Utility of Mini-Mental State Exam Scores in Predicting Functional Impairment Among White and African American Dementia Patients


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Background. The Mini-Mental State Exam (MMSE) is widely used to assess cognitive impairment. Although education and race have been shown to affect the validity of the MMSE in detecting dementia, whether race and education influence the validity of the MMSE in gauging severity of dementia is unknown.

Methods. Patients diagnosed with Alzheimer’s and other dementias (59 African American, 112 White) were administered the MMSE, and information was gathered on patient functional impairment, including Activities of Daily Living (ADL), Instrumental Activities of Daily Living (IADL), and the Memory and Behavior Problems Checklist (MBPC). Demographic information, including patient and caregiver education, and patient age, was also assessed.

Results. African American and White patients did not differ significantly on the MMSE or functional impairment variables, but White patients had higher educational attainment. Hierarchical multiple regression analysis showed that race and education did not predict functional impairment, and MMSE scores were strong predictors of ADL and IADL levels for both African American and White patients. MMSE predicted variability in MBPC scores for White patients only, perhaps related to racial differences in subjective caregiver report of behavioral problems.

Conclusions. While race and education may affect the validity of the MMSE in detecting the presence of cognitive impairment, the MMSE can be a useful predictor of degree of ADL and IADL impairment in patients diagnosed with dementia, regardless of race.

The Mini-Mental State Exam (MMSE) is the brief mental status instrument most widely used in the assessment of patients with dementia (1). Despite its brevity, the MMSE has generally been shown to be a valid instrument in detecting cognitive impairment (2), although several studies (3–5) have found that age and educational attainment are important to consider in using the MMSE for diagnostic purposes. Once educational attainment and impairment in activities of daily living are taken into account, the MMSE has similar sensitivity and specificity in detecting dementia in White and African American populations (4,5). This issue is of particular importance given that elderly African Americans are more likely to have lower educational attainment.

Whether race and educational attainment affect the validity of the MMSE in gauging the severity of dementia among patients who have already received diagnoses of AD or other dementias is unknown. While it is possible that education bias effects occur throughout the range of the MMSE, among patients who are already diagnosed with dementia, this education and/or race bias might be minimal. Simple items on the MMSE, such as naming of common objects, are unlikely to have significant racial or educational biases.

In general, previous research shows moderately strong relationships between MMSE scores and activities of daily living (ADL) and instrumental activities of daily living (IADL) performance, with poorer functioning in patients with lower MMSEs (6,7). The relationship of MMSE to behavioral problems is less consistent; some studies suggest that certain behavioral problems decrease in later dementia, attenuating any correlation of MMSE and behavioral problems (8,9). Behavioral problems may also be somewhat prone to biases in caregiver report (10).

The present investigation was aimed at assessing the usefulness of the MMSE in predicting functional impairment in a population already diagnosed with AD and other dementias. Through hierarchical regression analyses we assessed the degree to which MMSE score was predictive of functional impairment after controlling for patient age, education, and race, as well as caregiver education. We also assessed the degree to which the association between MMSE score and functional impairment differed according to race by exploring race by MMSE interactions within the regression analyses.

Method

Subjects

Subjects were drawn from the full sample of patients (N = 197) recruited through the UAB Memory Disorders Clinic as part of a larger, ongoing project that focuses on stress and coping in African American and White caregiving families (11). All patients were evaluated by a neurologist...
(LEH) knowledgeable in the diagnosis of dementia. Treatable etiologies of dementia were eliminated by performing cranial imaging with either CAT scan or MRI and through laboratory testing including CBC, blood chemistries, thyroid panel, Vitamin B12 and folate levels, and VDRL (Vene-
real Disease Research Laboratory). The diagnoses of probable and possible Alzheimer’s disease were based on NINCDS-ADRDA criteria (12), while the diagnoses of other dementias were based on standard neurological criteria. Those patients with missing MMSE or educational data were deleted, leaving the resultant sample of 59 African American and 112 White patients utilized in all analyses. Within these populations, 86% of African Americans and 95% of Whites were diagnosed with probable AD. The 14% of African Americans not diagnosed with probable AD were diagnosed with the following dementias: 2 – possible AD; 2 – frontal lobe dementia/Pick’s disease; 2 – mixed multi-infarct dementia (MID) and AD; 1 – MID; 1 – cortical basilar degeneration. The 5% of Whites not diagnosed with probable AD were diagnosed with the following dementias: 1 – possible AD; 1 – AD/Parkinson’s disease; 1 – Pick’s disease; 1 – diffuse Lewy Body Disease; 1 – MID.

Measures and Procedure
Clinic neurologists conducted all of these assessments with the MMSE, which ranges from 0 to 30, with lower scores indicating worse cognitive functioning.

The ADL Scale (13) assesses a patient’s need for assistance on six basic self-care activities, including bathing and dressing. The IADL Scale (14) includes eight specific higher order activities, such as using the telephone or traveling independently. Items on both the ADL and IADL scales range from 1 to 4, with 1 indicating no impairment and 4 indicating most severe impairment. The Memory and Behavior Problems Checklist [MBPC (15)] is a 30-item instrument which assesses the frequency of occurrence of memory and behavior problems exhibited by the patient during the past week, such as asking repetitive questions and wandering. Items were scaled from 0 to 3, with 0 indicating nonoccurrence of the problem, and 3 indicating occurrence of the problem on a daily basis or more often. The ADL, IADL, and MBPC, and patient age, education, and race, along with caregiver education were all assessed through caregiver report.

The data were analyzed using separate hierarchical multiple regressions for ADL, IADL, and MBPC scores. Patient variables (age, education, and race) were entered in the first step, followed by caregiver educational level in the second step. MMSE score was entered in the third step. Finally, the interaction of MMSE score and race was entered in the final step. MMSE score was entered in the third step. Finally, the interaction of MMSE score and race was entered in the final step. MMSE score was entered in the third step. Finally, the interaction of MMSE score and race was entered in the final step. MMSE score was entered in the third step. Finally, the interaction of MMSE score and race was entered in the final step. MMSE score was entered in the third step. Finally, the interaction of MMSE score and race was entered in the final step. MMSE score was entered in the third step. Finally, the interaction of MMSE score and race was entered in the final step. MMSE score was entered in the third step. Finally, the interaction of MMSE score and race was entered in the final step. MMSE score was entered in the third step. Finally, the interaction of MMSE score and race was entered in the final step. MMSE score was entered in the third step. Finally, the interaction of MMSE score and race was entered in the final step.

RESULTS

Characteristics of the Sample
The characteristics of these patients are presented by race in Table 1, which reveals that patients do not differ according to race on any of the following variables: age, duration of memory loss, MMSE score, ADL, IADL, or MBPC. Patients also do not differ significantly accordingly to race on diagnosis, although a trend was noted toward African American patients being more likely to have a diagnosis other than AD [Chi square (1, n = 171) = 3.35, p = .067], as discussed in the Method section. Supplemental analyses showed that scores on the MMSE, ADL, IADL, and MBPC were not significantly different between patients with AD and other dementias, and thus for all analyses data were pooled across diagnosis. Of the variables used in the present analyses, patients differ by race on education only, with African American patients having lower levels of educational attainment [F(1,169) = 19.98, p < .005]. Caregivers, however, did not differ by race on education. Characteristics of the caregiver population are given in detail in a previous publication from this project (11).

Hierarchical Regression Analyses
Table 2 presents the results of the hierarchical regression analyses for the ADL, IADL, and MBPC. For ADL and IADL scores the only patient or caregiver background variable in steps one and two to account for significant variability (less than 5%) was age, with greater age associated with worse impairment on the ADL and IADL. In the third step, with the effects of patient age, education, and race, along with caregiver education controlled, MMSE score accounted for significant and substantial increments of variance in ADL (40%) and IADL (29%) scores. Finally, no significant race by MMSE interaction effect was found for ADL or IADL scores, suggesting that lower levels of cognitive functioning on the MMSE were associated with greater functional impairment on the ADL and IADL for both African American and White patients.

On the MBPC, age was again the only significant demographic variable, but given that the overall step was not
significant, this finding should be interpreted with caution. MMSE scores again accounted for a significant proportion of the variability in MBPC scores, although accounting for less than half the variability in MBPC scores (13%) relative to ADL and IADL scores. Finally, in contrast to ADL and IADL scores, the predictive relationship for MMSE scores was found to differ for African American and White patients, although this final step accounted for only 2% of the variability. Analysis of this interaction effect revealed that African Americans suffering from AD performed more poorly than Whites on the MMSE, even when age, education, duration, and severity of illness were statistically controlled. Although the reasons for this discrepancy are unknown, Welsh et al. (17) also found that MMSE scores were lower in patients more functionally impaired, when measured with the Blessed Dementia Rating scale, which it was found that African Americans suffering from AD performed more poorly than Whites on the MMSE, even when age, education, duration, and severity of illness were statistically controlled. Although the reasons for this discrepancy are unknown, Welsh et al. (17) also found that MMSE scores were lower in patients more functionally impaired, when measured with the Blessed Dementia Rating scale.

**DISCUSSION**

The results of this study suggest that scores on the MMSE correlate to the degree of functional impairment in patients already diagnosed with AD and other dementias, regardless of race or education. Thus, the MMSE could be useful in both clinical and research settings to estimate the severity of dementia, without adjusting for education or race.

Previous studies have shown that when the MMSE is utilized to detect dementia, no differences exist between African Americans and Whites, once age, education, and functional status are taken into account (2-5). Our study suggests that once the diagnosis of dementia has been made, neither age nor education influences MMSE scores, although age was associated with worse functional impairment as measured by ADLs and IADLs. Further, our study also suggests that once the diagnosis of dementia is made, MMSE scores are not influenced by race. This finding is discrepant to those recently reported by Welsh et al. (17), in which it was found that African Americans suffering from AD performed more poorly than Whites on the MMSE, even when age, education, duration, and severity of illness were statistically controlled. Although the reasons for this discrepancy are unknown, Welsh et al. (17) also found that MMSE scores were lower in patients more functionally impaired, when measured with the Blessed Dementia Rating and Clinical Dementia Rating scales. Thus, even though patients' functional abilities were measured utilizing different instruments, the results of Welsh et al. mirror ours and suggest that MMSE scores correlate to functional impairment in the home.

A different relationship was found between race, MMSE, and memory and behavior problems. Lower MMSE scores were associated with greater behavioral problems for White patients only. Given that caregiver report of behavioral problems is more subjective (10) and less clearly linked with stage of dementia (6), this result does not appear to suggest a serious problem in the validity of the MMSE. Previous studies suggesting that African American families appraise caregiving differently than White families (11,16) may account for this finding.

While these results are encouraging for researchers wishing to use the MMSE in White and African American samples of patients with dementia, more objective assessment of patient functional impairment and behavioral problems, e.g., through observationally based measures, would provide greater confidence in the accuracy of measurement of patient

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**Table 2. Predictors of Functional Impairment in African American and White Dementia Patients**

<table>
<thead>
<tr>
<th>Dependent Variable</th>
<th>Predictor Variable</th>
<th>( \beta )</th>
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<th>( R^2 )cum</th>
<th>( R^2 )change</th>
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*Note: ADL = Activities of Daily Living; IADL = Instrumental Activities of Daily Living; MBPC = Memory and Behavior Problems Checklist; MMSE = Mini-Mental State Exam.

*p < .05; **p < .01; ***p < .001.
Impairments. It is hoped that evidence that the MMSE can be used in an equally valid manner to gauge functional impairment in dementia in White and African American patients will foster more clinical research on the important and neglected topic of AD in minority populations.

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References


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Announcing

A Conference on the Public-Use Tape on the Aging of Veterans of the Union Army

Dates: October 24-27, 1996
Place: The University of Chicago.

A Public-Use Tape tracing about 40,000 Union Army Men from early childhood to death is now being made available to investigators. The October conference is intended for potential users of the tape who wish to know more about the characteristics of the data set and the procedures that have been developed for managing approximately 9,000 variables on each observation. This randomly drawn longitudinal sample was designed to analyze early life factors that contribute to labor force behavior, chronic disease and mortality of individuals in later life. It can also be used to compare prevalence rates of diseases among males sixty-five and over in 1910 and at the present time. Individuals interested in participating in the conference should write to: Mark A. Rudberg, M.D., M.P.H., mrudberg@medicine.bsd.uchicago.edu (312)702-3795, Department of Medicine, MC6098, The University of Chicago, 5841 South Maryland Avenue, Chicago 60637 or Ms. Francie Margolin, Center on Aging/NORC, 1155 East 60th Street, Chicago, IL 60637 or e-mail fmar@eicero.spc.uchicago.edu Please indicate the nature of your interest in the data and the purposes to which they will be put. Requests for invitations to this conference must be received by July 15, 1996.