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Original Article

Comparison of the Taiwanese Versions of the Addenbrooke's Cognitive Examination-III (ACE-III), Mini-Mental State Examination (MMSE), and Montreal Cognitive Assessment (MoCA) for Screening Mild Cognitive Impairment Among Older Taiwanese People

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SUMMARY

Background: The purpose of this study was to screen for mild cognitive impairment among a sample of older Taiwanese adults with the Addenbrooke's Cognitive Examination-III (ACE-III) Taiwanese version (TACE-III) based on a comparison with Mini-Mental State Examination (MMSE) and Montreal Cognitive Assessment (MoCA).
Methods: A total of 145 participants aged 65 or above were enrolled by convenient sampling in the communities. The ACE-III was translated into a Taiwanese version (TACE-III) and modified. The TACE-III, MMSE, and MoCA were compared, and the ROC curve was applied to the suggested cutoff points.
Results: When using MMSE and MoCA to validate the ROC curve, the closest cut-off point for TACE-III between the two validations was suggested to be a score of 76.5 to screen for mild cognitive impairment with a sensitivity = 84% and a specificity = 85%. The consistency levels among the cognitive function domains across the 3 scales were also compared.
Conclusion: TACE-III is a potentially more useful tool for screening MCI.

1. Introduction

Dementia has been identified as a major health issue around the world.[1] In Taiwan, the prevalence of dementia among older adults is approximately 4.97%.[2] In addition, mild cognitive impairment (MCI) is also known to be a very serious issue. In Europe and the United States, the prevalence of MCI among older adults aged 65 or older is between 3% and 20%.[3–7] In Taiwan, the prevalence of MCI among people aged 65 or over is approximately 18.76%.[8]

Early detection of mild cognitive impairment may help patients obtain better care and may allow for improved medical treatment approaches. However, mild cognitive impairment is not easy to identify. The early symptoms of Alzheimer's disease (AD) include episodic memory impairment and problems in visuospatial perception, recognition, verbal fluency, and naming,[9] particularly in the areas of attention and memory.[10,11] AD cases had more cognitive impairments than those of the MCI cases in delaying recall memory, executive function, language, and visuospatial function.[9]

Some cognitive function screening scales have been widely applied, such as the Short Portable Mental State Questionnaire (SPMSQ)[12] or the Mini-Mental State Examination (MMSE).[13] Although these scales are easy to implement, some limitations have been identified, including the ceiling effect and weak identification in executive, visuospatial, or language items; less sensitivity in detecting MCI; and the inability to capture important cognitive domain measures.[14–17]

New cognitive assessment scales have been developed to identify mild cognitive impairment. These tools include Addenbrooke's Cognitive Examination (ACE, ACE-R, and ACE-III)[18–20] and the Montreal Cognitive Assessment (MoCA).[17] Different language versions of these scales have been translated and validated for ACE-III.[18–20] The MoCA has multi-language versions.[21–24] However, the Taiwanese version of ACE-III has not yet been validated. The purpose of this study was to define the mild cognitive impairment score by comparing the Taiwanese versions in ACE-III, MoCA, and MMSE among the community-based sample of older adults in Taiwan.

2. Materials and methods

2.1. Scale development

There were three main cognitive assessment scales used in this study: the MMSE, MoCA, and ACE-III. The Chinese version of MMSE was administered and authorized by the Psychological Assessment Resources (PAR), Inc. The Chinese version (Taiwan) of MoCA was obtained from the MoCA Montreal Cognitive Assessment website. Regarding the ACE-III, there was no official traditional Chinese version at the time of the study. First, we referred to the four existing versions of ACE-III (simplified Chinese, Japanese, Indian, and Eng-

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lish). Using these versions, we generated the new Taiwanese version of the ACE-III using traditional Chinese characters. Next, the Taiwan translation of the scale was validated by one psychiatric physician and one geriatric physician. The modified traditional Chinese version of ACE-III was then pre-tested ona community-based sample of 12 older adults of various education levels, genders, and age groups to ensure that the translated ACE-III scale was appropriate. The final Taiwanese version of ACE-III (TACE-III) was then used in the current study.

2.2. Data and samples

The participants recruited from community care centers were older adults who lived nearby. The health status among the community-based sample varied from healthy to moderate disability, and cognitive function also ranged from intact to mild or moderate cognitive impairment. A community-based sample was selected as it was more suitable than a clinical sample of patients who are typically more impaired than community-based older adults.

Individuals who lived in the 4 participating community care centers and who were 65 years of age or older were invited to participate in the study using a convenient sampling scheme. Those who were not fully conscious, who had serious vision or hearing problems, or who were unable to communicate in either Mandarin or Taiwanese were excluded. The survey was conducted by face-to-face interviews with the researchers. Study approval was obtained by the Medical Research Ethics Committee of Asia University (No. 10404003) before data collection began. After receiving informed consent, 145 participants were briefed before the survey on the research purpose and survey contents, and then they completed the interviews.

2.3. Measures

1. Mini-Mental State Examination (MMSE)[13] – Chinese version: The domains covered time orientation, location orientation, repetition and immediate memory, attention/calculation, delayed recall, naming, and executive function. The score on the MMSE ranged from 0–30. A score of 27 or less was defined as MCI or more severe cognitive impairment.[23] The traditional Chinese version of MMSE was authorized by the original author.
2. Montreal Cognitive Assessment (MoCA):[17] The domains included visual/spatial and executive function (i.e., recognizing, clock drawing), naming, immediate memory, attention, language, abstraction, delayed recall, and orientation. The score ranged from 0 to 30. A score of 23 or less was defined as MCI or as more severe cognitive impairment.[23]
3. Addenbrooke's Cognitive Examination-III version (ACE-III): The domains included time orientation, location orientation, repetition, calculation/attention, delayed recall, vocabulary fluency, immediate memory, language, visual/spatial execution, and episodic memory.

We translated the official ACE-III scale into traditional Chinese to develop the Taiwanese version (TACE-III). Some alterations to the contents of the scale were made due to differences in culture and customs such as"verbal fluency". For example, the participants were required to come up with as many idioms or vocabulary words as possible in one minute, with only one (given) Chinese character, "sky" (天). The original ACE-III US version had instead asked them to come up with words starting with the English letter "P". To assess "Anterograde Memory," participants were asked to memorize Taiwanese names and addresses. In the "Memory - Retrograde Memory - Famous People", the last question was altered to ask about "the name of the president in the 1960s". In the "Language-Single Word Repetition" and "Language-Proverb Repetition", all questions on vocabulary and sentences were altered to contain Chinese vocabulary and proverbs.

Second, in the "Language-Object Naming" item section, due to cultural differences, some pictures were less suitable for Taiwanese participants, and thus, the original questions (i.e., pictures) were replaced with the terms anchor, camel, harp, cask, crown, and accordion. After referencing the Japanese version and Indian version, the pictures mentioned above were changed to flag, giraffe, sickle, light bulb, umbrella, and trumpet.

Third, because some pictures were altered in the former questionnaire in the "Language - Comprehension" section, questions in this section were changed, and their content was altered accordingly. The original questions included the phrases "which is associated with the monarchy", "which is a marsupial", "which is found in the Antarctic", and "which has a nautical connection". After making the above amendments based on the Indian and Japanese versions, these descriptions were changed to "which is needed on rainy days", "which radiates and shines", "which farmers use", and "which is a mammal with a pocket".

Fourth, in the "Language-Reading" items, the original Engli大 questionnaire had five English words. After the Chinese translation, the words were changed into Fat (胖), Slim (瘦), Short (矮), Soup (湯), and Beauty (美), which were suitable and universal in both Mandarin and Taiwanese. For the visuospatial domain, in consideration of the linguistic differences, the original four letters were changed into four single-syllabled and fundamental Chinese characters. These were (big), 山 (mountain), 小 (small), and 中 (middle). Despite altering the questionnaires mentioned above, the grading standard remained the same.

The total scores of the three assessment scales and the proportions of the MCI cut-off points were calculated. Regarding the different cognitive domains across three scales, the items were grouped into the following domains: visual memory and executive function; naming, immediate memory, executive function and understanding; and calculating ability, verbal fluency, delayed memory, orientation, and episodic memory. Those individuals who participated in this study did not receive any evaluation from a psychiatrist such that the study focused on employing MMSE and MoCA as validation criteria to set the cut-off points.

Relevant demographic covariates were also examined, including age, sex, education level, marital status, and ethnic groups.

2.4. Analysis

Descriptive analysis and receiver operating characteristic curve (ROC) analysis were conducted. ROC analysis was used to suggest the proper cut-off points. Sensitivity and specificity analyses were also calculated using MMSE and MoCA as the standard criteria. Chi-square test was used for examining the relationship between cognitive function and demographics.

3. Results

The characteristics of the sample are shown in Table 1. Next, the ROC curve was used to confirm the sensitivity and specificity of the detection ability between the different assessment scales by adopting MMSE and MoCA as the validation criteria (Table 2 and Fig. 1). When using MoCA as the validation criteria, the possible cut-off points to detect MCI were 74.5 (sensitivity 89.5%, specificity 78.5%),

Table 1
Characteristics of the samples.

Variables	Persons (N = 145)	Mean (SD) or %
Age		
Age 65–74	76	52.4%
Age 75+	69	47.6%
Sex		
Males	41	28.3%
Females	104	71.7%
Education		
Elementary school or below	114	78.6%
Primary high school or above	31	21.4%
Marital status		
Having a spouse	75	51.7%
No spouse	70	48.3%
Ethnic groups		
Mingnan	135	93.1%
Hakka and mainland provicnes	10	6.9%
Chronic disease numbers	145	2.01 (1.25)

Table 2
Cut-off points of detection of mild cognitive impairment in ACE-III Taiwan version, by using MoCA and MMSE as validation.

Cutoff points	MoCA as validation		MMSE as validation	
	Sensitivity	Specificity	Sensitivity	Specificity
67.50	0.974	0.570	0.952	0.492
68.50	0.974	0.607	0.952	0.524
69.50	0.947	0.645	0.952	0.565
70.50	0.947	0.682	0.952	0.597
71.50	0.947	0.729	0.952	0.637
72.50	0.921	0.729	0.952	0.645
73.50	0.895	0.748	0.905	0.661
74.50	**0.895**	**0.785**	0.905	0.694
75.50	**0.868**	**0.804**	0.857	0.710
76.50	**0.842**	**0.850**	**0.857**	**0.758**
77.50	0.789	0.888	**0.810**	**0.798**
78.50	0.737	0.916	0.762	0.831
79.50	0.632	0.925	0.667	0.855
80.50	0.579	0.925	0.667	0.871
81.50	0.500	0.953	0.619	0.911
82.50	0.421	0.963	0.524	0.927
83.50	0.342	0.972	0.476	0.952
84.50	0.237	0.981	0.333	0.968
85.50	0.237	0.991	0.286	0.968
86.50	0.211	0.991	0.238	0.968
87.50	0.132	0.991	0.190	0.984
89.00	0.079	1.000	0.095	0.992
91.50	0.053	0.000	0.095	1.000
94.00	0.026	0.000	0.048	1.000
96.00	0.000	0.000	0.000	1.000

Note: N = 145. MCI refers to mild cognitive impairment. The bold numbers indicate the better cut-off points.

75.5 (sensitivity 86.8%, specificity 80.4%), and 76.5 (sensitivity 84.2%, specificity 85.0%). The AUC value for defining MCI was 0.916. When using MMSE as the validation criteria, the AUC value for defining MCI was 0.876. When using MMSE as the validation criteria, the possible cut-off points of Taiwanese ACE-III score to detect MCI were 76.5 (sensitivity 85.7%, specificity 75.8%) and 77.5 (sensitivity 81.0%, specificity 79.8%). The AUC value for defining MCI was 0.876. Considering the tradeoffs of sensitivity and specificity, the best cut-off points were determined when both sensitivity and specificity were maximized. Thus, the best cut-off point for the Taiwanese ACE-III score was 76.5 for defining MCI or more severe cognitive impairment.

Table 3 shows the comparison between every two cognitive

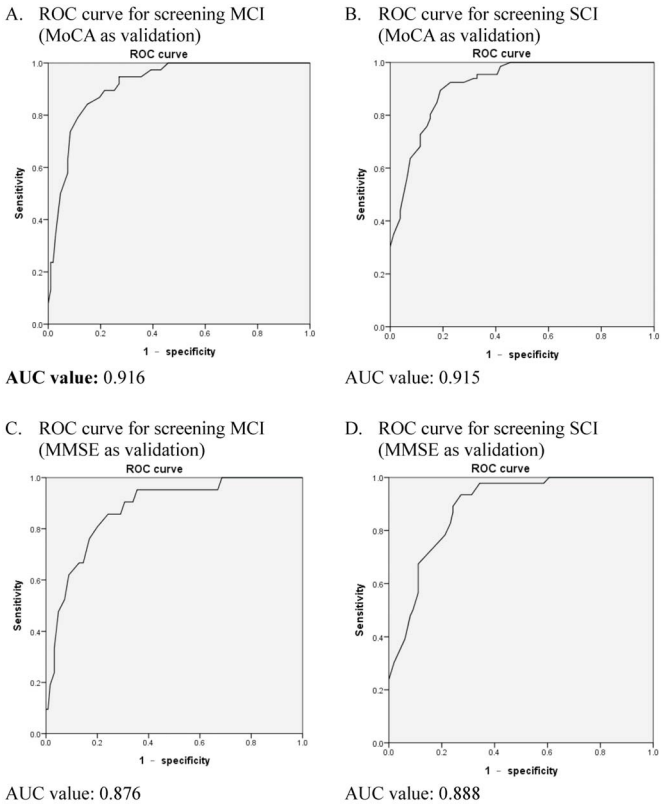

Fig. 1. Comparison of ROC curve of detection of MCI and SCI in ACE-III Taiwan version – with MoCA and MMSE as validation. Note: N = 145. MCI refers to mild cognitive impairment; SCI refers to severe cognitive impairment. The bold numbers indicate the better cut-off points.

assessment scales and percentage of agreement among the cognitive domains. In the nine domains of the scales, only eight domains could be compared due to the episodic memory items that were only available in ACE-III. Since the questionnaire in the domain of calculation ability was identical among the three scales, this domain was not able to be compared to the other domains. The TACE-III was consistent with MoCA in most domains, although the executive function and comprehension domains were similar to the results of MMSE. In addition, the "Naming" domain and the "Orientation" domain in ACE-III and MoCA showed only moderate consistency. The kappa value was 0.504 for naming and 0.549 for orientation.

The relationship of demographic variables with the cut-off points of the three scales were examined. Being older and less educated was related to mild cognitive impairment across 3 scales; sex and marital status were non-significant.

4. Discussion

This study used MMSE, MoCA, and TACE-III to compare the scores of a community-based sample of older adults in Taiwan. By using MMSE and MoCA as the validation criteria, the suggested cut-off point for TACE-III was 76.5 for screening MCI.

The consistency between TACE-III and MoCA was higher than that compared with MMSE,[18] as well as MoCA and ACE-III, which are more sensitive in detecting mild cognitive dysfunction as discussed in previous findings.[15] Calculation, verbal fluency, delayed recall memory, and orientation were all significantly different across the scales. In addition, TACE-III also included the episodic memory domain, which increases the probability of detecting MCI and early dementia. It was also found that TACE-III detected MCI more than

Table 3
The impaired rate and consistency among the MMSE, TACE-III, and MoCA scales in each cognitive domains.

Domains	MMSE	TACE-III	MoCA	TACE-III vs. MMSE	MoCA vs. MMSE	TACE-III vs. MoCA
	Impaired %	Impaired %	Impaired %	Kappa (S.E.)	Kappa (S.E.)	Kappa (S.E.)
Visual memory and executive function	33.1	77.2	77.9	0.091 (0.052)	0.153 (0.049)	0.385 (0.090)
Naming	11.7	49.7	55.2	0.099 (0.054)	0.016 (0.049)	0.504 (0.071)
Immediate memory	9.7	30.3	24.1	0.152 (0.076)	0.124 (0.084)	0.359 (0.085)
Executive functions and comprehension	33.8	37.9	81.4	0.162 (0.083)	0.072 (0.048)	0.078 (0.052)
Calculation	66.9	45.5	44.8	---	---	---
Verbal fluency	69.7	91.7	88.3	0.061 (0.020)	0.006 (0.070)	0.005 (0.010)
Delayed memory	86.9	65.5	58.6	0.159 (0.065)	0.099 (0.066)	0.301 (0.080)
Orientation	52.4	15.9	19.3	0.292 (0.055)	0.330 (0.059)	0.549 (0.091)
Episodic memory	---	89.0	---	---	---	---

Note 1: N = 145. Kappa was used for the comparison of consistency.
Note 2: Calculation items were the same in the three scales. The participants were asked only once, and thus the consistency between scales could not be compared.
Note 3: Episodic memory was only measured in TACE-III, and thus the consistency between scales could not be compared.

MoCA in calculation and verbal fluency, while MoCA detected MCI more than ACE-III in naming, immediate memory, delayed memory, and orientation. Both MoCA and ACE-R contain similar visual-executive tasks. However, MoCA includes abstractions and more attentional tests. For ACE-R, there are more language and memory items.[16] Another study yielded different results that MCI patients were impaired on the visuospatial task on the ACE-R, yet not on the MoCA.[25] Whether MoCA or TACE-III is the more appropriate tool to screen for MCI was not confirmed in this study.

The language domain in the cognitive function may have possibly been affected during the translation process. For example, the verbal fluency by asking the respondents to give words starting with "C" was replaced with the instruction to give a word, starting with the Chinese character "sky". Additionally, there were no consistent cut-off points for each domain across the scales for Taiwanese adults. Further validation studies are needed to determine if these items were too difficult for some older adults and if the cut-off points in each domain were appropriate.

Because the participants in this study were not evaluated by psychiatrists or neurological physicians, their cognitive status could not be classified in detail. Therefore, the cut-off point of TACE-III in this study used the MMSE and MoCA cut-off points, respectively, as the standards. The closest cut-off point for screening MCI between the two scales was 76.5 (sensitivity 84.2%, specificity 85%). The cut-off point for TACE-III in this study was similar to that of the Thailand version. The cut-off point for screening MCI in ACE-III was 75/76 (sensitivity 90%, specificity 96%).[21] However, in the MMSE and MoCA scales, the cut-off points are divided into to two points for educational years. The use of a single cut-off point in this study may have introduced biased results. Future studies should include a more diverse sample in terms of education, and the scale can be widely used in cases with different educational years.

Age and education were significantly different across the three scales. Older age is related to cognitive impairment as indicated by previous research on the incidence of higher of cognitive impairment.[6,25] The current older cohorts in Taiwan also had lower education. People with higher education levels were at a lower risk of cognitive impairment. This finding mirrors previous research,[26] suggesting that education is a potential protective factor. It is challenging to eliminate the influence of education when evaluating cognitive function, since language is a primary element of the cognitive function assessment, particularly in the TACE-III in which domains related to language emphasized. Future research should determine the distribution of cognitive function by education so that appropriate cut-off points can be identified for the target population.

This study has several limitations. First, diagnosis by a psychiatric physician, which is the gold standard for the confirmation of dementia, was not included as part of the study. As a result, we could only screen for possible cognitive impairment cases, and we could not diagnose dementia based on the screening. Future research should include diagnosis from neurological or psychiatric doctors and utilize the same scales on the diagnosed MCI patients for comparison. Second, answering any questionnaire on the three cognitive assessment scales for older adults could be exhausting and time-consuming. If the questions across the scales were identical, the items were only asked once, and the scores were recorded in their appropriate form according to the respective scales. Third, this study utilized convenience sampling; thus, the study results may not be generalized to the larger population in Taiwan.

Detecting MCI is necessary in geriatric care and health promotion/management for older adults. By examining and comparing three cognitive assessment scales, TACE-III was found to detect more domains in cognitive impairment. These results are important because mild changes could be monitored in the early stages. Further, this valid tool could be utilized in population-based screening. Future validation studies on TACE-III and the identification of the distribution of cognitive functioning among healthy older Taiwanese adults are warranted. We also suggest that these scales with higher sensitivity be utilized by geriatric physicians as screening tools in the primary care and in long-term care settings.

Conflict of interest

The authors declare that there is no conflict of interest in this study.

References

1. World Health Organization. *Dementia: A public health priority*. Geneva, Switzerland: World Health Organization, 2012. Available at http://apps.who.int/iris/bitstream/10665/75263/1/9789241564458_eng.pdf?ua=1English.pdf. Accessed December 17, 2017.
2. Ministry of Health and Welfare, Taiwan, R.O.C. *Report of the national dementia prevalence in 2011–2012*.
3. Busse A, Hensel A, Guhne U, et al. Mild cognitive impairment: Long-term course of four clinical subtypes. *Neurology.* 2006;67:2176–2185.
4. Palmer K, Bäckman L, Winblad B, et al. Mild cognitive impairment in the general population: Occurrence and progression to Alzheimer disease. *Am J Geriatr Psychiatry.* 2008;16:603–611.
5. Perquin M, Schuller AM, Vaillant M, et al. The epidemiology of mild cognitive impairment (MCI) and Alzheimer's disease (AD) in community-living seniors: Protocol of the MemoVie cohort study, Luxembourg.

BMC Public Health. 2012;12:519.
6. Petersen RC, Roberts RO, Knopman DS, et al. Prevalence of mild cognitive impairment is higher in men. The Mayo Clinic Study of Aging. *Neurology.* 2010;75:889–897.
7. Ravaglia G, Forti P, Montesi F, et al. Mild cognitive impairment: Epidemiology and dementia risk in an elderly Italian population. *J Am Geriatr Soc.* 2008;56:51–58.
8. Sun Y, Lee HJ, Yang SC, et al. A nationwide survey of mild cognitive impairment and dementia, including very mild dementia, in Taiwan. *PLoS One.* 2014;9(6):e100303.
9. Batum K, Cinar N, Sahin S, et al. The connection between MCI and Alzheimer disease: Neurocognitive clues. *Turk J Med Sci.* 2015;45:1137–1140.
10. Perry RJ, Hodges JR. Attention and executive deficits in Alzheimer's disease. A critical review. *Brain.* 1999;122:383–404.
11. Lines CR, Dawson C, Preston GC, et al. Memory and attention in patients with senile dementia of the Alzheimer type and in normal elderly subjects. *J Clin Exp Neuropsycol.* 1991;13:691–702.
12. Pfeiffer E. A short portable mental status questionnaire for the assessment of organic brain deficit in elderly patients. *J Am Geriatr Soc.* 1975;23:433–441.
13. 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.
14. Dag E, Ornek N, Ornek K, et al. Mini mental state exam versus montreal cognitive assessment in patients with age-related macular degeneration. *Eur Rev Med Pharmacol Sci.* 2014;18:3025–3028.
15. Fang R, Wang G, Huang Y, et al. Validation of the Chinese version of Addenbrooke's cognitive examination-Revised for screening mild Alzheimer's disease and mild cognitive impairment. *Dement Geriatr Cogn Disord.* 2014;37:223–231.
16. Pendlebury ST, Cuthbertson FC, Welch SJ, et al. Underestimation of cognitive impairment by Mini-Mental State Examination versus the Montreal Cognitive Assessment in patients with transient ischemic attack and stroke: A population-based study. *Stroke*. 2010;41:1290–1293.
17. Nasreddine ZS, Phillips NA, Bedirian V, et al. The Montreal Cognitive Assessment, MoCA: A brief screening tool for mild cognitive impairment. *J Am Geriatr Soc.* 2005;53:695–699.
18. Matias-Guiu JA, Fernandez-Bobadilla R, Fernandez-Oliveira A, et al. Normative data for the Spanish version of the Addenbrooke's Cognitive Examination III. *Dement Geriatr Cogn Disord.* 2016;41:243–250.
19. Mioshi E, Dawson K, Mitchell J, et al. The Addenbrooke's Cognitive Examination Revised (ACE-R): A brief cognitive test battery for dementia screening. *Int J Geriatr Psychiatry.* 2006;21:1078–1085.
20. Hsieh S, Schubert S, Hoon C, et al. Validation of the Addenbrooke's Cognitive Examination III in frontotemporal dementia and Alzheimer's disease. *Dement Geriatr Cogn Disord.* 2013;36:242–250.
21. Charernboon T, Jaisin K, Lerthattasilp T. The Thai version of the Addenbrooke's Cognitive Examination III. *Psychiatry Investig.* 2016;13:571–573.
22. Tsai CF, Lee WJ, Wang SJ, et al. Psychometrics of the Montreal Cognitive Assessment (MoCA) and its subscales: Validation of the Taiwanese version of the MoCA and an item response theory analysis. *Int Psychogeriatr.* 2012;24:651–658.
23. Fujiwara Y, Suzuki H, Yasunaga M, et al. Brief screening tool for mild cognitive impairment in older Japanese: Validation of the Japanese version of the Montreal Cognitive Assessment. *Geriatr Gerontol Int.* 2010;10:225–232.
24. Hu JB, Zhou WH, Hu SH, et al. Cross-cultural difference and validation of the Chinese version of Montreal Cognitive Assessment in older adults residing in Eastern China: Preliminary findings. *Arch Gerontol Geriatr.* 2013;56:38–43.
25. Ahmed S, de Jager C, Wilcock G. A comparison of screening tools for the assessment of mild cognitive impairment: Preliminary findings. *Neurocase.* 2012;18:336–351.
26. Reuser M, Willekens FJ, Bonneux L. Higher education delays and shortens cognitive impairment: A multistate life table analysis of the US Health and Retirement Study. *EurJ Epidemiol.* 2011;26(5):395–403.