

# Comparison of Cognitive Function Examination Using *Montreal Cognitive Assessment (MOCA-INA)* with *Telephone Moca (T-MOCA)*

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## ABSTRACT

**Introduction:** The prevalence of dementia tends to increase over time. MOCA assessment tool is a cognitive function screening test that has high sensitivity. Telephone-based MOCA assessment has potential of detection and monitoring dementia which can be widely applied.

**Methods:** This is an observational study with cross-sectional approach in the Neurology Outpatient Department RSUD Dr. Moewardi. The aim of this study is to compare the effectiveness of MOCA-INA assessment tool with the T-MOCA.

**Results:** There were 424 patients who underwent MOCA-INA examination during January-June 2022. After screening, 185 patients were able to complete the study. Subjects consisted of 67 males (36.2%) and 118 females (63.8%); aged 65-74 years (44.9%), 75-84 years (25.9%), and 85 years (29.2%). It was found that the conformity diagnosis of MOCA-INA to T-MOCA was 82.3% in the conversion test. There were significant differences between normal patients and MCI patients in age ( $p=0.000$ ), education level ( $p=0.000$ ), MOCA-INA score ( $p=0.000$ ), and T-MOCA score ( $p=0.000$ ). The relationship between MOCA-INA and T-MOCA has a strong positive correlation ( $p = 0.000$ ;  $r = 0.789$ ). Subsequent correlation test between MOCA-INA and T-MoCA showed a strong significant relationship in the direction of gender ( $p = 0.000$ ;  $r = 0.438$ ) and education level ( $p = 0.000$ ;  $r = -0.323$ )

**Conclusion:** Both MOCA-INA and T-MOCA could significantly determine the level of cognitive function with a strong correlation between the two assessments.

**Keywords:** *Cognitive Function; MOCA; Telephone-MOCA*

## INTRODUCTION

Dementia is a syndrome of the brain which is marked by cognitive function degradation compared to the previous condition, which therefore impacts social and professional activities that are reflected in daily activities, behavioral changes which are not caused by delirium or any major psychiatric disturbance. The prevalence of dementia ranges around 50 million of the population in 2018 and is predicted to increase in moderate to severe low income countries. It is estimated that the global

prevalence of dementia will reach 82 million in 2030<sup>2</sup>.

Dementia is associated with a neurological or medical condition which affects the brain, trauma, nutrient deficiency, chronic use of substance or certain drug, or exposure towards heavy metal or other toxins. The classification of dementia is based of the main cause of the dementia. The main subtype of dementia is Alzheimer's disease, vascular dementia, frontotemporal dementia, Lewy Body dementia<sup>1</sup>. Meanwhile, Mild Cognitive Impairment (MCI) is a complaint that might be present in the early stage of dementia, as a

prodromal symptom. MCI is defined as a difficulty at the cognitive domain such as language, memory, the ability to think, or the ability to make decisions which are clinically worse compared to cognitive changes as a result of aging, but not as bad as dementia<sup>1</sup>.

Age is the main factor of dementia. People affected with dementia is related to dependence, poor quality of life, and mortality<sup>3</sup>. Data from BAPPENAS 2013, the life expectancy in Indonesia (male and female) has increased from 70.1 years in 2010-2015 to 72.2 years in 2030-2035. The projection result has also showed that Indonesia's population in the next 25 years will increase from 238.5 million in 2010 to 305.8 million in 2035. The number of populations aged 65 years and above will increase from 5.0% to 10.8% in 2035<sup>4</sup>.

Montreal Cognitive Assessment (MOCA) is a cognitive function screening test to detect mild cognitive impairment or pre-dementia stage. MOCA has a high sensitivity, 90% in detecting MCI and 100% in detecting mild Alzheimer. MOCA has the advantage as an instrument to detect cognitive impairment because it covers all the cognitive domain<sup>1,5,6</sup>. MOCA has been validated and translated into an Indonesian version or MOCA-INA<sup>7,8</sup>.

A mobile version of MOCA which is telephone based MOCA (T-MOCA) has just been developed lately and has been validated. T-MOCA is initially validated by the Pendlebury et al research in 2013. In this research, T-MOCA showed that T-MOCA almost has the sensitivity of MOCA in detecting MCI<sup>6,9,10</sup>. Telephone MOCA has the maximum score 22 points, eliminating MOCA-30 items that required visual stimulation or the use of paper and pencil<sup>9,10</sup>.

Because adult population is increased, there is a need for screening tool for cognitive impairment that can be widely applied including to individuals who live far away to facilitate disease monitoring. Telephone based

examination have a potential in evolving the continuity of treatments which in application can be used to detect the risk of dementia in individuals that lack human resource, or to evaluate the elderly that don't have access to technology or are already experiencing cognitive impairments<sup>10</sup>.

In this study, the researcher wants to see the effectivity of MOCA-30 which was done directly in comparison to the use of MOCA-22 assessment using telephone. This was the first study held to prove the effectivity of T-MOCA which would really be beneficial to be used during pandemic era.

## METHODS

This research is a cross sectional research. This research was done by collecting patients' identity and MOCA-INA score results from medical record data. After getting data from the medical record then the T-MOCA-22 assessment using telephone begin from June 1<sup>st</sup> -10<sup>th</sup> 2022.

### Research Population

This research is applied to every patient of RSUD Dr. Moewardi Neurology Outpatient Department from January 2022 to June 2022. Sample size is calculated with the application OpenEpi, with confidence interval 95%, confidence limits 5%. Calculation with OpenEpi showed that the amount of sample needed for this research is 162.

### Research Subject

Subject collection is done based on purposive sampling method, where subjects within the inclusive and exclusive criteria that are appropriate to be taken as research subject.

- i. Inclusive Criteria
  - a. Aged more than or equal to 50 years' old
  - b. Has undergone MOCA-INA assessment in January 2022 to June 2022.
  - c. Willing to participate in the research.

- ii. Exclusive Criteria
  - a. Has a history of intracranial structural illness which is proven from the patient's medical record.
  - b. No information of telephone number in medical record.

**Research Instrument**

T-MOCA 22 has a total score of 22 points, eliminate items in MOCA-30 that require visual aspects and the use of pencil. MOCA surpasses MMSE in detecting mild cognitive impairments, T-MOCA is a promising assessment tool that can be used in long distance required examination. The time taken in the test is around 10-15 minutes. The maximum score that can be achieved is 22 points, scores below 17 considered as abnormal.

**Data Collection and Analysis**

Kolmogorov-Smirnov test was used to analyze the normality of data distribution. Further analysis is done by descriptive analysis of every data component. The Spearman and Mann-Whitney test method used if the data distribution is not normal. Logistic regression test was also done. The

significance degree used in this research was  $p=0.05$ .

**Ethical Clearence**

This research has passed the ethical review of the Health Research Ethics Committee of RSUD Dr. Moewardi with the registration number 12/UN27.06.6.1/KEP/EC/2022.

**RESULT**

Conversion of MOCA-INA score towards T-MOCA to view diagnosis conformity between the 2 test was done before analyzing data, based of the conversion table <sup>4</sup>. The value before and after MOCA-INA conversion and T-MOCA shows results as follows. The conformity between the diagnosis based on T-MOCA ad MOCA-INA increased after the conversion (66.1% vs 82.3%).

During the period of January-June 2022, there were 224 patients that had undergone MOCA-INA assessment and there were 185 patients that could finish the research.

Table 1. Demographic Characteristic

Variable	Normal		MCI		Total		P Score
	n	%	n	%	n	%	
<b>Gender</b>							
Male	42	34,7	25	39,1	67	36,2	0.558
Female	79	65.3	39	60.9	118	63.8	
<b>Age</b>							
65-74	78	64.5	5	7.8	83	44.9	0.000
75-84	35	28.9	13	20.3	43	25.9	
≥85	8	6.6	46	71.9	54	29.2	
<b>Level of Education</b>							
SD	8	6.6	35	54.7	43	23,24	0.000
SMP	14	11.6	17	26.6	31	16,76	
SMA	40	33.1	9	14.1	49	26,48	
University	59	48.8	3	4.7	62	33,51	
Interval between time of visit and telephone (day) (average±SD)	9.115±1.826		9.062±1.753		9.097±1.797		0.854
MoCA-INA (average ±SD)	27.811±0.795		21.349±1.637		25.610±3.279		0.000
T-MoCA (average ±SD)	19.951±0.872		15.065±0.834		18.340±2.458		0.000

MoCA-Ina: <26 (MCI), ≥26 Normal (Total 30, normal 26-30, MCI 18-25)  
 T-MoCA: <17 (MCI), ≥17 Normal (Total 22)  
<sup>a</sup>Chi-square (p<0.05)  
<sup>b</sup>Kruskall-wallis (p<0.05)  
<sup>c</sup>Mann-whitney (p<0.05)

## DISCUSSION

This research shows that there is a significant difference between age, education, MOCA-INA score, and T-MOCA score towards the patient's cognitive function (normal cognitive or mild cognitive injury (MCI)). Cognitive function differentiation in this research uses Jak/Bondi criteria. Previous research used MOCA at a big population in Spain has shown results that older age and lower education level has an effect at the MOCA score and tend to get a lower MOCA score <sup>10</sup>. The same result regarding age and education level is also found in a big population of geriatric in the United States and Korea <sup>11,12</sup>. The usage of Jak/Bondi's criteria was based on the research purpose to acknowledge the comparison of MOCA-INA and T-MOCA in differentiating cognitive function.

It has already acknowledged that a lot of studies showed that MOCAs' cut-off differ according to the patient's based characteristics. Age and education level differentiation might result in cognitive function difference as well <sup>12</sup>. Other studies also found the same that there is a need of stratification or correction in patients with older age and lower education, adjusting a certain cut-off score to differentiate between patients with normal cognitive function and MCI. This purpose is to emphasize MOCA-INA's accuracy <sup>14</sup>.

The cause for cognitive function difference in age cannot be confirmed yet. However, there has been research that submitted a hypothesis regarding the presence of the Flynn effect. This effect explains that there is a change in IQ score along with time. This might happen because of the change in

education has made today's population more familiar with types of the questions used to evaluate cognitive level <sup>12</sup>.

Discovery of MOCA-INA score and T-MOCA also has a significant effect on patient's cognitive function based of the Jak/Bondi criteria also shows that both assessments are truly capable of differentiating patients with normal cognitive function and MCI patients. In T-MOCA methods which has been converted according to the criteria to MOCA-INA, has better proportion in diagnosing MCI (98.41%) than normal (1.63%).

Direct comparison test to evaluate average score of MOCA-INA and T-MOCA at a normal cognitive function and MCI can not be applied because of the two modalities have very different cut-off scores and the results have an 8-point after the conversion test. Therefore, this study presents direct correlation between the two modalities. The correlation test showed a significant correlation between MOCA-INA and T-MOCA (p=0.000) with a strong positive correlation (r=0.789). This discovery is in line with Katz et al. (2021) which showed that T-MOCA can be used significantly to differentiate between patients with normal cognitive and MCI, equal to MOCA tool that has been long used <sup>6</sup>.

Table 2. T-MOCA to MOCA Conversion Score using percentile method<sup>2</sup>

T-MOCA	Converted MOCA-30
0	0
1	0
2	1
3	3
4	4
5	6
6	8
7	9
8	11
9	12
10	14
11	15

T-MOCA	Converted MOCA-30
12	16
13	18
14	19
15	20
16	22
17	23
18	24
19	25
20	27
21	28
22	30

A correlation test between MOCA-INA and T-MOCA is also done with the gender variable which resulted a moderate positive correlation ( $p=0.000$ ,  $r=0.438$ ). Meanwhile the correlation test on the age variable has moderate negative correlation ( $p=0.000$ ,  $r=-0.323$ ), this shows that the older patient is the MOCA-INA's and T-MOCA's probability score is lower. Furthermore, the correlation test between MOCA-INA and T-MOCA with the education level has a strong positive correlation ( $p=0.000$ ,  $r=0.854$ ), it shows that the higher education level, the higher MOCA-INA's and T-MOCA's score is. This study strengthens the differentiation test's result of the previous tables. which presence that age and education level have influence towards cognitive function, along with MOCA-INA and T-MOCA abilities in differentiating cognitive function. This is also presented in Katz et al. (2021) that MOCA-22 and T-MOCA significantly correlates with education and MOCA-22 correlates with patient age<sup>7</sup>.

MOCA test and T-MOCA test are screening tests, not a diagnostic tool, it needs to be further assessments before making a diagnosis of dementia. There is a need for further studies to validate the range scores of this screening tool<sup>7</sup>.

## CONCLUSION

This research shows that both MOCA-INA and T-MOCA can evaluate

cognitive function impairment significantly with a strong correlation between the two assessments.

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