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INECO Frontal Screening: an Instrument to assess Executive Dysfunction in Schizophrenia

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Abstract. Although several brief sensitive screening tools are available to detect executive dysfunction, few have been developed to quickly assess executive functioning. The INECO Frontal Screening (IFS) is a brief tool which has proved be useful for the assessment of the executive functions in patients with dementia. The aim of this study was to explore whether the IFS is as sensitive and specific as the BADS, a battery designed to assess the dysexecutive syndrome, in schizophrenia. Our sample comprised a group of 34 schizophrenic patients (*Mean age* = 39.59, *DP* = 10.697) and 31 healthy controls (*Mean age* = 35.52, *DP* = 10.211). To all groups were administered the BADS, Wisconsin Card Sorting Test and IFS. The results suggest that schizophrenic patients performed significantly worse than the control group in all tests ($p < .05$). The IFS total score was 13.29 for the experimental group and 26.21 for the control group ($p < .001$). Considering a cut-off of 14 points, the IFS sensitivity was 100% and specificity 56% in detection of executive dysfunction in schizophrenia, compared with the BADS, that if we consider a cut-off of 11 points, was a sensitivity of 100% and a specificity of 50%. Thus, IFS is a brief, sensitive and specific tool for the detection of executive dysfunction in schizophrenia.

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Within the scope of study of schizophrenia, cognitive dysfunction has received the main focus of attention in many recent investigations, being associated with a wide range of deficits, including impairment of memory, attention, executive functioning and general intellectual functioning (Goldberg, David, & Gold, 2003).

The impairment of executive functions is one of the more important and central deficits that is associated with schizophrenia (Carter et al., 2011; Goldman-Rakic, 1994; Kerns, Nuechterlein, Braver, & Barch, 2008; Liddle & Morris, 1991; Reeder, Newton, Frangou, & Wykes, 2004), occurring not only in the chronic stage of the disease, but also in the first episode (Chan, Chen, & Law, 2006), in the prodromic stage (Cornblatt, Lenzenweger, Dworkin, & Erlenmeyer-Kimling, 1992; Davidson et al., 1999), and in direct descendants (Snitz, Macdonald, & Carter, 2006; Szöke et al., 2005).

On the other hand, a large research body has identified a strong association between executive deficits and structural and functional cerebral deficits, by which the executive processes, although strongly dependant on the frontal cortex (Eisenberg & Berman, 2010), also require the cooperation of external structures of the frontal lobes, namely the inferior parietal lobe (Jansma, Ramsey, van der Wee, & Kahn, 2004; Jonides et al., 1998), medial / hippocampus temporal lobe (Graham et al., 2009), basal ganglia (Eslinger & Grattan, 1993) and thalamus (Tanibuchi & Goldman-Rakic, 2003).

The impairment of executive functions can further cause an impact on functional results in patients with schizophrenia, which can have a variety of effects on the daily life activities of these patients, including the capability to work or go to school, responsibilities at home or engaging in appropriate social relationships (Freedman & Brown, 2011; Kerns et al., 2008). Additionally, Green, Kern, and Heaton (2004) discovered that the executive function deficits found in patients with schizophrenia determined the poor functional results with regards to living in the community, self-care activities, social problem solving capabilities and psychosocial competences.

In this manner, if we try to understand the nature of the difficulties inherent to executive dysfunction, they can be reasonably understood as being a failure at the level of Norman & Shallice's SAS model (1986), also creating the basis for the main characteristics of *dysexecutive syndrome*, a term proposed by Baddeley (1986), characterized as a more functional cognitive deficit associated with frontal lobe syndrome. SAS is interpreted as being necessary for the effective control of an action in a number of situations: situations requiring planning or decision making; situations which involve the correction of errors or problem solving, situations in which the replies are not well perceived or contain new sequences of actions; situations deemed dangerous

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or technically difficult and, finally, situations which demand overcoming a strong usual response. Various tests have been planned based on the SAS model and have been designed specifically for the acquisition of different SAS components, namely the Six Element Test, first described by Shallice and Burgess (1991), later incorporated into BADS (Wilson, Alderman, Burgess, Emslie, & Evans, 1996), and also the Hayling Test (Burgess & Shallice, 1996), incorporated into INECO Frontal Screening.

Nonetheless, the neuropsychological study of executive dysfunction and its corresponding rehabilitation, however, face inherent difficulties. One of them is the precise and valid evaluation of executive functions. Executive functions are developed to understand a variety of competences in order to achieve a goal (Damasio, 1995; Shallice, 1988; Stuss et al., 2005; Stuss & Benson, 1986). Therefore, a failure in tests which assess executive functions may be due to many reasons, such as damage in any process of its components is difficult to be completely overlooked after the emergence of cerebral lesions or psychopathologies. Furthermore, the neuropsychological evaluation devices which have been used for this purpose are of an excessively artificial and structured nature and thus, few are those that have been developed to assess executive functions quickly, not reflecting conveniently the demands of real life, where dysfunctions are felt (Barbosa & Monteiro, 2008).

To this end new instruments have emerged that combine a solid theoretical foundation with adequate psychometric and ecologic al validity. The Behavioral Assessment of the Dysexecutive Syndrome (BADS) is one of the instruments that systematically use everyday tasks as a way to assess executive functions (Wilson et al., 1996). This battery was developed in response to the need for more sensitive, valid and reliable neuropsychological instruments in this area, while at the same time, trying to overcome the deficiencies associated with conventional tests. Despite its relatively recent development, according to several researchers (Crawford, 1998; Groth-Marnat, 2000; Norris & Tate, 2000; Wilson, Evans, Emslie, Alderman, & Burgess, 1998), this battery shows a promising potential for responding to the aforementioned needs.

This battery has also been applied to the research of executive functioning in schizophrenia. The research of Evans, Chua, McKennna, and Wilson (1997) and Krabbendam, Vugt, Derix, and Jolles (1999) showed that BADS is an essential contributor in the identification of executive deficits in people diagnosed with schizophrenia, especially in those with their general intellectual capability intact. Nonetheless, it is as extensive exam that requires time to be applied, expensive equipment or highly trained professionals to apply it. On the other hand, instruments designed specifically to quickly assess executive functions are few. Thus, a screening tool that is easy to use denotes high sensitivity, specificity and predictive value would be of great importance to practitioners. Various instruments of cognitive screening have desirable diagnostic and statistical properties (Keefe et al., 2004), but few were developed to specifically assess executive functioning. As proof of the intrinsic difficulties that arise with the development of such tools, various screening batteries that have tried to measure executive dysfunction do not show reasonable psychometric characteristics. For example, Rothlind and Brandt (1993) proposed a brief cognitive screening test for the identification of frontal-subcortical dysfunction, however, patients with AD showed worse results in this test than patients with frontal dysfunction, demonstrating the low specificity of the tool. Royall, Mahurin and Gray (1992) developed an interview for executive functioning by reflecting on a problem, however, it also revealed itself to be sensitive to non-executive dysfunction. Ettlin and Kischka (1999) developed the Frontal Lobe Index, but application of this tool requires at least 40 minutes. Nonetheless, this difficulty is not unilateral, in other words, a solely psychometric problem, but also an executive functioning construct which is multifaceted, complex and dynamic. Thus, even though efforts have been made to measure executive functions, their complexity constitutes an enormous challenge (Miyake et al., 2000).

Given the above mentioned difficulties and based on previous research relating to executive testing (Clark, Manes, Antoun, Sahakian, & Robbins, 2003; Clark & Manes 2004; Manes et al., 2002; Torralva et al., 2007), a tool has recently been developed at the Institute of Cognitive Neurology (INECO) in Buenos Aires, which aims at diagnosing executive dysfunction in a quick and specific manner: the INECO Frontal Screening (IFS; Torralva, Roca, Gleichgerrcht, López, & Manes, 2009). The authors of this study designed this screening test in order to make available to health care providers a sensitive and specific test, for early diagnosis of frontal dysfunction in dementia patients. To achieve this, they applied IFS to patients with Alzheimer's Disease (AD) and Frontotemporal Dementia (FTD). The results showed that patients with FTD presented more serious executive dysfunction, represented by their lower score in the general IFS, in comparison with patients with AD. In this manner, the study of Torralva et al. (2009) showed that IFS is a quick, sensitive and specific tool for the diagnosis of executive dysfunction associated with neurodegenerative diseases.

In this manner, the aim of the present study is to verify if the INECO Frontal Screening, test which quickly assesses executive functions, is as sensitive

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and specific as BADS, a battery for assessment of dysexecutive syndrome with high ecological validity, for detecting executive dysfunction in schizophrenia.

Method

Participants

65 Individuals participated in this research, in which the experimental group consisted of 34 patients with schizophrenia, mainly males (70.6%), with ages ranging between 22 and 62 years (M = 39.59, DP = 10.697). Data collection was obtained from the Alto Ave Hospital Center, E.P.E., in Guimarães, whose board and ethics committee consented to this research being carried out. Candidate selection was carried out based on inclusion and exclusion criteria for the sample, having included candidates with confirmed diagnosis of Schizophrenia, according to the criteria established in the DSM-IV-TR, and excluding all uncompensated candidates from a psychopathological point of view at the time of data collection, with dual diagnosis, with organic cerebral lesions, who presented a severe level of cognitive deterioration or even mental deficiency, who were illiterate, due to the nature of the proposed tasks, and that presented a current or recent history of substance abuse.

On the other hand, the control group consisted in 31 individuals, mainly males (61.3%), with ages ranging between 20 and 55 years (M = 35.52, DP = 10.211). This group was recruited in the Vale do Sousa residential area, in order to guarantee the best possible adjustment of the samples with regards to school qualifications (obligatory education or less), or socioeconomic background (lower or lower-middle class). All participants were informed of the nature and aims of the study and participation in all neuropsychological tests was voluntary.

The two groups do not differ significantly with regards to gender $t(63) = -.783$, $p = .437$, age $t(63) = 1.566$, $p = .122$, or level of education $t(63) = -.856$, $p = .395$.

Materials

In order to assess the executive functioning of the participants, neuropsychological tests deemed pertinent to completing the objectives of the study were applied: BADS, WCST and INECO Frontal Screening.

Behavioral Assessment of the Dysexecutive Syndrome

Consists of six tasks. For each task a reference score is obtained (maximum of 4 and minimum of 0). The *Rule Shift Card* test assesses the capability of changing an established response pattern using familiar items. The *Action Program* assesses the capability of solving practical problems. *Key Search* is a test to assess the capability to plan a strategy. The *Temporal Judgment Test* includes four questions that assess the capability to foresee or estimate how long it takes, in average, to complete various tasks, events or daily activities. The *Zoo Map Test* assesses the planning of actions. And lastly, the *Modified Six Elements Test* is a test of a planning, temporal organization of tasks and self-assessment of success test (Wilson et al., 1996).

Wisconsin Card Sorting Test

Consists in matching 128 answer cards with four stimulus cards. While carrying out the task, the participants try to lay out the cards according to a criterion which is unknown to them and should be inferred by means of feedback from the test administrator. The total number of errors, perseverative and non-perseverative errors and the number of complete categories was considered for the purpose of score. This test assesses capabilities for planning, organized research, orientated behavior and the adequate use of feedback to change strategies and modulate an impulsive response (Strauss, Sherman, & Spreen, 2006).

INECO Frontal Screening

Is a brief, sensitive and specific neuropsychological exam to detect executive dysfunction in neurodegenerative pathologies, developed by Torralva et al. (2009) and adapted for the Portuguese population by Caldeira (2011). The exam consists of eight sub-tests. In the *Motor Programming* subtest the subject should perform the Luria series "fist, edge, palm" by initially copying the administrator, and by subsequently doing the series on his or her own then by repeating the series six times alone. In the *Conflicting Instructions (Sensitivity to Interference)* subtest, the subjects are asked to hit the table once when the administrator hits it twice, or to hit the table twice when the administrator hits it only once. In the *Go–No Go* subtest, the subjects are told that when the test administrator hits the table once, they should hit it once as well, but when the examiner hits twice, they should do nothing. In the *Backward Digit Span* subtest, the subjects are invited to repeat string of digits in the reverse order. In turn, in the *Verbal Working Memory* subtest, the subjects are asked to list the months of the year backward, starting with December. In the *Spatial Working Memory* subtest, the administrator presents the subject with four cubes and points at them in a given sequence, which the patient should repeat in reverse order. In the *Abstraction Capacity - Proverb Interpretation* subtest, three proverbs are read to the subjects who are then invited to explain their meaning. The *Verbal Inhibitory Control* subtest is inspired in the Hayling Test, which measures the capacity of the subject to inhibit an expected response (Torralva et al., 2009).

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The *Mini Mental State Examination* (MMSE; Folstein, Folstein, & McHugh, 1975)

It was also applied as a control method, in the sense of excluding all individuals who presented a score lower than 22 points (cognitive deficit cut-off score for the Portuguese population with 1 to 11 years of education).

Procedures

The neuropsychological assessment was made in the Psychiatric and Mental Health Department of the Alto Ave Hospital Center, in Guimarães. The hospital's ethics committee issued a favorable report for completion of the study and the informed consent was obtained from all individuals that taking part in the study. Before the executive functioning evaluation, all participants were submitted to a MMSE, with the aim of determining the existence of more sever neurocognitive disorders. Consecutively, the previously mentioned neuropsychological tests were applied, such as BADS, WCST and IFS, with the aim of obtaining the results of the executive functioning evaluation. The instruments used in this study were applied transversely, with a duration that varied between one or two sessions, each lasting an hour, depending on the performance of the individual and also to avoid possible effects of fatigue. All participants completed the proposed assessment.

Analysis and Data Processing

The statistical analysis was performed using the statistical analysis program SPSS – *Statistical Package for the Social Sciences,* version 19.0. Univariate descriptive analysis procedures were employed, specifically central tendency and dispersion measures (median and standard deviation) and frequency distribution. Subsequently, a bivariate descriptive analysis using *Student's t-test* for independent samples was applied. Differences with $p < .05$ were considered as significant. The ability of the IFS to assessment executive functions in comparison to BADS was determined using a receiver operating characteristic (ROC) curve analysis.

Results

Description of the executive functioning of the Experimental and Control Group

The results obtained by the two groups in the BADS, regarding to total score obtained, demonstrate that the schizophrenia group obtained results which were clearly lower ($M = 10.65$, $DP = 3.074$) in comparison with the control group ($M = 20.55$, $DP = 1.786$), being the difference highly significant, $t(54) = -16.046$, $p < .001$, 95% CI [–11.163, –5.664] (see Figure 1). Also, the time it took to complete the battery revealed a statistically significant difference, $t(52) = 9.019$, $p < .001$, 95% CI

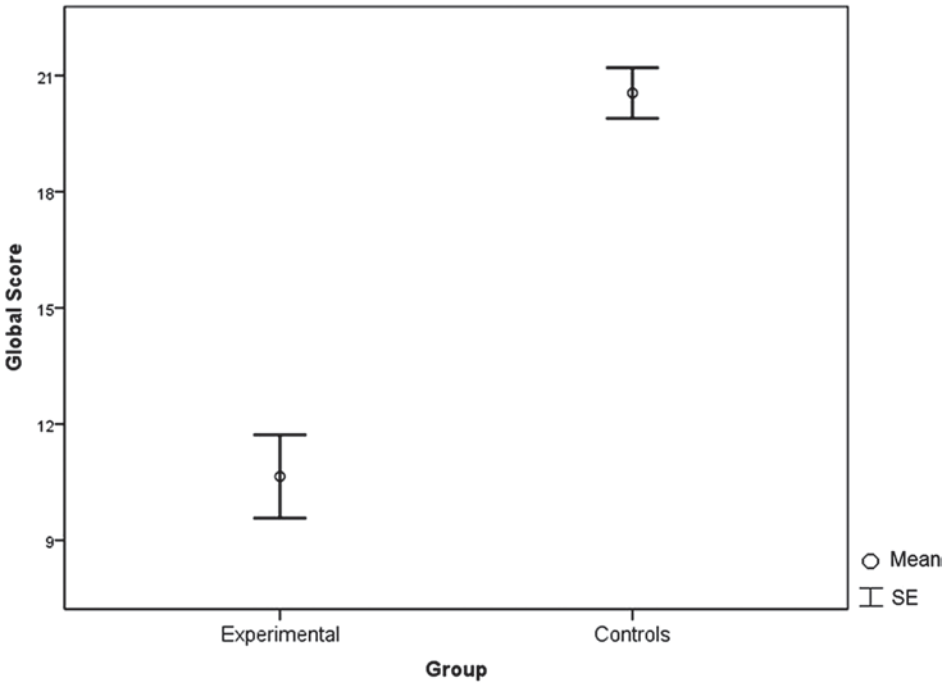

Figure 1. Averages and standard error of the total score obtained by the Experimental and Control Groups in BADS completion.

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[135.182, 212.534], in favor of the control group (M = 183.61, DP = 53.889) which demonstrated itself quicker in comparison with the experimental group (M = 357.47, DP = 97.213) (see Figure 2).

With regards to the scores obtained in each BADS subtest, we can realize that the schizophrenia group was less successful than the control group in all the subscales of the battery, without exception (see Table 1). The performance differences revealed to be statistically significant in all the subtests (p < .05).With regards to the time spent for complete each task, for the subtests in which time was a factor (subtests 1, 2, 3 and 5), it could be verified that the schizophrenia group required significantly longer periods of time in comparison with the control group, in order to conclude the tasks of all the subscales (see Table 2).

In regard to performance in the WCST, the group of patients with schizophrenia presented a greater number of errors, as well as a greater number of perseverative errors, more perseverative answers, more non-perseverative errors and a lesser amount of completed categories in comparison to the control group, in a statistically significant manner (see Table 3)

Finally, the total scores obtained by the different groups in the INECO Frontal Screening allow us understand that the group of patients with schizophrenia was less successful (M = 13.29, DP = 4.859), in a highly significant manner, $t(44) = -14.291$, p < .001, 95% CI [–14.737, –11.094], than the control group (M =26.21, DP = 1.948). In turn, if we analyze the scores obtained for each subtest, we can conclude the group of patients with schizophrenia clearly presents inferior results to those of the control group in all IFS subtests in a manner which is statistically significant (see Table 4).

Definition of sensitivity and specificity of IFS comparatively to BADS

The capacity of IFS in briefly assessing executive functioning, in comparison to BADS, was determined by the analysis of the ROC curves (see Figure 3). Analysis of the ROC curve for the total IFS score between the control group and the patients with schizophrenia generated an area under ROC curve of .999. If we consider a cut-off point of 14 points, IFS shows 100% sensitivity and 56% specificity, in the distinction between the patients with schizophrenia and control group. In turn, the ROC curve analysis for the total BADS score generated an area under curve of 1. If we consider a cut-off point of 11 points, BADS shows a 100% sensitivity and 50% specificity. This way, we can verify that IFS produces sensitivity and specificity results very close to those of BADS when detecting executive dysfunction in schizophrenia.

Discussion

The current research revealed the existence of deficits in executive functions of patients with schizophrenia,

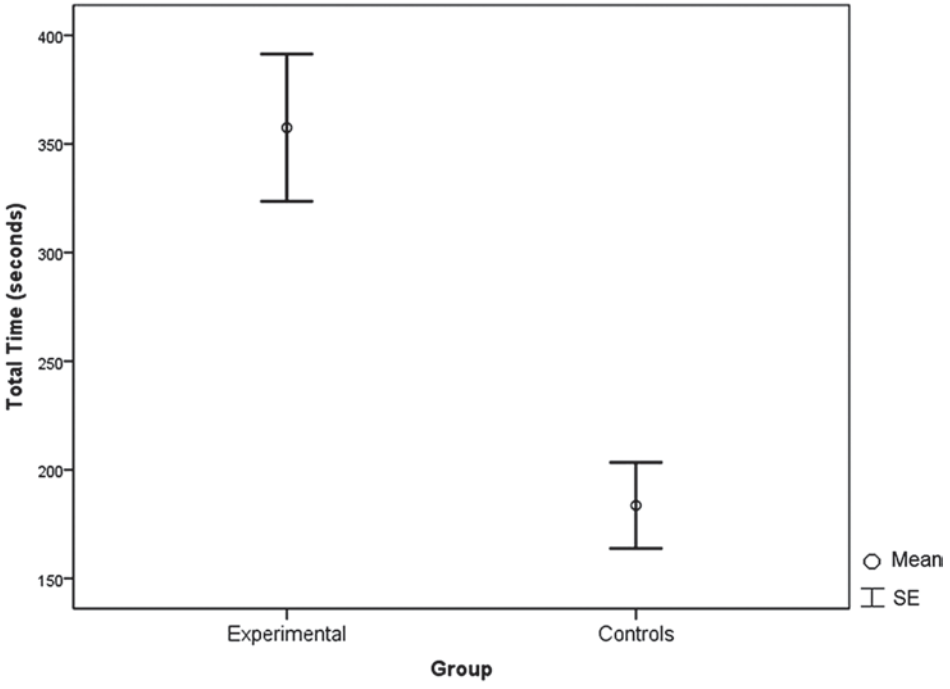

Figure 2. Averages and standard error of the total time spent (in seconds) by the Experimental and Control Groups in the completion of the BADS subscales.

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Table 1. *Averages, Standard Deviations, t Values, p Values and Confidence Intervals of the results of the Experimental and Control Groups in each of the BADS subtest*

	Experimental Group		Control Group				95% CI	
BADS Subscales	*M*	*SD*	*M*	*SD*	*t*	*p*	*LL*	*UL*
Rule Shift	2.18	1.167	3.81	.402	–7.662	< .001	–2.059	–1.2
Action Program	2.41	1.184	3.52	.570	–4.858	< .001	–1.561	–.647
Key Search	1.15	1.077	2.68	1.137	–5.573	< .001	–2.079	–.982
Temporal Judgement	1.38	.739	2.81	.833	–7.301	< .001	–1.814	–1.034
Zoo Map	1.26	.864	3.74	.445	–14.720	< .001	–2.815	–2.139
Modified Six Elements	2.15	.657	3.97	.180	–15.524	< .001	–2.058	–1.583

Note: Cl = confidence interval; *LL* = lower limit; *UL* = upper limit.

Table 2. *Averages, Standard Deviations, t Values, p Values and Confidence Intervals of time spent (in seconds) by the Experimental and Control Groups in completing each of the BADS subtest*

	Experimental Group		Control Group				95% CI	
Timed BADS subscales (seconds)	*M*	*SD*	*M*	*SD*	*t*	*p*	*LL*	*UL*
Rule Shift	51.76	14.317	27.26	6.846	8.925	< .001	18.986	30.027
Action Program	138.59	52.977	66.68	8.972	7.793	< .001	53.180	90.642
Key Search	61.74	31.581	32.29	18.932	4.604	< .001	16.628	42.262
Zoo Map	105.38	45.824	57.39	38.100	4.606	< .001	26.993	68.998

Note: Cl = confidence interval; *LL* = lower limit; *UL* = upper limit.

Table 3. *Averages, Standard Deviations, t Values, p Values and Confidence Intervals of the results obtained by the Experimental and Control Groups in the various dimensions of the WCST*

	Experimental Group		Control Group				95% CI	
WCST measure	*M*	*SD*	*M*	*SD*	*t*	*p*	*LL*	*UL*
Total errors	61.00	15.510	25.52	12.720	10.028	< .001	28.413	42.555
Perseverative errors	37.94	15.510	15.35	7.209	7.078	< .001	16.161	29.012
Perseverative responses	41.18	18.610	16.97	8.420	6.855	< .001	17.103	31.314
Non-perseverative errors	23.06	12.507	10.19	7.499	5.080	< .001	7.789	17.941
Categories completed	2.76	1.372	5.74	.514	–11.778	< .001	–3.487	–2.467

Note: Cl = confidence interval; *LL* = lower limit; *UL* = upper limit.

corroborating the data found in the literature (Eisenberg & Berman, 2010; Everett, Lavoie, Gagnon, & Gosselin, 2001; Heinrichs & Zakzanis, 1998; Palmer, Heiby, Fujii, & Kameoka, 2008). Analysing the results, the poor performance of the schizophrenia group in completing BADS suggests impairment in multiple components of executive functioning, since it is not a one-dimensional construct (Miyake et al., 2000). In the Rule Shift Card subtest, we can verify some difficulty in these patients to use feedback in order to control or modify their behavior (Strauss et al., 2006). In turn, the Action Program Test requires the subjects to be capable to manipulate a variety of materials in order to solve a non-routine problem (Wilson et al., 1996), and its validity lies in the difficulty found by patients with pre-frontal lesions to develop new plans or cognitive strategies in order to solve a problem. This test implies the action of the Supervisory Attentional System

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Table 4. *Averages, Standard Deviations, t Values, p Values and Confidence Intervals of the results obtained by the Experimental and Control Groups in each of the INECO Frontal Screening subtests*

	Experimental Group		Control Group				95% CI	
IFS subtests	*M*	*SD*	*M*	*SD*	*t*	*p*	*LL*	*UL*
Motor programming	1.32	1.224	2.97	.180	–7.742	< .001	–2.076	–1.213
Conflicting instructions	2.18	1,114	2.84	.374	–3.271	.002	–1.071	–.253
Go–No go	1.97	1.218	2.90	.301	–4.322	< .001	–1.370	–.496
Backwards Digit Span	1.94	.884	2.90	.301	–9,466	< .001	–2.884	–1.879
Verbal Working Memory	1.38	.817	2.00	.000	–4.408	< .001	–.903	–.333
Spatial Working Memory	1.21	.845	2.84	.898	–7,552	< .001	–2,065	–1,201
Proverb interpretation	.38	.551	2.34	.907	–10.385	< .001	–2.335	–1.578
Verbal inhibitory control (Modified Hayling test)	2.91	2,165	5.97	.180	–8.198	< .001	–3.814	–2.298

Note: Cl = confidence interval; *LL* = lower limit; *UL* = upper limit.

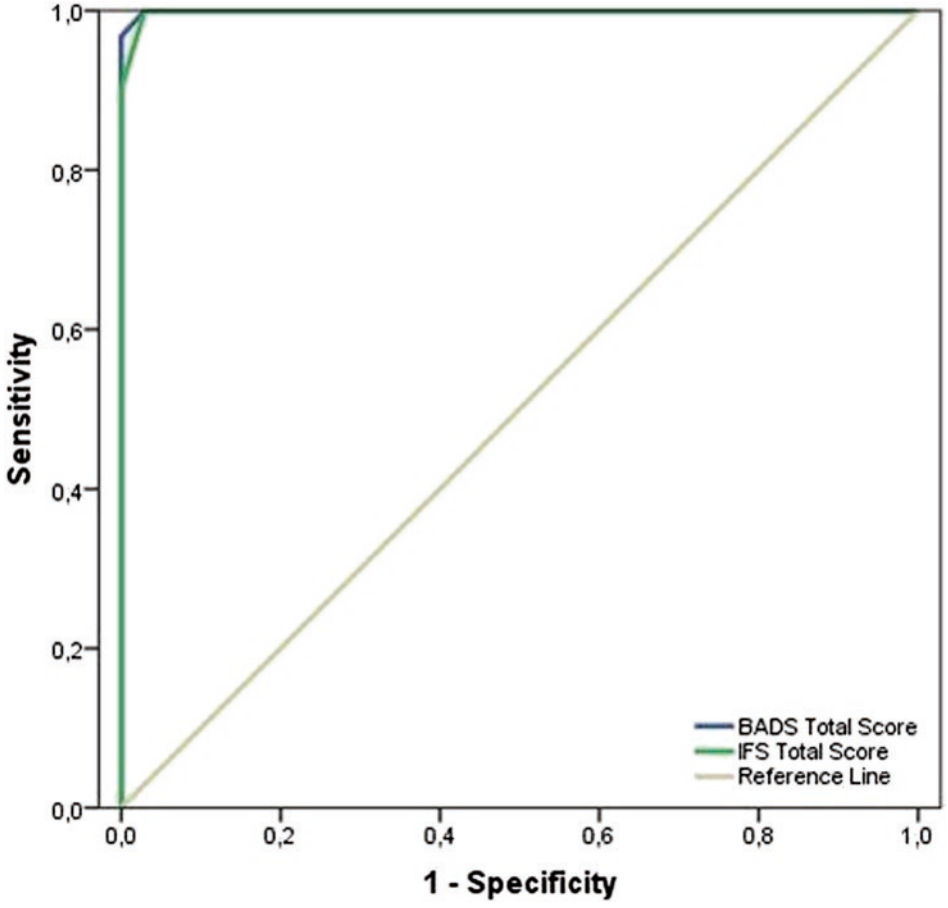

Figure 3. ROC curve analysis for evaluation of specificity and sensitivity of IFS comparatively to BADS in order to detect executive dysfunction in schizophrenia.

(Norman & Shallice, 1986), which stimulates or inhibits the representation of actions which are normally activated by certain stimuli, avoiding the creation of routine actions, such as completing the test by inverting the tube in order to access the plug, for example. Our research shows that the process of the Supervisory Attentional System is compromised in the schizophrenia group since they showed less capacity to solve

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the presented problem. In the Key Search Test, the patients with schizophrenia demonstrated poor performance, evidencing difficulties in planning efficient actions and in their capacity to monitor their own performance, since the patients could look at the lines drawn to show the itinerary followed and come to the conclusion that the search was not efficient. On the other hand, in the Temporal Judgment Test, it is required of the subject to make an estimate of the time needed to complete various tasks, therefore the existence of a highly significant difference between the groups in this test could be attributed to the impairment of abstract judgment and thought capacity of the schizophrenic patients, since the answers are based on common sense. In the Zoo Map Test, the schizophrenia group also demonstrated a less significant capacity for planning when compared to the control group. In this test, the subjects have to identify and temporarily organize various stages, depending on the rules and specific objectives. The deficit demonstrated by the schizophrenia group may be related to the frequent errors made by the patients with frontal lesions when they try to follow specific instructions. This becomes obvious in the labyrinth tests, or in learning tasks, where the subject has to choose the most adequate answer from between a set of answers to achieve the final objective. Finally, in the Modified Six Elements Test, the schizophrenia patients demonstrated difficulties in the conception and implementation of strategies, since the task requires the capacity to manage time.

These results are consistent with the findings obtained in other scientific investigations, such as the studies of Evans et al. (1997), Ihara, Berrios, and McKenna (2000), Krabbendam et al. (1999).

The group of patients with schizophrenia demonstrated a poorer performance in the WCST when compared to the control group, which is consistent with the conclusions found in literature (Heinrichs & Zakzanis, 1998). According to Koren et al. (1998), perseveration and the total number of categories completed seem to translate the more sensitive scores into deficits in schizophrenia; in fact, in the current study, significant differences were verified between controls and the schizophrenics for the segment of perseverative answers and a poor performance in average of the patients with schizophrenia the level of number of categories completed. According to Greve, Stickle, Love, Bianchini, and Stanford (2005), these results demonstrate the difficulty of the patient in changing to correct principled organization and as a consequence generate a large number of perseverative answers and few completed categories. Thus, the performance of patients with schizophrenia reflects a difficulty on abstraction and cognitive flexibility level.

In turn, with regards to the performance of the groups in completing the INECO Frontal Screening, it can be concluded that the group of patients with schizophrenia clearly presents poorer results in comparison to the control group. Similar results were obtained in a study by Báez et al. (2011), in which two groups of adult patients with Bipolar Disorder and with Attention Deficit Hyperactive Disorder obtained significantly lower scores than the control group with regards to the total score obtained in IFS. In this manner, this screening test proved to be a solid and useful tool for the detection of executive dysfunction in various psychiatric disorders, both in the study of Báez et al. (2011) as in the current study.

Thus, the results obtained by means of the neuropsychological tests used in the current study demonstrate the impairment of various executive function components in the group with schizophrenia, revealing the presence of an executive dysfunction. This disorder relates to a clinical state characterized by disorder in the planning and organization of actions, poor capacity for initiative, perseverance, inflexibility, a difficulty in conceiving and implementing strategies, difficulty in problem solving and in selective attention (Goldberg, David, & Gold, 2003; Palmer & Heaton, 2000). In the cases of pathology, lesion or cerebral dysfunction, the dysexecutive syndrome may manifest itself through a myriad of problems in everyday life, namely inappropriate social behavior, difficulty with decision making, high levels of impulsiveness, distraction, difficulty in using feedback from the environment to regulate behavior, preventing full functional recovery and the possibility of reclaiming a socially responsible life, independent and well adjusted (Barbosa & Monteiro, 2008; Gioia, Isquith, Guy, & Kenworthy, 2000).

In turn, when analyzing the objectives of this study, it was possible to verify that IFS is as sensitive and specific as BADS. It is an assessment battery for dysexecutive syndrome with high ecological validity, particularly efficient in the detection of subtle difficulties with the planning and organization of actions, especially in cases of people for whom cognitive capacity seems to be preserved in well-structured situations (Strauss et al., 2006). In this way, the current study concluded that IFS shows high sensitivity and specificity in comparison with BADS in the detection of executive dysfunction in schizophrenia, demonstrating itself to be a good way to briefly assess functions related with the frontal lobe, allowing for the differentiation of the two groups included in the study.

To this end, the current study demonstrated that IFS is an instrument of quick application and possesses high sensitivity in order to be used in clinical practice. However, it is possible that by being as

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sensitive as BADS, it is qualitatively less rich due to its lengthier nature and artificiality of the tasks, since BADS is a robust exam, with good theoretical background, good psychometric properties and has good ecological validity, reflecting the everyday problems of executive dysfunction presented by the patients. Yet, a brief cognitive screening tool which is easy to apply and presents high sensitivity, specificity and predictive value such as IFS would be of great importance to health care professionals since in clinical practice, they do not always have access to highly trained neuropsychologists, specific instruments to assess certain cognitive domains or the length of time required to administer a complete neuropsychological battery.

With the advent of discoveries related to executive functioning and the implication of the frontal lobe in such specific tasks, it is our understanding that this exam is a very useful tool for health care professionals for it allows them to evaluate certain areas of executive functioning and providing information on the need to carry out further neuropsychological exploration. It is definitely of vital importance to be able to count on sensitive and specific tools for the diagnosis of neurological and psychiatric diseases with the aim of furthering neuropsychological research and elaborate strategies for cognitive intervention in such a manner that the patients recover those capabilities that allow a person to live in an independent manner, with a specific goal, with self-sufficient behavior and in a satisfactory way (Lezak, Howieson, & Loring, 2004).

Still, many additional limitations of this study may be observed. There is no current symptomatology data for the patients, the sample is heterogeneous, the number of participants is relatively small and performance in the executive functioning tests and its relation to other cognitive processes may be different for individuals with schizophrenia that are stable in comparison to those with more active and severe symptoms. Further, future investigations should also explore behavioral observations (e.g., time taken to complete the tasks, latency of response, etc.) during IFS evaluation as alternative and complementary tools.

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