Article

Psychometric Properties of the Persian Adaptation of Mini-Cog Test in Iranian Older Adults

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Abstract

The aim of this study was to assess the psychometric properties of the Mini-Cog in Iranian older adults. It was a cross-sectional study; 50 older people with dementia and 50 without dementia who matched for age, gender, and education entered the study. The diagnostic and statistical manual of mental disorders criteria for dementia were used as gold standard. A battery of scales included the abbreviated mental test score (AMTS), the Geriatric Depression Scale, and the Mini-Cog was performed. Validity and reliability of the Mini-Cog determined using the Pearson product-moment correlation coefficient (Pearson's *r*), Cronbach's alpha, and Receiver Operating Characteristic (ROC) curve analysis. The Persian version of Mini-Cog showed a good inter-rater reliability ($K = 0.76$, $p < .01$) and a positive concurrent validity ($r = 0.39$, $p < .01$) with the AMTS. The sensitivity and specificity were 88%

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and 62.8%, respectively, using the original cutoff point of 2. The findings showed that the Persian version of Mini-Cog have an acceptable sensitivity, specificity, and substantial overall agreement with the AMTS.

Keywords
older adults, Mini-Cog, psychometrics, cognitive impairment, screening

Introduction

Some cognitive changes accompany the normal aging process. Decreased speed of information processing, slowing of free recall, and declined executive functions are parts of these age-related changes (Grady & Craik, 2000; Xie, Mayo, & Koski, 2012). These diminished cognitive abilities are affecting individuals differently but never impair their functions so severe that they become dependent on others (Alzheimer's-Disease-International, 2015; Xie et al., 2012). But, on the other hand, many conditions which are prevalent in older adults, such as Parkinson's disease, stroke, and depression, impair their cognitive abilities from very mild cognitive impairment to severe dementia (D) and drag them to a dependent life (Hosseini, Sobhani-Rad, Ghandehari, & Benamer, 2010; Rashedi, Rezaei, Foroughan, & Delbari, 2016; Rashedi, Rezaei, & Gharib, 2014; Soleimani, Bastani, Negarandeh, & Greysen, 2016). Dementia is usually described as a global cognitive deficit, including impairment in memory and at least one other cognitive function: agnosia, aphasia, apraxia, or disturbances of executive functioning. The deficits must be sufficient to cause functional impairment at home or at work and must represent a decline from previous functioning level (American-Psychiatric-Association, 2013).

It has been estimated that 36 million people lived with D in 2010; this proportion is nearly doubling every 20 years to 66 million by 2030 and to 115 million by 2050 (Prince et al., 2013). Age-standardized prevalence for those aged $\geq$60 years varied in a narrow band, 5% to 7% in most world regions, with a higher prevalence in Latin America (8.5%), and a distinctively lower prevalence in the four sub-Saharan African regions (2%–4%). The incidence of D increases exponentially with increasing age. The incidence of D doubles with every 6.3 year increase in age, from 3.9 per 1,000 person-years at age 60 to 64 years to 104.8 per 1,000 person-years at age 90+ years (Alzheimer's-Disease-International, 2015). In 2016, Sharifi et al. reported that the overall crude prevalence of D among people aged $\geq$60 years was 7.9% (8.7% in women and 6.5% men).

Dementia has profound implications on the lives of patients and their caregivers, so detecting it at an earlier stage may help health-care providers in on

time interventions including education of the patients and their families (Fillenbaum, Heyman, Williams, Prosnitz, & Burchett, 1990; Ismail, Rajji, & Shulman, 2010).

Considering the aforementioned, now cognitive screening is regarded as an integral part of assessing health and care needs of older persons. Early recognition of cognitive decline, D or nondementia (ND), has received considerable attention in the past few decades (Lindeboom, Schmand, Tulner, Walstra, & Jonker, 2002; Meulen et al., 2004). The value of detecting D in older adults is widely accepted, but physicians in crowded clinics cite time constraints and complexity of existing cognitive tools as barriers to formal cognitive screening. Some adds that current screening instruments such as mini-mental state examination (MMSE) are too long or do not improve their ability to detect D (Iliffe, Manthorpe, & Eden, 2003; Tangalos et al., 1996). To address these problems, the Mini-Cog, a 3-min cognitive screening tool, which is designed for primary care use, was developed by S. Borson, Scanlan, Brush, Vitaliano, and Dokmak in 2000 (Soo Borson, Scanlan, Watanabe, Tu, & Lessig, 2005; J. Scanlan & Borson, 2001).

The ideal instrument for using in primary care must be brief, simple, and acceptable to older persons, and also it must not be influenced by level of education and language barriers. The Mini-Cog is a new instrument that consists of a simple three word memory test besides the clock drawing test (CDT) and appears to fulfill these criteria (S. Borson et al., 2000). Its administration takes on average 3.2 minutes, making it much less time consuming compared with MMSE and is well accepted by older persons (McCarten, 2011), as there are no *shameful* questions to orientation included (Milian et al., 2013).

Mini-Cog has been translated into several languages (Choi, Lee, & Lee, 2006; Scanlan et al., 2007; Trongsakul, Lambert, Clark, Wongpakaran, & Cross, 2015). Most validation studies on Mini-Cog have been focused on its usefulness in primary care settings. In the Korean version that was applied to 116 community dweller older adults and 92 who lived in a nursing home, validity of Mini-Cog was confirmed and the results showed high levels of test sensitivity and specificity (sensitivity 90%, specificity 95.8%) in both the community-dwellers and nursing home older people, but details of age and education levels of the samples were not reported (Choi et al., 2006).

One of the important characteristics of an ideal cognitive test is being culturally unbiased. It has been reported that the scores of Mini-Cog are not or mildly affected by the culture or educational level of subjects (Soo Borson et al., 2005; Milian et al., 2012; Pérez-Mojica, González-Viruet, & Rodríguez, 2014); But this has not been confirmed in some other studies (Michieletto, Binkin, Saugo, Boorson, & Scanlan, 2005), and the subject remains open for further investigation.

The aim of this study was to develop a Persian version of the Mini-Cog test and evaluate its psychometric properties, as a candidate measure of cognitive

screening in Iranian older adults, and to see if the test scores are affected by education and other sociodemographic variables or not.

Method

Design and Participants

This is a cross-sectional study which was implemented between April 26th and May 27th, 2014, in the City of Hamedan, located in the northwest of Iran.

The study population involved all older adults who lived in Hamedan during the time period of the study. Convenient sampling method was used. The sample selected from older individuals who have been referred to the hospital-based neurology clinics of the city (totally consisting of three clinics). The physicians who worked in these clinics were asked to refer patients with probable D to the research team, if they agreed and consented. All referred cases were evaluated thoroughly (using comprehensive diagnostic work-up including history, physical exam, lab tests, and imaging) by a psychiatrist or neurologist who were members of the research team, and if they fulfilled diagnostic and statistical manual of mental disorders (DSM-5®) criteria entered the study. The recruitment continued until a sample consisting of 50 participants was obtained.

The control group, also consisting of 50, was selected from users of Hamedan day care centers. These centers were providing social services for older individuals who seemed grossly healthy. To select them, the total number of 312 clients were clinically evaluated, using DSM-5® criteria (to rule out D), and those who most matched (age, sex, and education) with the case group were entered the study. The evaluations performed by the consultant physicians of the centers who were asked and agreed to cooperate with the research team. The essential trainings on how to assess the participants were delivered to these physicians by the members of research team.

The participants were included into the study if they met the following inclusion criteria: willingness to participate, provision of an informed consent, and being 60 years old and older. The ND group was excluded if they had a history of using drugs affecting central nervous system during the previous month, history of certain neurological diseases such as stroke, Parkinson's disease, brain tumor or brain surgery, and so on, or having a history of depression or other prominent psychiatric disorder. The D subjects with a previous diagnosis of depressive disorder, schizophrenia, or epilepsy; any history of cerebrovascular accident or communication difficulties that could compromise the tests results were also excluded. To communicate well and understand the instructions provided by the researchers, all the participants selected among skilled Persian speakers (in some area of Hamedan, people speak Azari). The goal of the study was explained to the participants, a signed consent article was taken from all of them, and from the primary caregiver of the D patients.

This study was approved by the ethics committee of deputy of research & technology of University of Social Welfare and Rehabilitation Sciences.

Test Preparation Phase

Following Beaton Bombardier, Guillemin, and Ferraz (2000) method, the linguistic translation of the English version of Mini-Cog into the Persian involved several stages. The Mini-Cog test was translated by two translators (a gerontologist and a psychiatrist) who were fluent in both Persian and English, and then was back translated into English by two different accredited translators. The Mini-Cog is copyrighted by the developers (Cog, 2000), therefore permission was sought from them. In the original version of Mini-Cog, the 3-item recall words are *Banana*, *Sunrise*, and *Chair*. These words are not common among Iranians. Thus, a long list of 3-item words prepared by the members of research team and their linguist consultant, and a new set of words, consisting of *Hen*, *Pomegranate*, and *Chair* selected and agreed upon. These three words were chosen for their simplicity, number of syllables, and their familiarity among Iranians. Careful consideration was taken that each word would belong to a different item category, with different number of syllables, as the original test prescribed. A group discussion session with the translators and the present authors was arranged to evaluate and compare the original Mini-Cog version with the translated and back-translated Persian versions. In the process of group discussion, special attention was given to verb tenses and colloquial expressions considering local culture. Fortunately, the differences were few and appropriate changes, mainly in wording, were introduced to develop a test that is semantically and conceptually equivalent to the English version.

Measures

Trained interviewers administered a face-to-face interview to gather information on historical and sociodemographic variables.

DSM-5®, as our gold standard, used by trained and experienced physicians to differentiate D and ND groups at the beginning of the study.

A battery of scales and measures, which included the Persian version of abbreviated mental test score (AMTS; Foroughan et al., 2017), the Mini-Cog, and Persian version of the Geriatric Depression Scale (Malakouti, Fatollahi, Mirabzadeh, Salavati, & Zandi, 2006) performed for all the participants by a trained speech-therapist.

The Mini-Cog combines a 3-item word recall task (0–3 points; one point for each correctly recalled word) with a simple clock drawing task (abnormal clock = 0 points; normal clock = 2 points) used as a distraction before the free word recall. A normal CDT is included all the followings; the numbers (1−12), each only must come once, in the correct order and direction (clockwise), two hands, one pointing to 11 and one pointing to 2. Any clock drawing missing

either of these elements is considered as abnormal. Mini-Cog total possible scores range between 0 and 5, with 0 to 2 suggesting high and 3 to 5 suggesting low likelihood of cognitive impairment.

The AMTS is a relatively short cognitive screening tool (Pérez-Mojica et al., 2014). It consists of 10 items, with one point given to each correctly answered question. The original AMTS puts the following questions to the patient: age (Item 1), time (to the nearest hour; Item 2), address for recall at end of the test (42 West Street; Item 3), year (Item 4), name of this place (Item 5), identification of two persons (doctor, nurse, etc.; Item 6), date of birth (Item 7), year of first world war (Item 8), name of the Queen (Item 9), and counting backwards from 20 to 1 (Item 10). In the Persian version of AMTS, the Item 8 had been changed to the year of Islamic Revolution, and the Item 9 to the name of the current leader of the country to make the test culturally and historically more appropriate. A score of 7 or less suggests probable cognitive impairment at the time of testing. Regarding the high prevalence of very low and low literacy in current generation of older Iranians, we used AMTS for evaluating concurrent validity and substitute it for MMSE. MMSE is the most frequently used in similar studies; but as it has been known as a culturally biased and education dependent test which its performance needs good reading and writing abilities, we preferred to use AMTS (Foroughan et al., 2017; Parker & Philp, 2004). A study examined the correlation of MMSE and AMTS in Iranian elders has reported high and significant correlations between them (Foroughan, Jafari, Shirinbayan, Ghaem Magham Faraahani, & Rahgozar, 2008).

Internal consistency of the test was determined by Cronbach's alpha; reliability tested by inter-rater and test–retest methods. For evaluating inter-rater reliability, two independent raters simultaneously scored the subject's functioning on the test during a single test performance. Each rater was blinded to the other rater's results. For test–retest reliability, the same rater performed a second assessment exactly 2 weeks after the first on 24 ND.

Statistical Analysis

T test and chi-square test were used to compare the D and ND participants on demographic variables. Receiver Operating Characteristic (ROC) curve analysis was performed to test the sensitivity and specificity and to obtain optimal cutoff value. Inter-rater reliability was determined by Pearson's correlation test. To determine discriminate and concurrent validity, the Pearson product-moment correlation coefficient (Pearson's *r*) was applied.

Results

A total of 100 older individuals (50 D and 50 ND) agreed to participate in this study. Four of the D group did not complete the study. The mean ages were

Table 1. The Distribution of Socio-Demographic Variables Among the Study Sample.

	Dementia		Nondementia		
Variables	*N*	%	*N*	%	*p*'s
Gender					
Male	17	37.8	17	34	.08
Female	28	62.2	33	66	
Marital status					
Married	10	22.2	33	66	.12
Unmarried	35	77.8	17	34	
Education level					
Basic	21	46.7	25	50	.05
Primary	9	20.0	19	38	
Secondary	14	31.1	5	10	
Academic	2	2.2	1	2	
Language					
Unilingual	24	53.3	36	72	.34
Bilingual	21	46.7	14	28	

67.36 years (*SD*: 6.08) and 65.84 years (*SD*: 5.36) for the D and ND groups, respectively. The characteristics of the sample are presented in Table 1. As shown in this table, there was no statistically significant difference between the D and ND groups on the variables of age, sex, and schooling.

The Mean $\pm$ *SD* of the Mini-Cog and AMTS scores for the D group were 1.62 ± 0.49 and 6.22 ± 1.71, and for the ND group were 2.26 ± 0.96 and 8.14 ± 1.77, respectively (Table 2).

There was a significant difference between the mean scores of Mini-Cog between the two groups, as shown in Table 3.

Using Pearson's correlation coefficients (r) between the scores of Mini-Cog and AMTS showed a significant positive correlation ($r = 0.39$, $p < .01$; Table 4).

There was a negative, nonsignificant correlation between age and the Mini-Cog scores; the Mini-Cog scores between two sexes were not significantly different. However, a statistically significant correlation between level of schooling and the scores of Mini-Cog was found in the two groups (Table 5).

Overall Cronbach's alpha coefficient was 0.83 (95% CI = [0.67, 0.86]). Correlation between the total score and the scores of subscales (items) indicated a high degree of internal consistency and homogeneity between items of Mini-Cog test.

The inter-rater reliability of Mini-Cog scoring classified as ''normal cognitive function'' and ''abnormal cognitive function.'' The K statistic for the inter-rater reliability of Mini-Cog showed a good agreement ($K = 0.76$, $p < .01$).

Table 2. The Values of Study Instruments by the Two Groups of Dementia and Nondementia.

Group	Variables	Mean	*SD*	Minimum	Maximum
Dementia	Mini-Cog	1.62	0.49	1	2
	AMTS	6.22	1.71	2	10
	GDS	5.16	3.66	0	15
Nondementia	Mini-Cog	2.26	0.96	0	5
	AMTS	8.14	1.77	4	10
	GDS	5.88	3.20	0	14

AMTS = abbreviated mental test score; GDS = Geriatric Depression Scale.

Table 3. The Mean Difference of Mini-Cog in Dementia and Nondementia Groups.

	Dementia		Nondementia			
Variables	*M*	*SD*	*M*	*SD*	*t*	*p*
Mini-Cog	1.62	0.49	2.26	0.96	3.99	<.01

Table 4. Correlation Matrix of the Variables, Dementia.

Variables	Mini-Cog	AMTS	GDS
Mini-Cog	1	0.39**	0.10
AMTS		1	−0.15
GDS			1

AMTS = abbreviated mental test score; GDS = Geriatric Depression Scale.
**Correlation is significant at the .01 level.

The result of pearson's correlation for the total Mini-Cog score showed acceptable test–retest reliability of the Persian version of Mini-Cog ($r = 0.86$, $p < .01$).

The sensitivity and specificity of the Mini-Cog were 88% and 62.8%, respectively, using the original cutoff point of 2.

Discussion

It is necessary to evaluate psychometric properties of tests developed in other communities and different cultures before using them in another one. In the present study, the main object was to prepare a culturally appropriate and

Table 5. Mean Difference of Mini-Cog Based on Schooling in Dementia and Nondementia Groups.

Variables			SS	*df*	MS	*F*	*p*'s
Dementia	Mini-Cog	Between groups	16.98	3	5.66	9.09	<.01
		Within groups	28.64	46	0.62		
		Total	45.62	49			
Nondementia	Mini-Cog	Between groups	2.87	4	0.72	3.74	.01
		Within groups	7.69	40	0.19		
		Total	10.57	44			

MS = Mean Squares; SS = Sum of Squares.

valid cognitive test and ensure the applicability and interpretability of it in Iranian older people. This led to introduction of a Persian version of Mini-Cog which exhibits satisfactory psychometric properties.

The findings showed that the Persian version of Mini-Cog is a user friendly and acceptable cognitive test for the Persian-speaking older adults. The participants showed that they could clearly understand the words and instructions. The time needed to administer and interpret the test (4 min, at average) was acceptable to the both participants and clinicians. This finding highlights suitable face validity of the Persian version of the Mini-Cog.

To validate the Mini-Cog, we first applied it on two D and ND groups differentiated by DSM-5® criteria for D, and the results showed that Mini-Cog can do the same differentiation. Then, the concurrent validity checked by calculating the correlation between AMTS and Mini-Cog scores, and results confirmed this correlation in a significant level of $r = 0.39$, $p < .01$. And, last, we used discriminant validity to see how the new test (Mini-Cog) is related with an established test (Geriatric Depression Scale) which is designed to measure theoretically different construct (here, depressive symptoms); and the results, as expected, showed no significant relation between them. Most previous studies on validation of Mini-Cog have confirmed its discriminatory value on D screening (Holsinger et al., 2012; Kamenski et al., 2009; Michieletto et al., 2005; Milian et al., 2012; Pérez-Mojica et al., 2014; Trongsakul et al., 2015), but some has shed doubt on it and recommended for further research using more elaborated methodology (Carnero-Pardo et al., 2013; Costa, Severo, Fraga, & Barros, 2012; Fage et al., 2015).

We used AMTS for evaluating concurrent validity in this study. Most previous studies have tested Mini-Cog versus the MMSE (Costa, Hernández, Costa-Faidella, & Sebastián-Gallés, 2009; Pérez-Mojica et al., 2014; Trongsakul et al., 2015). Mitchell and Malladi (2010) in a meta-analysis comparing 29 cognitive brief batteries concluded that AMTS and MMSE, both, are optimal tests for rule-in or rule-out of D in primary care. Therefore, our study is most likely to be

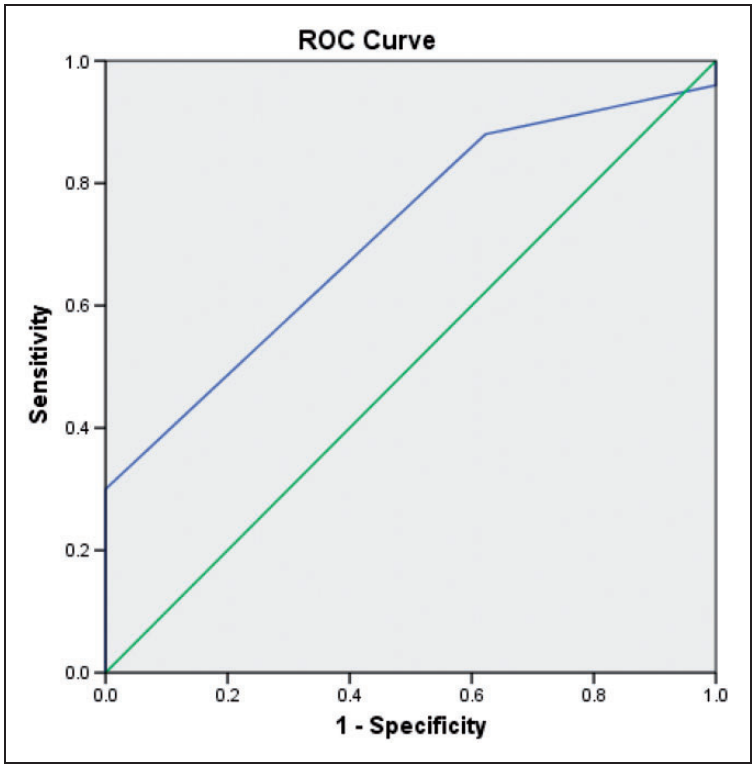

Figure 1. Receiver operating characteristic (ROC curve) for Mini-Cog; area under the curve: 0.71.

the first one which provides evidence regarding significant correlation between the Mini-Cog and the AMT scores.

The sensitivity of Mini-Cog has reported 0.66 to 0.99, and its specificity 1 to 0.73 in different studies. In our study, the sensitivity and specificity were 0.88 and 0.62, respectively (Figure 1), which are comparable to the previous studies (Fage et al., 2015; Kamenski et al., 2009; Pérez-Mojica et al., 2014).

When 24 subjects recompleted Mini-Cog after 2 weeks, test–retest correlation coefficient between the total Mini-Cog scores was 0.76. Our finding also revealed that there is a good level of test-takers agreement (inter-rater reliability) of the Persian version of the Mini-Cog with $K = 0.76$, $p < .01$.

The present study same as the Thai version only used two raters scoring method, whereas in the Italian version (Scanlan et al., 2007), there were 40 raters across a larger geographical area (11 regions). The Italian version reported reliability only for the part of the CDT that yielded an intraclass correlation coefficient of 0.89. However, in clinical practice, the reliability is the

repeatability under similar conditions, either by the same rater or different raters. It is a measure of the consistency that two or more individuals will have the same findings with the same assessment (Palmer et al., 2010). Furthermore, it is vital that any tool used in the assessment of a patient is repeatable between clinicians in the whole process (Morrison & Ferrari, 2009). So, the present study similar to Thai version used kappa analysis to measure inter-rater reliability of the overall test (Trongsakul et al., 2015). The sensitivity and specificity were 88% and 62.8%, respectively, adopting the original cutoff point of 2 that was previously found to be optimal for D screening in independent validation studies (S. Borson et al., 2000; Soo Borson, Scanlan, Chen, & Ganguli, 2003).

Our results showed there are significant relationships between the scores of Mini-Cog and level of education of the participants. This finding is partially in line with Michieletto et al. (2005) who reported no sex effect but major education influence on the scores of Mini-Cog.

This study had some limitations. One such limitation was that we did not blind the investigators performing the AMTS to the results of the Mini-Cog, and this could introduce bias. We also excluded severely ill patients which could introduce spectrum limitation.

Conclusions

In conclusion, we found that Mini-Cog have an acceptable sensitivity, specificity at the cut point two, and a modest overall agreement with the AMTS. The present study also showed the proper inter-rater and test–retest reliability of the Persian version of the Mini-Cog. The Persian version of the Mini-Cog can therefore be considered as a reliable and valid test comparable to similar screening tools, such as the MMSE and AMTS. These results can shed light on the future usage of the Persian version of the Mini-Cog, both in clinical practice and research. Overall, the Persian version of Mini-Cog has proper psychometric properties and can be considered appropriate for the cognitive evaluation of Iranian older adults. This is particularly the case in the primary care settings, where the time is limited and a brief cognitive screening method is required.

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Declaration of Conflicting Interests

The authors declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

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