## Evaluation of the mini-mental state examination among the elderly people in Konya, Turkey

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## ABSTRACT

**Objectives:** To evaluate cognitive function by using the Mini-Mental State Examination (MMSE) among the elderly people in Konya, Turkey, and to examine the acceptance, and screening efficacy of the MMSE in the family medicine practice setting.

**Methods:** A descriptive and cross-sectional study was carried out between 15th December 2004 and 15th February 2005, in Konya, Turkey. Two hundred elderly people were included in the study. Participants were selected from the cases who were at least 65 years of age and older. Cognitive levels were assessed with the MMSE. Two different MMSE forms for educated and uneducated individuals were applied. Socio-demographic characteristics, orientation, registry memory, attention and calculation, recall, and language status were determined. The data were evaluated with SPSS 10.0 software.

**Results:** Participants of 65 years of age and older (36.5%) women, n=73 and 63.5% men, n=127) were included in this study. The age interval of participants was 65 and 85, and the mean age was 71.02 (SD=4.569). Of the participants, 66% (n=132) were uneducated, and 34% (n=68) were educated. The mean score of MMSE was 23.33 (SD=4.799). The score of MMSE was considered as normal when the value was 24 and over. Of the

participants, 57% (n=114) were evaluated as normal score and 43% (n=86) as abnormal score. The female mean MMSE score was 21.808 (SD=5.352). The male mean MMSE score was 24.204 (SD= 4.230). It was observed that cognitive impairment was higher among women than men (p=0.002). When we compared the cognitive status, there was no significant difference between uneducated and educated people (p>0.05). The cognitive function of participants with a dominant left hand was significantly lower than those with a dominant right hand (p=0.027).

**Conclusion:** Family physicians should be able to competently diagnose, evaluate, and initiate treatment in most patients with dementia. Physicians should be familiar with psychometric instruments such as the MMSE. These instruments are useful both to diagnose Alzheimer's dementia and follow patients on therapy. The MSSE should be used by family physicians of elderly patients, as early diagnosis and treatment will enable patients to retain the greatest possible functional capacity, and may allow families to care for the patient successfully for a longer period. Consequently, early diagnosis and aggressive treatment are crucial for people with dementia.

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Dementia is a brain disorder that seriously affects ones ability to carry out daily activities among individuals who are 65 years of age and older. Alzheimer's disease (AD) is the most common form

of dementia. Alzheimer's disease is associated with diffuse neuron injury and death and characterized by pathologic findings of senile plaques and neurofibrillary tangles. Clinically, people with AD

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demonstrate a slow, progressive decline in multiple areas, including cognition and the ability to perform activities of daily living.1 It may start with slight memory loss and confusion, but it eventually leads to irreversible mental impairment that destroys the ability of a person to remember, reason, learn, and imagine.<sup>2</sup> Today, the only definite way to diagnose AD is to find out whether there are plaques and tangles in the brain tissue. Therefore, doctors should make a diagnosis of "possible" or "probable" AD. At specialized centers, doctors can diagnose AD correctly up to 90% of the time. Doctors use several tools to diagnose "probable" AD. A complete medical history includes information about general health, past medical problems of the individuals, and any difficulties the person faces while carrying out daily activities. Medical tests, such as tests of blood, urine, or spinal fluid help the doctor find other possible diseases causing the symptoms. Neuropsychological tests measure memory, problem solving, attention, counting, and language. Brain scans allow the doctor to look at a picture of the brain to see if anything does not look normal.<sup>3</sup> The most important diagnostic tools lie in the history given by the patient, family members and other caregivers, and the office-based clinical examination. The evaluation of a patient with suspected dementia should be implemented whenever an older person is reported to have gradually increasing difficulty or change at least in one of the following areas: learning and retaining new information, handling complex tasks, reasoning ability, spatial ability and orientation, language ability or behavior. The clinical evaluation should be used to review changes in daily function; to quantify the presence and degree of cognitive impairment through use of a standardized instrument, such as the Mini-Mental State Examination (MMSE), and to identify localizing neurologic findings.<sup>1,4</sup> In this study, we examined the acceptance, and screening efficacy of the MMSE in the family medicine practice setting. We also aimed to determine the prevalence of the cognitive impairment among individuals 65 years of age and older by using the MMSE.

**Methods.** A descriptive and cross-sectional study was carried out between 15th December 2004 and 15th February 2005 in Konya, Turkey. Questionnaires were applied with the permission and cooperation of the head of the Provincial Health Administration. Two hundred elderly patients were included in this communitybased study. Participants were selected from the cases who were at least 65 years of age and older with any problems. All participants answered the questionnaire in a face-to-face interview. The presence or absence of memory complaints was evaluated. Cognitive levels were assessed with MMSE. The clinical utility of the MMSE and its acceptance by physicians may be improved through awareness of the influences of age and education on the MMSE and by its application in settings with a high base rate of dementia.<sup>5</sup> In this study, we applied the Turkish version of the MMSE, which was previously proven to be valid and reliable among the Turkish people.<sup>6,7</sup> Two different MMSE tests for educated and uneducated individuals were applied. An interview consisting of questions on sociodemographic characteristics, orientation, registry memory, attention and calculation, recall, and language status was performed. Participants were divided into 2 cognitive categories: normal (MMSE score of 24-30) and borderline-impaired (MMSE scores less than 24). Some previous studies accepted 2 cognitive categories: normal (MMSE scores of 26-30) and borderline-impaired (MMSE scores less than 26).4,8

Statistical analyses were performed using the software package SPSS version 10.0. The mean, standard deviation, and frequency values were used as descriptive statistics. Chi-square and *p*-values were used as cross-sectional statistics.

**Results.** The socio-demographic characteristics of the study group are shown in Table 1. On evaluation of education status, dominant hand, and cognitive functions according to gender, we found that the educational level of male participants was higher than female participants. There was no significant difference in using the dominant hand. However, in cognitive scoring, when an MMSE value of  $\geq 24$  was evaluated as normal, the cognitive function of the males were significantly higher than those of females (Table 2). The mean score of the MMSE in females was 21.808 (SD=5.352), and in males was 24.204 (SD=4.230). The prevalence of cognitive impairment in females was 57.5% (n=42), and 34.6% (n=44) in males. We found that the cognitive impairment was significantly higher in females than in males (p=0.002). When the scores of MMSE between genders were examined, the orientation scores of men were significantly higher than females. However, there was no significant difference in registration, attention and calculation, recall and language (Table 3). There was no significant difference when we compared cognitive function according to age group (divided into 10-year intervals), or education level. However, the cognitive function of patients with a dominant left hand was significantly lower than patients with a dominant right hand (p=0.027) (Table 4).

Table 1 - Socio-demographic characteristics of the study population.

Characteristic	n	(%)
Gender		
Female	73	(35.5)
Male	127	(63.5)
Age (65-85, mean 71.02±4.569)		` ´
65-74	155	(77.5)
75-84	43	(21.5)
85 and over	2	(1.0)
Education status		
Uneducated	132	(66)
Educated	68	(34)
Dominant hand		
Right hand	180	(90)
Left hand	20	(10)
Cognitive categories*		
$(mean SMMT = 23.33 \pm 4.799)$		
24-30 (normal score)	114	(57)
20-23 (mild)	50	(25)
10-19 (moderate)	33	(16.5)
1.0 (any one)	3	(1.5)

**Table 2** - Characteristic features according to gender.

Characteristics	Female		Male		<b>x</b> <sup>2</sup>	р
	No.	(%)	No.	(%)		
Education status						
Uneducated	69	(94.5)	63	(49.6)	3.858	0.049
Educated	4	(5.5)	64	(50.4)		
Dominant hand						
Right hand	67	(91.8)	113	(89)	0.153	0.695
Left hand	6	(8.2)	14	(11)		
Cognitive categories		. /		· /		
24-30 (normal)	31	(42.5)	83	(65.4)	9.908	0.002
20-23 (mild)	20	(27.4)	30	(23.6)		
10-19 (moderate)	20	(27.4)	13	(10.2)		
1-9 (severe)	2	(2.7)	1	(0.8)		
0 (profound)	-	-	-	-		

**Table 3** - Distribution of MMSE results according to gender.

Parameters	Total expected score	Mean female value	Mean male value	t	р
Orientation Registration	10	$6.86 \pm 2.162$ 2 47+0 92	8.94±1.524 2.59±0.75	7.455	<0.01
Attention and	5	$3.41\pm2.04$	$3.19 \pm 1.94$	0.79	>0.05
Recall Language	3 9	1.41±1.12 7.58±1.11	1.60±0.96 7.87±1.21	1.22 1.77	>0.05 >0.05

Table 4 - Comparison of cognitive status with different parameters.

Characteristics	Cognitive status				<b>X</b> <sup>2</sup>	р
	Normal		Impairment			
	No.	(%)	No.	(%)		
Age						
65-74	64	(41.3)	91	(58.7)	0.063	0.803
75 and over	17	(37.8)	28	(62.2)		
Educational status		. ,		. ,		
Educated	29	(42.6)	39	(57.4)	0.197	0.657
Uneducated	52	(39.4)	80	(60.6)		
Dominant hand		. ,		. ,		
Right hand	78	(43.0)	102	(57.0)	4.878	0.027
Left hand	3	(15.0)	17	(85.0)		

Discussion. In this study, we met with some limitations due to illiteracy, visual and hearing impairment, and dementia in some of the participants. We examined the acceptance, and screening efficacy of the MMSE in the family medicine practice setting. The clinical utility of the MMSE and acceptance by physicians may be improved through its application in settings with a high base rate of dementia. Due to its simple and low cost, it can be applied in primary health care. Periodic monitoring and assessment of functional ability and MMSE score is useful for patients with AD who are treated with acetylcholinesterase inhibitors. The assessments can also help in deciding whether to continue therapy or change to another acetvlcholinesterase inhibitor.<sup>9</sup> The MMSE was used by Quiroga et al<sup>10</sup> for the diagnosis of dementia in Chile due to its good sensitivity and specificity. Wilson et al,<sup>11</sup> showed that the MMSE score declined at an average of 3.19 points per year in patients without hallucinations. In those with hallucinations, the MMSE score was 1.85 points lower at baseline, and declined at an average of 0.59 additional points per year. This represents an 18% increase in the rate of MMSE decline associated with hallucinations. The MMSE includes the evaluation of the cognitive performance of patients and comparisons of subjects. The AD patients included an excess of women, experiencing the onset of cognitive impairment at a mean age of 69, and manifesting a moderate level of cognitive and functional impairment on average as reflected by mean MMSE score of 18 and a Clinical Dementia Rating of 1.6.12 Changes in global and specific measures of cognitive function were studied in a cohort of 410 cases with AD at Rush Alzheimer's Disease Center.<sup>13</sup> The annual average decline was 3.26 points on the MMSE. On both global and specific measures, the rate of cognitive decline decreased greatly in older people compared with younger people.

Family physicians should be able to competently diagnose, evaluate and initiate treatment in most patients with dementia. Physicians should be familiar with psychometric instruments such as the MMSE. These instruments are useful to both diagnose AD and follow patients on therapy. The MSSE should be used in the family physician departments for the elderly people as early diagnosis and treatment will enable patients to retain the greatest possible functional capacity and may allow families to care for the patient successfully for longer periods of time.<sup>14</sup>

The Hisayama study,<sup>15</sup> an epidemiological study on dementia in a Japanese elderly population aged 65 years or older, has shown that AD remains unchanged in both sexes during a 7-year follow-up period (19851992). The age-adjusted incidence of total dementia was approximately 20 per 1000 people-years in either gender; AD was more frequent in women. In our study, the mean score of the MMSE in women was 21.808 (SD=5.352) and the mean score of the MMSE in men was 24.204 (SD=4.230). The cognitive functions of males were significantly higher than the cognitive functions of females.

The Rotterdam study<sup>16</sup> showed that low education was associated with higher dementia risk in women but not in men. However, the cross-sectional studies may overrate the association between education and risk of dementia. In our study, when we compared cognitive function, there was no significantly difference between uneducated and educated people (p>0.05). Wilson et al,<sup>17</sup> working at Rush University Medical Center in Chicago have shown that higher educational attainment is associated with a slightly accelerated rate of cognitive decline in AD. The incidence rates of AD increased with age from an estimated 0.08% per year in the 60-65 age group to an estimated 6.48% per year in the 85+ age group for men and women combined. The doubling time of the incidence rates was estimated to be approximately 4.4 years, and the median time of conversion from mild cognitive impairment to diagnosis of AD was estimated to be 4.4 years. There was a trend for women to have a higher incidence rate than men, and fewer years of education could be associated with higher incidence rates; however, these effects were not significant.<sup>18</sup> In our study, when the scores of MMSE were compared between gender, the orientation scores of men were significantly higher than the scores of females. Ott et al,<sup>19</sup> presented detailed age specific prevalence of dementia, which indicates AD as the main contribution to the exponential increase of dementia with age

Alzheimer's disease is the most common cause of dementia among the elderly. The defining features of AD include progressive, global cognitive impairment that emerges in individuals whose brains develop densities of senile plaques that exceed those expected for age. However, patients with this disorder manifest remarkable interindividual variability in other clinical characteristics, including age at symptomatic onset; rate and pattern of progression; emergence of disturbances of mood, thought, perception, and behavior; development of extrapyramidal symptoms; and the presence of a family history of Alzheimer's disease-like dementia.<sup>12</sup> Alzheimer's disease is the leading cause of declining memory and other forms of cognition in old age. At necropsy examination, however, quantitative indices of AD pathology (for example, neuritic plaques, neurofibrillary tangles) are only modestly related to the presence of dementia and cognitive impairment close to the time of death, suggesting that other neurobiological mechanisms are involved.<sup>20,21</sup>

The prevalence of AD rises sharply with advancing age, with rates doubling approximately every 5 years over the age of 65. Ott et al<sup>19</sup> suggest that the prevalence of AD increases with age and the dementia, particularly AD is inversely related to educational status. Conversely, in our study, we could not find significant difference between age and education level in cognitive function. Unless we find the means to diagnose the Alzheimer process, the prevalence of AD in an aging and increasingly diverse population will continue to grow.<sup>22</sup> We found that the cognitive function of left hand dominant patients was significantly lower than right hand dominant patients (p=0.027). We were unable to find any related articles on this subject, and consequently, believe it should be evaluated in other detailed studies.

The approach of the physicians to the patients with dementia consisted primarily of helping family members to cope with the burden of caregiving and providing information about services such as adult day care programs and nursing homes.<sup>1,23</sup>Alzheimer's disease is predicted to increase in prevalence in the coming decades as long as the U.S. population continues to live longer. At the same time, advances in basic and clinical research will help make management of the disease more sophisticated. Tests are likely to be available to identify the people at risk for AD as well as those who have very early disease. More drugs will become available, and it is possible that disease progression may be delayed for many years.<sup>1</sup>

In conclusion, as the proportion of elderly people in the population increases, AD will become a major public health problem. Interventions that could delay the onset of the disease, even modestly, would therefore have a major impact on public health.<sup>24</sup> Individuals with AD demonstrate a slow, progressive decline in multiple areas, including cognition and the ability to perform activities of daily living. Physicians can play a crucial role in this disease by advising and guiding caregiving staff and family in the management of daily chores. Thus, the role of the family physician will become increasingly pivotal, as early diagnosis and initiating treatment are added to the care coordination and caregiver support roles that family physicians have traditionally provided for persons with dementia. Therefore, early diagnosis and aggressive treatment are crucial for people with dementia.

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