

Correlates of Visuospatial Ability among Older People in Indonesia

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Abstract

Introduction: The Indonesian elderly population keeps increasing. Aging is related with degeneration process, one of which is a decrease in cognitive function, including visuospatial ability. This is the first study on the visuospatial ability of Indonesian older people. **Objective:** This research aimed to assess the visuospatial ability and its correlation with sex, age, education, and general cognitive function among older people in Indonesia. **Subjects and Methods:** The research subjects were older people aged ≥ 60 years with Mini-Mental State Examination (MMSE) score ≥ 24 . The visuospatial ability was assessed using Wechsler Adult Intelligence Scale-Revised (WAIS-R) Block Design Test (BDT). Regression analysis was performed to reveal the correlation of sex, age, education, and global cognitive function with visuospatial ability. **Results:** Sixty older people participated in this research, with an average age of 68.08 ± 6.24 , mean MMSE score of 27.43 ± 1.71 , and mean WAIS-R BDT score of 27.8 ± 7.27 . The female and older individuals tended to have lower scores. Subjects with higher education and global cognitive function had higher WAIS-R BDT scores. Regression analysis showed that age and sex did not have significant effect, but education and global cognitive function had positive effect on visuospatial ability. **Conclusion:** There is a significant correlation between education and global cognitive function with visuospatial ability among older people in Indonesia.

Keywords: Age, cognitive function, education, elderly, sex, visuospatial

INTRODUCTION

Cognitive function including visuospatial ability decreases with age. Visuospatial ability is a person's capacity to understand the visual and spatial relationships of objects, which is important in daily activities, i.e., driving, using a map, and playing sports.^[1,2]

Numerous research of older people's cognitive function has been carried out in Indonesia, but none discussed about visuospatial ability.^[3-5] This is the first report on the visuospatial ability of Indonesian older people.

This study aimed to develop a smartphone application design for the elderly, with a paper already published on the design.^[6] This paper reported the visuospatial ability and its correlation with sex, age, education, and general cognitive function.

SUBJECTS AND METHODS

This cross-sectional study collected data in October–November

2018. The participants were people aged ≥ 60 years with Mini-Mental State Examination (MMSE) score ≥ 24 , without visual impairment and communication problem. They were recruited using purposive sampling in Gondokusuman District, Yogyakarta Municipality.

The Jaeger Reading and Eye Test Chart were used to test near vision acuity of the respondents.

The visuospatial ability was evaluated using the Block Design Test (BDT) of Wechsler Adult Intelligence Scale-Revised (WAIS-R). The BDT requires respondents to arrange a set of either four or nine, two-colored blocks to duplicate ten patterns. The total score ranges from 0–48; a higher score reflects better visuospatial ability. This test has

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been used in other research assessing visuospatial function of older people.^[7-10]

Linear regression was conducted to assess the relationship of sex, age, education, and general cognitive function with visuospatial ability.

Ethical clearance was obtained from the Committee of Ethics for Health Research, Faculty of Medicine, Universitas Kristen Duta Wacana no. 790/C.16/FK/2018. All research subjects gave written informed consent to participate in this research.

RESULTS

Characteristics of respondents

Sixty older (43 females and 17 males) people participated in this study. Age ranged from 60 to 85 years, with a mean and standard deviation of 68.1 ± 6.2 years. There were 21 (35%) people in the 60–64, 17 (28.3%) in the 65–69, 13 (21.7%) in the 70–74, and 9 (15%) in the 75 + age range.

Twenty-four (40%) subjects had senior high school, 16 (26.7%) had college/university, 11 (18.3%) had primary school, and 9 (15%) had junior high school education.

Previously 18 (30%) participants were homemakers, 11 (18.3%) were civil servants, 8 (13.3%) were private employees, 6 (10%) had micro-business, and the rest had various employments. At the time of the research, 39 (65%) no longer worked, 18 (30%) were homemakers, 2 (3.3%) had micro-business, and 1 (1.7%) worked as a seamstress.

Twelve (20%) individuals lived with their spouse; 10 (16.7%) with their spouse and children; 9 (15%) with their spouse, children, and grandchildren; 8 (13.3%) lived alone; and the rest lived with their children, grandchildren, siblings, or aunts.

Cognitive function

The cognitive function was assessed using MMSE. The MMSE scores' mean and standard deviation was 27.43 ± 1.71 . The cognitive function data were further analyzed by sex, age group, and education as presented in Table 1. It can be seen that the MMSE scores of male and female individuals were comparable, declined increasing age, and higher in people with higher education.

Visuospatial ability

The WAIS-R BDT was used to assess the participants' visuospatial ability. An analysis was conducted on the scores and time to finish BDT in each level of difficulty for sex, age group, and education. The results are presented in Table 1. It can be observed that the scores decreased with increasing age, while time to complete the test increased with increasing age. Individuals with higher education had higher scores and needed less time to complete the tasks. Female participants had lower scores and spent more time to complete the BDT.

Effect of sex, age, education, and cognitive function on visuospatial ability

Linear regression was conducted to reveal the effect of sex, age, education, and MMSE on the BDT score and time and

presented in Table 2. Age and sex did not show a significant effect on the respondents' accuracy and speed in completing BDT, while MMSE and education played a significant role in both the accuracy and speed in BDT. However, MMSE had bigger contribution than education (as shown by the R^2) in both accuracy and speed.

DISCUSSION

This research studied the cognitive function, visuospatial ability, and its correlates among Indonesian older people.

The results showed that cognitive function tended to decline with age, as reported by numerous studies.^[11-13] There was no significant difference among participants of different age groups. This finding may be caused by the small number of

Table 1: Mini-Mental State Examination score by age group and educational level

	MMSE score (mean ± SD)	BDT score (mean ± SD)	BDT time in second (mean ± SD)
All	27.43±1.71	27.80±7.27	598.87±103.61
Sex			
Male	27.47±1.94	29.06±8.13	583.24±109.11
Female	27.42±1.64	27.30±6.94	605.05±102.01
Age range			
60-64	27.90±1.70	29.14±7.84	583.81±113.01
65-69	27.24±1.79	27.18±6.78	598.59±103.37
70-74	27.31±1.65	27.08±6.71	608.54±87.53
75+	26.89±1.69	26.89±8.31	620.56±114.46
Education			
Primary	25.7±1.55	22.18±6.78	689.18±95.14
Junior high	27.1±1.25	24.44±6.69	638.22±68.99
Senior high	27.7±1.55	29.08±5.75	578.88±76.83
College/University	28.4±1.50	31.63±7.38	544.63±117.94

MMSE: Mini-Mental State Examination, BDT: Block design test, SD: Standard deviation

Table 2: Linear regression on the effect of sex, age, education, and Mini-Mental State Examination on block design test score and time

	R^2	B	95% CI	t	P
BDT total score					
Age group	0.006	-0.202	-0.476-0.071	-1.484	0.144
Sex	0.011	-1.156	-4.762-2.451	-0.642	0.523
Education	0.254	2.212	0.323-4.101	2.346	0.023
MMSE	0.317	1.414	0.277-2.551	2.492	0.016
BDT total time					
Age group	0.009	2.607	-1.042-6.256	1.432	0.158
Sex	0.011	13.663	-34.494-61.820	0.569	0.572
Education	0.283	-28.479	-53.705-3.254	-2.263	0.028
MMSE	0.401	-26.286	-41.470-11.102	-3.469	0.001

MMSE: Mini-Mental State Examination, BDT: Block design test, CI: Confidence interval

individuals in the age groups and the purposive sampling in which this study recruited participants without cognitive impairment with an MMSE score ≥ 24 .

Analysis on cognitive function based on education suggests people with higher education have higher cognitive function. This result is similar to those reported by other researchers.^[14-16]

The BDT of WAIS-R reflects the visuospatial ability of the examinees. The BDT mean score of this study's respondents was lower than the mean score of the US older people of the same age group.^[7] Yin *et al.* (2015) assessed the visuospatial characteristics of 846 Chinese older people aged between 60 and 93 years without cognitive impairment (MMSE >23) using BDT. The mean BDT score of their study participants was lower than that of the individuals in this study.

Linear regression was conducted to assess the effect of age, sex, education, and general cognitive function on visuospatial ability. Although the result did not show strong effect of sex on visuospatial ability, data presented in Table 1 showed that female respondents had lower score than the males. A recent study reported that the men outperformed women on BDT and arithmetic subtests of WAIS-R.^[10]

Analyzing the effect of age on visuospatial ability, this study's individuals showed that performance on BDT tended to decline with age, although the effect of age on BDT was not significant. Sprague *et al.* investigated 940 participants aged 16–75 and found that performance in BDT decreases with increasing age.^[9] Another study reported a strong decline in the BDT performance with aging, although variability also significantly increases in older age groups.^[7] One study suggests that visuospatial ability is preserved in older people, and poorer performance is caused by slower visuomotor speed.^[17] This study data indicate that age affects not only time but also score of BDT. A review of age effect on cognition found declines in visuospatial performance with increasing age even after factoring out time.^[18]

The linear regression revealed a significant effect of education on the BDT performance, consistent with the findings of other studies. Paulo *et al.* investigated the global cognition (MMSE) and executive functions (Selective Reminding Test; Stroop Color and Word Test; and BDT) and found that education is a protective factor against cognitive decline.^[19]

The result of linear regression also revealed that cognitive function has a strong contribution to the visuospatial ability in older people. Cognitive function has cognitive components such as perception, attention, memory, language, executive functions. When cognitive function decreases, the components of cognitive function including visuospatial ability also decline. This study's finding is consistent with that of a study that compared the cognitive function of older people with intact cognitive function, mild cognitive impairment, and dementia.^[8] The study reported that people with mild cognitive impairment and dementia experience a decrease in their cognitive function and its components, including visuospatial ability. Another

study that investigated age-related changes in visuospatial performance reported a significant correlation between MMSE and BDT scores, especially in difficult patterns.^[20]

Visuospatial ability has been associated with falls in older people.^[21,22] As falls are a major health problem in geriatrics, falls prevention is one of the main health programs targeting older people. The results of this study recommend that falls prevention should focus on people with cognitive impairment and lower educational level.

CONCLUSION

Visuospatial ability is needed in many activities, including moving around, reading maps, reaching nearby places that are important in daily activities. However, this function declines with aging and consequently will adversely affect independence in daily activities and quality of life.^[23-26] Thus, it is very important to preserve visuospatial ability to maintain independence in daily activities and more importantly quality of life of older people.

Limitation of the study is assessing the correlation between MMSE and BDT. MMSE is supposed to represent general cognitive function, while BDT represents visuospatial ability that is part of general cognitive function.

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Conflicts of interest

There are no conflicts of interest.

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