Title: Psychometric Evaluation of Self-Assessment Persian Version of Alzheimer’s Questionnaire (AQ)

Running Title: Psychometric Evaluation of AQ

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To appear in: Basic and Clinical Neuroscience

Received date: 2019/11/28

Revised date: 2020/05/19

Accepted date: 2020/07/12
This is a “Just Accepted” manuscript, which has been examined by the peer-review process and has been accepted for publication. A “Just Accepted” manuscript is published online shortly after its acceptance, which is prior to technical editing and formatting and author proofing. Basic and Clinical Neuroscience provides “Just Accepted” as an optional and free service which allows authors to make their results available to the research community as soon as possible after acceptance. After a manuscript has been technically edited and formatted, it will be removed from the “Just Accepted” Web site and published as a published article. Please note that technical editing may introduce minor changes to the manuscript text and/or graphics which may affect the content, and all legal disclaimers that apply to the journal pertain.

Please cite this article as:

DOI: http://dx.doi.org/10.32598/bcn.2021.2238.1
Abstract

**Background:** Mild Cognitive impairment (MCI) is a primary disorder intensifies by aging. Rapid diagnosis of MCI can prevent its progression towards the development of dementia. Thus, the present study was conducted to evaluate the psychometric features of the self-assessment Persian version of Alzheimer's questionnaire (AQ) in the elderly to detect MCI.

**Methods:** First, the Alzheimer's questionnaire was translated into the Persian language; then, content validity was evaluated by CVI and CVR method, face validity was determined by two checklists for expert panel and the elderly. Convergent validity of the self-assessment AQ with MoCA was assessed using Pearson correlation. Test-retest and internal consistency reliability using Intra-Class Correlation (ICC) and Kuder-Richardson coefficients, respectively, were evaluated; moreover, the receiver operating characteristic curve was used to determine the optimal cut-off point of self-assessment AQ. Among 148 older people took part, 93 of them met our inclusion criteria (aged 60 years old or older, had reading and writing skills and able to speak and communicate).

**Result:** A translated version of the questionnaire was named “M-check”. The developed test showed good content and face validity. Statistically significant correlations were found between M-check and MoCA ($r = -0.83, p < 0.05$). Kuder–Richardson and ICC coefficient were obtained as 0.84 and 0.92, respectively. Area under the curve presented satisfactory values (AUC =0.852, sensitivity =0.62, specificity =0.94).

**Conclusion:** The M-check can be used as a valid and reliable instrument for assessing cognitive state and screening MCI in older adults.

**Keywords:** Aging, Cognitive Dysfunction, Self-Assessment, Psychometrics, Persian.
Introduction

Cognition is a complex set of mental processes, including memory, attention, language, and decision making (Ashford et al., 2007). Cognitive skills have a pivotal function in the daily activity of the elderly. Unfortunately, aging can lead to a decrease in some cognitive skills (e.g., memory, problem-solving activities, or speed processing) (Harada, Natelson Love, & Triebel, 2013).

The time course of brain cognitive change respectively includes normal cognitive change, Subjective Cognitive Impairment (SCI), Mild Cognitive Impairment (MCI), and Alzheimer’s Disease (AD) (Reisberg et al., 2008). SCI refers to the recognition of changes in memory and cognition without clinical examination. SCI is a risk factor that may be changed into MCI (Jessen et al., 2014; Reisberg, Shulman, Torossian, Leng, & Zhu, 2010). MCI is a primary disorder that may lead to dementia and can be accompanied by systemic, neurological, or psychiatric disorders, which in turn can lead to cognitive impairment (Lopez, 2013). MCI is a moderate condition between normal cognition change and dementia, with normal functional abilities (Hugo & Ganguli, 2014). Both SCI and MCI are pre-dementia stages, which can progress to AD (Reisberg et al., 2010). Dementia is a progressive disease destroying cognitive and mental function and daily physical activity of the patient (Mental, Gap, & Programme, 2012). AD is one of the most prevalent causes of dementia without definitive treatment (Malik & Robertson, 2017; Prince, Comas-Herrera, Knapp, Guerchet, & Karagiannidou, 2016). Understanding normal cognitive changes is essential due to their effects on the daily functions of the elderly and helping in determining the normal form of the disease (Harada et al., 2013).

It is estimated that dementia and also the elderly population will increase from 2015 to 2050 (Malik & Robertson, 2017; Mental et al., 2012; Prince et al., 2016; “WHO | Mental health of older adults,” 2017). Also, the prevalence of MCI in adults older than 65 years old
is between 10 -20% (Langa & Levine, 2014). Accordingly, rapid diagnosis of MCI, as well as appropriate and timely interventions and treatment, can prevent progression to dementia and other cognitive impairments (Alzheimer’s Association, 2015; Roberts R, 2014). Due to a lack of valid and reliable clinical tools, MCI cannot be timely diagnosed (Chin, Ng, Narasimhalu, & Kandiah, 2013). The challenge for physicians is distinguishing between normal and abnormal cognitive functions (Knopman & Petersen, 2014). Also, most of the available assessment tests of mild cognitive impairment are usually objective or traditional tests taken by physicians in a clinical setting (Vancouver Cost al Health, 2014), and are needed to be interpreted by an experienced clinician making it challenging to be used by the people in the society. Hence, there is a need for a short screener tool for the diagnosis of dementia, especially in early stages (Chin et al., 2013).

On the other hand, screening tools are essential to the diagnosis of MCI or dementia, as there are different kinds of tests available; Montreal Cognitive Assessment (MoCA) was more sensitive to the detection of MCI among the older population (Ciesielska et al., 2016). But to assess the elderly by MoCA test, an expert should be present to evaluate the elderly and also interpret it.

Some studies were conducted on the psychometric evaluation of the Persian version of tests to assess the cognition stage. They can be used as a valid and reliable tool for assessing the cognitive state of older people (Lotfi, Tagharrobi, Sharifi, & Abolhasani, 2016; Rezaei, Rashedi, Lotfi, Shirinbayan, & Foroughan, 2018), but they should be interpreted by an expert.

The Alzheimer’s Questionnaire (AQ) was designed to be used in a primary care setting, which can be completed approximately within 3 minutes based on daily activities. The AQ is completed by an expert from one of the family members of the patient (Sabbagh et al., 2010). In this study, AQ was used to detect MCI in healthy adult people, which can be done by
them. Self-assessment testing of cognitive impairment based on their daily life activities may be effective. A person with SCI can individually implement the test, and in case of progress to MCI, his family members and relatives can evaluate him by the test. Therefore, this research was conducted to evaluate the psychometric features of the self-assessment version of the Alzheimer’s Questionnaire in the older adults.

**Method**

This is a cross-sectional study that was implemented between December 23th, 2018, and June 22th, 2019. The study designed to evaluate the validity and reliability of the Persian version of the Self-Assessment Version of Alzheimer Questionnaire (AQ), a brief and quick screener for cognitive impairment developed by Sabbagh et al. in 2010 (Sabbagh et al., 2010).

**Participants**

The present study was conducted in two elderly day-care centers located in Shiraz, Iran. Among 148 older adults who took part, 56 of them were excluded due to not meeting our inclusion criteria. Thus, the final sample was composed of 93 subjects. Participants included the elderly aged 60 years old or older, had reading and writing skills, and able to speak and communicate. Also, participants were excluded from the study if they did not tend to participate in the survey, used psychosocial medications, or had a history of neurological disease.

**Instruments**

**Alzheimer Questionnaire**

The AQ is a 21-item (yes / no format) scale designed to be used in a primary care setting, which can be completed approximately within three minutes. It has five main
domains: Memory, Orientation, Functional Ability, Visuospatial Ability, and Language. Items receiving a ‘yes’ response are given one point; however, six items are given two points. Total AQ score ranges from 0 to 27, in which higher scores indicate greater impairment. The AQ is completed by an expert from one of the family members of the patient (Sabbagh et al., 2010). Since the primary purpose of this study was using a self-assessment tool to identify the elderly, who may have a mild cognitive impairment, so the AQ was translated to be evaluated with the first-person pronoun.

Montreal Cognitive Assessment

The Montreal Cognitive Assessment (MoCA) is a brief 30-question test (takes around 10 to 12 minutes to be completed) assessing people regarding the existence of dementia. The MoCA evaluates different domains of cognitive abilities: Attention and Concentration, Executive Functions, Memory, Language, Visuoconstructional Skills, Conceptual Thinking, Calculations, and Orientation. Total MoCA score ranges from 0 to 30, in which a score of 26 and higher is generally considered normal (Nasreddine et al., 2005). A psychometric evaluation of the Persian version of assessing cognitive deficits was also performed. MoCA can be a valid and reliable tool for the evaluation of cognitive impairment in the Iranian population. The Cronbach's alpha of the Persian version of MoCA (MoCA-P) and Spearman's correlation coefficients between the MMSE and the MoCA-P was reported 0.808 and 0.738, respectively. And also, The MoCA-P had acceptable content validity and face validity (Badrkhan, Sikaroodi, Sharifi, Kouti, & Noroozian, 2019). Furthermore, in another study, "Evaluating the Reliability of the MoCA and its Agreement with Mini-Mental State Examination (MMSE) Among Healthy Elderly" Showed that the MoCA has high internal consistency. And, MoCA test was more proper for the early detection of MCI in older adults compared to MMSE (Chehrehnegar, Shams, Zarshenas, & Kazemi, 2012).
Translation of AQ into the Persian Language

Forward Translation

In the first stage, two translators (Translators 1 and 2) who were native speakers of Persian and had sufficient proficiency in English and Persian languages independently translated the AQ. These two versions were reviewed by a neuroscientist (N.M) after applying changes and providing suggestions for improving translation, and then the initial self-assessment Persian version of AQ was developed.

Back-Translation

The initial applying changes and providing suggestions for improving translation, and then the initial self-assessment Persian version of AQ Persian version was back-translated into English by an expert translator (Translator 3) without awareness of the original questionnaire text. The back-translated version was compared with the original English version by the expert panel, and any distinction or variation between them was resolved. Finale Persian version of self-assessment AQ was obtained after cultural adjustment and expert panel discussion.

Expert Panel

Ten experts and professors of Shiraz University of Medical Sciences were selected based on their academic background and were asked to cooperate with the researcher, including two clinical psychologists, two psychiatrists, two neuroscientists, two occupational therapists, and two speech therapists.

Measurement of Validity and Reliability of the Questionnaire

Content Validity

Five to ten experts are needed to determine content validity(Lynn, 1986). Therefore, to calculate content validity, Content Validity Ratio (CVR) according to Lawshe’s method
(Lawshe, 1975) and Content Validity Index (CVI) based on Waltz and Basel method (Polit & Beck, 2006) were used. “There are two forms of CVI, in which CVI for item (I-CVI) and CVI for scale (S-CVI)” (Yusoff, 2019). In this study we used the I-CVI forms to calculate the CVI.

**Face Validity**

To determine face validity, two checklists with 14, and 15 items, respectively, were designed for two groups (expert panel and the elderly). Each item of face validity checklists was provided by the researcher and neuroscience experts. The checklists were given to expert panel and ten older adults; the checklists were scored ranging from 0 to 10 based on colored Visual Analog Scale (VAS) (score of 0 means the lowest score and score of 10 means the highest score in that feature for testing).

**Convergent Validity**

At this stage, the AQ was given to 60 older adults. Therefore, to assess convergent validity, the MoCA test was used. The results of both tests were compared with each other.

**Reliability**

To determine Test-retest reliability, the AQ was given to 23 older people twice at a 2-week interval. Moreover, to assess internal consistency reliability, 93 older people took part.

**Procedure**

Necessary permissions were obtained from the Welfare Organization in Fars province (Iran) for data gathering. Then, the researcher explained the purpose of the study for the elderly before the start of their educational classes in the two elderly day-care centers so that people were free to take part if they wished. The questionnaires were distributed before the beginning of the elderly's classes. After completing, they were delivered to the researcher.
The MoCA test also was taken in a quiet room individually. Informed consent was obtained from all study participants, and then they received the Persian version of the questionnaire. Some demographic data were also collected, including sex, marital status, handedness (left, right or both), smoking, alcohol use, and physical activity, daily usage of fruit and vegetables, and family history of Alzheimer’s disease or forgetfulness.

**Statistical Analyses**

For evaluation of face validity, the mean of VAS was considered. Pearson correlation, Kuder-Richardson, and Inter-Class Correlation Coefficient (ICC) were used to evaluate convergent validity, test-retest reliability, and internal consistency, respectively. Moreover, the standard error of measurement (SEM) was used to assess response stability, considering the standard error of measurement, the absolute Minimal Detectable Change (MDC95%) was calculated. The following formulas were used (Mesquita et al., 2013):

\[
SEM = SD \sqrt{1-ICC}
\]

\[
MDC_{95\%} = 1.96 \times SEM \sqrt{2}
\]

Reliability correlation coefficient values greater than 0.7 were considered to be satisfactory. Moreover, the Receiver Operating Characteristic Curve (ROC) was used to determine the optimal cut-off point (OCP) of the self-assessment MCI test. The area under the ROC curve (AUC) was calculated, as a higher AUC indicated a better ability to differentiate the two groups. Sensitivity and specificity were also calculated using Youden’s J index (i.e., \( J = \text{sensitivity} + \text{specificity} - 1 \)) (Böhning, Böhning, & Holling, 2008). The analysis was done in IBM SPSS software 16.0 and Microsoft Excel software 2010. A P-value of <0.05 was considered statistically significant in all statistical procedures.
Results

Mean (Standard Deviation) age of the participants was equal to 67.49 (5.28 years old), with an age range of 60-85 years old. Sociodemographic characteristics of study participants are shown in Table 1.

Content Validity

The degree to which a test includes which items are necessary to measure the concept is referred to as content validity (Lawshe, 1975). The expert panel evaluated the content validity of the Persian version of AQ. Total CVR for all five domains and 21 Items of self-assessment MCI tool were obtained as 0.87 and CVI was obtained as 0.97. Therefore, it was found that all the questions were valid. Since the CVR was above 0.62 (0.87) and CVI was higher than 0.79, the validity of this tool was confirmed. Also, the translated version was named “M-check” standing for “Memory check”.

Face Validity

Face validity shows the validity of the test based on its appearance. Based on the VAS checklist completed by the expert panel and the elderly, the total mean of face validity of the test based on VAS was measured as 8.86 and 9.20, respectively, for the expert panel and the elderly as shown in Table 2.

Convergent Validity

Convergent validity applies to how a new scale is relevant closely to other variables and measures of the same construct (P. F. M. Krabbe & Krabbe, 2017). To assess convergent validity, the Pearson correlation coefficient “r” was used, the value of “r” was -0.83 for correct answers. Statistically significant negative correlations were found between M-Check and MoCA total scores (p < 0.05). Details on convergent validity are shown in Figure 1.
As shown in Figure 1, MoCA and M-check are negatively correlated. In the MoCA test, if a person scores more than 26, the person is cognitively healthy, and a lower score (below 26) indicates cognitive inefficiencies. While in the M-Check test, it was opposite, meaning that a higher score on the M-Check test indicates possible cognitive disorder (score more than 4), and lower ratings indicate normal cognitive ability (score lower equal than 4). Hence, a statistically significant negative correlation was found in this regard \( r = -0.83 \)

**Internal Consistency**

Internal consistency shows how closely related a set of items are as a group (Tavakol & Dennick, 2011) Kuder–Richardson coefficient is suitable for a nominal variable with two-choice options (yes or no, or true or false) (Zeller & Carmines, 1979). So, in the assessment of the internal reliability of the Persian version of self-assessment AQ, Kuder–Richardson coefficient was used. Kuder–Richardson coefficient was obtained as 0.84.

**Tests- Retest Reliability**

Among 93 older people, 23 of them completed the questionnaire for the first time and filled it out again after 2 weeks. ICC was used for test-retest reliability assessment. ICC coefficient was obtained as 0.92 for the total score (95% confidence interval [CI], 0.81-0.96) \( P<.0001 \) (Figure 2).

The SEM estimates the standard error in a set of repeated measures. The standard error of measurement rises as the standard deviation increases. Also, the standard error of measurement increases as the test reliability declines, showing an inverse relationship (Russek, 2004).

The MDC values indicate the minimum amount of change that is detectable in repeated measures beyond the threshold of error (Mesquita et al., 2013). The MDC is calculated with different confidence intervals usually 95% (Huang et al., 2011). Hence, the SEM and MDC \( 0.95 \) values in this research were 0.92 and 2.55, respectively.
Figure 2 illustrates test-retest reliability, in which the test showed significant reliability over time (ICC=0.92).

**Cut-off Scores**

The area under the curve presented satisfactory values (AUC =0.852). The curve is shown in Figure 3.

Also, to find an ideal cut-off point for M-Check test, sensitivity and specificity were used. The results are shown in Table 3. According to the highest value found for differences in sensitivity and specificity, a score of 4.50 is the ideal cut-off point (sensitivity =0.62 and specificity =0.94).

**Discussion**

The aging population is growing, which leads to an increase in the prevalence and incidence of age-related cognitive disorder. So, neuropsychological tools may be effective in detecting and appropriate management of this disorder (Badrkhahan et al., 2019). The present study aimed to evaluate the psychometric features of the self-assessment Persian version of Alzheimer's questionnaire (AQ) in the elderly to detect MCI.

In the current study, the AQ was translated to Persian using a forward-backward translation method. In the translation stage, according to suggestions by the expert panel, small changes were made. These changes were mainly related to vocabulary in order to convert the test to a self-assessment questionnaire (change the third-person to first-person format). Also, some minor cross-cultural changes (e.g., golf and dance in the main questionnaire changed to physical activity) were applied. One of the aims of the translation process is to generate an instrument that is suitable based on culture and target population.
(“WHO | Process of translation and adaptation of instruments,” 2010). Also, the translated version was named “M-check” standing for “Memory check”.

Cognitive function is typically classified in five areas: learning and memory, language, visual-spatial visibility, executive and psychomotor (Knopman & Petersen, 2014). Some studies have used self-assessment tools for the diagnosis of cognitive impairment with different scopes. Rattanabannakit et al. (2016) used Cognitive Change Index (CCI) for cognitive impairment. This tool consists of 3 domains with 20 subsets: Memory (12 questions), Executive Function (5 questions), and Language (3 questions) with a 5-point Likert scale (Rattanabannakit et al., 2016). Also, Broadbent et al. (1982) designed the Cognitive Failures Questionnaire (CFQ). This 25-item questionnaire was a 5-point Likert questionnaire, which was a self-assessment scale to identify cognitive decline, including domains of slips and errors of perception, memory, and motor function (Broadbent, Cooper, FitzGerald, & Parkes, 1982). The AQ questionnaire in this study consists of five domains: Memory, Orientation, Functional Ability, Visuo-Spatial, and Language, which were more completed than other researches.

Content Validity

The content validity process is critical to the development of new tools (Almanasreh, Moles, & Chen, 2019). Two common methods to measure content validity are CVI and CVR, so in the assessment of content validity, CVI, and CVR were measured. Acceptable CVI score must be at least 0.79 and, preferably higher than 0.90 (Polit & Beck, 2006). In this study, the CVI score among 21 items indicated good content validity of the scale (CVI=0.97). According to Lawshe (1978), acceptable CVR value for ten experts is equal to 0.62 (Lawshe, 1975), and as mentioned earlier, CVR score among 21 items was obtained as 0.87, which was satisfactory.
**Face Validity**

In the assessment of face validity by two groups (consisting of the expert panel and the elderly), all of face validity questions (14 for expert panel and 15 for the elderly) achieved desired face validity. Face validity means how an instrument “looks valid to the respondents who have to fill it up” (P. Krabbe, 2016). Connell et al. (2018) noted that face validity is an important step in the acceptability and validity of items in the development of a new instrument (Connell et al., 2018).

Finally, assessment of content and face validities of M-Check did not result in changes in the number of items, and only some revises were applied.

**Convergent Validity**

The Pearson correlation coefficient was used to measure convergent validity, which “r” between scores of M-Check and MoCA was obtained as -0.83. Hinkle et al. (1988) reported the size of correlation in range of 0.70 to 0.90 (0.70 to -0.90) as a high positive (negative) correlation (Hinkle, Wiersma, & Jurs, 1988). Accordingly, the convergent validity of M-Check was confirmed.

**Reliability**

To measure the internal consistency of the M-Check, the questionnaire was distributed among several older people, and the Kuder-Richardson coefficient was measured. This method is beneficial for tests comprising of two responses (true and false or yes or no) (Zeller & Carmines, 1979). Minimal acceptable value for internal consistency is equal to 0.7, indicating an excellent amount for internal consistency.

Stability measures the consistency of repetition, so to assess stability; the test-retest method was used. ICC is one of the most used tests to measure stability (de Vet, Terwee, Knol, & Bouter, 2006). The minimum value of 0.70 is considered satisfactory (Terwee et al., 2007). The ICC and SEM of M-Check both were reported as 0.92. The ICC and SEM can
differ: the ICC of measurements may be close to perfect, but the SEM may be small and vice versa. In other words, it is dependents on how measurement will be interpreted (Russek, 2004). Also, Musselwhite & Wesolowski have stated, “if the reliability is close to perfect (r=1), the standard error will be small, indicating the examinee’s observed score is very similar to the true score” (Musselwhite & Wesolowski, 2018). In this study, the small SEM value indicated that test-retest measurements were stable over time, thereby mentioning accuracy in measurement. Accordingly, the M-Check had acceptable stability, repeatability, and reliability.

Rezaei et al. (2017) assessed the psychometric properties of the Mini-Cog in Iranian older adults. The result showed that the test-retest reliability of the Persian version of Mini-Cog was acceptable (r=0.86, p<0.01) (Rezaei et al., 2018). Another study that evaluated the psychometric properties of the Persian version of the cognitive state test (COST) in a sample of Iranian older adults showed that the COST had a significant correlation with the clinical dementia rating (rS = -0.76, P-value < 0.001). It indicated an acceptable concurrent validity for the test (Lotfi et al., 2016). These studies were in accordance with the result of this study. But both mentioned researches were not self-assessment, and the tests performed for all the participants by a trained therapist or aimed to promote the clinical assessment (Malakouti, Panaghi, Foroughan, Salehi, & Zandi, 2012). Yet, in this study, the M-Check can be conducted by older people at home without any expert's help.

Results of this study showed that area under the ROC curve of predicting MCI based on M-Check was equal to 0.85, and cut-off value was measured as 4.5; sensitivity and specificity were equal to 0.62 and 0.94, respectively. All findings demonstrated that the M-Check had high values in predicting MCI in the early stages.
**Strengths and Limitations of the Study**

An essential strength of our study was using AQ as a self-assessment tool in MCI detection. It can be done in the home without the presence of a physician.

There were also some limitations in this study: First, the sample size was small; it is suggested to conduct the same survey with a large group of the elderly. Second, it is suggested to conduct a study in the future based on the main version (a physician completes the main version of AQ by asking the patient’s family or relatives), which was not done in this study due to time limitation. Third, one of the main risk factors for MCI is lower educational level and male sex (Roberts et al., 2012). While in this study, most participants were female, and we excluded the elderly who were illiterate. This limitation may reduce the effectiveness of these instruments in the identifying of MCI, so it is recommended to conduct further studies to clarify the sensitivity of self-assessment AQ for the recognizing of MCI.

**Conclusion**

Screening tools are essential to detect MCI or dementia, as there are different kinds of tests available. They can be used as a valid and reliable tool for assessing the cognitive state of older people (Lotfi et al., 2016; Rezaei et al., 2018), but they should have interpreted by an expert. Therefore, a valid test to assess cognitive dysfunction in the elderly by themselves can be beneficial in the timely management of this dysfunction. The M-Check has adequate psychometric properties as a screening instrument for the detection of MCI among Iranian elderly. So, the M-check can be used as a valid and reliable instrument for assessing cognitive state and screening MCI in older adults. Also, it can be used by the elderly to monitor their cognitive status at home.
Ethical Considerations

This study was approved by the Ethics Committee of Shiraz University of Medical Sciences (no.IR.SUMS.REC.1397.715). Participation in the study was voluntary, and all participants submitted written informed consent prior to enrolment.

Grants

This work was supported by grants from Shiraz University of Medical Sciences (grant number: 97-01-07-17037).

Acknowledgment

This paper is a part of a MSc. thesis of the first author, entitled “Mobile-Based Self-Assessment Tool for Mild Cognitive Impairment (Design and Assessment)”. The authors wish to thank the Welfare Organization of Fars province (Iran) and senior care centers in Shiraz, Iran. We are grateful to all the experts, and the elderly participated in this study.

Conflict of Interest

The authors declare that there are no conflicts of interest.
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https://doi.org/10.1016/j.cger.2013.07.003.Classification


https://doi.org/10.2519/jospt.2004.0797


### Table 1

*Sociodemographic Characteristics of Study Participants*

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<td><strong>Sex (n=87)</strong></td>
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<td>Female</td>
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<td><strong>Marital status (n=85)</strong></td>
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<td><strong>Smoking (n=86)</strong></td>
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<td><strong>Alcohol use (n=86)</strong></td>
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</tbody>
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<sup>a</sup> Represents valid percent.
Table 2

Mean of Face Validity’s Items of VAS for Expert Panel and the Elderly

<table>
<thead>
<tr>
<th>Items of VAS for expert panel</th>
<th>Mean</th>
<th>Number of participations</th>
</tr>
</thead>
<tbody>
<tr>
<td>Simplicity of test</td>
<td>9.11</td>
<td>9</td>
</tr>
<tr>
<td>Level of used clarity terms in the test</td>
<td>8.46</td>
<td>9</td>
</tr>
<tr>
<td>Ease of learning in using the test</td>
<td>9</td>
<td>9</td>
</tr>
<tr>
<td>Effectiveness in connecting to the medical staff</td>
<td>8.62</td>
<td>8</td>
</tr>
<tr>
<td>Ease of using the test</td>
<td>9.34</td>
<td>9</td>
</tr>
<tr>
<td>Short time for completing the test</td>
<td>9.02</td>
<td>9</td>
</tr>
<tr>
<td>Effectiveness of the test</td>
<td>8.89</td>
<td>9</td>
</tr>
<tr>
<td>Degree of satisfaction with the test</td>
<td>8.89</td>
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</tr>
<tr>
<td>Degree of suitability for age range of the elderly</td>
<td>8.79</td>
<td>9</td>
</tr>
<tr>
<td>Level of communication and correlation of questions with each other</td>
<td>9</td>
<td>9</td>
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<tr>
<td>Amount of concept taken from the questions</td>
<td>8.37</td>
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<tr>
<td>Level of communication with the scale</td>
<td>8.98</td>
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<tr>
<td>Likelihood of future re-testing as part of diagnostic care for patients</td>
<td>8.79</td>
<td>9</td>
</tr>
<tr>
<td>Level of introducing to colleagues or friends</td>
<td>8.79</td>
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</table>

<table>
<thead>
<tr>
<th>Items of VAS for the elderly</th>
<th>Mean</th>
<th>Number of participations</th>
</tr>
</thead>
<tbody>
<tr>
<td>Simplicity of test</td>
<td>9.45</td>
<td>11</td>
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<tr>
<td>Level of test organization</td>
<td>8.82</td>
<td>11</td>
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<tr>
<td>Clear terms</td>
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<tr>
<td>Ease of learning in using the test</td>
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<tr>
<td>Effectiveness in connecting to the medical staff</td>
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<td>Ease of using the test</td>
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<td>Short time for completing the test</td>
<td>9.27</td>
<td>8</td>
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<tr>
<td>Effectiveness of the test</td>
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<tr>
<td>Degree of satisfaction with the test</td>
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<tr>
<td>Items of VAS for the elderly</td>
<td>Mean</td>
<td>Number of participations</td>
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<tr>
<td>-----------------------------------------------------------------</td>
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<tr>
<td>Degree of suitability for age range of the elderly</td>
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<td>Amount of concept taken from the questions</td>
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<tr>
<td>Amount of help in talking about disease condition for patients</td>
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<td>The amount of pleasure is the test</td>
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<td>Likelihood of future re-testing as part of diagnostic care for patients</td>
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<tr>
<td>Level of introducing to friends</td>
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<td>10</td>
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<tr>
<td>Score</td>
<td>Sensitivity</td>
<td>Specificity</td>
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<td>---------</td>
<td>-------------</td>
<td>-------------</td>
</tr>
<tr>
<td>≥-1.00</td>
<td>1.000</td>
<td>0</td>
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<tr>
<td>≥.50</td>
<td>.958</td>
<td>0.333</td>
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<tr>
<td>≥1.50</td>
<td>.833</td>
<td>0.527</td>
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<td>≥2.50</td>
<td>.792</td>
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<td>≥3.50</td>
<td>.750</td>
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<td>≥4.50</td>
<td>.625</td>
<td>0.944</td>
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<td>≥5.50</td>
<td>.542</td>
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</table>
Figure 1. Convergent Validity of MoCA and M-Check
Figure 2. Test-Retest Reliability of M-Check
Figure 3. ROC Curve of M-Check

Note: AUC=0.852/SE=0.054 /p<0.05/95% CI=0.746-0.957.

AUC: Area Under the Curve; SE: Standard Error; CI: Confidence Interval