

Social Determinants of Health Associated with Cognitive Performance Among Elderly with Hypertension in Klaten Regency, Central Java, Indonesia: A Cross-Sectional Study

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ABSTRACT

Background: Cognitive decline is one of the major impacts of hypertension in the elderly population. Social Determinants of Health (SDoH) framework plays an important role for understanding how non-medical factors influence individual health outcomes, including cognitive performance. This study aimed to analyze the relationship between social determinants of health factors and cognitive performance among elderly with hypertension in Klaten Regency, Central Java, Indonesia.

Subjects and Methods: This cross-sectional study was conducted at elderly health post and the Chronic Disease Management Program (Prolanis) groups in Klaten Regency, Central Java, Indonesia from February to March 2026. A total of 120 elderly with hypertension aged ≥ 60 years were selected using multistage sampling. The dependent variable was cognitive performance. The independent variables were education level, living arrangement, physical activity, social activity. Cognitive performance was measured using the Mini Mental State Examination (MMSE), social activity using the Australian Community Participation Questionnaire (ACPQ), and physical activity using the Stanford Brief Activity Survey (SBAS). Data were analyzed using multiple linear regression analysis.

Results: Higher education level ($b=1.97$; 95% CI= 0.86 to 3.08; $p=0.001$), light physical activity ($b=2.67$; 95% CI= 1.34 to 4.01; $p<0.001$), moderate physical activity ($b=3.48$; 95% CI= 2.02 to 4.94; $p<0.001$), and higher social activity ($b=0.193$; 95% CI= 0.148 to 0.239; $p<0.001$) had positive and significant associations with cognitive performance. There was no significant difference in cognitive performance between elderly living alone and those living with spouse ($b=0.14$; 95% CI= -1.50 to 1.79; $p=0.863$) or family ($b=0.343$; 95% CI= -1.01 to 1.69; $p=0.617$).

Conclusion: Cognitive performance among elderly with hypertension is influenced by education level, physical activity and social activity. Community-based promotive and preventive programs may support the maintenance of cognitive performance.

Keywords: cognitive performance, hypertension, older people, social determinant of health

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BACKGROUND

The Sustainable Development Goals (SDGs) aim to ensure healthy and prosperous lives for people of all ages, including elderly, by 2030 ([United Nations, 2015](#)). One indicator of successful global health development is the increase in life expectancy, which is accompanied by a growing elderly population. However, this demographic transition also leads to an increase in age-related health problems, particularly cognitive decline. Cognitive performance refers to the ability to acquire, process, store, and use information, including attention, memory, language, executive function, and problem-solving abilities ([Chapey, 2008](#)). Cognitive decline among elderly individuals can be characterized by impairments in attention, memory, language ability, comprehension, decision-making, executive function, and the ability to perform activities of daily living (ADL) ([Badawy, 2024](#)). Therefore, maintaining cognitive health among elderly has become an important issue in achieving healthy ageing.

In line with this issue, the World Health Organization (WHO) reported that approximately one in six people worldwide will be elderly, with the population aged ≥ 60 years projected to increase from 1 billion in 2020 to 1.4 billion in 2030 ([WHO, 2025](#)). As the elderly population continues to grow rapidly, cognitive impairment has become an increasingly important public health concern. Among the various contributing factors, hypertension has been identified as one of the major risk factors for cognitive decline and dementia (Bao et al., 2022). According to the 2025 AHA/ACC Hyper-

tension Guidelines, hypertension is recognized as a common and modifiable risk factor for cognitive impairment and dementia. Hypertension may lead to cerebral vascular changes, including cerebral ischemia, endothelial dysfunction, blood-brain barrier disruption, and cerebral atrophy, all of which contribute to cognitive decline ([Canavan & O'Donnell, 2022](#)). Supporting this evidence, [Jiang et al. \(2025\)](#) found that the prevalence of cognitive decline among elderly individuals with hypertension reached 45.2%.

Given the complex nature of cognitive decline among elderly individuals with hypertension, the Social Determinants of Health (SDoH) framework provides an important perspective for understanding the factors that may influence cognitive performance. [WHO \(2010\)](#) defines social determinants of health as non-medical factors affecting health outcomes through the conditions in which people are born, grow, work, live, and age, as well as the broader systems shaping those conditions. The SDoH framework consists of structural and intermediary determinants. Structural determinants include governance systems, macroeconomic policies, social policies, public policies, and cultural and social values, while intermediary determinants include education, employment and working conditions, income, social class, gender, ethnicity, race, material conditions, psychosocial factors, behavioral factors, and access to health systems. Through this framework, cognitive performance among elderly individuals can be understood not only from

biological aspects but also from social and environmental influences.

Based on the SDoH framework, this study focuses on several determinants considered closely related to cognitive performance among elderly individuals with hypertension, namely educational level, living arrangement status, social activity, and physical activity. Educational level is strongly associated with cognitive function because higher education may increase cognitive reserve, enabling individuals to better maintain cognitive performance during ageing. Previous studies by [Amin et al. \(2025\)](#) and [Passos et al. \(2021\)](#) reported a positive and significant relationship between education and cognitive ability. In addition, living arrangement status is associated with social support and the psychological well-being of elderly. Elderly individuals living with family members tend to have better protection against cognitive decline compared to those living alone ([Choi et al., 2021](#); [Yu et al., 2022](#)), although some studies have reported inconsistent findings ([Roystonn et al., 2020](#)). Furthermore, social activity plays an important role in maintaining mental stimulation, strengthening social interaction, and improving emotional well-being, all of which may help preserve cognitive performance ([Saito et al., 2018](#); [Shen et al., 2022](#); [Zhang et al., 2025](#)). Similarly, physical activity has been shown to improve cerebral blood flow, neuroplasticity, and neural connectivity, thereby reducing the risk of cognitive impairment among elderly ([Livingston et al., 2020](#); [Gökçe & Gün, 2023](#)).

The importance of studying these determinants is becoming increasingly relevant in Indonesia, which has entered the ageing population phase. The proportion of the population aged ≥ 60 years in Indonesia reached 12.00% in 2024, while life expectancy increased from 70.78 years in

2015 to 72.39 years in 2024 ([Statistics of Indonesia, 2024](#)). Alongside these demographic changes, most elderly individuals in Indonesia still have relatively low educational attainment, with 28.89% not completing elementary school and 32.57% completing only elementary school. Low educational attainment may limit cognitive reserve and increase vulnerability to cognitive decline, particularly among elderly individuals with chronic diseases such as hypertension. Consequently, understanding the influence of social determinants on cognitive performance is essential in the Indonesian context.

A similar condition can also be observed in Klaten Regency, Central Java, Indonesia, the location of this study. The proportion of the elderly population in Klaten Regency increased from 15.65% in 2022 to 16.50% in 2024, while the prevalence of hypertension rose from 324,122 cases in 2023 to 340,201 cases in 2024. In addition, the majority of elderly individuals in Klaten Regency have low educational levels, with 37.45% never attending school and 28.68% completing only elementary school ([Statistics of Klaten Regency, 2024](#)). These demographic and health conditions may increase the risk of cognitive decline among elderly individuals with hypertension. Therefore, Klaten Regency provides an important setting for examining the relationship between social determinants of health and cognitive performance.

Based on the explanation above, this study seeks to examine whether social determinants of health, including educational level, living arrangement status, social activity, and physical activity, are associated with cognitive performance among elderly individuals with hypertension in Klaten Regency, Central Java, Indonesia.

SUBJECTS AND METHOD

1. Study Design

This was a cross-sectional study. The study was conducted in Klaten Regency, specifically at elderly health post and Prolanis groups in Klaten, Central Java, Indonesia from February to March 2025.

2. Population and Sample

The population in this study consisted of elderly with hypertension aged 60 years and above. The sampling technique used was multistage sampling. The sample size determination referred to Murti (2013), who stated that studies using multivariate analysis require a minimum of 15–20 subjects for each independent variable. Based on this consideration, the sample size in this study was determined to be 120 respondents.

3. Study Variables

The dependent variable was cognitive performance. The independent variables consisted of education level, living arrangement, physical activity, and social activity.

4. Operational Definition of Variables

Cognitive performance is the ability of elderly to perform mental functions including memory, attention, orientation, language, recall and executive function.

Educational level is the highest formal education completed by elderly.

Living arrangement is household members living together with elderly.

Physical activity is body movement produced by skeletal muscles that results in energy expenditure among elderly.

Social activity is a form of activity reflected in conscious interactions between individuals through the process of communication including community, religious, social, or interpersonal activities.

5. Study Instruments

Data were collected using questionnaires and standardized instruments administered through face-to-face interviews with respondents. Cognitive performance was measured

using the Mini Mental State Examination (MMSE) questionnaire developed by the Indonesian Psychiatry Collegium (2008), social activity was measured using the Australian Community Participation Questionnaire (ACPQ), and physical activity was measured using the Stanford Brief Activity Survey (SBAS) questionnaire.

6. Data Analysis

Univariate analysis was conducted with the aim of explaining respondent characteristic and frequency distribution of each research variable. Bivariate analysis was conducted to assess the effect of independent variables on the dependent variable using simple linear regression. Furthermore, multivariate analysis was performed using multiple linear regression.

7. Research Ethics

Research ethical issues including informed consent, anonymity, and confidentiality, were addressed carefully during the study process. The research ethical clearance approval letter was obtained from the Research Ethics Committee at Ministry of Health, Semarang Health Politechnic, Indonesia, No. 137/EA/F.XXIII.38/2026, on February 6, 2026.

RESULTS

1. Sample Characteristics

Based on Table 1, the distribution of respondents' characteristics in this study showed that female respondents constituted the majority of the sample, accounting for 87 individuals (72.5%), with a mean age of 67.89 years (SD= 6.27) with a minimum score of 60 and a maximum score of 85. Most respondents had a history of stage 1 hypertension (140–159/90–99 mmHg), totaling 107 individuals (89.17%). The most respondents had an elementary school education level, accounting for 41 individuals (34.17%), lived with family members or children, totaling 75 individuals

(62.50%), and engaged in light-intensity physical activity, reported by 45 individuals (37.5%). The mean social activity score of respondents was 56.28 (SD=13.30) with a minimum score of 21 and a maximum score

of 101. In addition, the mean cognitive performance score was 24.12 (SD=4.7) with a minimum score of 6 and a maximum score of 30.

Table 1. Frequency Distribution of Respondents' Characteristics

Variable	n	%
Sex		
Male	33	27.5
Female	87	72.5
Hypertension (mmHg)		
Stage 1 140-159/ 90-99 mmHg	107	89.17
Stage 2 160-179/100-109 mmHg	9	7.5
Stage 3 ≥ 180 / ≥ 110 mmHg	4	3.33
Education Level		
No formal education	16	13.33
Elementary school	41	34.17
Junior high school	16	13.33
Senior high school	28	23.33
College (Diploma, Masters, and Doctoral)	19	15.83
Living Arrangement		
Living alone	19	15.83
With spouse	26	21.67
With family/children	75	62.50
Physical Activity		
Inactive	34	28.33
Light intensity	45	37.5
Moderate intensity	34	28.33
Vigorous intensity	7	5.83
Age (years old)	Mean= 67.89, SD= 6.27, min=60, max= 85	
Cognitive performance (score)	Mean= 24.12, SD= 4.70, min= 6, max= 30	
Social activity (score)	Mean= 56.28, SD= 13.30, min= 21, max= 101	

Based on Table 2, most elderly with normal cognitive performance (scores 24–30) had a high education (45 respondents), lived with their children/family (54 respondents), engaged in light to vigorous intensity physical activity, and had social activity levels equal to or above the average (62 respondents). In contrast, the majority of elderly with mild cognitive impairment (scores 17–23) had an elementary school education (19 respondents), lived with their children/family (18 respondents), were

physically inactive (19 respondents), and had social activity levels below the average (25 respondents). Meanwhile, severe cognitive impairment (scores 0–16) was more commonly observed among elderly with no formal education (6 respondents), those living alone or with their children/family (3 respondents each), those who were physically inactive (8 respondents), and those with social activity levels below the average (8 respondents).

Table 2. Cross-Tabulation of Cognitive Performance by Independent Variables

Variables	Cognitive Performance		
	Normal	Mild cognitive impairment	Severe cognitive impairment
Education Level			
Low Education (< Senior High School)	35	30	8
High Education (≥Senior High School)	45	2	0
Living Arrangement			
Living alone	9	7	3
With spouse	17	7	2
With family/children	54	18	3
Physical Activity			
Inactive	7	19	8
Light intensity	34	11	0
Moderate intensity	32	2	0
Vigorous intensity	7	0	0
Social Activity			
Below average (<56)	18	25	8
Equal to or above average (≥56)	62	7	0

2. Bivariate Analysis

Bivariate analysis was conducted to determine the relationship between independent variables and the dependent variable. Table 3 presents the results of simple linear regression analysis between several independent variables and cognitive performance among elderly. The variables analyzed included education level, living arrangement, physical activity, and social activity.

Elderly with higher education levels (senior high school/college) had cognitive performance scores that were 5.32 units higher compared to those with lower education levels (no formal education, elementary school, junior high school). This association was statistically significant ($b=5.32$; 95% CI= 3.86 to 6.77; $p<0.001$). These findings indicate that higher educational attainment is associated with better cognitive performance among elderly.

Elderly living with a spouse had cognitive performance scores that were 2.99 units higher compared to those living alone ($b=2.99$; 95% CI= 0.242 to 5.75; $p=0.033$). In addition, elderly living with family/children had cognitive performance scores that were 3.03 units higher ($b=3.03$; 95% CI= 0.69 to

5.38; $p=0.012$). These findings indicate that social support from spouses and family members is associated with better cognitive performance.

In the physical activity variable, all categories of physical activity showed a positive association with cognitive performance compared to the inactive group. Elderly with light physical activity had cognitive scores that were 5.64 units higher ($b=5.64$; 95% CI= 4.03 to 7.24; $p<0.001$), moderate physical activity 7.59 units higher ($b=7.59$; 95% CI= 5.97 to 9.30; $p<0.001$), and vigorous physical activity 8.18 units higher ($b=8.18$; 95% CI= 5.26 to 11.11; $p<0.001$). These results indicate that higher levels of physical activity intensity are associated with better cognitive performance among elderly.

Meanwhile, social activity also showed a positive and significant association with cognitive performance, with a regression coefficient of 0.27 ($b=0.27$; 95% CI= 0.23 to 0.31; $p<0.001$). This means that every 1-unit increase in social activity score was associated with a 0.27-unit increase in cognitive performance score among elderly with hypertension.

Table 3. Results of Simple Linear Regression Analysis of Cognitive Performance and independent variables

Independent variable	b	95% CI		p
		Lower limit	Upper limit	
Education Level				
Low Education (< Senior High School)	Ref.			
High Education (≥ Senior High School)	5.32	3.86	6.77	<0.001
Living Arrangement				
Living alone	Ref.			
With spouse	2.99	0.24	5.75	0.033
With family/children	3.03	0.69	5.38	0.012
Physical Activity				
Inactive	Ref.			
Light intensity	5.64	4.03	7.24	<0.001
Moderate intensity	7.59	5.87	9.30	<0.001
Vigorous intensity	8.18	5.26	11.11	<0.001
Social activity	0.27	0.23	0.31	<0.001

3. Multivariate Analysis

Multivariate analysis was conducted to examine the simultaneous relationship between independent variables and the dependent variable. Table 4 presents the results of multiple linear regression analysis examining the association between several independent variables and cognitive performance among elderly. The variables included in the analysis were education level, living arrangement, physical activity, and social activity. The regression coefficient (b) indicates the magnitude of the effect of each variable on cognitive performance scores after controlling for other variables in the model.

Elderly with higher education levels (high school/college) had cognitive performance scores that were 1.97 units higher compared to those with lower education levels (no formal education, elementary school, junior high school). This association was statistically significant (b=1.97; 95% CI= 0.86 to 3.08; p=0.001). These findings indicate that higher educational attainment is associated with better cognitive performance among elderly.

In the physical activity variable, elderly with light physical activity had cognitive

performance scores that were 2.67 units higher compared to inactive elderly (b= 2.67; 95% CI= 1.34 to 4.01; p<0.001;). Elderly with moderate physical activity had scores that were 3.48 units higher (b= 3.48; 95% CI= 2.02 to 4.94; p<0.001). However, vigorous physical activity was not significantly associated with cognitive performance (b=1.09; 95% CI= -1.44 to 3.63; p= 0.392).

Meanwhile, social activity consistently showed a significant association with cognitive function among elderly (b=0.193; 95% CI= 0.148 to 0.239; p<0.001). Each one-unit increase in social activity score was associated with a 0.193-unit increase in cognitive performance score.

In contrast, living arrangement was not significantly associated with cognitive performance among elderly. Elderly living with a spouse (b=0.14; 95% CI= -1.50 to 1.79; p=0.863) and those living with family/children (b=0.343; 95% CI= -1.01 to 1.69; p=0.617) did not show significantly different cognitive function scores compared to elderly living alone.

Overall, the regression model was statistically significant (p<0.001) with an adjusted R² value of 70.14%, indicating that

approximately 70.14% of the variation in cognitive performance could be explained by

the independent variables included in the model.

Table 4. Results of Multiple Linear Regression Analysis of Cognitive Performance and independent variables

Independent variable	b	CI 95 %		p
		Lower limit	Upper limit	
Education Level				
Low education	<i>Ref.</i>			
High Education	1.97	0.86	3.08	0.001
Living Arrangement				
Living alone	<i>Ref.</i>			
With spouse	0.14	-1.50	1.79	0.863
With family/children	0.34	-1.01	1.69	0.617
Physical Activity				
Inactive	<i>Ref.</i>			
Light intensity	2.67	1.34	4.01	<0.001
Moderate intensity	3.48	2.02	4.94	<0.001
Vigorous intensity	1.09	-1.44	3.63	0.392
Social activity	0.19	0.15	0.24	<0.001
Adj R ² = 70.14%; p<0.001				

DISCUSSION

1. The influence of level education on cognitive performance

Higher education level showed a positive relationship with cognitive performance. In this study, it can be interpreted that the higher the level of education, the more likely cognitive performance is to remain normal or achieve better cognitive performance scores. Most elderly with normal cognitive performance are in the senior high school and college, while mild cognitive impairment is most commonly found among those with elementary school education and no formal schooling, and severe cognitive impairment is predominantly observed among those with no formal schooling. These findings indicate a tendency that the higher the level of education, the better the cognitive performance among the elderly. These findings are consistent with [Amin et al. \(2025\)](#), who stated that educational level is one of the indicators of cognitive reserve. Individuals with higher educational attainment tend to have better abilities in process-

ing and storing information, enabling them to maintain optimal cognitive performance despite the brain aging process. In addition, individuals with higher levels of education are generally more likely to engage in occupations requiring cognitive abilities and participate actively in activities that stimulate cognitive function. Engagement in such activities contributes to strengthening cognitive reserve, which ultimately helps maintain cognitive performance.

In addition, the characteristics of elderly with hypertension who have higher educational attainment in this study are generally associated with better ability to understand health information, recognize risk factors, adhere to treatment, and adopt healthy lifestyles to control blood pressure. Better hypertension control can help reduce damage to cerebral blood vessels, which plays a role in cognitive decline. This is consistent with a study conducted by [Jiang et al. \(2025\)](#) among elderly individuals with hypertension, which reported that those with higher educational attainment tend to

have better logical thinking abilities and a lower risk of cognitive impairment. They also generally have greater self-awareness, learning capacity, and self-care behaviors, making them more proactive in preventing cognitive decline. In addition, according to [Lee et al. \(2023\)](#), higher educational levels also positively influence elderly individuals' understanding of conditions such as dementia and improve their knowledge of healthy lifestyle behaviors for dementia prevention.

In this study, respondents with higher educational attainment tended to frequently engage in activities such as reading, watching news on television or social media, using information technology, participating in cognitively demanding tasks, and being active in organizational or social activities. These activities provide continuous stimulation to memory, attention, language, and problem-solving abilities, thereby helping to maintain cognitive performance into older age. This is consistent with [Jiang et al. \(2025\)](#), who reported that engagement in intellectual activities such as reading and writing helps maintain brain stimulation, while continuous learning and intellectual challenges contribute to building and sustaining cognitive reserve. In addition, [Amin et al. \(2025\)](#) stated that individuals with higher education are generally more likely to be involved in occupations that require cognitive skills and to participate in various activities that stimulate cognitive function. Such engagement contributes to strengthening cognitive reserve, which in turn helps preserve cognitive performance.

In contrast, in this study, elderly with low educational attainment or no formal schooling often had limited access to and understanding of health information, leading to less optimal hypertension management and efforts to maintain cognitive performance. As a result, elderly with lower education are more vulnerable to cognitive

decline compared to those with higher education. This is in line with [Farron et al. \(2020\)](#), who found that low educational attainment is significantly associated with poorer cognitive performance. These findings further strengthen the evidence that education is an important determinant in maintaining cognitive performance among elderly.

2. The influence physical activity on cognitive performance

Light physical activity and moderate physical activity showed a positive relationship with cognitive performance. These findings indicate that elderly who engage in higher levels or greater intensity of physical activity tend to have better cognitive performance. This result is consistent with the study conducted by [Jiang et al. \(2025\)](#), which found that long-term regular physical activity is a protective factor against cognitive decline among elderly with hypertension. Physical activity is considered a modifiable determinant that contributes significantly to preventing cognitive decline by up to 40% ([Livingston et al., 2020](#)).

Biologically, physical activity may improve cognitive performance through changes in the structure and functional dynamics of the central nervous system, as well as through increased cerebral blood flow. Physical activity also enhances cognitive performance through the regulation of neurotransmitter release. For example, aerobic exercise may improve cognitive performance by enhancing cardiovascular fitness, increasing cerebral blood flow, improving oxygen and glucose supply to brain tissue, and increasing neurotransmitter availability ([Yi et al., 2025](#)). In addition, the American Heart Association recommends physical activity as an essential component in the management of hypertension among elderly to maintain their overall health condition ([Gibbs et al., 2021](#)). Physi-

cal activity not only plays a role in controlling blood pressure but also helps improve blood flow to the brain, maintain neural function, and preserve cognitive abilities among elderly with hypertension. Therefore, elderly who regularly engage in physical activity tend to have better cognitive performance compared to those who are less physically active.

Based on this study, vigorous physical activity was not significantly associated with cognitive performance, possibly due to the small number of older adults included in this category. In this study, the majority of older adults with normal cognitive performance were in the light to moderate-intensity physical activity group. This finding may be attributed to the characteristics of the respondents, who generally experienced a decline in physical capacity due to the aging process, making them more likely to engage in activities that are appropriate for their abilities and can be performed consistently. The physical activities performed included occupational activities, leisure-time activities, and household activities. Some respondents were still working as farmers, laborers, tailors, or retirees who remained physically active in their daily lives. In addition, physical activity was also obtained through household chores, such as sweeping, mopping, gardening, and mowing the lawn, which were generally performed for 45 minutes to 1 hour. Physical activities performed at light to moderate intensity include walking, swimming, elderly gymnastics, and cycling for 15–20 minutes per session. These activities are carried out 1–3 times per week and provide sufficient physical stimulation to support brain health without causing excessive fatigue. This finding is consistent with the study by [Yi et al. \(2025\)](#), which reported a positive correlation between physical activity, household activities, and cognitive performance. Simi-

larly, [Zhang and Chen \(2021\)](#) found that walking is the most commonly chosen and preferred form of physical activity among elderly. Furthermore, a review of 23 studies demonstrated that moderate-to-vigorous physical activity is positively associated with cognitive performance in elderly ([Oliveira et al., 2023](#)). According to the World Health Organization (WHO), elderly are recommended to engage in at least 150 minutes of moderate-intensity physical activity per week to maintain overall health and cognitive function.

3. The influence social activity on cognitive performance

Social activity showed a positive relationship with cognitive performance. The results presented in Table 2 showed that the majority of elderly with normal cognitive performance had social activity levels equal to or above the average. In contrast, elderly with mild cognitive impairment were more frequently found among those with below-average social activity, and all cases of severe cognitive impairment were also observed in the below-average social activity group. These findings suggest that higher levels of social activity are associated with better cognitive function among the elderly. This result is consistent with the study conducted by [Choi et al. \(2021\)](#), which demonstrated that participation in social activities serves as a protective factor against cognitive decline among the elderly. Social activity increases opportunities for the elderly to interact with their environment, providing cognitive stimulation, fostering a sense of belonging, and enhancing emotional well-being, thereby reducing the likelihood of cognitive impairment ([Shen et al., 2022](#)).

In this study, the majority of respondents lived with their children or other family members and maintained active contact with family members, friends, and neighbors. They also participated in

community and religious activities. These conditions indicate that a supportive social environment provides greater opportunities for the elderly to interact, communicate, and engage in various activities that stimulate cognitive function. Regular social interaction can enhance a sense of belonging, reduce stress, and provide emotional support, all of which contribute to better mental and cognitive health. In addition, some respondents reported reading regularly and following news through social media or television. Such activities may serve as forms of cognitive stimulation by exercising attention, comprehension, memory, and critical thinking skills. Elderly individuals who actively seek and process new information tend to develop greater cognitive reserve, enabling them to better maintain cognitive function despite the aging process.

These findings are also supported by the study of [Zhang et al. \(2025\)](#), which classified social activities into three categories and found that self-entertainment activities contributed the most to improved cognitive performance among the elderly. Such activities help the elderly feel more relaxed, increase their sense of control over life, and reduce the risk of cognitive decline. For example, watching television or listening to the radio can provide opportunities to acquire information, broaden knowledge, and support the maintenance of cognitive function. Furthermore, social activities involving household tasks were also found to have a positive influence on cognitive performance. Through activities such as cooking with family members or caring for grandchildren, elderly individuals not only strengthen family relationships but also gain physical activity and emotional support that benefit cognitive health. Moreover, social interaction through group activities provides significant positive effects. Participation in group-based activities can expand

social networks and generate positive feedback from interpersonal interactions, which may help prevent cognitive decline. Involvement in religious activities, social gatherings, alumni associations, community groups, and extended family relationships has been shown to be effective in maintaining cognitive performance among the elderly.

Therefore, efforts to increase elderly participation in various social activities should continue to be encouraged through community-based programs such as Elderly Health Posts, The Chronic Disease Management Programs (Prolanis), elderly exercise groups, religious activities, recreational programs, and other social activities. These programs not only play an important role in enhancing social interaction but also serve as sources of cognitive stimulation that support the maintenance of cognitive function among the elderly.

4. The influence living arrangement on cognitive performance

These findings indicate that living arrangement, whether living alone, with a spouse or with children/family members does not directly determine cognitive performance. Our finding showed that the majority of elderly individuals with normal cognitive performance lived with their children/family members or with a spouse. Among those with mild cognitive impairment, the largest proportion was also found among elderly individuals living with their children/family members. Meanwhile, in the severe cognitive impairment category, the highest proportions were observed among those living alone and those living with their children/family members. These findings suggest that living arrangement alone is not a determining factor of cognitive performance. Other factors may have a stronger influence on cognitive function, including social activity, engagement in

cognitively stimulating activities, physical activity, psychological well-being, and other individual characteristics. This interpretation is consistent with the findings of [Lee et al. \(2025\)](#), who reported that elderly individuals living alone can maintain cognitive performance through various forms of social support, independence in daily activities, and participation in physical activities.

In this study, most elderly with normal cognitive performance lived with their children/family members or with a spouse. This finding suggests that the presence of family members or a spouse may provide social support that contributes to maintaining cognitive function. Elderly individuals living with family members or a spouse have greater opportunities for interaction, communication, and participation in daily activities, thereby receiving cognitive stimulation that helps preserve thinking, memory, and problem-solving abilities. Among elderly individuals with hypertension, support from family members or a spouse may also facilitate disease management, such as medication adherence, blood pressure monitoring, and the adoption of healthy lifestyles. According to [Yu et al. \(2022\)](#), elderly individuals living with a spouse exhibited a slower rate of cognitive decline compared with those in other living arrangements. This finding suggests that a spouse may serve as a primary source of support in later life through emotional support, more frequent social interaction, and an expanded social network. These factors may enhance cognitive reserve and consequently slow cognitive decline.

In addition, the findings of this study revealed that the largest proportion of severe cognitive impairment was observed among elderly individuals living alone and those living with their children or family members. Elderly individuals who live alone tend to experience limited social interaction,

lower levels of social participation, loneliness, and social isolation. These conditions may result from limited social support, reducing opportunities for mental stimulation and increasing vulnerability to cognitive decline. Furthermore, insufficient support in managing daily activities and hypertension may further increase the risk of cognitive impairment. This finding is consistent with [Yu et al. \(2022\)](#), who reported that elderly individuals living alone tend to experience more rapid cognitive decline. This may be attributable to increased social isolation, restricted social networks, and the psychological stress associated with the loss of a spouse.

However, the presence of severe cognitive impairment among elderly individuals living with children or family members suggests that family co-residence alone may not be sufficient to prevent cognitive decline. The benefits of living with family depend not only on the physical presence of family members but also on the quality of support provided. Elderly individuals living with family may still experience cognitive decline if interactions are limited, if they are rarely involved in conversations or daily activities, or if they receive insufficient cognitive stimulation. Moreover, family members who are occupied with work or other responsibilities may have limited time to provide companionship, resulting in unmet emotional and social needs.

On the other hand, this situation may also be influenced by overly protective family attitudes. Family members often restrict the activities of elderly individuals due to concerns about falls, fatigue, or worsening health conditions related to hypertension. Although such restrictions are intended to provide protection, excessive limitations may reduce opportunities for elderly individuals to engage independently in daily activities, interact with their

surroundings, participate in social activities, and perform cognitively stimulating tasks. As a result, they may become more passive and dependent on family members, leading to reduced stimulation of thinking, memory, and decision-making abilities. Over time, this condition may accelerate cognitive decline. This explanation is supported by the findings of [Yu et al. \(2022\)](#), who reported that elderly individuals living with children or other family members experienced faster cognitive decline than those living alone. This phenomenon may be associated with intergenerational conflicts, emotional or financial dependence, and chronic stress arising from co-residence with adult children, all of which may negatively affect cognitive performance.

This study concludes that cognitive performance among elderly individuals with hypertension is significantly influenced by education level, physical activity, and social activity, while living arrangement showed a positive but non-significant association with cognitive performance. Strategies to improve cognitive performance among elderly with hypertension should focus on maintaining optimal blood pressure control, providing older adults with the opportunity to maintain independence in activities of daily living, strengthening physical activity and social engagement, and providing cognitive stimulation through community and family based promotive and preventive approaches.

This study has several limitations, including (1) This study implemented several measures to minimize the influence of confounding factors through the use of inclusion and exclusion criteria. Nevertheless, it did not fully control for all potential confounders that may have affected the study outcomes, including age, sex, hypertension stage, educational attainment, and characteristics of the respondents' living

environments. (2) the variables included in this study may not fully represent all social determinants of health that potentially influence cognitive performance among elderly.

AUTHOR CONTRIBUTION

Emalia Rizqi Anggita led the study conceptualization, data collection and analysis, interpretation of data, writing original draft preparation, and manuscript revision. Argyo Demartoto contributed to manuscript supervision, critical review, and editing of the manuscript. Rizka Ayu Setyani contributed to manuscript supervision, methodology guidance, critical review and editing of the manuscript. Endang Sutisna Sulaeman contributed to research proposal supervision, methodological input, and critical review of the study design. Haryani Saptaningtyas contributed to manuscript examination, scientific evaluation, and critical review of the manuscript. Maria Paskanita Widjanarti contributed to manuscript examination, critical evaluation, and final review of the manuscript. All authors have read and approved the final manuscript.

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CONFLICT OF INTEREST

There is no conflict of interest in this study.

REFERENCES

Amin V, Behrman JR, Fletcher JM, Flores CA, Flores-Lagunes A, Kohler I, et al.

- (2025). Causal effects of schooling on memory at older ages in six low- and middle-income countries: Nonparametric evidence with harmonized datasets. *J Gerontol B Psychol Sci Soc Sci.* 80(6). <https://doi.org/10.1093/geronb/gbafo57>.
- Badawy W. (2024). The relationship between language functioning and cognitive decline in elderly individuals with disabilities. *Evol Stud Imaginative Cult.* 8:285–298. <https://doi.org/10.70082/esiculture.vi.967>.
- Bao J, Liu J, Li Z, Zhang Z, Su X, Sun J, et al. (2022). Relationship between hypertension and cognitive function in an elderly population: A population-based study in rural Northern China. *Front Neurol.* 13:885598. <https://doi.org/10.3389/fneur.2022.885598>.
- Canavan M, O'Donnell MJ. (2022). Hypertension and cognitive impairment: A review of mechanisms and key concepts. *Front Neurol.* 13:821135. <https://doi.org/10.3389/fneur.2022.821135>.
- Chapey R. (2008). *Language Intervention Strategies in Aphasia and Related Neurogenic Communication Disorders*. Philadelphia: Lippincott Williams & Wilkins.
- Choi YJ, Hong YC, Do YK. (2021). The effects of social activities and living arrangements on cognitive functions in middle-aged and elderly adults: A panel study using the 2006–2018 Korean Longitudinal Study of Aging. *J Prev Med Public Health.* 54(6):395–403. <https://doi.org/10.3961/jpmph.-21.384>.
- Farron MR, Kabeto MU, Dey AB, Levine DA, Langa KM, Glymour MM, et al. (2021). Hypertension and cognitive health among older adults: Findings from the Harmonized Cognitive Assessment Protocol. *J Am Geriatr Soc.* 68(3): S323–S330. <https://doi.org/10.1111/jgs.16741>.
- Gibbs BB, Hivert MF, Jerome GJ, Kraus WE, Rosenkranz SK, Schorr EN, Spartano NL, et al. (2021). Physical activity as a critical component of first-line treatment for elevated blood pressure or cholesterol: Who, what, and how?: A scientific statement from the American Heart Association. *Hypertension.* 78(2). <https://doi.org/10.1161/HYP.000000000000196>.
- Gökçe E, Gün N. (2023). The relationship between exercise, cathepsin B, and cognitive functions: A systematic review. *Percept Mot Skills.* 130(4): 1366–1385. <https://doi.org/10.1177/00315125231176980>.
- Jiang X, Huo M, Yu Q, Yan J, Cong Z, Yu H. (2025). Analysis of factors affecting subjective cognitive decline in elderly hypertensive patients and the construction of a risk prediction model. *Geriatr Nurs.* 61:302–310. <https://doi.org/10.1016/j.gerinurse.2024.10.071>.
- Lee J, Cho E, Kim H, Lee KH, Kim E, Ye BS. (2023). The development and evaluation of a self-efficacy enhancement program for elderly with mild cognitive impairment. *Appl Nurs Res.* 73: 151726. <https://doi.org/10.1016/j.apnr.2023.151726>.
- Lee ES, Seo YM. (2025). Factors associated with subjective cognitive decline in community-dwelling elderly individuals based on living area and living arrangement: A cross-sectional study. *Geriatr Nurs.* 62:155–164. <https://doi.org/10.1016/j.gerinurse.2025.02.005>.
- Livingston G, Huntley J, Sommerlad A, Ames D, Ballard C, Banerjee S, et al. (2020). Dementia prevention, inter-

- vention, and care: 2020 report of the Lancet Commission. *Lancet*. 396 (10248):413–446. [https://doi.org/10.1016/S0140-6736\(20\)30367-6](https://doi.org/10.1016/S0140-6736(20)30367-6).
- Murti B. (2013). *Desain dan ukuran sampel untuk penelitian kuantitatif dan kualitatif di bidang kesehatan*. Yogyakarta: Gadjah Mada University Press.
- Oliveira JJ, Ribeiro AGSV, Oliveira Silva JA, Barbosa CGR, Silva ASE, Santos GM, et al. (2023). Association between physical activity measured by accelerometry and cognitive function in elderly: A systematic review. *Aging Ment Health*. 27(11):2089–2101. <https://doi.org/10.1080/13607863.2023.2248477>.
- Passos VMA, Raymundo CE, Bezerra FF, Faerstein E. (2021). Diabetes and hypertension are associated with lowered cognitive performance among middle-aged Brazilian adults: Cross-sectional analyses nested in the longitudinal Pró-Saúde study. *Sao Paulo Med J*. 139(1):46–52. <https://doi.org/10.1590/1516-3180.2020.0269.r1.3-0102020>.
- Roystonn K, Abdin E, Shahwan S, Zhang Y, Sambasivam R, Vaingankar JA, et al. (2020). Living arrangements and cognitive abilities of community-dwelling elderly in Singapore. *Psychogeriatrics*. 20(5):625–635. <https://doi.org/10.1111/psyg.12532>.
- Saito T, Murata C, Saito M, Takeda T, Kondo K. (2018). Influence of social relationship domains and their combinations on incident dementia: A prospective cohort study. *J Epidemiol Community Health*. 72(1):7–12. <https://doi.org/10.1136/jech-2017-209811>.
- Shen C, Rolls ET, Cheng W, Kang J, Dong G, Xie C, et al. (2022). Associations of social isolation and loneliness with later dementia. *Neurology*. 99(2):e164–e175. <https://doi.org/10.1212/WNL.0000000000200583>.
- Statistics Indonesia. (2024). *Statistik Penduduk Lanjut Usia 2024* (Statistics of the Aging Population 2024). Jakarta: Statistics Indonesia. Retrieved from <https://www.bps.go.id/id/publication/2024/12/31/a00d4477490caaf0716b711d/statistics-of-aging-population-2024.html>.
- Statistics of Klaten Regency (2024). *Profil Lansia Kabupaten Klaten 2024* (Aging Population Profile of Klaten Regency 2024). Retrieved from <https://klaten-kab.bps.go.id/id/publication/2025/11/21/1fd563f0cf8fa91eccb2e30d/profil-lansia-kabupaten-klaten-2024.html>.
- United Nations. (2015). *Transforming Our World: The 2030 Agenda for Sustainable Development*. New York: United Nations. Retrieved from <https://sdgs.un.org/2030agenda>.
- WHO. (2010). *A conceptual framework for action on the social determinants of health*. Social Determinants of Health Discussion Paper 2. Geneva: World Health Organization. Retrieved from <https://www.who.int/publications/i-item/9789241500852>.
- WHO. (2025). *Ageing and Health*. Geneva: World Health Organization. Retrieved from <https://www.who.int/news-room/fact-sheets/detail/ageing-and-health>.
- Yi Q, Yang C, Qi Y, Feng X, Tan J, Song X, et al. (2025). Physical activity and cognitive function among community-dwelling elderly: A mediating role of functional fitness. *BMC Public Health*. 25(1). <https://doi.org/10.1186/s12889-025-22321-2>.
- Yu Y, Lv J, Liu J, Chen Y, Chen K, Yang Y. (2022). Association between living arrangements and cognitive decline in elderly: A nationally representative

- longitudinal study in China. *BMC Geriatr.* 22(1). <https://doi.org/10.1186/s12877-022-03473-x>.
- Zhang Z, Chen W. (2021). Longitudinal associations between physical activity and purpose in life among older adults: A cross-lagged panel analysis. *J Aging Health.* 33(10):941–952. <https://doi.org/10.1177/08982643211019508>.
- Zhang C, Xiong J, Luo W, Sun L. (2025). The relationship between social participation and cognitive function in elderly: The mediating role of activities of daily living. *SAGE Open.* 15(3). <https://doi.org/10.1177/21582440251356754>.