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Original Study

The Saint Louis University Mental Status Examination Is Better than the Mini-Mental State Examination to Determine the Cognitive Impairment in Turkish Elderly People

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A B S T R A C T

Introduction: Presence of detailed screening instruments to detect cognitive impairment in the older adults' culture and language is very essential. The Saint Louis University Mental Status Examination (SLUMS) is one of cognitive screening scales used. The aim of the study was to establish the validity and reliability of the Turkish version of SLUMS (SLUMS-T).

Methods: Two hundred seventy-four participants aged 60 years and older admitted to our geriatric clinic were screened for cognitive impairment using SLUMS-T and Mini-Mental State Examination. Internal consistency was analyzed with Cronbach α test. Area under curves of receiver operating characteristic analyses were used to test the predictive accuracy of the SLUMS-T for detecting amnestic mild cognitive impairment (aMCI) and Alzheimer disease (AD) to set an appropriate cut-off point.

Results: The SLUMS-T scores were positively correlated with the Mini-Mental State Examination scores of the patients with aMCI and patients with AD and controls ($r = 0.687$, $P < .001$; $r = 0.880$, $P < .001$; respectively). Internal consistency of the SLUMS-T was Cronbach $\alpha = 0.85$. It was found that SLUMS-T with a cut-off point of 23 had a sensitivity of 66.6% and a specificity of 72.3% for the diagnosis of aMCI, and with a cut-off point of 20 had a sensitivity of 83.8% and a specificity of 87.3% for the diagnosis of AD.

Conclusions: SLUMS-T was demonstrated to have sufficient validity and reliability to evaluate cognitive impairment including MCI among Turkish elderly people.

Screening older adults for cognitive impairment has been of great concern in clinical practice and in research settings because complaints of cognitive problems are very common among older adults in clinical practices, and identification of its presence affects the treatment regimen and future plan of the patient and the family. In research settings, to identify study participants with or without cognitive impairment related to the study's criteria is essential for ensuring the best targeted treatment effect or outcome.[1] Furthermore, researchers strive to investigate how the changes that result from age-related disease differ from those that result from cognitive aging.[2] Therefore, it is important to have a validated and reliable instrument to detect those with cognitive impairment. There are few detailed cognitive screening instruments available for use with adults older than 60 years of age in our country. One of the most commonly used measures is the Mini-Mental State Examination (MMSE),[3] but it has several limitations such as ceiling effects when used with individuals with high educational circumstances, poor specificity rates in identifying mild cognitive impairment (MCI), and poor staging for questionable dementia.[4–6] The Saint Louis University Mental Status Examination (SLUMS) is an 11-item, 30-point clinician-administered cognitive screening measure. It has been reported to be easy to administer, to assess several cognitive domains including attention, calculation, immediate and delayed recall, animal naming, abstract thinking, and visuospatial skills in a short amount of time (approximately 7 minutes). It does not require collateral informants.[4,7]

Tariq et al[4] showed that the SLUMS and the MMSE both could be used as a screening tool to detect dementia, and that the SLUMS could recognize a group of patients with mild neurocognitive disorder,

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which the MMSE failed to recognize as defined by the Diagnostic and Statistical Manual of Mental Disorders, 4th Edition criteria. They not only demonstrated that the SLUMS had excellent sensitivity and specificity rates for mild neurocognitive disorder in both high and low educated groups in a large veteran population, but they also demonstrated that the sensitivity and specificity rates for dementia in both education level groups were very high (0.92/0.81, respectively, in a less than high school educated population; and 0.95/0.76, respectively, in a greater than high school educated population). Cruz-Oliver et al[8] continued the validation work for the SLUMS by exploring its predictive validity for institutionalization and mortality after 7.5 years in patients with dementia. Feliciano et al[5] then validated SLUMS in community-dwelling older adults and found that the SLUMS had predictive neuropsychological functioning over the MMSE and was more likely to better determine memory and executive functioning. It was not so surprising because different from the MMSE with regard to these functions, the SLUMS had monetary calculations in addition to digits backward task, animal naming, and clock drawing. In a very recent long follow-up study by using SLUMS scores, it was reported that discontinuation of anticholinergic drugs and visual corrections provided improvement or reversion back to normal cognition in 24% of the individuals.[9]

The SLUMS has been translated to several languages and validated in different cultures.[10,11] Cao et al[10] had studied the SLUMS in a Chinese population. The scores of SLUMS were found to be fairly consistent with the Chinese version of MMSE and the Beijing version of Montreal Cognitive Assessment. Likewise, Arabic version of SLUMS examination was found to be a valid and reliable cognitive screening tool in the community dwelling Egyptian elderly.[11]

Therefore, the present study aimed to establish the validity and reliability of the Turkish version of the SLUMS in patients with impaired cognitive status and to investigate the discriminative power of the test in patients with mild cognitive disorder and in normal participants.

Methods

Translation and Adaptation Procedure

The process of Turkish translation of the SLUMS (SLUMS-T) examination included the following steps. First, 2 independent forward translations into Turkish were done by 2 native linguistic specialists. Both translators were blinded to the other's translation text. Second, a consensus forward version was developed by 2 specialists who are highly skilled in English. Finally, this consensus forward version was back-translated into English by a bilingual person; the backward version and the original text were compared by an independent supervisor. It was found that some contents required modifications. In third item "state" was modified to "city/şehir," in the fourth item one of the objects "tie" for immediate and delayed recall was modified to "ball/top"; "car" to "train/tren." In the fifth item, "$100" was modified to "100Liras"; "$3" to "6Liras"; "$20" to "20Liras"; "apples" to "egg/yumurta"; "tricycle" to "saucepan/tencere". In the eleventh item, in the story "Jill" was modified to "Nil" and "stockbroker" to "teacher"; "Chicago" to "Istanbul" and "Jack" to "Cenk" for being commonly used in Turkish and for having a similar number of syllables as the original version. Otherwise the contents of the test did not require further modification.

Participants

The participants were aged 60 years and older and were enrolled from June 2014 to June 2015 in a geriatric outpatient clinic. The investigators evaluated each participant during a routine clinic visit and, in addition, a history was obtained from corroborating sources, and a comprehensive geriatric assessment including physical and mental status examination and laboratory evaluation was performed.[12] The diagnosis of amnestic MCI was established according to the Mayo Clinic Criteria (Petersen et al[13]), and the diagnosis of Alzheimer disease (AD) was established according to the National Institute of Neurological and Communicative Disorders and Stroke and the Alzheimer's Disease and Related Disorders Association (NINDS-ADRDA) criteria (McKhann et al).[14] A geriatrician blinded to the diagnosis then completed the MMSE and SLUMS-T. Those who did not qualify by any of those criteria were considered having normal cognition or as controls. A sample size of 143 participants was calculated to ensure that the minimum required size was within a 95% confidence interval and 5% of the true proportion.

The inclusion criteria for the study were that the participants were at least 60 years of age and consent to the tests. Patients with severe deafness and blindness and those considered to be too sick to be questioned, including those in delirium, were excluded from participating. Those who were taking medications that might affect their memory or thinking and those who reported previous head injury resulting in unconsciousness and/or a period of memory impairment and patients who were unable to provide informed consent and those who were illiterate were also excluded from participation. This study was approved by the university institutional review board. All of the participants signed informed consent forms.

Measures

The SLUMS is a brief screen for cognitive impairment, developed in 2006 and validated in a large veteran population. The scale was obtained from the official website (Veterans Affairs Medical Center SLUMS examination) which is available at http://aging.slu.edu/uploads/slums/English%20Australia%20final%20translation.pdf For less than high school education SLUMS normal score is 25–30, SLUMS mild neurocognitive impairment score is 20–24, and SLUMS dementia score is 1–19. For high school or more than high school education, SLUMS normal cognition score is 27–30, SLUMS mild neurocognitive impairment score is 21–26, and SLUMS dementia score is 1–20. SLUMS was grouped into 6 subitems including orientation, memory, executive functions, attention, visuospatial skill, and clock drawing.

The MMSE is widely used in practice as screening tool for dementia and has been validated in Turkish population.[15]

The Geriatric Depression Scale[16,17] was administered to all participants; those with Geriatric Depression Scale scores higher than 7 were excluded.

According to the patients' education level, they were divided into 2 groups: less than high school education ($\leq$8 years) and high school education and higher ($\geq$9 years).

Initially, the SLUMS-T examination was administered before the clinical evaluation and 1 week after the initial examination for investigating test-retest reliability. The data were collected by a geriatrician who was blinded to the diagnosis, as well as the previous MMSE and the SLUMS-T. A total of 60 participants (12 were the patients with AD, 13 were the patients with amnestic MCI, and 35 were participants with normal cognition) completed the retest. Others were not available after 1 week.

Data Analysis

Analyses were performed using the statistical package for the social sciences (SPSS v 20.0; SPSS Inc, Chicago, IL). Descriptive statistics are reported as means $\pm$ standard deviations or percentages. Between group differences were tested either 1-way analysis of variance or Kruskal-Wallis test because of the distributional characteristics. Interclass correlation coefficient was evaluated for the test-retest reliability analysis. Internal consistency was analyzed with Cronbach α test. In order to test the predictive accuracy of the SLUMS for

detecting MCI and AD and to set an appropriate cut-off point for the test, area under curves of receiver operating characteristic (ROC) analysis were used.

Results

Sociodemographic Characteristics of the Groups

Older adults (170 female/104 male) between the ages of 60 and 92 years (mean age = 74.1 years; SD = 7.5) were recruited after exclusion. The mean number of years of education was 8.23 years with SD of 3.9. Only 16.4% of them were living alone and 62.4% were married.

There was no difference in the patients with MCI, AD, and control groups with regard to total years of education or educational level of the participants (for each $P > .05$). There was a significant difference between the 3 groups in terms of gender and age; more male participants in MCI group ($P = .008$) and older patients in AD group ($P < .001$) (Table 1). The duration of the SLUMS-T was 12.3 ± 3.4 minutes.

Validity Analysis

To establish the validity of SLUMS-T, the association between SLUMS and MMSE scores was calculated. The SLUMS-T scores were positively correlated with the MMSE scores of the patients with MCI and patients with AD and controls (r = 0.687, $P < .001$; r = 0.880, $P < .001$; respectively). Nonparametric statistical analyses were used to compare the SLUMS-T scores of the groups because the scores were not normally distributed. The Kruskal-Wallis test was performed, and χ^2 values were analyzed to estimate the significance of group membership on the SLUMS-T scores. The scores were significantly different in 3 groups, and the Bonferroni post hoc analysis was carried out by Kruskal- Wallis analysis. The SLUMS-T scores of the patients with AD were significantly different from the scores of patients with MCI and controls (Table 1). The agreement of the SLUMS-T and MMSE for cognitive status was shown in Table 2.

Table 1
Patient Characteristics

	Control (n = 213)	MCI (n = 30)	AD (n = 31)	*P* Value
Sex (male/female)	70/143	18/12	15/16	.008*
Age	73.0 ± 7.3	76.5 ± 7.2	79.6 ± 6.9	<.001†
Education (years)	8.2 ± 3.9	7.9 ± 4.0	8.0 ± 4.0	.791‡
Education level (%)				
≤8 years	54.4	60.0	48.4	.348*
≥9 years	45.6	40.0	51.6	
Married (%)	62.4	66.7	58.1	.786*
Number of drugs used	5.3 ± 3.3	5.1 ± 2.9	6.7 ± 3.9	.575‡
Number of comorbidities§	4.9 ± 2.8	6.2 ± 3.1	8.9 ± 4.1	.075‡
BADL [0 (worst)-100 (best)]	95.9 ± 5.2	95.5 ± 6.7	83.9 ± 17.1	<.001‡
IADL [0 (worst)-17 (best)]	14.1 ± 2.6	12.3 ± 2.6	7.4 ± 4.4	<.001‡
GDS [0 (worst)-15 (best)]	3.1 ± 3.5	2.1 ± 2.3	4.3 ± 3.7	.170‡
SLUMS [0 (worst)-30 (best)]	24.3 ± 4.2	20.9 ± 3.9	13.4 ± 7.3	<.001‡
MMSE [0 (worst)-30 (best)]	27.9 ± 2.1	26.2 ± 3.1	20.4 ± 5.4	<.001‡

ANOVA, analysis of variance; GDS, Geriatric Depression Scale.
*χ^2.
†ANOVA.
‡Kruskal-Wallis ANOVA test.
§Comorbidities are diagnoses according to International Classification of Diseases, Tenth Edition codes (eg, depression, cardiovascular disease, hypertension, congestive heart failure, diabetes mellitus, and stroke).

Table 2
SLUMS-T vs MMSE for MCI and AD

	n	Cohen κ Value	*P**
Screening for MCI	243	0.223	<.001
Screening for AD	244	0.546	<.001

*McNemar χ^2.

ROC Analysis

SLUMS-T with a cut-off point of 23 had a sensitivity of 66.6% and a specificity of 72.3% for the diagnosis of MCI, and with a cut-off point of 20 had a sensitivity of 83.8% and a specificity of 87.3% for the diagnosis of AD (Figure 1). Cut-off points according to education level are presented in Table 3.

Reliability Analysis

Interclass correlation coefficient for the test-retest reliability was found as 0.68. Internal consistency of the SLUMS-T was Cronbach $\alpha = 0.85$.

Correlations of subitems of the SLUMS-T in participants with MCI and AD were shown in Table 4. When the correlations of the SLUMS-T and basic activities of daily living (BADL)[18] index and the instrumental activities of daily living (IADL) scale[19] were analyzed in each group; we observed that the SLUMS-T of the patients with AD was weakly correlated with both BADL and IADL (r = 0.373, $P = .039$; r = 0.371, $P = .04$; respectively), was also weakly correlated in controls (r = 0.197, $P = .004$; r = 0.390, $P < .001$; respectively) and was not correlated in the patients with MCI ($P = .169$, $P = .137$; respectively).

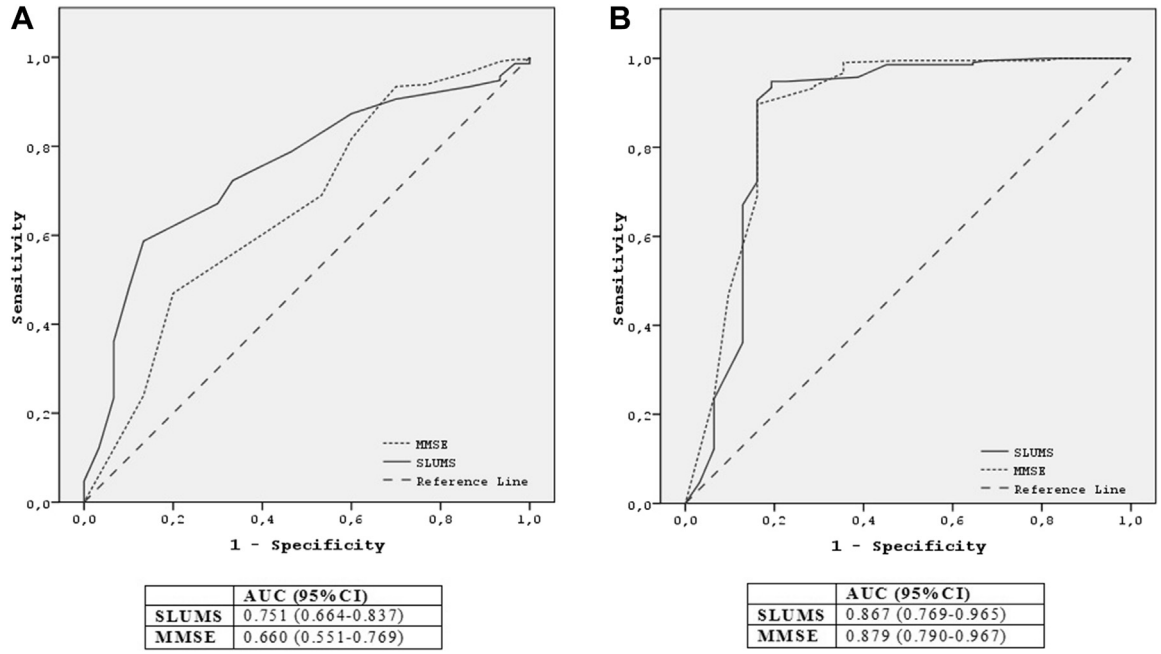
Discussion

The present study showed that the SLUMS-T is a reliable and valid instrument for evaluating cognitive impairment among Turkish geriatric population. This study also presents psychometric characteristics of the SLUMS-T, also the discriminative power of the test in the differentiation of AD from controls and in the differentiation of participants with MCI from controls.

It is quite important to find out those with MCI because early recognition of cognitive impairment could allow patients to make decisions regarding financial and long-term care issues at a time when they are capable of doing so. This is especially important when considering possible new medical interventions, especially biomarkers for MCI and AD, which is now the target of the active research. This increases the need and the importance of having effective screening measures for early identification of cognitive impairment which becomes crucial for clinical practice.

Clinical evaluation, including cognitive screening scales, even though unable to make definitive diagnosis, is still important. For this purpose, the SLUMS was developed because of the limitations of MMSE, which is commonly used for cognitive screening worldwide. In the present study, the SLUMS-T and MMSE were found to be strongly correlated with each other in patients with dementia and moderately correlated in patients with MCI. Different from previous studies, the agreement of these 2 measures for MCI was, however, mild. One of the reasons for the poor agreement might be due to the failure of the MMSE to recognize MCI which is a very-well known feature of the test.[3–5] In addition to the former limitation of the MMSE,[20–22] it was demonstrated that the SLUMS-T was not affected neither by the age nor the education of the patients.

Tariq et al[4] reported that the scores for mild neurocognitive disorder and dementia for patients with less than a high school education were 23.5 and 19.5, respectively. The cut-off scores for the 2 conditions for patients with a high school education and higher were 25.5 and



	AUC (95% CI)
SLUMS	0.751 (0.664-0.837)
MMSE	0.660 (0.551-0.769)

	AUC (95% CI)
SLUMS	0.867 (0.769-0.965)
MMSE	0.879 (0.790-0.967)

Fig. 1. ROC test AUC: (A) for MCI and (B) for AD. AUC, area under the curve; CI, confidence interval.

21.5, respectively. For patients with ≤8 years of education, the cut-off scores of SLUMS-T were 20 and 17 for MCI and AD, respectively. For patients with ≥9 years of education, the cut-off scores of SLUMS-T were 24 and 21 for MCI and AD, respectively. In addition, SLUMS-T could also be used as a screening tool to detect dementia because ROC analysis revealed a good predictive accuracy for the diagnosis of dementia.

SLUMS-T was grouped into 6 subitems including orientation, memory, executive functions, attention, visuospatial skill and clock drawing. When evaluating subitems scores of the patients, the best correlations were found with orientation, memory, and executive functions subscores, and moderate correlations were found with clock drawing and attention subscores in elderly patients with AD, whereas in elderly patients with MCI, the best correlation was found with only memory subitem score, and executive function was found to be moderately correlated. Because all MCI patients were amnestic subtype, this result was not unexpected but shows the importance of SLUMS-T in determining aMCI. All these findings also support that SLUMS-T is effective in differentiation of cognitive impairment in elderly patients.

Cruz-Oliver et al[8] reported the SLUMS had had predictive validity for mortality in only male patients with dementia. Current literature shows that ADL and IADL are highly associated with mortality in elderly patients.[23] In addition, cognitive and functional performances are predictors of survival especially in the oldest old.[24] In the present study, it was demonstrated that SLUMS-T was weakly correlated with both BADL and IADL in the elderly patients with AD and controls and was not correlated in the elderly patients with MCI. Therefore, it seems that SLUMS-T may be strong enough to predict mortality in elderly patients.

The duration of the SLUMS-T takes 12.3 ± 3.4 minutes; it was longer than Tariq et al.[4] This difference may explain why the number of participants with lower education was more than in that study.

One of the limitations of the present study was that our results were obtained from patients who were admitted to a tertiary center, so may not represent the entire community. Another limitation was illiterate participants were not included in the study, but in our clinical practice, Cognitive State Test [25] is preferable for illiterate Turkish elderly people. However, further studies related to SLUMS-T could be performed for illiterate elderly Turkish people.

Table 3
Sensitivity and Specificity of SLUMS-T for MCI and AD According to Education Level

	Education Level	Cut-off for SLUMS-T	Sensitivity	Specificity	PPV	NPV
MCI	General*	<23	66.6	72.3	25.3	93.9
	General*	<22	53.3	78.9	26.2	92.3
	General*	<21	83.1	46.7	28.0	91.7
	≤8 years	<20	55.6	71.4	21.2	92.1
	≥9 years	<24	50.0	82.6	26.1	93.1
AD	General*	<20	83.8	87.3	49.0	97.3
	≤8 years	<17	93.3	91.7	56.0	99.1
	≥9 years	<21	75.0	93.6	63.1	96.2

NPV, negative predictive value; PPV, positive predictive value.
*All of the patients.

Conclusions

It is important to have a simple, efficient, and sensitive/specific screening tool for detecting cognitive disorders, particularly mild ones, in the older adults' culture and language. The present study suggests that the SLUMS-T has sufficient validity and reliability that provides quantitative data about cognitive impairment in elderly as in the MMSE, but SLUMS-T has more advantages. It offers detailed

Table 4
Correlations of Subitems of SLUMS-T in Participants With MCI and AD

		Orientaton	Memory	Executive Functions	Clock Drawing	Attention	Visuospatial Skills
MCI							
	r	0.441	0.762	0.592	0.099	0.64	0.184
	P	<.02	<.001	<.001	.602	<.001	.332
AD							
	r	0.737	0.767	0.850	0.597	0.674	0.029
	P	<.001	<.001	<.001	<.001	<.001	.879

cognitive evaluation different from MMSE, such as clock drawing, animal naming, and immediate recall of facts from a paragraph, not confounded by the age and the education of the patient, and does not require collateral informants. Therefore, the SLUMS-T can be used to evaluate cognitive function in elderly patients. Moreover, it has discriminative power to differentiate AD or MCI from controls.

References

1. Hilsabeck RC, Holdnack JA, Cullum CM, et al. The Brief Cognitive Status Examination (BCSE): Comparing diagnostic utility and equating scores to the Mini-Mental State Examination (MMSE). Arch Clin Neuropsychol 2015;30:458–467.
2. Isik AT. Late onset Alzheimer's disease in older people. Clin Interv Aging 2010;5:307–311.
3. Folstein MF, Folstein SE, McHugh PR. "Mini-Mental State." A practical method for grading the cognitive state of patients for the clinician. J Psychiatr Res 1975;12:189–198.
4. Tariq SH, Tumosa N, Chibnall JT, et al. Comparison of the Saint Louis University Mental Status Examination and the Mini-Mental State Examination for detecting dementia and mild neurocognitive disorder: A pilot study. Am J Geriatr Psychiatry 2006;14:900–910.
5. Feliciano L, Horning SM, Klebe KJ, et al. Utility of the SLUMS as a cognitive screening tool among a nonveteran sample of older adults. Am J Geriatr Psychiatry 2013;21:623–630.
6. Wildman RW, McDaniel WF. Investigations into the construct validity of the Saint Louis University Mental Status Examination: Crystalized versus fluid intelligence. J Psychol Behav Sci 2014;2:187–196.
7. Morley J, Tumosa N. Saint Louis University Mental Status Examination (SLUMS). Aging Success 2002;12:4.
8. Cruz-Oliver DM, Malmstrom TK, Allen CM, et al. The Veterans Affairs Saint Louis University Mental Status Exam (SLUMS Exam) and the Mini-Mental Status Exam as predictors of mortality and institutionalization. J Nutr Health Aging 2012;16:636–641.
9. Cruz-Oliver DM, Malmstrom TK, Roegner M, et al. Cognitive deficit reversal as shown by changes in the Veterans Affairs Saint Louis University Mental Status (SLUMS) examination scores 7.5 years later. J Am Med Dir Assoc 2014;15:687.e5–687.e10.
10. Cao L, Hai S, Lin X, et al. Comparison of the Saint Louis University Mental Status Examination, the Mini-Mental State Examination, and the Montreal Cognitive Assessment in detection of cognitive impairment in Chinese elderly from the geriatric department. J Am Med Dir Assoc 2012;13:626–629.
11. Abdelrahman HMM, El Gaafary MM. Validation of Arabic Version of Saint-Louis-University-Mental-Status (SLUMS)—Examination and prevalence of cognitive impairment in community dwelling Egyptian older adults. Middle East J Age Ageing 2014;7:11–19.
12. Isik AT, Bozoglu E, Yay A, et al. Which cholinesterase inhibitor is the safest for heart in elderly patients with Alzheimer disease? Am J Alzheimers Dis Other Demen 2012;27:171–174.
13. Petersen R, Doody R, Kurz A, et al. Current concepts in mild cognitive impairment. Arch Neurol 2001;58:1985–1992.
14. McKhann G, Drachman D, Folstein M, et al. "Clinical diagnosis of Alzheimer's disease: Report of the NINCDS-ADRDA Work Group under the auspices of Department of Health and Human Services Task Force on Alzheimer's Disease". Neurology 1984;34:939–944.
15. Gungen C, Ertan T, Eker E, et al. Reliability and validity of the standardized Mini Mental State Examination in the diagnosis of mild dementia in Turkish population. Turk Psikiyatri Derg 2002;13:273–281.
16. Sheikh JI, Yesavage JA. Geriatric Depression Scale (GDS): Recent evidence and development of a shorter version. Clin Gerontol 1986;5:165–173.
17. Ertan T, Eker E. Reliability, validity, and factor structure of the Geriatric Depression Scale in Turkish Elderly: Are there different factor structures for different cultures? Int Psychogeriatr 2000;12:163–172.
18. Mahoney FI, Barthel D. Functional evaluation: The Barthel Index. Md State Med J 1965;14:56–61.
19. Lawton MP, Brody EM. Assessment of older people: Self-maintaining and instrumental activities of daily living. Gerontologist 1969;9:179–186.
20. Ismail Z, Rajji TK, Shulman KI. Brief cognitive screening instruments: An update. Int J Geriatr Psychiatry 2010;25:111–120.
21. Lonie JA, Tierney KM, Ebmeier KP. Screening for mild cognitive impairment: A systematic review. Int J Geriatr Psychiatry 2009;24:902–915.
22. Mitchell AJ. A meta-analysis of the accuracy of the Mini-Mental State Examination in the detection of dementia and mild cognitive impairment. J Psychiatr Res 2009;43:411–431.
23. Hennessy S, Kurichi JE, Pan Q, et al. Disability stage is an independent risk factor for mortality in Medicare beneficiaries aged 65 years and older. PM R 2015;7:1215–1225.
24. Mossakowska M, Broczek K, Wieczorowska-Tobis K, et al. Cognitive performance and functional status are the major factors predicting survival of centenarians in Poland. J Gerontol A Biol Sci Med Sci 2014;69:1269–1275.
25. Babacan-Yildiz G, Isik AT, Ur E, et al. COST: Cognitive State Test, a brief screening battery for Alzheimer disease in illiterate and literate patients. Int Psychogeriatr 2013;25:403–412.