PRELIMINARY ASSESSMENT OF AN ARABIC VERSION OF THE MINI-MENTAL STATE EXAMINATION

Saad Al-Rajeh, MD, FAAN; Adesola Ogunniyi, MD; Adnan Awada, MD; Abdulkader Daif, MD; Radwan Zaidan, MD, PhD

The Mini-Mental State Examination (MMSE) is one of the most widely used instruments for quantitative assessment of cognitive functions and for dementia screening.[1,2] It assesses many cognitive domains, including orientation, memory, language, calculation and visual construction. The test, however, shows educational as well as cultural bias, and appears to be more suited to Western culture.[2-4] The use of the MMSE in other cultures, therefore, entails translation into the specific languages, modification and/or substitution of some of the items with culturally relevant ones, and pilot-testing these for reliability, sensitivity and specificity. There are many versions and translations of the MMSE, including Chinese, German, Spanish and Nigerian, which have been used for studies in the respective cultures.[4-7] An Arabic version of the MMSE was developed and pilot-tested on Saudi patients. The results are presented in this report.

Materials and Methods

The MMSE was translated into the Arabic language, with many items left unchanged from the original version. The names of the area of the Kingdom and its location were substituted for the name of the country and the particular state, which appear in the original version. Date (a popular palm produce), chair and money, were the three items most often used. We used serial subtraction of 3s from 100 for assessing calculation, attention and concentration. We omitted spelling "world" backwards because the concept appeared difficult in a predominantly illiterate population. The expression "no ifs, ands or buts" was replaced by an Arabic phrase. The Arabic version produced was then translated back into English to ensure consistency of the items. The questionnaire was then administered by the same interviewer to 33 subjects, comprising 27 males and 6 females, who volunteered to take part in the study. The participants were mainly relations of inpatients at the King Khalid University Hospital, Riyadh (KKUH), who had no evidence of central nervous system dysfunction and were not on medications that could depress cognitive function or alertness. The responses were recorded as either correct or incorrect. The educational status of the individuals was obtained at the end of the administration of the questionnaire. Individuals who had not attended school or had spent less than six years in school were regarded as uneducated.

Using sequential analysis, the questionnaire was administered by the same interviewer to four clinically diagnosed demented patients (based on DSM-IV criteria)[8] being managed at KKUH, for the determination of its psychometric properties. The dementia diagnoses were vascular (two cases), probable Alzheimer's disease (one case) and dementia associated with meningioma (one case). The patients included three females and one male, with a mean age of 69.8$\pm$11.2 years (range, 54-80 years), who were uneducated.

Data Analysis

Frequency counts were used for all the variables. The scores were summated for each patient to derive the total score. The subjects were categorized into three groups: group 1="educated normal" comprised 14 individuals (mean age, 39.4 years); group 2="uneducated normal" comprised 19 individuals (mean age, 57.5 years); and group 3="demented patients." Because of the small sample size and problems with outliers in terms of total scores, we used non-parametric statistics, including Kruskal-Wallis one-way analysis of variance and Spearman correlation coefficients to compare the results between groups. The corrected chi-squared values with two degrees of freedom were recorded. Sensitivity and specificity values were calculated from the tabulation of the total scores for the normal and demented subjects using standard methods. All the analysis was done with SPSS version 6.0 (1993) for Windows. Probability values below 0.05 were accepted as significant.

Results

The demented subjects (mean age rank=28.9 years) were significantly older, when compared with either the

From the Neurology Division, Department of Medicine, King Khalid University Hospital and from King Fahad National Guard Hospital, Riyadh, Saudi Arabia.

Address reprint requests and correspondence to Dr. Al-Rajeh: Neurology Division, Department of Medicine, King Khalid University Hospital, P.O. Box 7805 (38), Riyadh 11472, Saudi Arabia.

Accepted for publication 21 November 1998. Received 21 April 1998.

"uneducated normal" (mean age rank=21.4 years) or the "educated normal" (mean age rank =10.8 year) (corrected chi-squared + 13.8, $P<0.001$). The total scores of the normal subjects ranged between 11 and a maximum of 30, with a mean of 22.3 (SD=6.3). For the demented patients, the scores ranged between 3 (the lowest obtainable) and 10, with a mean of 8.0 (SD=3.4). Figure 1 shows the range and mean scores for all the normal, as compared with the demented, subjects without overlap.

The respective total score mean ranks for the "educated normal," "uneducated normal" and the demented subjects were 29.3, 14.9, and 2.5, respectively. The chi-squared value was 24.8, $P<0.0001$. The total score was correlated with educational status (r_s = 0.75, $P<0.0001$), inversely with both age group (r_s =–0.74, $P<0.0001$) and with sex (r_s =–0.33, P=0.047).

Table 1 shows the performances of the three groups of subjects on the various test items. As expected, the educated subjects recorded the highest ranks in correct responses for virtually all the items, and the demented patients performed poorly in these aspects. Table 2 shows the sensitivity and specificity values for the different scores. Any score below 11 yielded perfect sensitivity and specificity for the diagnosis of dementia in this study.

Discussion

The superior performance of the educated as compared to the uneducated subjects studied confirmed the educational bias of the MMSE, as other workers have reported.[1-8] Their performance reflected better information, attention and knowledge in general, whereas the disorientation of the demented patients was striking. MMSE scores are reported to be affected by age, with a decrease in performance as age advances.[5,6,9,10] In this study, an inverse correlation was observed because the uneducated and demented subjects were significantly older. There is, therefore, a need to adjust the scores according to age and educational status, as has been done in other studies.[5,6]

TABLE 1. *Mean ranks of correct responses on the test items according to subject classification.**

Test	Educated n=14	Not educated n=19	Demented n=4	Corrected chi-square**
Orientation (time)				
Year	27.0	15.3	8.5	18.5
Season	23.5	20.0	7.1	18.9
Month	23.0	16.2	16.4	6.3
Day of the week	21.9	18.7	10.6	5.4**
Date	25.9	15.8	10.0	13.3
All items correct	28.0	14.9	7.2	18.8
Orientation (place)				
Region	24.0	18.2	5.5	15.7
City/town	21.0	19.1	11.8	7.9
Orientation in city	23.7	17.3	10.5	7.5
Floor	22.2	19.6	5.0	14.4
Address	21.0	20.0	7.1	18.9
All items correct	26.6	16.9	2.8	18.0
Three-word registration	19.2	20.5	11.5	6.4
Series of 3s	27.2	16.0	5.0	17.1
Three-word recall	26.9	15.5	8.4	14.6
Visual recognition	20.0	19.0	15.4	3.7**
Sentence repetition	23.7	17.2	11.1	8.0
Visual command	27.0	14.4	13.2	16.8
Three-step command	21.5	19.6	7.6	14.8
Writing	28.2	13.9	11.0	22.3
Drawing	26.5	14.9	12.0	15.8

*Kruskal-Wallis one-way analysis of variance; **$P>0.05$, not statistically significant.

TABLE 2. *Derivation of sensitivity and specificity for different scores.*

Demented scores n=4	Normal scores n=33	Sensitivity (%)	Specificity (%)
3	–	25	100
9	–	50	100
10 (2)	–	100	100
–	11	100	97
–	13 (2)	100	90.9
–	14 (2)	100	84.8
–	15 (2)	100	78.8
–	16	100	75.8
–	17 (3)	100	66.7
–	19	100	63.6
–	20	100	60.6
–	21 (2)	100	54.5
–	23	100	51.5
–	24	100	45.5
–	25 (2)	100	42.4
–	26 (2)	100	36.4
–	27 (4)	100	24.2
–	29 (3)	100	15.2
–	30 (5)	100	0

*Frequencies in parentheses, with exception of single scores.

Our results also showed an inverse correlation with sex, which is perhaps not surprising, since many females do not seek employment in the traditional Arabic society, and so might have limited education. These cultural and educational biases may underlie the overall low scores of the subjects studied. The pattern may change with time because of noticeable efforts at improving female education. We used serial subtraction of 3s from 100, rather than 7s, because of the high proportion of illiterate subjects, whom we presumed could only handle simple calculations. Galasko et al.[11] have shown that serial subtraction was not a substitute for spelling "world" backwards, and that the two items had to be studied independently for the enhancement of the sensitivity of the MMSE. In populations with low education, adjustment of the items, such as easier subtraction, might provide a way of assessing concentration and attention rather than omitting these aspects completely. The three-word recall and orientation for place items have been reported to be the most valuable items for dementia screening.[11] The Arabic version we tested showed similar poor performance of the demented subjects on those items, in addition to poorer

performance in serial subtraction, orientation for time and 3-step command.

Our results suggested that any subject who scored below 11 on the questionnaire was, for all intents and purposes, demented. The mean score of our educated subjects falls within the conventional cut-off score of <24 in Western countries,[1,2] and there would have been no need for any adjustment if all the individuals were literate. However, this cut-off value has a low specificity of 51.5%, with sensitivity of 100% for the diagnosis of dementia. The specificity associated with the mean score of the "uneducated normal" subjects lies around 66.7%. This cut-off score would identify all the demented subjects, but approximately one-third of the individuals screened would be false-positives, who could then be sorted out during the second phase of the usual two-stage dementia screening design. The ideal situation would be to have different cut-off scores according to the educational status of the participants. For educated subjects who were young, a cut-off score of <24 would be ideal, whereas for the illiterate subjects, a cut-off score of <19 would appear reasonable.

Although the sample on which the instrument was pilot-tested was small, our results appeared to agree with the findings of other studies. Validation of this version of the MMSE in subsequent larger studies is necessary before it can be recommended for cognitive impairment and dementia screening in Arab population.

Acknowledgements

The authors wish to thank Dr. Omar Sheikh for the questionnaire administration and Ms. Lydia Gallardo for secretarial assistance.

References

1. Folstein MF, Folstein SE, McHugh PR. Mini-Mental State Examination: a practical method for grading the cognitive state of patients for the clinician. J Psychiatr Res 1975;12:189-98.
2. Kukull WA, Larson EB, Teri L, Bowen J, McCormick W, Pfanschmidt ML. The Mini-Mental State Examination score and the clinical diagnosis of dementia. J Clin Epidemiol 1994;47:1061-7.
3. Henderson AS. Dementia. Geneva: World Health Organization, 1994:6-7.
4. Katzman R, Zhang MY, Ouang YQ, et al. A Chinese version of the Mini-Mental State Examination: impact of illiteracy in a Shanghai dementia survey. J Clin Epidemiol 1988;41:971-8.
5. Monsch AU, Foldi NS, Ermini-Funfschilling DE, et al. Improving the diagnostic accuracy of the Mini-Mental State Examination. Acta Neurol Scand 1995;92:145-50.
6. Mungas D, Marshall SC, Weldon M, Haan M, Reed BR. Age and education correction of the Mini-Mental State Examination for English- and Spanish-speaking elderly. Neurology 1996;46:700-6.
7. Ogunniyi A, Osuntokun BO, Lekwauwa UG. Screening for dementia in elderly Nigerians: results of the pilot test of a new instrument. East Afr Med J 1991;68:448-54.
8. American Psychiatric Association. Diagnostic criteria from Diagnostic and Statistical Manual, version IV. Washington, D.C.: APA, 1994:85-93.
9. Anthony JC, Le Resche L, Niaz U, Von Korff MR, Folstein MF. Limits of the "Mini-Mental State" as a screening test for dementia and delirium among hospital patients. Psychol Med 1982;12:397-408.
10. Blecker ML, Bolla-Wilson K, Kawas C, Agnew J. Age-specific norms for the Mini-Mental State Exam. Neurology 1988;38:1565-8.
11. Galasko D, Klaber MR, Hofsetter R, Salmon DP, Lasker B, Thal LJ. The Mini-Mental State Examination in the early diagnosis of Alzheimer's disease. Arch Neurol 1990;47:49-52.