

## The Mini Mental State Examination in healthy individuals in Medan, Indonesia by age and education level

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### Abstract

**Objective:** To determine the distribution of Mini Mental State Examination (MMSE) score in healthy individuals in Medan by age and educational level. **Methods:** Cross sectional study with survey conducted between June 1999 and December 1999. The participants were healthy volunteers from the community in Medan. Subjects were included in the study if they had no past history of head trauma with loss of consciousness, stroke, seizure, uncontrolled hypertension, diabetes, congestive heart failure, abnormal thyroid function, electro-convulsive therapy, sleep disorders, coma, psychiatric disorders, alcohol or drug abuse. Study participants were administered the MMSE survey form. **Results:** Four hundred and seventy three subjects participated in the study. They consisted of 185 males and 287 females. The age ranged from 16 to 75 years. The MMSE scores were related to both age and educational level. The scores ranged from a median of 27 for those < 20 years of age, 28 for 20 to 39 years of age, 26 for 40 to 49 years of age, 27 for 50 to 59 years of age, and 21 for those 60 years of age and older. The median MMSE score was 24 for subjects with less than 6 years of schooling, 26 for those with 7 to 12 years of schooling, and 28 for those with longer than 12 years of schooling.

**Conclusions:** Cognitive performance as measured by the MMSE varies within the normal population by age and education. This results is similar to other previous studies done elsewhere.

### INTRODUCTION

Assessment of cognitive function has a considerable clinical importance in view of the high prevalence of cognitive disorders. The high prevalence is related to increase in life expectancy with corresponding increase in the proportion of elderly population. In the developing world, this is compounded by the continuing growth of the overall population. Assessment of cognitive function is also important because patients with mild cognitive impairment carries a 10-12% risk of evolving into Alzheimer's disease.<sup>1-5</sup> Early diagnosis, treatment and prevention of risk factors<sup>2,4,6,7</sup> of mild cognitive impairment to prevent its progression may thus be a novel therapeutic approach.

Mini-Mental State Examination (MMSE) was first introduced by Folstein et al in 1975.<sup>8</sup> It has currently been widely used as a standard scoring tools in many countries and translated into various languages, including the Indonesian language. With some modifications MMSE can even be used for patients with deafness.<sup>9</sup> MMSE is used to assess cognitive function in clinical practice as well as in research. It can help to confirm the diagnosis, assess the severity,

monitor the progression and outcome of treatment.

MMSE measures the orientation, attention and calculation, immediate and short-term recall, language and the ability to accomplish simple verbal and written instruction as well as visual construction. It can be performed quickly. All the tests appear to be easy, except that for attention and calculation, which are more complex and take longer time.

Using a cutoff score of 23, the sensitivity and specificity of the MMSE has been reported to be 87% and 82% respectively, for detecting delirium or dementia in hospitalized patients.<sup>10</sup> However, it is a screening test and does not identify specific disorders.

The prevalence rate of cognitive impairment has been shown to increase with increasing age. Individuals aged 55-74 years were found to have 1.4-2.5 times the prevalence of severe cognitive impairment (MMSE score, 17 or lower) as compared to those aged 35-54 years.<sup>11</sup> However, the MMSE score has been found to be related to age and education.<sup>12-14</sup> A study on normal population has found a median MMSE score of 29 for those 18-24 years of age, and 25 for individuals 80 years of age and older. The

MMSE score was 29 for individuals with at least 9 years of schooling, 26 for those with 5-8 years of schooling, and 22 for those with 0-4 years of schooling.<sup>13</sup> Difference of MMSE score accross race and ethnic groups has also been reported.<sup>11</sup> Medan is the largest city in Sumatra, with about 2 million population. This is the first study involving large number of subjects to evaluate the use of MMSE among healthy adult population in Medan. The objective of this study was to determine the distribution of MMSE score in the local population. This study also aims to study the correlation between MMSE score and age, as well as level of education.

**METHODS**

This is a cross sectional study using the standard MMSE which has been previously translated into Indonesian by the Kelompok Studi Fungsi Luhur (Higher Function Study Group). The Indonesian MMSE has also been previously

validated. (Personal communication: Setyopranoto et al, Dr Sardjito General Hospital, Gadjia Mada University, Jogjakarta) The study period was from 1st June 1999 to 31st December 1999. The study population consisted of adult healthy subjects of more than 15 years of age, from various occupational and educational background. They mainly consisted of students, clerical and other supportive staffs of the North Sumatra Medical Faculty, nurses and other staffs, relatives of patients from the Haji Adam Malik Hospital. Subjects who had previous history of head injury with loss of consciousness, stroke, seizure, uncontrolled hypertension, diabetes mellitus, congestive heart failure, thyroid disorder, electroconvulsive therapy, sleep disturbance, coma, psychiatric illness, alcohol and drug abuse were excluded from the study.

For statistical analysis, one-way ANOVA and non-parametric Krusskal Wallis, Spearman's correlation test and Independent *t* test were used with the aid of SPSS.

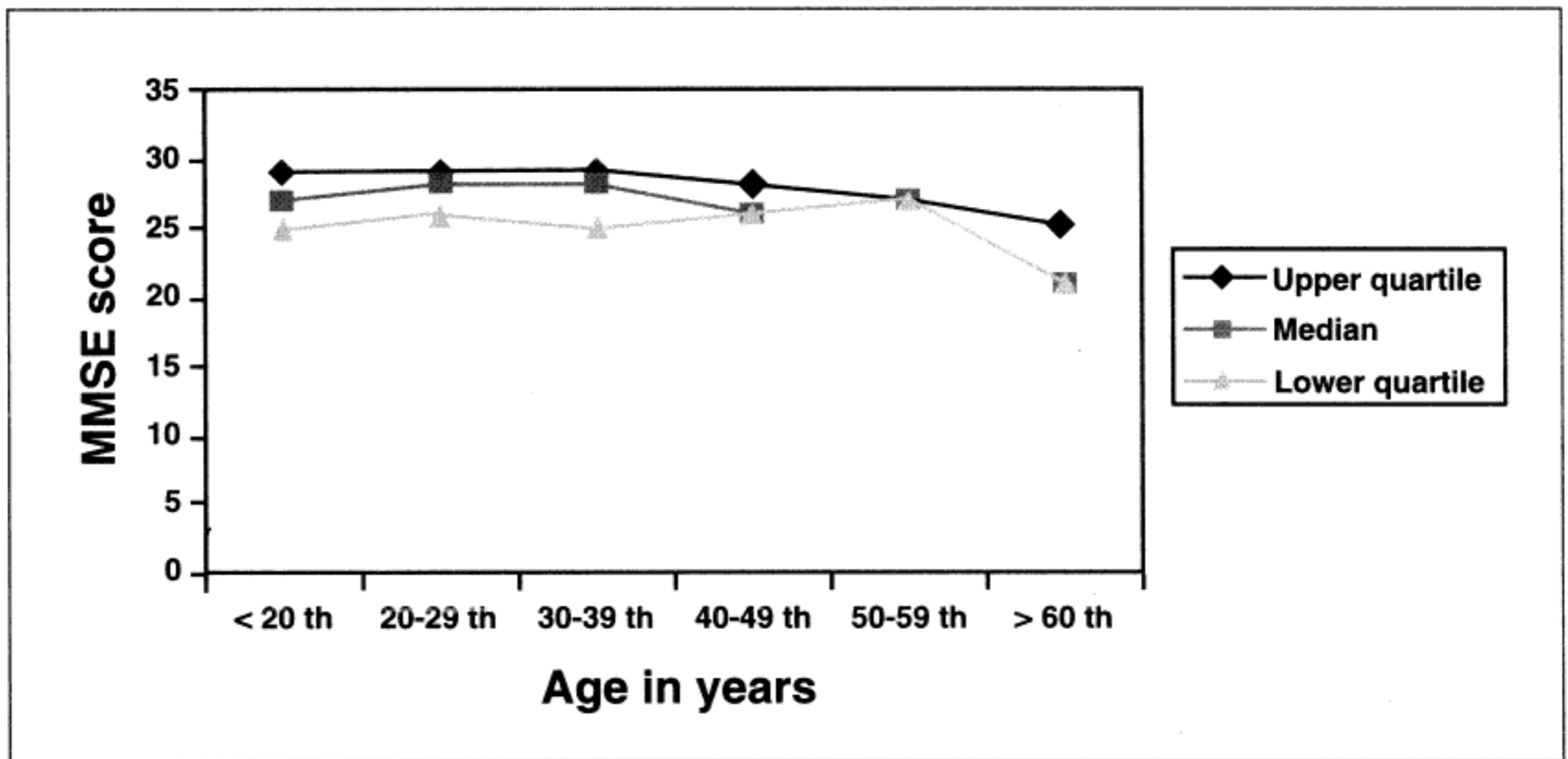


Figure 1: Mini Mental State Examination Score by age and selected quartile

Table 1: MMSE score by age.

Age (years)	Median scores				Lower quartile			
	Sjahrir (n=473)	Tedjasuk mana <sup>15</sup> (n=204)	Crum <sup>13</sup> (n=18,056)	Blecker <sup>12</sup> (n=194)	Sjahrir (n=473)	Tedjasuk mana <sup>15</sup> (n=204)	Crum <sup>13</sup> (n=18,056)	Blecker <sup>12</sup> (n=194)
<20	27	30	29		25	29	28	
21-30	28	30	29		26	29	28	
31-40	28	28	29		26	27	28	
41-50	26	29	29	30	25	27	27	29
51-60	27	29	29	29	24	25	26	28
>60	21	26	27	29	17	25	26	28

## RESULTS

Four hundred and seventy three subjects consisting of 185 males (39%) and 287 females (61%) participated in the study. Their age ranged from 16 to 75 years. Table 1 and Figure 1 shows the median, upper and lower quartile MMSE score according to age. Table 2 and Figure 2 shows the median, upper and lower quartile MMSE score according to educational level. There was no significant correlation between age and MMSE score. Analysis of age and MMSE score resulted in Spearman's correlation coefficient of -0.04. There was a correlation between MMSE score and educational level, the higher the education the higher the score with correlation value of + 0.36,  $p < 0.05$ . There was no significant difference in the MMSE score between the sexes. The mean MMSE scores for males was 27.0 (SD 2.5), and for females, 26.8 (SD 2.6).

## DISCUSSION

Table 1 and 2 shows the comparison between the MMSE scores in the present study and that of the previous studies. The study by

Tedjasukmana et al was done in Jakarta.<sup>15</sup> Similar to previous studies, there was a correlation between age as well as level of education and MMSE score.<sup>12-15</sup>

The median and lower quartile MMSE scores by age in this study is lower than that in the previous studies, this was particularly so for the group 60 years and older. For example, the median MMSE score for those 60 years and older was 21 in this study, whereas it was 26-29 in the other studies. The lower quartile MMSE score for the 60 years and older age group was 17 in this study, whereas it was 25-28 in the other studies. As for the MMSE score by level of education, the scores obtained in this study was generally lower than that obtained by previous study done in Jakarta. The reasons for this difference in MMSE score particularly when comparing with that of Jakarta is unclear.

For the application of the the MMSE score in the clinical setting, a common practice is to use the 5<sup>th</sup> percentile as the cut-off, which is the score based on 95% of a normative sample in a particular population. Alternatively, a normal value may also be based on 2 SD from the mean.

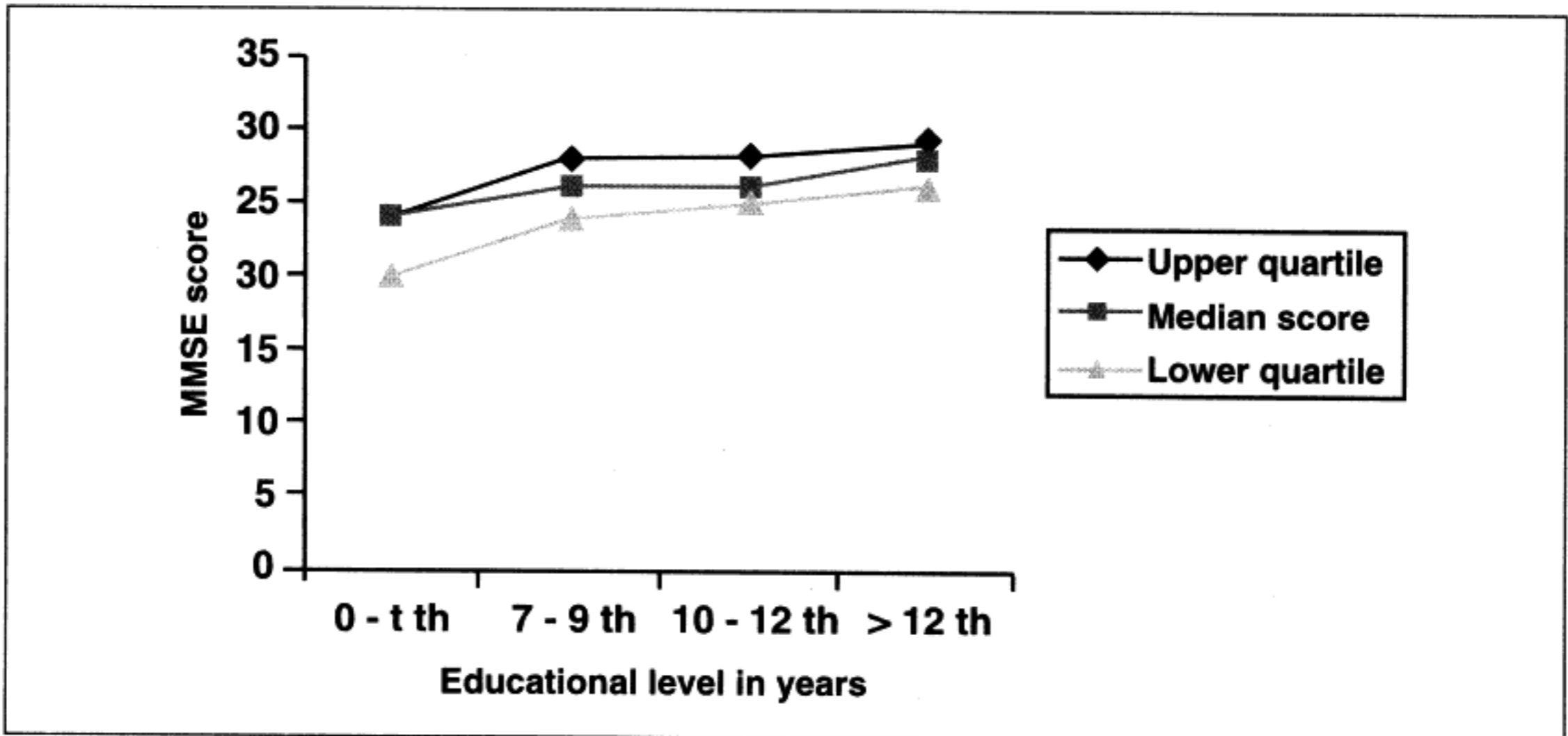


Figure 2: Mini Mental State Examination Score by education level and selected quartile

Table 2: MMSE score by level of education.

Education	Median scores			Lower quartile		
	Sjahrir (n=473)	Tedjasuk mana <sup>15</sup> (n=204)	Crum <sup>13</sup> (n=18,056)	Sjahrir n=473	Tedjasuk mana <sup>15</sup> (n=204)	Crum <sup>13</sup> (n=18,056)
0-6 years	24	26	22	20	24	19
7-9 y	26	29	26	24	27	23
10-12 y	26	29	29	25	29	27
>12 y	28	30	29	26	29	29

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