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# The effectiveness of puzzle therapy on cognitive functions among elderly with dementia at Balai Pelayanan Sosial Tresna Werdha (BPSTW) Yogyakarta, Indonesia

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## ABSTRACT

**Background:** People with Alzheimer's dementia can experience a disruption in their daily activities, which can increase the burden of treatment costs. Puzzle therapy can encourage the release of the expression of the person living with Alzheimer's through artistic expression and creative processes. This study aims to determine the effectiveness of puzzle therapy on cognitive function of elderly dementia.

**Methods:** A quasi-experimental approach using pre-post with control group design was used in this study. The number of respondents in the intervention group was 44 and in the control group was 27. The cognitive function on the elderly was assessed by the questionnaire of the Hopkins Verbal Learning Test (HVLT). Data were analyzed using

SPSS version 17 for Windows. Bivariate paired T-test and Independent T-test were used in this study.

**Results:** There was a significant increase in the mean value of cognitive function among the intervention group ( $2.16 \pm 2.67$ ;  $P=0.013$ ) after puzzle therapy. The intervention group without dementia was also found significantly increase ( $2.10 \pm 2.19$ ;  $0.000$ ). While in the control group who had dementia obtained a non-significant decrease in cognitive functions ( $0.29 \pm 0.75$ ;  $0.356$ ). However, the control group without dementia was found to be significantly increased ( $0.5 \pm 0.7$ ;  $0.008$ ) in the cognitive function.

**Conclusion:** Puzzle therapy intervention can improve cognitive scores significantly in all elderly people.

**Keywords:** Elderly with Dementia, Cognitive status, Puzzle Therapy

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## INTRODUCTION

According to the data from the United Nations Department of Economic and Social Affairs, there was 8.9% of the elderly population in Indonesia during 2015. The result of the 2010-2035 population projection indicated that Indonesia had entered the ageing period.<sup>1</sup> The province which has the highest proportion of the elderly population is the Yogyakarta Special Region (13.04%).<sup>2</sup> Elderly has various degradations of body functions; one of them is the degradation of cognitive function. The degradation of cognitive function affects the daily social activities of the elderly, which becomes a public health issue that also affects the increasing amount of financing for family, community, and government. In Indonesia, the population of Person with Dementia (ODD) is predicted to increase from 960,000 in 2013 to 1,890,000 in 2030, and 3,980,000 ODD in 2050.<sup>3,4</sup> The prevalence of elderly dementia in the age of 60 years old or above in Yogyakarta reached 20.1%. The older a person becomes; the prevalence rate of dementia will increase as well. If compared to the prevalence at a global level, the prevalence of dementia in Yogyakarta was much higher.<sup>5</sup>

Yogyakarta Special Region has *Balai Pelayanan Sosial Tresna Werdha* (BPSTW) as the social service centre for elderly which is responsible for providing coaching and service for abandoned elders to have a good life and well-cared in the social life. According to the result of the research conducted by the previous author, data have been obtained in which 25% of the elderly in BPSTW Yogyakarta was suffering from dementia. The activities provided in BPSTW Yogyakarta are still ineffective to prevent and decrease the incidence rate of dementia.

According to those mentioned above, efforts to overcome the issue of dementia on the elderly are required. One of the efforts which can be given is through puzzle therapy. The puzzle is done by arranging a semi-circular block into a specific pattern. The elderly arranges the blocks based on 16 patterns about the guideline. This activity is performed with the other elders. This activity is following the research conducted by Dewi in 2016 at UPT PSLU Jember which resulted that the brain gym combined with playing puzzle for 30 minutes, three times a week for one month can increase the cognitive function of the elderly.<sup>6</sup>

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The elderly who conduct a reminiscence therapy by playing puzzle from the pieces of old photos can increase the cognitive and verbal skills of the dementia patient.<sup>7</sup> The activity of crossword puzzle which performed in the afternoon can improve the intellectual function on someone with dementia.<sup>8</sup>

Based on those as mentioned earlier, this study aims to evaluate the effectiveness of puzzle therapy on cognitive functions among the elderly with dementia at Balai Pelayanan Sosial Tresna Werdha (BPSTW) Yogyakarta, Indonesia

## METHODS

A quasi-experimental study which uses the pre and post with control group design to discover the effectiveness of puzzle therapy on the cognitive function of the elderly with dementia was conducted. The research was performed in BPSTW Yogyakarta, which consisted of Budi Luhur and Abiyoso Units. The data were collected for 1 month.

The elderly in BPSTW Yogyakarta who fulfilled the study criteria namely aged > 60 years old, willing to become the research subject by using informed consent, being present at the time of the study, and do not have mental disorder were made as to the sample in this research. The quota sampling was

used as the sampling technique by keep referring to the criteria of the research sample.

The researcher divided the sample into two groups, namely the intervention group (44 respondents) and control group (27 respondents). The intervention group consisted of 13 respondents who have dementia and 31 respondents without dementia, while the control group consisted of 7 respondents who have dementia and 20 respondents without dementia.

The researcher measured the cognitive function on the elderly by using the questionnaire of the Hopkins Verbal Learning Test (HVLT). The researcher collected the data of elderly by mentioning 36 words; then, the respondents repeated some of those words. The researcher recorded the correct answers then summed the total score of correct answers. If the overall score is between 0-18, thus, the elderly has memory disorder or dementia, and if the score is between 18-13; it means that the elderly has no memory disorder or dementia. After the data of the elderly with dementia have been acquired, the researcher gave intervention with puzzle therapy by arranging blocks according to the sample images, which consist of 16 models. The intervention was given three times a week for one month. After the intervention was provided, the researcher collected the posttest data of the cognitive function of the elderly with dementia by using the HVLT instrument.

The univariate analysis was performed to describe every variable being studied separately by creating the frequency table for each variable. The age, sex, education, and cognitive status of the elderly were the studied variables. The researcher used Shapiro-Wilk's normality test in which > 0.05 p-value has been acquired (data distributed normally). The researcher used bivariate tests such as paired t-test and independent t-test because the entire data were distributed normally that processed by using SPSS version 17 for Windows software.

## RESULTS

About 50% of respondents in the intervention group are elderly (60-74 years old), 56.8% of them are female, 34.1% did not acquire education, and 70.5% do not have dementia. In the control group, 77.8% of respondents are elderly (60-74 years old), 63% of them are female, 44% did not acquire education, and 74% do not have dementia (Table 1).

The score of the cognitive function of the elderly in the intervention group has increased. On the elderly with dementia, the score increase was 2.16, while the score increase for the elderly without dementia was 2.10. The result of the paired t-test indicated 0.013 of the p-value (the group of elderly

**Table 1** Baseline characteristics of respondents at BPSTW Yogyakarta in June 2019

Parameters	Intervention Group (n=44)		Control Group (n=27)	
	n	%	n	%
<b>Age (Years)</b>				
60-74	22	50	21	77.8
75-90	22	50	6	22.2
<b>Sex</b>				
Male	19	43.2	10	37
Female	25	56.8	17	63
<b>Education Level</b>				
No Education	15	34.1	12	44.4
Elementary School	12	27.3	9	33.3
Junior High School	7	15.9	2	7.4
Senior High School	6	13.6	2	7.4
Diploma	2	4.5	1	3.7
Bachelor Degree	0	0	1	3.7
Master Degree	1	2.3	0	0
Doctoral Degree	1	2.3	0	0
<b>Cognitive Status</b>				
Dementia	13	29.5	7	25.9
Without Dementia	31	70.5	20	74.1

**Table 2** The effectiveness of the puzzle therapy intervention toward the cognitive function among the elderly at BPSTW Yogyakarta

Group	Cognitive status		Mean	SD	P-value
Intervention	Dementia (n=13)	Pretest	8.46	3.526	0.013
		Posttest	10.62	4.538	
	Without Dementia (n=31)	Pretest	19.87	4.849	0.000
		Posttest	21.97	5.313	
Control	Dementia (n=7)	Pretest	7.86	3.532	0.356
		Posttest	7.57	3.599	
	Without Dementia (n=20)	Pretest	20.70	6.424	0.008
		Posttest	21.20	6.614	

**Table 3** The disparity of cognitive status among the elderly after interventions between groups

Cognitive status	Group	Mean disparity (CI = 95%)	P-value
Dementia	Intervention (n=13)	3.044	0.144
	Control (n=7)		
Without Dementia	Intervention (n=31)	0.768	0.649
	Control (n=20)		

with dementia) and 0.000 of the p-value (the group of elderly without dementia). In the control group, the score of the elderly with dementia has decreased by 0.29, while the score of the elderly without dementia has increased by 0.19. The result of Paired t-test indicated 0.356 of the p-value (the group of elderly with dementia) and 0.008 of the p-value (the group of elderly without dementia) (Table 2).

The result of independent t-test showed 0.144 (> 0.05) of the p-value for a cognitive score after the group of elderly with dementia were provided with the intervention, while 0.694 (> 0.05) of the p-value for a cognitive score after the group of elderly without dementia were provided with the intervention (Table 3).

## DISCUSSION

Statistically, puzzle therapy intervention was sufficient to improve cognitive on every elderly, both the elderly with and without dementia (p-value < 0.05). However, if seen from the score increase of mean value in the pre and post-intervention; the score of elderly with dementia experienced a higher increase compared to the elderly without dementia. Theoretically, the intervention on elderly with dementia will be hard to conduct because these people are the vulnerable population whom their activities are restricted.<sup>9,10</sup> However, in this research, the elderly with dementia have a higher disparity of mean value (0.06) compared to the elderly without dementia. This condition occurred

because the intervention of puzzle therapy was easy to be done by the elderly with dementia, unlike the previous study which showed that jigsaw puzzles were solely used to improve the visuospatial cognition on the elderly without dementia.<sup>11</sup> The elderly with dementia tend to be passive in following the activity provided by BPSTW. Therefore, the researcher visited the elderly in each homestead. During the activity of playing puzzle, the elderly seemed enthusiast and passionate in following the activity toward the end.

The part of the human brain has two hemispheres or separated lobes, namely right and left brains which have different functions. The left brain plays a role in thoughts and logics, while the right brain manages creativity, intuition, and emotion. A puzzle is functioned to train both parts of the brain. When someone is practicing with a jigsaw puzzle, thus, both brain functions will be exercised. The continuous activities of the brain cause the brain cells to be trained while improving the efficiency and capacity of brain cells. Mc Arthur expressed that individuals who perform jigsaw puzzle have a longer life, and the risk of memory loss on the elderly with Alzheimer will decrease. Imagining a picture will improve the focus and participation of an individual. The brain produces a chemical substance named dopamine which used in the memory and learning process. The production of dopamine will increase when an individual is solving a puzzle. Arranging puzzle can improve awareness, concentration, and creativity. In addition,

continually looking at images can help the visualization process beneficial for physical or mental activities. This condition also affects physical health by lowering the respiratory rate, heart rate, and blood pressure. A jigsaw puzzle is similar to the meditation, which generates tranquillity toward the mind if being conducted regularly that will also sharpen the memory and concentration.<sup>11</sup>

According to the statistical result of paired t-test, there was no significant difference between the means of cognitive scores in pre and post-tests conducted toward the elderly with dementia ( $p$ -value  $> 0.05$ ). According to the posttest result, the cognitive score on the elderly with dementia has decreased by 0.29. The cognitive score of the elderly with dementia will continue to decline if they are not provided with a puzzle therapy intervention. The elderly with dementia will feel closed in their rooms, rarely participating in the activities in BPSTW and rarely socializing with other elders, although, elderly with dementia have to conduct physical activities such as strength, balance, mobility training while also doing their daily activities.<sup>12</sup> Physical activity is a non-pharmacological intervention to prevent cognitive degradation and neurodegenerative disease in the elderly.<sup>13</sup> The physical activity conducted routinely for 8 weeks could also significantly reduce the level of malondialdehyde (MDA). MDA will inhibit the development of free radicals within the body; thus, the health and quality of life can be improved.<sup>14</sup>

The result was different with the control group that consisted of non-dementia respondents. There was a significant difference in the cognitive scores in pre and post-tests ( $p$ -value  $< 0.05$ ) and the cognitive score has increased by 0.19. This condition occurred because in BPSTW, routine activities such as morning exercises, singing, skill development, and spiritual coaching have been organized. The elderly without dementia are actively and routinely participating in these activities. Therefore, although the elderly have not conducted puzzle therapy, the cognitive score was still increased. However, the score improvement is still lower than the group of elderly who follow the puzzle therapy intervention.

According to the result of the statistical test by using independent t-test, it has been acquired that there was no difference in cognitive scores between the elderly (with or without dementia) after the interventions of puzzle therapy were performed on the intervention and control group ( $p$ -value  $> 0.05$ ). It means that regardless of the puzzle therapy intervention, the cognitive status of the elderly has increased. This condition might occur because BPSTW has organized routine activities to enhance the cognitive function of the elderly. However, the

issue is, not all elderly can follow those activities, especially those who have dementia. The puzzle therapy intervention can improve the cognitive function of the elderly with dementia because this intervention is easy to conduct by the related elderly. The elderly only have to arrange 16 blocks according to the original images while also be guided by the facilitator. According to the previous study, the elderly have the perception of adequate time in arranging 24 pairs of jigsaw puzzle while the younger can arrange 54 pairs of the puzzle in a sufficient time.<sup>15</sup>

The intervention of puzzle therapy is expected to be implemented as a routine activity in BPSTW. The knowledge and skills of the nurse or the caregiver regarding dementia are crucial in improving the cognitive status of the elderly. However, BPSTW is still lacking in providing the training for the caregiver or the nurse regarding the treatment for the elderly with dementia. The previous study explained that a train-the-trainer model could be used to give education and knowledge to the professionals in the primary health service. This program generates positive impacts on knowledge, attitude, even practices in the treatment of patients with dementia.<sup>16</sup>

## CONCLUSION

Puzzle therapy was effective in improving the cognitive function of the elderly with dementia. The elderly with dementia will continue to experience the degradation of cognitive function progressively if they do not participate in the activities held by BPSTW. The elderly with dementia who participate in routine activities of BPSTW will experience the increase of cognitive score. The puzzle therapy intervention helps the improvement of cognitive function on the elderly in BPSTW. The puzzle therapy intervention can be made as an additional routine activity to improve the cognitive function of the elderly in BPSTW Yogyakarta besides exercises, music therapy, spiritual therapy, and skills training.

## CONFLICT OF INTEREST

The authors declare that there is no conflict of interest.

## ETHICS CONSIDERATION

Ethics approval has been obtained from the Ethics Committee of Universitas Respati Yogyakarta, Yogyakarta, Indonesia prior to the study being conducted.

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## AUTHOR CONTRIBUTION

All of the authors are equally contributed to the study from the conceptual framework, data gathering, data analysis, until reporting the results of study.

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