



## Factors other than dementia affecting performance in Mini-Mental State Examination in elderly: Home health care based study

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**Abstract:** Aim: to assess factors other than dementia affecting performance in Mini-Mental State Examination among home-based health care elderly patients. Subjects & Methods : A cross sectional study was conducted on 240 elderly patients aged  $\geq 60$  years both males and females who were included in home health care program in Aseer central hospital, south Saudi Arabia. All participants underwent comprehensive geriatric assessment, mental status assessment using validated Arabic version of Mini mental status examination, assessment of various comorbidities, functional status and depression assessment using geriatric depression scale. Results: The study sample included 240 elderly, 50% males and 50% females. Mean age of subjects was 73.8 ( $\pm 5.1$ ) years. Out of 240, 60 patients scored  $< 24$  in MMSE assessment, 40 (16.6%) of them had difficulties in completing one or more item of MMSE, 24 were males and 16 were females. Percent of those who had difficulties increased with increasing age, highest percent was in the age group  $> 80$  years of age. The most common cause of inability to complete one or more items in MMSE among both males and females was manual disability as a consequence of neurological disease mostly in stroke patients and Parkinson disease followed by low educational level then visual and hearing impairment followed by other causes as aphasia, depression and psychosis. 78% of persons with poor test performance due to causes other than dementia were unable to complete the writing of a sentence, and (75%) could not draw pentagons. (62%) did not complete the reading and repetition test item and (55%) could not complete calculations. Conclusion: Mini-mental status protocol should contain components in which the health care practitioner can report potential confounding factors which can lead to poor performance and false positive screening results of the test.

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### Introduction

The mini-mental status examination (MMSE) is a widely used assessment instrument designed to screen the cognitive impairments seen in a variety of dementia conditions, especially Alzheimer dementia. (1)

It has been found to be sensitive to the severity of dementia in patients with Alzheimer's type and is also useful in detecting cognitive changes over time. MMSE has been used to assess cognition in epidemiological studies of dementia and as part of neuropsychological test batteries in various research studies (2). The test assesses six areas of cognitive ability for a maximal score of 30 points (3).

Although the MMSE has high sensitivity (4), specificity varies in certain subgroups of elderly people. For instance, low socioeconomic status and low educational level are associated with lower MMSE

scores (5-7), and this has been suggested to reflect bias (4).

Visual impairment, functional disability, very old age and lack of manual dexterity are also associated with lower MMSE scores and expose it to bias (7,8).

Although there are a number of studies on the sensitivity and specificity of the MMSE, detailed analysis for the factors affecting specificity has not been well presented. In the current study, we highlight possible factors other than dementia causing poor performance in MMSE in elderly.

### SUBJECTS AND METHODS

A cross sectional study was conducted on 240 elderly patients aged  $\geq 60$  years both males and females who were enrolled in home health care program in Aseer central Hospital, Aseer province, south Saudi

Arabia, subjects were enrolled in the program starting January 2021.

All participants underwent comprehensive geriatric assessment, mental status assessment using validated Arabic version of Mini mental status examination (normal is MMSE  $\geq$  24) (9), assessment of various comorbidities, functional status assessment and depression assessment using Geriatric depression scale (score  $>$ 5 is positive for depression)

The MMSE is a 30-point test used to measure cognitive function. It is the most widely used test for assessing dementia.

The test includes the following:

1. Orientation to time and place
2. Registration (for names of 3 objects)
3. Recall (for the three mentioned names )
4. Attention and calculation
5. Language
  - identifying common objects by name
  - repetition of a sentence
  - read and obey (close your eyes)
  - writing a sentence
  - follow three order command
  - copy a design

The MMSE was administered following collecting background medical data, functional abilities, affect status, vision and hearing were assessed during the visit and recorded.

Whenever an individual was unable to complete any item on the MMSE, the causes which interfered with performance in the test were reported (e.g. poor vision, poor hearing, or functional disability, aphasia, depression, deficient schooling, psychosis), in addition to possible cognitive impairment.

#### *Statistical analysis*

The collected data were coded, tabulated, revised and statistical analyzed using SPSS program (version 20). Descriptive statistics were done using

mean and standard deviation for numerical parametric data and by number and percentage for categorical data.

#### RESULTS

The study sample included 240 elderly, 50% males and 50% females. Mean age of subjects was 73.8 ( $\pm$ 5.1) years.

Out of 240, 60 (25%) patients scored  $<$ 24 in MMSE assessment, 40 (16.6%) of them had difficulties in completing one or more item of MMSE, 24 were males and 16 were females as shown in **Table 1**.

**Table 2 shows** Percent of those who had difficulties increased with increasing age, highest percent was in the age group  $>$ 80 years of age.

**Table 3 demonstrates** that the most common cause of inability to complete one or more items in MMSE among both males and females was manual disability as a consequence of neurological disease mostly in stroke patients and Parkinson disease followed by low educational level then visual and hearing impairment followed by other causes as aphasia, depression and psychosis.

When considering the individual 11 test items, (78%) of persons with poor test performance due to causes other than dementia were unable to complete the writing of a sentence, and (75%) could not draw pentagons. (62%) did not complete the reading and repetition test item and (55%) could not complete calculations

Lack of manual dexterity, physical disabilities caused difficulties, particularly on the test items which included the writing of a sentence, drawing pentagons or folding a paper (in 3 order command item).

Hearing impairments, depression and psychosis caused difficulties in completing almost the whole test pattern. Subjects with deficient schooling could not accomplish the reverse calculations, writing of a sentence and reading.

#### **Tables**

Table 1: distribution of patients who were unable to complete one or more items in MMSE

	All sample	Female	Male
	240(100%)	120(50%)	120(50%)
Unable to complete	40 (16.66%)	16(6.66%)	24(10%)

Table 2: distribution of subjects who were not able to complete one or more items in MMSE by age group.

Age group	60-70yrs	71-80yrs	$>$ 80yrs	Total n %
males	6	8	10	24(10%)
females	5	5	6	16(6.66%)

Table 3: Causes of poor performance in the MMSE among males and females

	Men total n =24	Women total n =16	All 40
causes	N	N	N %
Manual disability	6	6	12(30%)
Low education	6	5	11(27.5%)
Poor vision	5	1	6(15%)
Poor hearing	2	1	3(7.5%)
depression	2	1	3(7.5%)
aphasia	2	2	4(10%)
psychotic	1	0	1(2.5%)

## DISCUSSION

The aim of the study was to examine causes other than dementia that can lead to poor performance on the MMSE in the elderly.

16.6% of patients had health problems which interfered with their performance in MMSE test and the percent of difficulties increased with age.

The most common causes for poor test performance were manual disability as a consequence of neurological disease mostly as a consequence of stroke in patients or due to tremors and/or rigidity in Parkinson disease patients followed by low educational level then visual and hearing impairment followed by other causes as aphasia (as a consequence of stroke), depression and psychosis.

The present study results came in agreement with *kurbwicz and Wallace* who reported that patients who have impaired hearing or vision, deficient schooling or with communication disorders may perform poorly in MMSE even if cognitively intact.(10) The Agency for Health Care Policy and Research (AHCPR) guideline on Alzheimer diagnosis recommends that confounding factors such as age and educational level should be considered during interpretation of MMSE scores (11). Also, Davous et al reported a lowered specificity of the test in individuals with psychiatric disorders (12).

According to *Tombaugh and McIntyre*, confounding factors should be taken into account as the number of false-positive cases requiring further examination will be high. Therefore it may be useful to adjust the MMSE for the confounding factors or to develop complementary test versions for the screening of individuals with mental problems, neurological disorders, poor vision and or hearing. (4).

*Bernard and Goldman* suggested that MMSE cannot be used as the only criterion for diagnosing dementia, since there are other reasons that lead to low scores and that the score should be used in conjunction with the clinical history, the neurological examination, and other neuropsychological tests in order to establish a diagnosis of dementia.(2)

In addition to consequences of stroke like motor disability and aphasia, poor performance in individuals who have stroke could partly be a result of vascular dementia. Also, dementia may be associated with Parkinson disease, but the poor performance observed during MMSE assessment of Parkinson cases was seen to be associated with tremor and/or rigidity rather than with dementia.

Various studies have provided evidence that those having Alzheimer's dementia would have most of the test errors occurring in only four of the six cognitive domains: recall of information, reverse calculations, drawing a pentagon, and orientation (13-15). In the present study, the errors due to causes other than dementia appeared throughout all test items.

The original version of the MMSE was compared with the version adjusted for age and education by *cosca et al* who concluded that despite the adjusted version improved specificity, it also caused a significant decline in sensitivity. So, instead of using the adjusted test version, it may be more useful to recognize individuals with impairments that interfere with performance in the MMSE during the test and to utilize complementary tests and clinical assessment with them. (16)

We recommend that mini-mental assessment protocol should contain components in which the health care practitioner can report potential factors which can lead to poor performance and false positive screening results.

It is essential to consider confounding factors carefully, especially in very old individuals. This will be of interest not only to those who evaluate the patients for dementia, but also those who use the MMSE in research or who develop assessment tools.

## Ethical considerations

Informed consent was taken from every elder participating in the present study; also an approval was obtained from the General Manager of home health care in Aseer province, south Saudi Arabia.

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