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Original Article

Factors Associated with Cognitive Impairment Among Indonesian Older Adults

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ABSTRACT

Background/Purpose: The rising number of older adults in Indonesia potentially caused a new challenge in the field of public health, including the prevalence of dementia, which mostly preceded by cognitive impairment. Given the irreversible nature of dementia and cognitive impairment, it is crucial to comprehend the associated factors, such as sociodemographic, lifestyle, psychosocial, and other health-related factors. By understanding these factors, proactive measures can be taken to prevent and address the future challenge in health and aging.

Methods: Data from individuals aged 55 years or over who fully participated in the cognitive measurement session of the fifth wave of Indonesia Family Life Survey (IFLS5) were analyzed cross-sectionally. The associations of cognitive impairment with each factor were analyzed using multiple logistic regression model.

Results: The final model indicated that cognitive impairment was more likely to occur in older adults with lower education level, less physical activity, less community participation, severe depressive symptoms, and lower body mass index as they are advancing in years.

Conclusion: As most factors associated are modifiable, it is expected that the results indicated can be reflected in the current health program so that the number of people with cognitive impairment will not drastically rise as the population continue to age in the future.

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1. INTRODUCTION

Aging of the populations starts when the proportion of older people in a society is increasing.[1] One of the most notable causes of population aging, fertility declines, firstly emerged in developed countries during the late nineteenth century and escalated around the world during the last quarter of the twentieth century.[2] Since the beginning of the twenty-first century, population aging has become a global phenomenon and continues to become one of the most unprecedented changes of the century.[3] Data from the United Nations Department of Economic and Social Affairs showed that there were more than 700 million older adults globally in 2019.[4] This number is predicted to double at almost 1.5 billion in 2050. In Indonesia, the number of older adults aged 60 or over projected to surpass 60 million individuals, or almost 20% of the total population, by 2045.[5]

The rising number of older adults potentially becomes a new challenge in the field of public health as it

is commonly followed by the increasement of life expectancy but not necessarily by the improvement of healthy life years.[6] Health and well-being of older adults tend to be associated with the structural and functional changes of their body, which further referred biological aging.[1] As the changes can occur in several domains of the body, including cognitive function, dementia is predicted to be one of the greatest public health challenges that will emerge with the phenomenon of population aging.[1,7]

The number of people living with dementia are predicted to reach over 115 million individuals by 2050, with a higher increase in low and middle income countries.[7] Cognitive impairment, which said to precede one-third of dementia cases, also predicted to increase globally and increase more proportionately in developing countries.[8,9] Previous studies in developing countries proven that the prevalence of cognitive impairment among older adults are ranging from 13.8–51.9%.[9–11] In Indonesia, there are only a limited number of studies on cognitive impairment conducted in the national level. However, one study in 2019 stated the prevalence of possible dementia among older adults aged 65 or over in Indonesia was at 6.8%.[12]

As dementia and cognitive impairment are irreversible, understanding the factors associated with them are urgently needed as a preventive action for any unpredictable situation as the population continue to ages. According to previous studies around the world, several factors that are possibly associated with cognitive impairment other than older age varies from low number of years education, vascular risk factors (diabetes, hypertension, and obesity), cardiovascular disease outcomes (coronary artery disease and congestive heart failure), physical inactivity, smoking habit, heavy consumption of alcohol, up to other psychosocial condition including low social support, depression and late-life anxiety.[13–15] However, no such study had been done in Indonesia before, except to identify factors associated with cognitive impairment in a small or specific community.

This study, thus, aimed to identify factors, including sociodemographic, psychosocial, lifestyle, and health-related conditions, that are possibly related to cognitive impairment in overall Indonesian older adults aged 55 or above. The study will use a nation-wide dataset from Indonesia Family Live Survey which said to represent 83% of Indonesia population in 2014.

2. METHODS

2.1. Design and Sample

Datasets that used for this study were obtained from the fifth wave of Indonesia Family Life Survey (IFLS5). Public use data of IFLS5 were collected collaboratively by RAND, the center for Population and Policy Studies (CPPS) of the University of Gadjah Mada, and Survey Meter.[16] It is stated that all Indonesia Family Life Survey (IFLS) waves have had their ethical procedures reviewed properly and approved by the Institutional Review Boards in the United States and Indonesia.[16]

The survey sample in IFLS5 was selected using a multistage stratified random sampling. In this study, data from 6755 individuals aged 55 years or over who fully participated in the cognitive measurement session of IFLS5 were analyzed cross-sectionally. The data were weighted using cross-sectional weight with attrition which was constructed by raking all individuals listed as being present in IFLS5.[17] The respondents have been stratified by province and urban-rural sector of residence, as well as by sex and age, so that they were able to represent Indonesian population in all IFLS provinces in 2014.[17]

Though all variables of IFLS5 were collected using the computer-assisted personal interview system by previously-trained interviewer, the following list were the measurement techniques of all variables used in this study.

2.2. Measures

2.2.1 Cognitive impairment

Cognitive impairment was measured with the modified version of Telephone Interview for Cognitive Status (TICS).[12,16,17] The cognitive domains that were measured with this modified instrument consist of attention (5 points), memory (20 points), intelligence (2 points). Using Langa and Weir approach, the total scores of this measurement were ranging from 0–27, with the higher scores representing better cognitive function.[18–21] The TICS score was categorized into three groups, with respondents who scored 0–6 classified as demented, 7–11 as cognitive impairment without dementia (CIND), and 12–27 as normal cognition. Thus, based on the cut-off point of previous studies[18,19], older adults in this study were considered having cognitive impairment if their total score was lower than 12.

2.2.2. Sociodemographic factors

Other than age, sociodemographic factors that were analyzed in this study include sex, level of education, living with partner, and retirement status. Age was categorized in three groups as "55–64 years", "65–74 years", and "≥75 years". In this study, individuals aged 55–59 years were considered as elderly or older adults as 55 was Indonesian normal retirement age in 2015.[22]

Based on the respondents answer on the survey, sex was categorized as "male" and "female", living with

spouse or partner was categorized as "yes" or "no", and retirement status was categorized as "working/not retired", "partially retired", and "retired". Meanwhile, education levels were categorized in three groups including "higher education", "high school", and "elementary/no formal education". Respondents were categorized of having higher education if they have ever attended university or equal and categorized in high school if they have ever attended junior or senior high school. Those with no history of attending school or no history of formal education were categorized in the same level as those who have ever attended elementary school in this study.

2.2.3. Psychosocial conditions

Psychosocial conditions that were analyzed in this study consisted of community participation and depressive symptom. Community participation was categorized in three groups as "actively participating", "somewhat participating", and "not participating". Older adults were categorized as actively participating if they participate in labor or time, money, goods, or others in more than two social activities, and somewhat participating if they participate in one or two.

In IFLS5, depressive symptoms were collected by the short Center of Epidemiologic Studies Depression Scale (CES-D) instrument, which consisted of a series of 10 questions. Referring to previous study[23], respondents was determined as having "mild or no depressive symptoms" if they scored 0–9, "moderate symptoms" if they scored 10–14, and "severe symptoms" if they scored 15 or more out of 30 maximum points.

2.2.4. Lifestyle

Lifestyle factors that were analyzed in this study include smoking status and physical activity. Older adults who have never smoked (i.e., smoking cigarettes or consumed tobacco) were categorized as "non-smoker". Meanwhile those who have ever smoked were categorized as "smoker" and "ex-smoker" if they have stopped smoking.

Older adults were categorized as physically "less active" if they answered no to all questions related to physical activity or answered yes to only "walking for at least 10 minutes continuously" question.

2.2.5. Health-related conditions

Health-related conditions in this study consisted of self-rated health, body mass index (BMI), and history of chronic diseases. Self-related health was categorized in three groups, including "excellent", "fair", and "poor". Respondents who answered "very healthy" to IFLS5 "generally how is your health" question were considered as excellent. Respondents who answered with "somewhat healthy" and "somewhat unhealthy" to the question were categorized "fair", while those who responded "very unhealth" were categorized "poor" self-rated health.

BMI was classified using World Health Organization International cut-off point of <18.5 kg/m^2 (underweight), 18.5–24.9 kg/m^2 (normal/ideal), 25–29.9 kg/m^2 (overweight), and ≥30 kg/m^2 (obese).[24]

This study also considered whether older adults were ever diagnosed with chronic diseases. Older adults who have never diagnosed with hypertension, diabetes, coronary heart disease, or stroke were categorized as "never diagnosed", while those who have ever diagnosed with one or more than one of them were categorized as "diagnosed with one disease" and "diagnosed with >1 disease" respectively.

2.3. Data Analysis

The measure of association which mainly used in this study was odds ratio, wherein both unadjusted and adjusted odds ratio were measured. The univariate analysis in this study was performed to describe the percentage of each group in all variables. Meanwhile, the bivariate analysis became the selection step of model candidate. Variables with *p*-value <0.25 were then analyzed using multiple logistic regression. The final model was obtained by excluding variables with *p*-value >0.05 one by one from the highest value. If any variable has ≥10% changes in its *OR* after the exclusion, the excluded variable will be returned to the model.

3. RESULTS

The mean score of cognitive measurement among Indonesian older adults in IFLS Provinces was 10.6±4.1 (mean±*SD*). With the mean score lower than the cut-off pint of cognitive impairment, the percentage of elderly with cognitive impairment was slightly higher at 56.9% than older adults with normal cognition.

Disaggregated by age, the mean score of cognitive measurement among older adults aged 75 or over was the lowest compared to the other two groups at 6.8±3.3. The mean scores of cognitive measurements among older adults aged 55–64 years and 65–74 years were 11.4±3.8 and 9.7±4.3, respectively. In this study, advancing age as a well-known factor of cognitive decline or cognitive impairment was proven to be true as the proportions of older adults with cognitive impairment within the oldest group were higher compared to the middle-old and younger-old with the percentage of cognitive impairment reaching slightly more than 90% for those aged 75 or older, and more than 50% and 60% for those aged 55–64 and 65–74 years, respectively.

Table 1 shows the proportions of cognitive impairment according to the other variables. It also shows the unadjusted associations of cognitive impairment with each variable, and the *p*-value to determine whether the variable is eligible for further analysis.

Other than age, significant relationships were found between cognitive impairment and the other sociodemographic factors, including sex, education, living with spouse or partner, as well as retirement status with p <0.001. In this study, the proportions of cognitive impairment among female older adults were found higher than in male. Those who have no history of formal education or have only attended elementary school had approximately two to three times higher percentages of cognitive impairment respectively compared to those who have ever attended high school and higher education. A rather unique finding was also found in this study whereas older adults who are not living with partners had a lower proportion of cognitive impairment. Based on the analysis, retirement status was not significantly associated with cognitive impairment.

The descriptive result also found that older adults who actively participate in the community in terms of labor, time, money, goods, or others have the lowest rate of cognitive impairment compared to those in the other groups. Regarding the depressive symptoms, there are slightly different percentages of cognitive impairment between those who have mild to no symptoms and those who have moderate depressive symptoms, with the following group was higher than the first one. The mean score of CES-D

Table 1. Descriptive analysis of cognitive impairment and other factors (data analyzed from IFLS5, 2014–2015).

	n (%)	Cognitive impairment (N)		Unadjusted *OR* (95% CI)	SE	*p*-value
		No (%)	Yes (%)			
Age (years)						
55–64 years	67.2	49.5	50.5	Reference		
65–74 years	25.2	36.0	64.0	1.75 (1.50–2.03)	0.134	0.001
≥75 years	7.5	10.0	90.0	8.87 (6.21–12.66)	1.612	
Sex						
Male	50.2	48.0	52.0	Reference		0.001
Female	49.8	38.3	61.7	1.49 (1.31–1.70)	0.099	
Education						
Higher education	6.5	80.7	19.3	Reference		
High school	21.4	64.4	35.6	2.79 (1.91–4.10)	0.539	0.001
Elementary/no formal education	72.1	30.5	69.5	14.43 (10.07–20.67)	2.645	
Living with spouse/partner						
Yes	69.8	45.9	54.1	Reference		0.001
No	30.2	36.8	63.2	1.46 (1.26–1.68)	0.110	
Retirement status						
Working/not retired	77.7	42.6	57.4	Reference		
Partially retired	3.0	51.3	48.7	0.70 (0.48–1.04)	0.140	0.175
Retired	19.3	43.9	56.1	0.95 (0.81–1.11)	0.078	
Community participation						
Actively participating	38.3	51.0	49.0	Reference		
Somewhat participating	45.4	39.8	60.2	1.58 (1.37–1.82)	0.115	0.001
Less participating	16.2	33.8	66.2	2.04 (1.67–2.49)	0.206	
Depressive symptom						
Mild to no symptoms	83.3	44.1	55.9	Reference		
Moderate symptoms	11.1	41.5	58.5	1.12 (0.90–1.38)	0.120	0.002
Severe symptoms	5.6	31.6	68.4	1.71 (1.27–2.29)	0.257	
Smoking						
Non-smoker	55.3	42.2	57.8	Reference		
Ex-smoker	10.5	48.5	51.5	0.78 (0.63–0.96)	0.084	0.070
Smoker	34.2	43.0	57.0	0.97 (0.84–1.12)	0.071	
Physical activity						
Active	55.9	46.2	53.8	Reference		0.001
Less active	44.1	39.2	60.8	1.33 (1.17–1.52)	0.089	
Self-rated health						
Excellent	14.2	38.7	61.3	Reference		
Good	53.8	45.5	54.5	0.75 (0.62–0.92)	0.078	0.001
Fair	29.7	42.1	57.9	0.87 (0.70–1.08)	0.096	
Poor	2.4	28.9	71.1	1.55 (0.95–2.55)	0.392	
BMI						
Ideal (18.5–24.9 kg/m^2)	56.8	41.2	58.8	Reference		
Underweight (<18.5 kg/m^2)	14.3	28.6	71.4	1.74 (1.42–2.16)	0.187	0.001
Overweight (25.0–29.9 kg/m^2)	22.2	53.2	46.8	0.62 (0.53–0.72)	0.050	
Obese (30.0 kg/m^2 or over)	6.6	57.5	42.5	0.52 (0.40–0.67)	0.070	
Ever diagnosed with >1 chronic diseases						
Never diagnosed	68.1	41.9	58.1	Reference		
Diagnosed with one disease	24.9	44.1	55.9	0.91 (0.78–1.06)	0.061	0.005
Diagnosed with >1 disease	7.0	52.0	48.0	0.66 (0.52–0.86)	0.086	

results of Indonesian older adults in IFLS Provinces was 5.6±4.1.

This study also attempted to identify whether there are any association between smoking status and cognitive impairment. Though, how long the older adults were ever smoked or how long have it been since they have stopped was not measured in this study. As a result of the bivariate analysis, no significant association was found between smoking status and cognitive status of older adults ($p > 0.05$). The descriptive analysis showed that higher proportion of impaired cognitive older adults was also found on higher in those with less physical activity compared to those who more active physically.

The bivariate analysis also found that BMI and history of chronic diseases were significantly associated with cognitive impairment with p-value <0.05. Lower proportions of cognitive impairment were found in older adults with high BMI, whereas older adults who have never diagnosed with chronic diseases were having a higher percentage of cognitive impairment compared to the other groups.

While some variables (i.e., retirement and smoking status) were not statistically significant based on the bivariate test, they were still eligible to be included in the early model of multiple logistic regression analysis as the p-value is still lower than 0.25. This analysis was conducted to identify how far the factors associated with cognitive impairment after adjusted and to determine which of the factors are dominantly associated with cognitive impairment.

The final model indicated that cognitive impairment was more likely to occur in older adults with lower education level, less physical activity, less community participation, severe depressive symptoms, and lower body mass index as they are advancing in years. Thus, Table 2 shows the final model of the multiple logistic regression analysis.

Other than age, the final model showed that level of education also resulted p <0.001. Older adults who have no history of formal education or have only ever attended elementary have 12.15 times higher risks (95% CI = 8.30–17.78) of experiencing cognitive impairment compared to those who have ever attended higher education (Table 2). In this study, sex was somehow also included in the final model with female older adults were having a higher chance of experiencing cognitive impairment compared to male older adults (*OR* = 1.24; 95% CI = 1.06–1.45).

Out of seven factors included in the final model, four of them were possibly modifiable (physical activity, participation in the community, depressive symptoms, and BMI). As seen on table 2, older adults with less physical activity are 1.22 times higher to experience cognitive impairment compared to those who are physically active (95% CI = 1.05–1.42). Older adults with less participation in the community are also more likely to experience cognitive impairment with the odds ratio of those who are somewhat participating and who are not participating at all are 1.18 (95% CI = 1.00–1.40) and 1.36 (95% CI = 1.09–1.71), compared to the actively participating older adults, respectively. In terms of depressive symptoms, older adults with severe symptoms are at a higher risk of experiencing cognitive impairment than those with mild to no symptoms (*OR* = 1.37; 95% CI = 1.00–1.89). Underweight older adults are also more likely to experience cognitive impairment compared to those with higher BMI.

Table 2. Final model of multiple logistic regression of cognitive impairment and other factors (data analyzed from IFLS5, 2014–2015).

	Adjusted *OR*	SE	95% CI		*p*
			Lower	Upper	
Age (years)					
55–64 years	Reference				
65–74 years	1.45	0.122	1.23	1.71	0.001
≥75 years	7.65	1.541	5.16	11.36	0.001
Sex					
Male	Reference				
Female	1.24	0.098	1.06	1.45	0.006
Education					
Higher education	Reference				
High school	2.88	0.584	1.94	4.29	0.001
Elementary/no formal education	12.15	2.360	8.30	17.78	0.001
Physical activity					
Active	Reference				
Less active	1.22	0.092	1.05	1.42	0.008
Community participation					
Actively participating	Reference				
Somewhat participating	1.18	0.100	1.00	1.40	0.043
Not participating	1.36	0.156	1.09	1.71	0.007
Depressive symptoms					
Mild to no symptoms	Reference				
Moderate symptoms	1.02	0.122	0.81	1.29	0.862
Severe symptoms	1.37	0.224	1.00	1.89	0.050
BMI					
Ideal	Reference				
Underweight	1.34	0.152	1.08	1.68	0.008
Overweight	0.75	0.071	0.62	0.90	0.002
Obese	0.68	0.102	0.50	0.91	0.011

4. DISCUSSION

The term cognitive impairment is often used inseparably with dementia. In which, most studies stated that cognitive impairment is associated with a higher risk of progression to dementia.[13,18] Cognitive impairment and dementia are often differentiated by the ability to perform activity of daily living, wherein people with severe cognitive impairment or dementia tended to have increasing need of support to perform activity of daily living.[25] While the number of cognitive impairment and dementia are predicted to keep increasing as the population age, it is often still confusing to differentiate this condition with normal aging.

This study revealed that the majority of older adults in Indonesia were experiencing cognitive impairment with the prevalence of 56.9%. This percentage was similar to the previous studies in the local and community level in Indonesia which prevalence ranged from 54.7–75.5%.[26,27]

Nevertheless, this number is considerably high compared to the other Asian countries with similar nation-wide studies where it ranged between 24.1–27.9% in South Korea, and 22.2% in Taiwan.[15,28,29] The high number shown in this study might be influenced by the other aspects of the measurement, including the modified version of instrument used, the classification method of the cognitive measurement scores, as well as disaggregation of respondent scores by literacy and any other factor.

The IFLS-modified TICS in this study was similar to the one used in previous study in the United States.[19,20] TICS has proven to become an alternative of the widely-known Mini Mental State Examination.[30] Using the same 27-point TICS, the prevalence of CIND among older adults aged 65 or over in the United States was 21.2% in 2000 and 18.8% in 2012.[19] The same study also stated the prevalence of dementia which were 11.6% and 8.8% in 2000 and 2012, respectively.[19] Dementia was not classified separably from cognitive impairment in this study. However, if we apply the classification method of Langa and Weir[19,20], the average TICS score of older adults aged 75 years or over in Indonesia were only slightly higher than the dementia cut-off at 6.8±3.3. Compared to the ADAMS dementia diagnosis as the gold standard, Langa and Weir approach of 27-point TICS categorization method correctly classifies 78% of respondents having dementia or not.[19]

Measurement bias might also present in this study as the respondents were not disaggregated by their literacy level. Similar study in Taiwan differentiated the cut-off point for those who were illiterate or being uneducated by one point.[15] In Pakistan, the cut-off point used for defining cognitive impairment was differentiated by two points between literate and illiterate respondents wherein the cut-off point for the illiterate was set to be lower than the educated one.[31] This might also explain the huge gap of the proportions of older adults with cognitive impairment between the higher education and no education groups in this study.

Though the measurement was not disaggregated by the literacy level, this study considered level of education in the analysis which resulted older adults who have ever experienced higher education have a lower risk of experiencing cognitive impairment than those who were being uneducated. Education was said to provide knowledge, skill, and competencies for establishing a lifetime participation of cognitive or intellectual activities.[32] Cognitive stimulating activities tended to have an enhancing effect on cognition.[14,33] Daily cognitive activity also often used as an intervention to improve cognitive health in older adults.[33] However, further studies that examine the efficacy of this intervention in decreasing the likelihood of developing cognitive impairment and dementia are still needed as both conditions are widely-known as irreversible.

Other than education and age, sex, physical activity, community participation, and BMI were also significantly associated with cognitive impairment in this study. This study implied that female older adults tended to experience cognitive impairment compared to male older adults. The result observed in this study also support previous study which suggested higher life expectancy in women and domination of visuospatial function, brain structure and capacity, as well as social role and function in men tended to increase the risk of cognitive decline in women.[34] The association between sex and cognitive status has become a long debate between researchers. Some studies implied that the risks of cognitive impairment were higher in men, while some others stated otherwise.[13] Regardless of these results, further clinical assessment is needed to prove the association.

Physical activity in this study was significantly associated with cognitive impairment wherein older adults with lesser physical activity have a higher risk of experiencing cognitive impairment. This result is consistent with previous studies that stated older adults with higher level of physical activity can reduce the risk of neurodegenerative diseases.[14,35] How the types and durations of physical activity can be associated with cognitive decline or cognitive function in later life is also interesting for future study.

Duration of physical activity were once revealed to have an association with BMI, wherein the increase of activity duration can decrease BMI at all ages.[36] Regarding BMI, this study found a contradictive result with most previous studies where it shows that older

adults with higher BMI is protective against cognitive impairment. Most previous studies reported high BMI (i.e., overweight and obesity) tends to increase the risk of cognitive decline, cognitive impairment, as well as dementia.[14,37,38] However, another study in 2005 has implied similar result to this study due to better cognitive performance in terms of reasoning and speed of processing in elderly with higher BMI.[38]

Community participation in this study expected to reflect the social support they seek from the community. This study implied that older adults who actively participate in the community are more likely to not experience cognitive impairment. In contrast to this, some previous studies found no significant positive relationship between social support and cognitive function.[39,40] However, some other studies that were conducted in early 2000s demonstrated how poor social connections, infrequent participation in social activities, and low engagement in mental, social, or other productive activities predicted higher risk of cognitive decline and progression to dementia.[41,42]

Social support can also be linked to late-life depression if depression is assessed more broadly to include the feeling of loneliness, loss of support network, as well as inability to get going.[1] Depression itself said to have a complex association with dementia where major depression in earlier adulthood appears to predict the risk of dementia in later life.[14] Other than early onset depression, recent study proven that late-onset depression caused a greater impairment in cognitive status compared to those with early-onset depression.[43] The study also found that the verbal ability and delayed memory of people with late-onset depression declined more rapidly compared to the non-depressive one.[43] In line with the previous study, the finding on our study revealed that older adults with severe depressive symptoms tended to have a higher risk of experiencing cognitive impairment compared to those with mild to no depressive symptoms.

Though the findings of this study served a new perspective towards the risk of cognitive impairment at the national level, several limitations were still unavoidable. Other than the limitation of cognitive measurement instrument at the national level as discussed earlier on this section, the cross-sectional design applied in this study also became a barrier that prevent researchers from capturing causal associations in this study. This might be also the cause of several well-known factors of cognitive decline were not significantly associated and included in the final model of this study. For example, smoking and chronic diseases.

5. CONCLUSION

The study suggests that older adults who physically and socially active were having a lower risk of experiencing cognitive impairment as they age. Since some associated factors are modifiable, it is expected that the results indicated in this study can be reflected in the current health program so that the number of people with cognitive impairment will not drastically rise as the population continue to age in the future. At this point, Indonesia might need to adapt elderly health programs in the other parts of the world, including daily cognitive stimulation for elderly, regular physical activity program for elderly, and so on.

Though the findings of this study might help in giving new insight to prevent future cognitive decline or dementia crisis in Indonesia, further studies with better instruments and methods are still needed to clarify the cognitive aging process from time to time. It is expected that Indonesia can develop or adapt any cognitive measurement consistently in the future so that longitudinal study with more advanced findings will be possible to conduct.

CONFLICTS OF INTEREST

The authors have no conflicts of interest to declare.

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