Standardization and Diagnostic Utility of the Frontal Assessment Battery for healthy people and patients with dementia in the Chilean population

Abstract:

Background: The Frontal Assessment Battery (FAB) is a screening test that measures executive functions. Although this instrument has been validated in several countries, its diagnostic utility in a Chilean population has not been studied yet.

Objectives: (1) To adapt FAB in a Chilean population; (2) To study the psychometric properties of the FAB in a Chilean population; (3) to assess the sociodemographic influence in the performance of the FAB in a sample of healthy controls, and (4) to develop normative data for this last group.

Methods: A healthy control (n = 344) and a group of patients with dementia (n = 156) were assessed with the Chilean version of FAB.

Results: FAB showed good internal consistency (Cronbach's alpha = 0.79) and acceptable validity based on the relationship with other variables. Factor analysis showed the unidimensionality of the instrument. Significant differences were found in the total FAB value between the healthy control and dementia groups. With the matched sample, the established cut-off point was 13.5, showing a sensitivity of 80.8% and a specificity of 90.4%. Regression analysis showed that education and age significantly predicted FAB performance in the healthy group. Finally, normative data are provided.

Conclusions: The present study has shown that FAB is a useful tool to discriminate between healthy people and people with dementia. However, further studies are needed to explore the capacity of the instrument to characterize the dysexecutive syndrome in people with dementia in the Chilean population.

Keywords: Executive functions, FAB-Ch, Dementia, Chilean population.
INTRODUCTION

The Executive Functions (EF) comprise a wide range of cognitive processes and behavioral competencies, including reasoning, problem-solving, planning, sequencing, resistance to interference, multitasking, cognitive flexibility, and the capacity to deal with novelty, among others [1]. These processes mainly depend on neural circuits involving the prefrontal cortex, the basal ganglia, the parietal cortex, the cerebellum, and the thalamus [2]. Assessing EF can be helpful in the diagnosis and prognosis of many brain disorders and other neuropsychiatric conditions, such as vascular cognitive impairment, frontotemporal dementia, parkinsonian disorders, and schizophrenia [3]. Along with the comprehensive neuropsychological evaluation of executive disfunction, brief screening tools that are easy and quick to administer and contribute to determining whether a person presents with executive impairments and, accordingly, improving the quality of preliminary diagnostic workup [4,5]. In this context, the Frontal Assessment Battery (FAB) was devised as a rapid bedside screening of frontal functions. The FAB comprises six subtests that assess different domains of EF [5]. Each subset explores a specific cognitive or behavioral domain related to the functions of frontal lobes: conceptualization, mental flexibility, motor programming, sensitivity to interference, inhibitory control, and environmental autonomy. The global performance on these six subtests gives a composite score that summarizes the severity of the dysexecutive syndrome [6]. The FAB has good correlations with other executive measures such as the Wisconsin Card Sorting Test (WCST) (number of perseverative errors $\rho = 0.68$ and number of criteria: $\rho = 0.77$) as well as measures of general cognitive functioning (Mattis Dementia Rating Scale) ($\rho = 0.82$) [5].

Since its first publication, the FAB has been adapted to diverse languages and cultures, including Brazil [7], Korea [8], Japan [9], Italy [10], Germany [11], France [5,12], China [13], Portugal [14], Spain [15], Turkey [16], Taiwan [17] and Persia[18]. Several studies have reported that the FAB has presented adequate reliability and validity.

The diagnostic utility of the FAB has been reported in patients with Alzheimer’s disease [8], amyotrophic lateral sclerosis [19], frontotemporal dementia [12] and in small study of patients with stroke [13]. Age, education and race influence performance in executive tests [16,20,21]. Although some empirical work has been done on FAB in Latin
there has not been yet any studies in this region that provide normative data in Spanish. More studies are needed in Spanish speaking LAC countries to support its used in clinical practice.

Therefore, our aims are a) to adapt FAB in a Chilean population; b) to study the psychometric properties of the FAB in this population (healthy people and people with dementia); c) to assess the influence of sociodemographic variables in the performance of the FAB in the healthy controls and d) to develop normative data in this last group.

1. METHODS

1.1. Participants

The normative study involved 344 healthy controls (HC) (194 women and 150 men). All of them were native Spanish speakers (Chilean), lived in the community, and met the following inclusion criteria: a) with at least a minimal writing capacity (correct writing regardless of orthographic errors due to low education); b) scores above 24/30 on the Mini-Mental State Examination (MMSE) [20]; c) scores below 5 on the Geriatric Depression Scale [22] and finally; d) scores below 51 in the Zung Anxiety Scale [23]. Subjects were excluded if they had current major psychiatric diseases including alcohol or drug abuse, were taking psychoactive drugs, had history of brain injury (stroke, dementia or any other neurological illness detected on a semi-structured clinical interview) or had a severe sensory deficit (loss of vision and/or hearing) that could impede neuropsychological evaluation.

They were recruited through a variety of advertisements at citizen activity centers and workplaces. Participation was voluntary, and the participants did not receive any compensation for their contribution to the study. The study was approved by the Comité de Ética of the Servicio Metropolitano Oriente, Santiago, Chile. Written informed consent was obtained from all the participants.

The clinical sample included 156 patients with dementia syndromes (83 women and 73 men) (see table 1). All patients were evaluated in the Cognitive Neurology and Dementia Unit (UNCD) at the Department of Neurology, Hospital del Salvador in Santiago, Chile. The Unit receives patients with suspected dementia from primary care facilities. A diagnosis was made by a neurologist based on the DSM-IV-TR criteria for dementia using multidisciplinary
approach (neurological, neuropsychological, laboratory and neuroimaging data). There were 115 patients with Alzheimer’s Disease, 17 with Fronto-temporal dementia behavioral variant, 6 with Lewy Body Dementia, 3 with vascular dementia, 2 with mixed dementia, 1 with semantic dementia, 1 with Progressive Supra-nuclear Palsy, 1 with alcoholic dementia and 10 with dementia of unknown etiology.

1.2. Instruments and procedure

All participants were initially assessed with the MMSE. The adaptation of the FAB to Spanish was achieved by 2 translations from English to Spanish based on the original FAB, followed by 2 back-translations from Spanish to English that were reviewed with one of the authors’ original FAB. The forward- and back-translations were performed independently by different individuals, in each case by 1 bilingual expert in the field of dementia and by 1 bilingual layperson. The Chilean version of the FAB (FAB-Ch) can be found in the Supplementary material (section 1). It maintains the structure and number of items of the original English version, and is grouped into 6 sections: conceptualization, mental flexibility, motor programming, sensitivity to interference, inhibitory control and environmental autonomy. The original lexical fluency task with letter ‘S’ in the English version was changed to lexical fluency with letter with letter ‘A’ because the number of words starting with A in Spanish is higher than those starting with letter S. Each subtest is scored from 3 (high score) to 0 (low score). The maximum score is 18 points.

1.3. Statistical analyses

All the analyses were conducted using IBM SPSS Statistics 25 for Microsoft Windows (Armonk. NY: IBM Corp. USA). Descriptive and comparative analyses were conducted using either t-tests to compare the two groups. Regarding to psychometric aspects, reliability was explored via internal consistency of the instrument with Cronbach’s alpha. Evidence of validity based on the relationship with other variables was evaluated by assessing the association between performance on the FAB-Ch and MMSE. We also studied the correlation between our instrument and two executive functions tests: (a) number of sorts in
Wisconsin Card Sorting Test and (b) categorial fluency, collected in the Chilean-Argentine version of the ACE-III test [24] using Pearson's correlation. In the case of categorial fluency the participant must say the names of animals.

The diagnostic utility was determined using the ROC analysis to calculate sensitivity and specificity values. The first analysis was carried out with the complete sample and the second analysis included the matched sample in the variables age and education. The influence of sociodemographic variables in the HC was also studied using linear regression. Finally, we present means and standard deviations of the total FAB-Ch scores stratified by age and education, as well as scores in the single subtests of this instrument.

2. RESULTS

2.1. Socioemomographic variables

Demographic and neuropsychological data of the sample are presented in table 1. The HC was younger [t (502) = -12.485. p< .001] and showed more years of education [t (502) = -2.639. p< .01] than the patients group. People with dementia performed significantly worse than the HC on the MMSE [ANCOVA covaried by age and years of education: F(1,499)= 579.60; p <.001]. In the case of the HC, the proportion of women was 53.2% and of men was 45.8%, while dementia patients showed, respectively, a proportion of 56.4% and 43.6%. This last case is probably associated with epidemiological variables. Alternatively, to control the effect of demographic variables on the difference between HC and patients, we performed an analysis in a sub-sample of participants matched by age and education level. The outcome was very similar to the obtained from total data (see Table 2).

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INSERT TABLE 1 HERE

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3.2 Performance on FAB-Ch: Total Score and Subtests

Significant differences were found in the total FAB-Ch values between the HC and the dementia group (see Table 1). Regarding the scores obtained in the subtests that make up the FAB-Ch, significant differences were again found between the two study groups in the domains of “conceptualization”, “mental flexibility”, “motor programming”, “sensitivity to interference”, “inhibitory control” and “environmental autonomy”. Additionally, a MANCOVA was conducted to compare results across subtests of the FAB-Ch by diagnosis category controlling for age, sex and years of education. Performance differed significantly between the two groups for each subtest of the FAB-Ch [Wilks’ lambda = 0.488 $F(6,487)= 77.352; p<.001$]. HC and patients differed in each of the subtests: Conceptualization [$F(1,492)= 91.176, p< .001$]; mental flexibility [$F (1,492)= 198.732, p< .001$]; motor programming [$F(1,492)= 141.212,p< .001$]; sensitivity to interference [$F(1,492)=171.490, p < .001$]; inhibitory control [ $F(1,492)= 148.245,p < .001$] and environmental autonomy [$F (1,492)= 60.176, p< .001$].

3.3 Psychometric properties

3.3.1 Reliability
The Cronbach’s alpha for the FAB-Ch considering the 6 subscales and calculated for all 500 subjects was $\alpha = 0.797$, which shows a good reliability of the instrument. Cronbach’s values of the six subtests suggest that all items positively contributed to the overall reliability.

3.3.2 Validity based on the relationship with other variables

The FAB-Ch showed a statistically significant association with the MMSE (Pearson’s $r = 0.83; p < .001, n=499$) and other measures of executive function: [number of sorts in Wisconsin Card Sorting Test: $r = 0.678, p < .001, n= 413$) and category fluency ($r =0.71, p < .001, n =493$)] collected in the ACE-III test, so we have a high validity based on the relationship with other variables [25].

3.3.3 Structure of the FAB-Ch.

The six subscales of the FAB-Ch were subjected to an Exploratory Factorial Analysis in order to obtain its factorial structure. We used Kaiser’s criterion (eigenvalues above 1.0) and the extraction method was by principal axis factoring. The factors were then orthogonally rotated using a varimax rotation. The Kaiser-Meyer–Olkin test for sampling adequacy was .85 that indicates that factor analysis is appropriate. Bartlett’s test of sphericity reached statistical significance ($\chi^2 = 805.95, p< .001$) supporting the factorability of the correlation matrix. The results showed that the FAB-Ch has a unidimensional structure. The explained variance was 41% and the factorial loadings were mostly above 0.5.

3.3.4 Utility of the FAB-Ch to classify patient and HC.

The results of the ROC curve analysis for the FAB are shown in Table 3 and Figure 1. The AUC for the FAB was 0.92 (95% confidence interval: 0.89–0.95), indicating an overall high diagnostic usefulness of the test [26]. The optimal balance between sensitivity and specificity for the FAB was obtained with a cutoff point of 13.5 (sensitivity = 80.8%, specificity = 90.4%).

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INSERT TABLE 3 HERE

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Finally, we evaluated the sample matched by age and education level. The optimal balance between sensitivity and specificity for the FAB was again obtained with a cut-off point of 13.5 (See Table 4 and Figure 2).

3.4 The influence of sociodemographic variables in the HC

Multiple regression analysis was used to test whether sociodemographic variables (gender, age, years of education) significantly predicted FAB-Ch performance in the normative sample. The results of the regression indicated these predictors explained 34.9% of the variance ($r^2=0.349$, $F(3,344)=60.796$, $p<.001$). Both education ($\beta=0.569$, $t(344)=12.831$, $p<0.01$) and age ($\beta=-0.127$, $t(344)=-0.127$, $p<0.01$) significantly predicted FAB-Ch score. Based on this analysis, we calculated an FAB-Ch predicted value for each patient using: $13.977 - 0.012*age\ (years) + 0.218*\ education\ (years)$. We then subtracted the patient’s actual score on the FAB-Ch score from the predicted score. The mean difference between FAB-Ch observed score (10.06 ± 3.86) and the FAB-Ch predicted score (15.79±1.03) was –5.73 (SD=3.67). This value is significantly different from zero ($t\ (155) = -19.53, p< .001$).

3.5 Normative data in the healthy control group.
We created a table of normative values based only on age and education. Table 5 shows the normative data for total scores for the FAB-Ch in the HC group.

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INSERT TABLE 5 HERE
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3. DISCUSSION

This report describes the standardization of the FAB-Ch in a Chilean sample of a HC and patients with dementia syndrome. We provide psychometric evidence and normative data of this instrument.

Regarding psychometric properties, the FAB-Ch has strong evidence of reliability based on internal consistency, similar to the data reported in previous studies [5,18]. The Chilean version has a high correlation with two measures of executive functions: the Wisconsin Card Sorting Test and categorial fluency, which provides an acceptable validity based on the relationship with other variables. However, it is important to highlight that categorial fluency is not a pure executive test and depends also on language and semantic memory [27,28,29]. Nevertheless, Junquera et al [30] showed that the executive component of this instrument significantly predicted conversion to dementia (one year later) in patients with mild cognitive impairment who presented a dysexecutive phenotype, independently of impairment at baseline. This result is consistent with other studies with different populations showing that the FAB-Ch has appropriate convergent validity for testing frontal lobe function [13,17].

We also found that the FAB-Ch strongly correlated with the MMSE, which is a measure of global cognitive function, which is different from previous results [5,13,31,32]. These results are unexpected since the MMSE does not formally evaluate executive functions [33]. One possible explanation for this finding is the interaction between education and MMSE performance, with the former being associated with the FAB-Ch [13]. An alternative explanation is that FAB is sensitive to the disease progression what makes it useful to monitor the clinical course of dementing diseases.

The factor analysis identified a single factor explaining most of the variance of the
FAB-Ch, similar to previous findings [34]. The optimal balance between sensitivity and specificity for the FAB-Ch was obtained with a cutoff point of 13.5, highlighting that this test can discriminate between HC and people with dementia syndrome.

Performance on the FAB-Ch is explained by education and age, while gender does not contribute to performance. Cognitive aging is associated with a mild decline in executive function [35,36], and education affects performance on executive tests [37,38]. Our results are consistent with previous data on the effect of sociodemographic factors on the FAB-Ch [7,8,10,11,34,39,40].

The availability of a normative sample including people with a wide range of educational levels is essential for using FAB-Ch in clinical practice, especially in countries like Chile, where the range of educational levels in the populations is very heterogeneous wide [8].

Several limitations warrant consideration in generalizing our observations. Firstly, although we have participants of different ages and educational ranges, the variability of the data is small, which could impact on the relative position of an individual concerning standard scores. Therefore, assessors interpreting FAB-Ch scores should always review the overall distribution of scores on this test and consider the raw score obtained by the individual, which could be especially important when, for example, trying to determine if a person's score is far outside the normal range [41]. Second, the main limitation of our study is that we only provide indirect evidence of the ability of the FAB-Ch to detect a dysexecutive syndrome (validity based on the relationship with other variables). We did not provide specific evidence of the utility of the FAB-Ch in the diagnosis of a dysexecutive syndrome. In this way, it is important to note that as has been highlighted for other screening instruments, FAB-Ch cannot lead to the specific diagnosis of the type of dementia, such as Alzheimer's disease or fronto-temporal dementia [4].

Emphasize this limitation is particularly important since executive dysfunction is present in many dementia syndromes (Lewy Body Dementia, vascular dementia, frontotemporal dementia, Alzheimer's Disease, etc.) [42,43,44].

In the present study, we did not consider types of dementia in the analysis as its aim was to investigate the sensitivity and specificity of this screening tool relative to healthy
controls. **In this line, we do not have measures of the level of severity of dementia from the point of view of functionality or a global level of severity of dementia such as the Global Deterioration Scale (GDS). However, we have the MMSE, a cognitive screening test that is widely used as a measure of cognitive severity, which can reduce this limitation**

In addition, illiterate subjects were excluded, and only 13 participants of the HC have four years of education or below. Therefore, our norms have limited use for people with low educational level, who are still an important percentage of the Latin American population [45]. More studies are needed to establish norms in subjects with a low socio-economic status. The present study only included Chilean subjects, consequently limiting our data to other Spanish-speaking countries. Yet, recent normative data for ten Spanish-language neuropsychological tests in eleven Latin American countries suggest that most of the differences in test performance are explained by age and educational factors. Inter-country factors only account for a small proportion of variance [46]. Finally, the inclusion of HC whose performances are above or equal to 24 on the MMSE could be criticized as too strict. However, as 95.9% of our sample has more than four years of education, this criterion ensured the inclusion of healthy subjects without cognitive impairment [47].

In conclusion, the main results of our study are (a) the FAB-Ch is an instrument with strong evidence of reliability and validity based on international standard, b) an adequate diagnosis utility for dementia (c) the effect of aging and level of education on FAB-Ch performances, and finally (d) the availability of normative data for the FAB-Ch, improving the usefulness of this instrument in clinical settings. In addition to other tests such as the MMSE, the administration of the FAB-Ch allows a more comprehensive evaluation in the diagnosis process of dementia. Future studies need to address if FAB-Ch presents good diagnostic utility to show the degree of executive dysfunction and its contribution in the differential diagnosis of types dementia.

References


### SECTION 2: TABLES

#### Table 1

Age, years of formal education, MMSE, FAB total score and subscales.

<table>
<thead>
<tr>
<th></th>
<th>Control (n= 344)</th>
<th>Dementia (n =150)</th>
<th>Control vs. Dementia</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Age</strong></td>
<td>55.35±18.096 (20-89)</td>
<td>72.80±8.278 (49-89)</td>
<td>0.000*</td>
</tr>
<tr>
<td><strong>Years of education</strong></td>
<td>12.62±4.565 (3-26)</td>
<td>11.81±4.644 (3-24)</td>
<td>0.074</td>
</tr>
<tr>
<td><strong>MMSE</strong></td>
<td>28.53±1.578 (23-30)</td>
<td>20.52±5.642 (3-30)</td>
<td>0.000</td>
</tr>
<tr>
<td><strong>FAB total</strong></td>
<td>16.07±1.751 (10-18)</td>
<td>10.50±3.906 (0-18)</td>
<td>0.000</td>
</tr>
<tr>
<td><strong>FAB Subtest 1</strong></td>
<td>2.32±0.685 (0-3)</td>
<td>1.58±1.012 (0-3)</td>
<td>0.000</td>
</tr>
<tr>
<td><strong>FAB Subtest 2</strong></td>
<td>2.73±0.530 (0-3)</td>
<td>1.67±0.993 (0-3)</td>
<td>0.000</td>
</tr>
<tr>
<td><strong>FAB Subtest 3</strong></td>
<td>2.53±0.755 (0-3)</td>
<td>1.49±1.001 (0-3)</td>
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<tr>
<td><strong>FAB Subtest 4</strong></td>
<td>2.86±0.402 (0-3)</td>
<td>1.86±1.213 (0-3)</td>
<td>0.000</td>
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<tr>
<td><strong>FAB Subtest 5</strong></td>
<td>2.63±0.729 (0-3)</td>
<td>1.33±1.191 (0-3)</td>
<td>0.000</td>
</tr>
<tr>
<td><strong>FAB Subtest 6</strong></td>
<td>2.98±0.178 (1-3)</td>
<td>2.54±0.897 (0-3)</td>
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* p value less than 0.05 (p<0.05)
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<tr>
<th>Subtest</th>
<th>Factor 1</th>
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</thead>
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<tr>
<td>FAB Subtest: Mental flexibility</td>
<td>0.804</td>
</tr>
<tr>
<td>FAB Subtest: Sensitivity to interference</td>
<td>0.771</td>
</tr>
<tr>
<td>FAB Subtest: Inhibitory control</td>
<td>0.714</td>
</tr>
<tr>
<td>FAB Subtest: Conceptualization</td>
<td>0.661</td>
</tr>
<tr>
<td>FAB Subtest: Motor programming</td>
<td>0.660</td>
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<tr>
<td>FAB Subtest: Environmental autonomy</td>
<td>0.537</td>
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### Table 3: Logistic Regression Analysis

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<th></th>
<th>B</th>
<th>S.E.</th>
<th>Wald</th>
<th>df</th>
<th>Sig.</th>
<th>Exp(B)</th>
<th>95% confidence interval for B</th>
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<td></td>
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<td>Lower bound</td>
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<td>FAB</td>
<td>-0.768</td>
<td>0.089</td>
<td>74.854</td>
<td>1</td>
<td>0.000</td>
<td>0.464</td>
<td>0.390</td>
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<td>Age</td>
<td>0.030</td>
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<td>1.622</td>
<td>1</td>
<td>0.203</td>
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<td>Education</td>
<td>0.174</td>
<td>0.042</td>
<td>17.105</td>
<td>1</td>
<td>0.000</td>
<td>1.190</td>
<td>1.096</td>
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<tr>
<td>Gender</td>
<td>-0.611</td>
<td>0.352</td>
<td>3.017</td>
<td>1</td>
<td>0.082</td>
<td>0.543</td>
<td>0.272</td>
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<tr>
<td>Constant</td>
<td>6.579</td>
<td>2.133</td>
<td>9.513</td>
<td>1</td>
<td>0.002</td>
<td>719.92</td>
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Table 4: sensitivity, specificity and cut-off score of the FAB for the discrimination of dementia patients and HC

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<th>Cut-off point</th>
<th>Sensitivity</th>
<th>Specificity</th>
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<tr>
<td>-1.00</td>
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<td>1.00</td>
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<td>2.50</td>
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<td>3.50</td>
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<td>4.50</td>
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<td>5.50</td>
<td>0.110</td>
<td>1.000</td>
</tr>
<tr>
<td>6.50</td>
<td>0.164</td>
<td>1.000</td>
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<td>7.50</td>
<td>0.253</td>
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<tr>
<td>8.50</td>
<td>0.322</td>
<td>1.000</td>
</tr>
<tr>
<td>9.50</td>
<td>0.404</td>
<td>1.000</td>
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<td>10.50</td>
<td>0.500</td>
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<tr>
<td>11.50</td>
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<td>0.985</td>
</tr>
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<td>12.50</td>
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<td>13.50</td>
<td>0.760</td>
<td>0.904</td>
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<td>14.50</td>
<td>0.829</td>
<td>0.805</td>
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<td>15.50</td>
<td>0.877</td>
<td>0.689</td>
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<td>16.50</td>
<td>0.952</td>
<td>0.520</td>
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<td>17.50</td>
<td>0.979</td>
<td>0.218</td>
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<td>19.00</td>
<td>1.000</td>
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### Table 5. Normative data for the FAB Score Total.

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<tr>
<th>Age</th>
<th>n</th>
<th>Education</th>
<th>Mean</th>
<th>S.D.</th>
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<tr>
<td>30</td>
<td>0-8</td>
<td>15.00</td>
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<tr>
<td>29</td>
<td>9-12</td>
<td>15.86</td>
<td>1.83</td>
<td></td>
</tr>
<tr>
<td>66</td>
<td>13 or +</td>
<td>17.11</td>
<td>1.14</td>
<td></td>
</tr>
<tr>
<td>30</td>
<td>0-8</td>
<td>14.17</td>
<td>1.76</td>
<td></td>
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<td>23</td>
<td>9-12</td>
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</tr>
<tr>
<td>64</td>
<td>13 or +</td>
<td>16.77</td>
<td>1.25</td>
<td></td>
</tr>
<tr>
<td>26</td>
<td>0-8</td>
<td>14.00</td>
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<td></td>
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<td>16.22</td>
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<td>53</td>
<td>13 or +</td>
<td>16.74</td>
<td>1.26</td>
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</table>
SECTION 3: FIGURES

Figure 1. Performance on FAB subtests in the group of patients with dementia and controls (1=“conceptualization; 2=”mental flexibility”, 3= “motor programming”, 4= “sensitivity to interference”, 5=“inhibitory control” and 6=“environmental autonomy”.

![Graph showing performance on FAB subtests](image)
Figure 2: ROC curve for FAB score in HC and dementia patients.
SUPPLEMENTARY MATERIAL

SECTION 1: CHILEAN’S VERSION OF THE FAB

1. Semejanzas (conceptualización).
   “¿En qué se parecen...?”
   a. Un plátano y una naranja.
   b. Una mesa y una silla.
   c. Un tulipán, una rosa y una margarita.
Ayudar al paciente en caso de fracaso total “no se parecen” o parcial “los 2 tienen cáscara” en el primer ítem, no en los siguientes. Sólo las respuestas de categoría (frutas, muebles, flores) se consideran correctas.

Puntaje: 3 correctas =3; 2 correctas =2; 1 correcta =1; ninguna correcta =0.

2. Fluidez léxica (flexibilidad mental).
   “Diga todas las palabras que pueda (por ejemplo animales, plantas y objetos, pero no nombres propios ni apellidos) que comiencen con A”. Si no responde en los primeros 5 segundos decirle “por ejemplo, árbol”. Si se detiene por más de 10 segundos, insista “cualquier palabra que empiece con A”. Tiempo: 60 segundos. Las repeticiones, derivaciones (árbol, arbolito), nombres propios y apellidos no se cuentan.

Puntaje: 10 o más palabras =3; 6 a 9 =2; 3 a 5 =1; menos de 3 =0.

3. Secuencias motoras (programación).
   “Mire con atención lo que hago”; el examinador frente al paciente realiza 3 veces la prueba de Luria (golpear con nudillo, canto y palma) con su mano izquierda. “Con su mano derecha haga lo mismo que yo, primero juntos, después solo”. El examinador hace la serie 3 veces con el paciente y le dice “ahora haga lo mismo Ud. solo”.


Puntaje: 6 series consecutivas correctas =3; 3 a 5 series correctas =2; no lo hace solo, pero sí 3 series consecutivas con el examinador =1; no logra ni siquiera imitar 3 veces =0.

4. **Instrucciones conflictivas (sensibilidad a la interferencia).**


Puntaje: sin errores =3; 1 o 2 errores =2; más de 2 errores =1; si golpea igual que el examinador al menos 4 veces consecutivas =0.

5. **Go-no Go (control inhibitorio).**


Puntaje: sin errores =3; 1 o 2 errores =2; más de 2 errores =1; golpea igual que el examinador al menos 4 veces seguidas =0.

6. **Conducta de prehensión (autonomía del ambiente).**

El examinador se sienta frente al paciente, que tiene las manos sobre sus rodillas, con las palmas hacia arriba. El examinador acerca lentamente sus manos hasta tocar las del paciente para ver si se las toma espontáneamente. Si lo hace, dice “ahora, no me tome las manos” y vuelve a tocárselas.

Puntaje: no le toma las manos =3; duda o pregunta qué tiene que hacer =2; las toma sin vacilar =1; las toma aún después de decirle que no lo haga =0.
Puntaje:

(1) Semejanzas = 3 –2 –1 –0
(2) Fluencia lexical = 3 –2 –1 –0
(3) Secuencias motoras = 3 –2 –1 –0
(4) Instrucciones conflictivas = 3 –2 –1 –0
(5) Go-no go = 3 –2 –1 –0
(6) Conducta deprehension = 3 –2 –1 –0

Total= /18