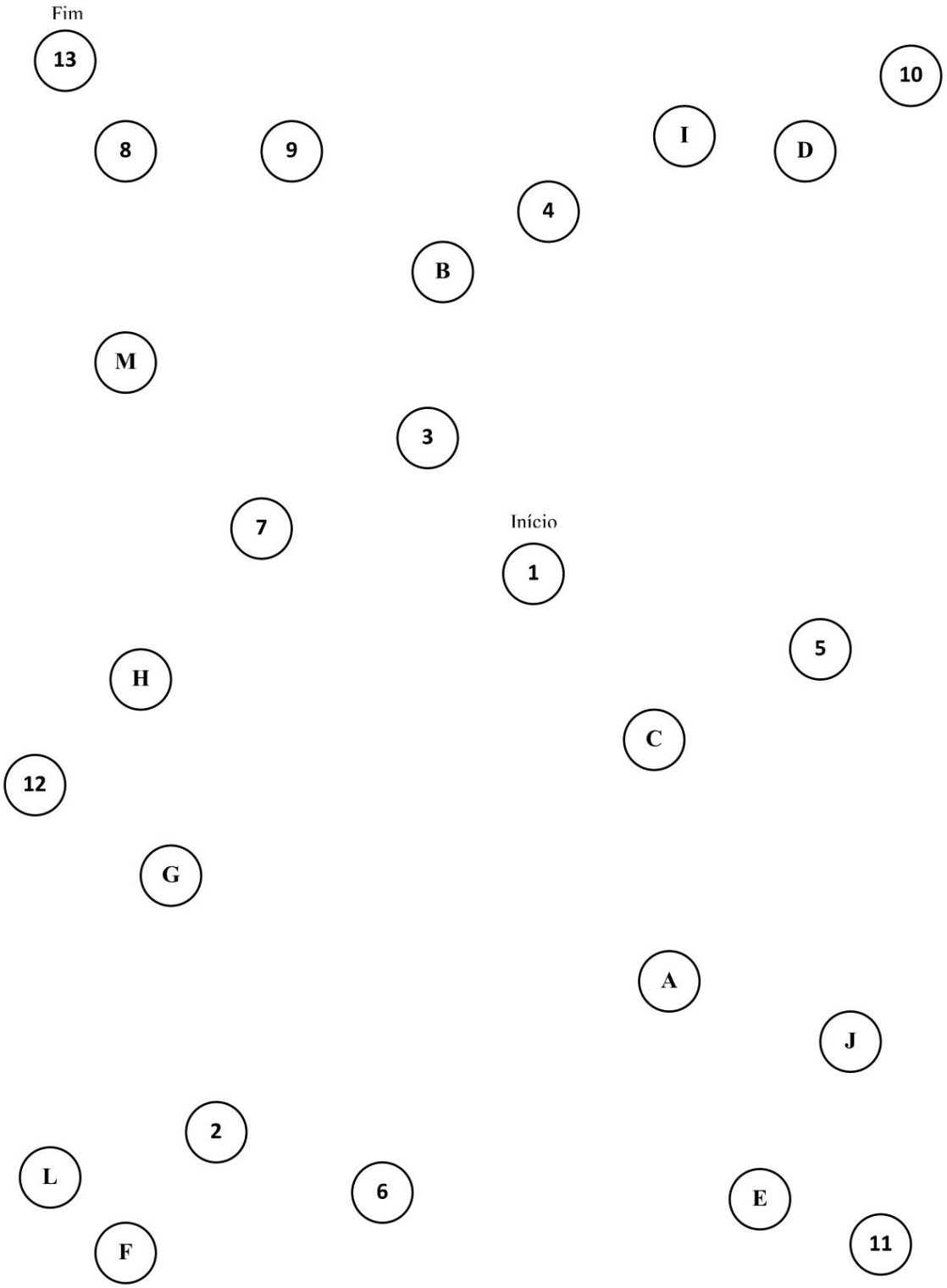

15
17
21
20
19
16
18
5
4
22
13
6
Início
24
7
1
14
2
8
10
3
9
Fim
12
11
25
23

Trail-Making Test Part B

Trail Making Test - Parte B

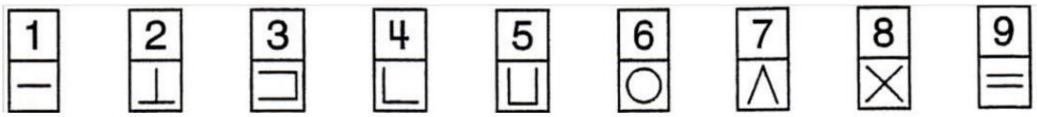
Exemplo:




Fim
13
10
I
8
9
D
4
B
M
3
7
Início
1
5
H
C
12
G
A
J
2
L
6
E
F
11

Digit Symbol Substitution Test

Código - Codificação



2	1	3	7	2	4	8	2	1	3	2	1	4	2	3	5	2	3	1	4

5	6	3	1	4	1	5	4	2	7	6	3	5	7	2	8	5	4	6	3

7	2	8	1	9	5	8	4	7	3	6	2	5	1	9	2	8	3	7	4

6	5	9	4	8	3	7	2	6	1	5	4	6	3	7	9	2	8	1	7

9	4	6	8	5	9	7	1	8	5	2	9	4	8	6	3	7	9	8	6

2	7	3	6	5	1	9	8	4	5	7	3	1	4	8	7	9	1	4	5

7	1	8	2	9	3	6	7	2	8	5	2	3	1	4	8	4	2	7	6

Animal Fluency

Fluência Verbal

Animais

1_____	8_____	15_____	22_____
2_____	9_____	16_____	23_____
3_____	10_____	17_____	24_____
4_____	11_____	18_____	25_____
5_____	12_____	19_____	26_____
6_____	13_____	20_____	27_____
7_____	14_____	21_____	28_____