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ABSTRACT

Relatively little data exist concerning the utility of brief cognitive measures to detect dementia among African Americans. The current study evaluated the clinical utility of the Mini-Mental Status Exam (MMSE) and the Fuld Object Memory Evaluation (FOME) in detecting Alzheimer's disease (AD) among both African American and European American older adults. One hundred and forty geriatric patients from a large urban academic medical center were examined. Overall, the FOME appeared to be more effective in detecting AD than was the MMSE (93% sensitivity vs. 75% sensitivity, respectively), although both measures suffered from relatively low specificity (63.5) in the full sample. The FOME demonstrated exceptional clinical utility among African American patients (sensitivity 98.3%; specificity = 64.5; positive predictive power 83.8%; negative predictive power 95.2%). The results of this study support the use of the FOME among older African Americans to detect dementia.

African American older adults have typically been underrepresented in Alzheimer's disease (AD) research (Ballard, Nash, Raiford, & Harrell, 1993; Welsh, Ballard, Nash, Raiford, & Harrell, 1994). As a result, there is a paucity of empirical evidence concerning clinical aspects of AD in this population. For example, although the number of studies on AD among African Americans has increased in recent years in general (Auchus, 1997; Gorelick et al., 1994; Ripich, Carpenter, & Ziol, 1997; Shadlen, Larson, Gibbons, Mc-Cormick, & Teri, 1999; Welsh et al., 1995) the clinical utility of brief cognitive screening measures among African American patients has not been firmly established. Moreover, some reports have estimated that the prevalence of dementia may be higher among African Americans than among European Americans (Gurland et al., 1999). Although these findings are equivocal (Fillenbaum et al., 1998) they further highlight the need for effective detection of AD among African Americans.

Two previous clinical utility studies have demonstrated that existing screening instruments are less accurate in detecting dementia among African Americans than they are among European Americans (Anthony, LeResche, Nias, Von Korff, & Folstein, 1982; Fillenbaum, Heyman, Williams, Prosnitz, & Burchett, 1990). In the first study (Anthony et al., 1982), the utility of the Mini-Mental Status Exam (MMSE; Folstein, Folstein, & McHugh, 1975) was used to detect

dementia and delirium among 97 inpatients (77% African American). This study demonstrated lower specificity rates among African American patients than among European American patients. A 39% false positive rate (i.e., 61% positive predictive power) was reported (11 of the 12 false positives were African American, all had less than nine years of formal education). These findings highlight racial differences in screening results and the impact of education upon the utility of cognitive screening measures. That is, non-demented African American patients with lower levels of education were likely to be incorrectly classified as demented on the basis of MMSE scores.

In the second study, Fillenbaum and colleagues (1990) examined the ability of six measures (Orientation-Memory-Concentration Test; Mental Status Questionnaire (SPMSQ); MMSE; Storandt battery; Iowa battery; and Kendrick Cognitive tests) to detect dementia among both African American and European American community residents. All of the tests except the SPMSQ and the Kendrick tests were significantly correlated with education and race. These tests yielded excellent sensitivity but poor specificity especially among African American elders. A high false positive rate was found, especially among African American elders.

The present study examined the utility of two dementia screening measures, the Mini-Mental State Exam (Folstein, Folstein, & McHugh, 1975) and the Fuld Object Memory Evaluation (Fuld, 1977). The Mini-Mental State Exam (MMSE) purports to tap multiple cognitive abilities, has been frequently studied, and often is used with dementia patients. The Fuld Object Memory Evaluation (FOME) focuses solely on memory, has been less frequently studied and less frequently incorporated into screening for Alzheimer's disease. Although the body of research concerning the FOME is much smaller than that of the MMSE, available research has demonstrated the FOME's potential utility in predicting the onset of dementia among healthy older adults (Masur, Sliwinski, Lipton, Blau, & Crystal, 1994), differentiating progressive dementia from depression (LaRue, 1989), and differentiating demented from non-demented geriatric patients (Summers, Lichtenberg, & Vangel, 1995).

It was hypothesized that the Fuld Object Memory Evaluation (FOME) would be more clinically effective in detecting Alzheimer's disease than would the MMSE. This prediction was made on the basis of the following points. First, performance on neuropsychological tests is influenced by a variety of variables including brain impairment and level of education. One of the difficulties involved in screening for Alzheimer's disease among older adults with lower levels of education concerns differentiating low performance due to brain pathology from low performance due to low levels of education. However, the extent to which education influences neuropsychological performance varies widely as a function of the particular tests being used and studied. Previous research has demonstrated that performance on the FOME is not significantly correlated with years of formal education (LaRue, 1989; LaRue, Romero, Ortiz, Liang, & Lindeman, in press; Summers, Lichtenberg, & Vangel, 1995; Wall, Deshpande, MacNeill, & Lichtenberg, 1998). As a result, the FOME should be more effective as a screening measure than is a screener that is heavily influenced by education.

Second, memory impairment is the hallmark cognitive symptom of Alzheimer's disease and has been implicated as the first cognitive ability to decline in early stages of AD (Bondi, Salmon, Galasko, Thomas, & Thal, 1999). The FOME is a measure solely of memory unlike other screening measures like the MMSE, which purposefully tap multiple domains. Given that memory decline is both the earliest and most prominent symptom of Alzheimer's disease, it is hypothesized that a memory measure would be the most effective in detecting the disease.

METHODS

Participants

One hundred-seventeen consecutively evaluated outpatients from the Detroit satellite of the Michigan Alzheimer's Disease Research Center (MADRC) were included in this study. Patients were deter-

mined to be cognitively intact or demented on the basis of a geriatrician examination in accordance with NINCDS-ADRDA criteria (McKhann et al., 1984). All determinations regarding cognitive status (dementia or no dementia) were made by the geriatrician independent of cognitive test scores (i.e., MMSE or FOME). This determination by the geriatrician was heavily based on patient history and interviews with the patient and caregivers. Of these patients, 88 (75%) met the NINCDS-ADRDA criteria for dementia and the remaining 29 were determined to be non-demented. Fifty-six (63.6%) of the dementia patients met criteria for probable Alzheimer's disease. Twenty patients (22.7%) met criteria for probable vascular dementia.

The clinical utility demonstrated by screening instruments is partly dependent upon the base-rate of dementia within the sample under study, such that as the base-rate departs from moderate values (i.e., 50%), it becomes increasingly difficulty to demonstrate utility estimates that improve upon the base-rate prediction. Because the base-rate of dementia was unusually high in this sample, an additional 23 non-demented patients from another geriatric clinic within the Detroit Medical Center were included. In this combined sample ($N = 140$), the base-rate of dementia was 62.9. The base-rate of dementia did not differ by race in this sample. Characteristics of the full sample are listed in Table 1. The demented and non-demented samples did not differ by age, education, gender, or racial composition. The European American patients in this sample had significantly more years of formal education (mean = 11.6, $SD = 2.2$) than did the African American patients (mean = 10.2, $SD = 3.7$). In contrast to published reports that observed that most patients presenting in memory disorders clinics are White and highly educated (e.g., Morris, Mohs, Rogers, Fillenbaum, & Heyman, 1988), a large majority of the patients in this study were African American and had relatively low levels of formal education. Four patients were neither African American nor European American and were therefore included only in analyses concerning the full sample.

Measures

The Mini-Mental State Exam (MMSE) is an 11-item measure that was designed as a measure of cognitive impairment among psychiatric patients. It purports to tap a variety of cognitive domains including orientation, attention and calculation, immediate registration, short-term recall, language, and visual construction. Scores range from zero to 30, with a frequently employed cut score of 24, below which cognitive impairment is indicated.

The Fuld Object Memory Evaluation (FOME) is an instrument that assesses both storage and retrieval of information across five trials via a selective reminding procedure. The materials for this instrument include a bag that contains 10 common items including a ball, nail, scissors, cup, bottle, key, card, button, ring, and matches. Patients are asked to reach into the bag and identify one object by touch alone without viewing it. After identifying the object via touch they remove the object from the bag and confirm its identity visually. If the patient is unable to recognize the object either through touch or vision, the examiner provides the name of the object. This allows for encoding of the objects via multiple sensory modalities. The patient repeats this process for all 10 objects. All of the objects are then placed back into the bag. A brief verbal distracter task is then used to prevent rehearsal. Following the distracter task the patient is asked to recall as many objects from the bag as possible in 60 seconds. The patient is then reminded of each object that was not correctly recalled on that particular trial (i.e., selective reminding). This is repeated for a total of five recall

Table 1. Sample Characteristics.

	Dementia patients ($n = 88$)	Non-demented patients ($n = 52$)	
Mean age, (SD)	76.4 (6.4)	74.5 (7.6)	$p = .11$
Mean yrs of education (SD)	11.0 (3.2)	10.4 (3.3)	$p = .34$
Gender (% female)	71.6%	55.8%	$p = .06$
Race (% African American)	68.2%	60.8%	$p = .37$
Mean MMSE score (SD)	20.2 (4.0)	24.3 (3.9)	$p < .01$
Mean FOME retrieval score (SD)	14.9 (9.3)	31.0 (9.2)	$p < .01$

SD = Standard Deviation; MMSE = Mini-Mental State Exam; FOME = Fuld Object Memory Evaluation.

trials. The number of objects recalled in each of the five trials is then summed into a total retrieval score that can range from zero to 50. A cut score of 30 is frequently employed as suggestive of impairment. This study examines the utility of the total retrieval score (i.e., sum of trials 1–5).

Statistical Procedures

First, the relationship between cognitive test scores and demographic variables (i.e., age, education, race, and gender) were examined using bivariate correlations. Second, the clinical utility of the MMSE and FOME were examined using logistic regression in the full sample of patients to determine the test's ability to differentiate dementia patients from those who were not demented. These analyses yielded four estimates of clinical utility: sensitivity (the percent of dementia cases correctly identified as demented), specificity (the percent of non-demented cases correctly identified as non-demented), positive predictive power (the percent of cases scoring below a cutoff score who were actually demented), and negative predictive power (the percent of cases scoring above a cutoff score who were non-demented). In the context of evaluating screening measures, positive and negative predictive power are arguably most important as these indices evaluate the initial hypothesis a clinician would form regarding a patient's cognitive status based upon the test score when the true status of the patient is yet unknown. In the first set of logistic regression analyses, the clinical utility estimates for the MMSE and FOME were examined in the full sample using a cut scores of 24 and 30, respectively. In the second set of logistic regression analyses, the clinical utility of the MMSE and FOME were examined separately for African Americans and European Americans.

RESULTS

Demographic Influences on MMSE and FOME Scores

The correlations between the demographic characteristics of the sample and cognitive test scores are presented in Table 2. Twenty-three cases had missing data for education. These cases were excluded from the computation of correlation coefficients involving education. Performance on the MMSE was moderately influenced by level of education, whereas performance on the FOME was not significantly correlated with education. These findings are consistent with previous research demonstrating education effects on the MMSE (Crum, Anthony, Bassett, & Folstein, 1993; Tombaugh & McIntyre, 1992) and an absence of education effects on the FOME (LaRue et al., in press; LaRue 1989; Wall et al., 1998). Neither test was significantly correlated with age, but each was mildly correlated with race. The MMSE demonstrated a very modest correlation with gender.

Clinical Utility of the MMSE and FOME

The results of the initial logistic regression analysis using the MMSE (with cut score of 24) in the full sample yielded an overall correct classification rate of 70.7%. The sensitivity and specificity estimates of the MMSE were 75.0% and 63.5% respectively. The positive predictive power was 77.6% and negative predictive power was 60.0%. This low negative predictive power suggests that

Table 2. Bivariate Correlations Among Study Variables.

	Age	Education	Gender	Race	Dementia	MMSE
Education	−.10					
Gender	.21*	−.13				
Race	−.02	.22*	−.09			
Dementia	.14	.09	.16	−.08		
MMSE	−.16	.32***	−.22**	.17*	−.46***	
FOME	−.14	.04	−.11	.21*	−.65***	.61***

Gender (1 = Male; 2 = Female).
Race (1 = African American; 2 = European American).
Dementia (0 = Non-Demented; 1 = Demented).
MMSE = Mini-Mental State Exam; FOME = Fuld Object Memory Evaluation.
$^*p < .05$; $^{**}p < .01$; $^{***}p < .001$.

Table 3. Clinical Utility of the MMSE and Fuld Object Memory Evaluation (FOME) in Detecting Dementia.

	Sensitivity	Specificity	PPP	NPP
Full sample ($N = 140$)				
MMSE	75.0	63.5	77.6	60.0
FOME	93.2	63.5	81.2	84.6
African American ($N = 89$)				
MMSE	79.3	64.5	80.7	62.5
FOME	98.3	64.5	83.8	95.2
Euro-American ($N = 47$)				
MMSE	66.7	60.0	69.2	57.1
FOME	81.5	65.0	75.7	72.2

PPP = Positive Predictive Power; NPP = Negative Predictive Power.
MMSE = Mini-Mental State Exam; FOME = Fuld Object Memory Evaluation.

roughly 40% of the patients who were classified as cognitively intact on the basis of MMSE scores actually met NINCDS-ADRDA criteria for dementia.

The results of the initial logistic regression analysis using the FOME in the full sample yielded an overall correct classification rate of 82.1%. The sensitivity and specificity estimates of the FOME were 93.2% and 63.5%, respectively. The positive predictive power was 81.2% and negative predictive power was 84.6%.

Second, the clinical utility estimates of the MMSE and FOME were examined separately among European Americans and African Americans. Among African Americans the MMSE overall correct classification rate was 74.2%. Sensitivity and specificity values were 79.3% and 64.5%, respectively. Positive predictive power was 80.7% and negative predictive power was 62.5%. Among European Americans the MMSE yielded an overall correct classification of 63.8%. Sensitivity and specificity values were 66.7% and 60.0%, respectively. Positive predictive power was 69.2% and negative predictive power was 57.1%.

Among African Americans the FOME yielded an overall correct classification rate of 86.5%. Sensitivity and specificity values were 98.3% and 64.5%, respectively. Positive predictive power was 83.8% and negative predictive power was 95.2%. Among European Americans the FOME demonstrated an overall correct classification rate of 74.5%. Sensitivity and specificity values were

81.5% and 65.0%, respectively. Positive predictive power was 75.7% and negative predictive power was 72.2%.

In addition to the main analyses presented above, additional analyses of clinical utility were conducted on a sub-sample of the data including only the memory clinic patients ($n = 117$). This was done to determine if supplementing these data with non-demented patients from another clinic introduced any systematic bias into our results. The results of these additional analyses were largely consistent with those from the larger sample, with the exception that specificity estimates were generally lower as would be expected with a dementia base-rate of 75%.

DISCUSSION

The results of this study support the use of the FOME as a screening measure for Alzheimer's disease among urban older adults. More specifically, in this study the FOME demonstrated exceptional utility among African American elders. Given the dearth of research concerning Alzheimer's disease (AD) among urban minority elders, this study is an important step toward effective screening for AD among African Americans.

Although the MMSE was not designed as a screening measure for use specifically with AD, it is commonly used for this purpose. In terms of face validity, the MMSE appears to be advanta-

geous in that purports to tap into multiple domains of cognitive functioning including orientation, recall, language, and visual construction. However, the analyses in this study support the FOME, a measure of memory, as a potentially more accurate screener for AD. This finding is consistent with recent reports emphasizing the prominence of memory deficits both in early and middle stages of AD (Bondi et al., 1999). In other words, because memory disturbances are the most prominent cognitive deficits in early to middle stage AD, memory screens like the FOME may be most effective in differentiating AD from non-demented elderly. In contrast, only 3 of 30 points on the MMSE reflect memory performance (i.e., recall of three objects after a short delay).

In addition, given the absence of education effects, the FOME appears to be more accurate when using a single cut-off score than is the MMSE, which has repeatedly demonstrated a significant correlation with education (Crum et al., 1993; Tombaugh & McIntrye, 1992). In the present study the difference between the MMSE and the FOME was most notable in terms of each test's ability to rule out dementia (i.e., negative predictive power) particularly among African American elders. When the FOME score suggested there was no dementia (i.e., retrieval score greater than 30) it was correct 95.2% of the time among African Americans, whereas the MMSE was correct only 62.5% of the time among African Americans.

One strength of this study is its sample which includes a large number of African Americans. Many dementia studies have focused upon moderately to highly educated, European American samples, partly due to the nature of memory clinic populations (Morris et al., 1988). This sample from the Detroit MADRC is unique in terms of its racial composition and allows us to address a crucial question in AD research. That is, can current screening instruments effectively detect AD among urban African Americans? This study clearly supports the clinical utility of the FOME among African Americans. Although this study also provides modest support for the clinical utility of the MMSE among African American patients, the MMSE appeared to be less accurate than the FOME. In addition, although results are

also presented separately for European Americans, these results should be interpreted with caution given the relatively small sample size for that population.

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