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# The Utility of a Brief Memory Screen in the Diagnosis of Mild Memory Impairment in the Elderly: A Preliminary Study

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## Abstract

**Objective—**This study evaluated the utility of the Florida Brief Memory Screen (FBMS), a new memory screening measure developed for Spanish-speaking and English-speaking subjects that takes only 3 to 4 minutes to administer.

**Methods—**The FBMS was administered to 25 patients with probable Alzheimer's disease (pAD), 23 patients with amnestic mild cognitive impairment (aMCI) and 80 cognitively normal elderly.

**Results—**The FBMS evidenced good test-retest reliability and high correlation with standard measures of memory. In ROC analyses, the FBMS correctly classified 100% of pAD patients and 87.5% of normal elderly subjects. Sensitivity and specificity for aMCI patients was 82.6% and 87.5%; respectively. Performance on the FBMS was generally independent of the effects of age, education, or primary language.

**Conclusion—**The FBMS is a reliable and valid measure when screening for memory impairment in the elderly and when determining whether a more extensive evaluation is warranted.

### Keywords

Cognitive screening; mild cognitive impairment; dementia; Alzheimer's disease; memory

## INTRODUCTION

The number of individuals over the age of 65 has continued to increase dramatically in the United States. Given that memory complaints are frequent in this segment of the population[1] clinicians are required to distinguish normal cognitive changes associated with aging from the early stages of a progressive neurodegenerative disorder[2]. This differentiation is often difficult for health professionals who frequently have limited time to assess the patient's cognitive abilities. This difficulty is more pronounced when assessing individuals of heterogeneous ethno-cultural and/or linguistic backgrounds, whose premorbid functioning

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may be unknown, who may have limited English proficiency, or who may have low educational or occupational attainment[3]. Because of these factors, the identification of a brief memory screen with high ability to differentiate normal versus compromised memory functioning in English- and Spanish-speaking elderly is of utmost importance. Instruments such as the Clock Drawing Test, MMSE, Memory Impairment Screen (MIS), General Practioner Assessment of Cognition (GP-Cog), and the 7-Minute Screen may be appropriate for the screening for dementia but may not have adequate sensitivity for conditions such as mild cognitive impairment (MCI)[4,5,6].

While a recent screening instrument such as the Montreal Cognitive Assessment (MoCA) have shown promise in detecting MCI in different cultural/language groups, it may have limited utility in primary care settings because it may take eight to ten minutes or longer to administer[7].

**In this study,** we developed a new 3 to 4 minute memory screening task that addresses these issues. The task requires subjects to recall 15 items that belong to three common semantic categories (fruits, musical instruments, and clothing). We examined the test-retest reliability, concurrent validity and the ability of the instrument to discriminate patients with amnestic mild cognitive impairment (aMCI) and probable Alzheimer's disease (pAD) from a large number of cognitively normal subjects.

## METHODS

### Subjects

We recruited 48 subjects who had been evaluated for memory disorders at the Wien Center for Alzheimer's disease and Memory Disorders. All subjects received a neurocognitive battery, an extensive neurological evaluation, blood laboratories, and an MRI of the brain. Twenty-five of these individuals (15 males and 10 females; Mean Age= 81.2 years; SD= 5.9; Mean Education= 13.6 years; SD= 5.8 years) met NINCDS-ADRDA criteria[8] for pAD. An additional twenty-three persons (14 males and 9 females; Mean age= 79.7 years, SD= 6.0; Mean Education= 14.4 years, SD=4.3) met Petersens[9] criteria for aMCI. All aMCI subjects met criteria for pAD except that they did not meet criteria for social or occupational impairment required for a DSM-IV dementia diagnosis[10]. We also recruited 80 community-dwelling elderly subjects (26 males and 54 females; Mean age = 77.8 years, SD= 4.7; Mean Education= 14.9 years, SD=3.4) who were participants in a study of neuropsychological predictors of cognitive decline in the elderly. These 80 subjects were participants in a longitudinal study of aging and had previously scored obtained a global Clinical Dementia Rating (CDR) of 0 and evidenced scores deemed within normal limits on a neuropsychological battery of tests tapping memory, attention, language, visuospatial skills and executive function. The mean MMSE[11] scores were 21.1 (SD=2.9) for the pAD group, 25.7 (SD=2.1) for the aMCI group, and 27.3 (SD=2.0) for the cognitively normal group. The distribution of Spanish-speaking individuals was 40.0% in the pAD group, 26.1% in the MCI group, and 15.2% among the cognitively normal subjects.

### Study Measures

All subjects in the study were administered the Florida Brief Memory Screen (FBMS). The instrument consists of a list of 15 to-be-remembered words that represent three semantic categories (i.e., fruits, musical instruments, and clothing). Subjects are told of the semantic categories before administration of the FBMS to enhance initial encoding. Each printed word is presented separately for 4 seconds and the subject is asked to read the word out loud. If the subject has difficulty reading any of the words, the word is read out loud by the examiner and the subject is asked to repeat it. A word from each category is presented

before additional words from each of the categories are presented, with no two words of the same category presented consecutively. Subjects are then asked to recall all of the words on the list. The FBMS has cued recall as well as an additional recall trial, but for purposes of this study, only the first trial was examined as a potential memory screening since pilot work indicated it significantly extended the administration time of the test. Further, the additional recall trial did not appreciably enhance sensitivity or specificity of the instrument.

While all subjects received the FBMS and the MMSE, half of the total subjects in the study had been administered the following measures on the same day or within two weeks of the FBMS Performance, the three-trial recall of the modified Fuld Object Memory Evaluation,[12] the Semantic Interference Test Bag B Recall Score[13] and immediate and delayed recall of stories in the Logical Memory subtest of the Wechsler Memory Scale-III[14]. The performance on these measures was evaluated relative to performance on the FBMS to determine concurrent validity. Test-retest reliability on the FBMS was obtained for the subset of 29 memory impaired subjects who were diagnosed with pAD or aMCI who were recruited for this purpose. The mean test-retest interval of 8.9 weeks (SD=6.2).

## RESULTS

There were statistically significant age effects among groups [$F(2,125) = 4.40$; $p<.02$]. Level of educational attainment did not significantly differ among the groups [$F(2,125)=1.20$; $p>.30$]. A Scheffe' test of means indicated that cognitively normal elderly subjects tended to be younger than pAD groups. There was also a greater percentage of females in the cognitively normal group [$X^2$ (df=2) = 9.54; $p<.009$] and a greater number of English-speakers [$X^2$ (df=2)= 7.07; $p<.03$]. Groups differed on their MMSE scores [$F(2,124)=72.63$; $p<.001$]. The highest MMSE scores were obtained by cognitively normal subjects, followed by MCI subjects, with the lowest scores obtained by the pAD group.

Despite some initial demographic differences among study groups, neither age ($r=-.08$; df=78, $p= .49$) nor level of educational attainment ($r= -.08$; df=78, $p= .47$) were associated with FBMS performance among cognitively normal subjects. In addition, there was no association between gender ($r=.18$; df=78, $p= .11$) or language ($r=-.04$; df=78, $p= .71$) on level of performance on the FBMS. Among cognitively impaired (i.e., pAD and aMCI) subjects, age ($r =-.09$; df=46; $p=.55$), gender ($r =-.24$; df=46; $p=.11$) and language ($r =-.15$; df=46; $p=.31$) were not associated with level of performance on the FBMS. Although there was a weak correlation between level of educational attainment and FMBS ($r=.297$; df=46, $p=.04$), education explained less than 9% of the total variability in FMBS scores.

### Test-Retest Reliabilities And Concurrent Validity

The test-retest reliability for the FBMS among a subset of 29 cognitively impaired subjects who had either been diagnosed with pAD or aMCI over an average 9 week test-retest interval was $r=.65$ ($p<.001$). Among sixty of the 128 subjects in the total sample who had neuropsychological test scores, there was a high level of association of the FBMS with immediate memory for passages ($r=.80$; $p<.001$); the delayed memory for passages ($r=.79$; $p<.001$), the free recall of the Fuld Object Memory Evaluation ($r=.73$; $p<.001$) and Bag B Recall of the Semantic Interference Test ($r=.70$; $p<.001$). Among 19 cognitively impaired subjects with pAD or aMCI, the association of the FBMS with the MMSE was $r=.75$ ($p<.001$), with the immediate memory for passages was $r=.53$ ($p<.03$), with the delayed memory for passages was $r=.44$ ($p<.06$), with the free recall of the Fuld Object Memory Evaluation was $r=.54$ ($p<.02$), and with Bag B Recall of the Semantic Interference Test was $r=.66$; ($p<.003$).

### Discriminative Validity

The scores of the patients in the MCI and pAD groups were compared to those of the cognitively normal group. ROC analyses using SPSS 15 indicated that for aMCIpAD/ normal contrasts the area under the curve (AUC) was .895 (SE=.04; 95% CI of .819 to .970) which was statistically significant at p<.001 (Wilcoxon z = 22.4). For PAD normal comparisons, the AUC was .975 (SE=.01; 95% CI of .950 to .999) which was statistically at p<.001 (Wilcoxon z = 97.5). As indicated in Table 1, an optimal cut-off of 7 resulted in correct classification of 82.6% of aMCI patients and 100% of pAD patients while correctly classifying 87.5% of cognitively normal subjects.

## DISCUSSION

The FBMS demonstrated good test-retest reliability and good concurrent validity with frequently used memory measures and with the MMSE. Excellent discriminative ability was observed in differentiating patients with suspected prodromal AD. The test is brief, taking only 3 to 4 minutes to administer. The test uses auditory and visual encoding and it alerts the subject of the semantic categories represented by the words, thus facilitating the organization of to-be-remembered material. Performance on the measure does not appear to be influenced by factors such as age, education, language and other factors that have been associated with other memory measures[1,3]. Having 15 recall targets reduces ceiling effects in normals. In addition, the facilitation of semantic encoding avoids floor effects among individuals with mild cognitive impairment or mild AD. Further research will need to be conducted to determine whether the present FBMS results can be replicated with other community and epidemiological samples. Additional studies would also clarify the utility of the instrument in monitoring cognitive change over time. There were no significant difficulties observed with either ceiling effects or floor effects, a finding that also awaits replication. While this test could be performed by our subjects with as little as 2 years of formal education, our sample as a whole was relatively highly educated. Thus, future work should be conducted with persons with lower levels of education.

Taken together, the FBMS exhibited good reliability and validity. It also exhibited excellent discriminative validity in differentiating MCI from cognitively normal subjects with a sensitivity of approximately 83% and specificity of approximately 88%. Post-hoc analyses indicated that at a similar level of specificity, (90.0%), the MMSE only correctly classified 39.1% of aMCI subjects. Discriminative validity also compares favorably to studies of the MOCA in MCI which have yielded sensitivities of 83% to 90% while yielding specificities ranging from 50% to 87%[6,15]. While other measures such as the MOCA may take as much as 10 minutes to administer, the brevity of administration of the FBMS, lack of ceiling and floor effects and lack of educational or language confounds suggests that the FBMS is a promising instrument that may be useful in epidemiological and community health settings.

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## TABLE 1

Sensitivity and Specificity of Cut-Off Scores for Amnestic MCI and Probable AD Subjects Versus 80 Cognitively Normal Elders

| Cut-Off Score of the FBMS | Amnestic MCI N=23 | | Probable AD N=25 | |
|---|---|---|---|---|
| | Sensitivity | Specificity | Sensitivity | Specificity |
| 5 | 43.5% | 96.2% | 80.01% | 96.2% |
| 6 | 69.6% | 92.5% | 88.0% | 92.5% |
| 7 | 82.6% | 87.5% | 100.0% | 87.5% |
| 8 | 87.0% | 77.5% | 100.0% | 77.5% |