Sleep quality and cognitive function on self-rated health status among older adults: Findings from the Indonesian Family Life Survey (IFLS-5)

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Sleep quality and cognitive function on self-rated health status among older adults: Findings from the Indonesian Family Life Survey (IFLS-5)

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Abstract

Cognitive decline is one of the main challenges older adults face globally. This study aimed to estimate the prevalence of cognitive functions and associated factors from the national survey of older adults in Indonesia. The study used data from the Indonesia Family Life Survey (IFLS-5) conducted from 2014 to 2015. The analysis included socio-demographic cognitive function and health-related variables collected through measurements. Multivariate logistic regression was used to identify the factors associated with these variables. The study found that 44.6% of older adults from 2,929 respondents reported poor cognitive function. Factors significantly associated with cognitive function before adjustment included residence, region, sleep quality, self-rated health status, happiness, and depression. After adjustments, residence, region, self-rated health, happiness, and sleep quality remained significantly associated with cognitive function. Several factors associated with cognitive function were identified. These findings emphasize the importance of interventions aimed at improving sleep quality and general health as efforts to maintain and enhance cognitive function in older adults. Implementing comprehensive health programs can contribute to the improved quality of life for older adults.

Keywords: Cognitive Function, Sleep Quality, Happiness, Self-rated Health, Depression, Quality of Life.

Introduction

Cognitive function is an important aspect of an individual's quality of life, especially in old age (Segel-Karpas and Lachman, 2018). Cognitive function includes thinking, remembering, and making decisions (DiNapoli *et al.*, 2014). Cognitive decline is one of the main challenges faced by older adults; this decline can also increase the risk of diseases such as dementia and Alzheimer's (Kang *et al.*, 2017; Poey *et al.*, 2017; Lussier *et al.*, 2019). Studies show that cognitive function in older adults is influenced by several factors, including social contact (Segel-Karpas and Lachman, 2018), social support (Poey *et al.*, 2017), sleep quality (Kang *et al.*, 2017; Gildner *et al.*, 2019; Yang *et al.*, 2024), self-rate health (Sexton *et al.*, 2017; Byrd *et al.*, 2020), depression (Esteves *et al.*, 2017; Yoon *et al.*, 2019; Farina *et al.*, 2020), social isolation and loneliness (DiNapoli *et al.*, 2014; Poey *et al.*, 2017), and well-being (Langlois *et al.*, 2013; Poey *et al.*, 2017). Good quality sleep is

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one of the key factors in maintaining cognitive function (Kang *et al.*, 2017). Sufficient and quality sleep plays a role in brain recovery, memory consolidation, and emotional regulation (Gildner *et al.*, 2019). However, older adults often experience sleep problems such as insomnia and other sleep disorders. Research shows that chronic sleep disturbances can contribute to cognitive decline and increase the risk of dementia (Ezzati *et al.*, 2019; Zhu *et al.*, 2022). Some research suggests that poor sleep quality may become more prevalent with decreasing cognitive function (Sun *et al.*, 2013; Nakakubo *et al.*, 2017; Yang *et al.*, 2024), and 33 % of older adults reported some poor sleep quality (Sexton *et al.*, 2017).

The relationship between sleep disturbances and cognitive decline in older adults remains controversial. Previous research found no significant difference in cognitive function between groups with good and poor sleep quality (Sexton *et al.*, 2017). Additionally, several studies found that older individuals with poor sleep were more likely to experience symptoms of depression rather than cognitive decline, leading to a higher use of sleeping pills (Kang *et al.*, 2017; Gildner *et al.*, 2019). This is supported by previous research that suggests depression symptoms can be a risk factor or symptom of cognitive decline (Lee *et al.*, 2019; Desai *et al.*, 2020; Farina *et al.*, 2020). In older adults, psychological well-being can be influenced by factors such as loneliness, depression, and lack of social support. Low well-being can negatively impact cognitive function. There is a significant positive relationship between all predictor variables of social isolation or loneliness and cognitive function variables (DiNapoli *et al.*, 2014; Poey *et al.*, 2017), as well a significant improvement in variables such as the quality of life of older adults (Poey *et al.*, 2017), social relationships (Garms-Homolova *et al.*, 2017), health status (Byrd *et al.*, 2020), and well-being (Langlois *et al.*, 2013; Poey *et al.*, 2017) with cognitive changes. Therefore, older adult individuals with good cognitive function tend to have a positive view of themselves (Hughes and Lachman, 2018). General health, such as chronic diseases like hypertension, diabetes, and cardiovascular diseases, is associated with cognitive decline. Therefore, good health management and prevention of chronic diseases can help maintain cognitive function in older adults (Byrd *et al.*, 2020).

In Indonesia, along with the significant increase in the population of older adults, the issue of cognitive decline is becoming increasingly relevant. Data from the Badan Pusat Statistik (BPS) in Indonesia shows that 2023, the older adult population reached around 11.75% (Badan Pusat Statistik, 2023). This figure is projected to continue to rise with the growing older population. Therefore, a deep understanding of these factors becomes increasingly important to support their well-being and quality of life. Meanwhile, studies on sleep quality, general health, and cognitive function in older adults are still limited. Therefore, more in-depth research is needed to understand how geographic diversity, urban versus rural residency, self-rated health, happiness, and sleep quality impact cognitive functioning in older adults. This study aimed to estimate the prevalence of cognitive function and associated factors. A better understanding of cognitive function in older adults will provide important contributions to improving their quality of life and reducing the public health burden in Indonesia.

Methods

Design and Sample

This study utilized the data from the Indonesia Family Life Survey (IFLS-5) obtained from the Research and Development (RAND) Corporation http://www.rand.org/labor/FLS/IFLS.html, which uses the cross-sectional design from 2014 to 2015. The IFLS-5 has tracked individuals, families, households, and communities for over 20 years. The sampling method involved stratified sampling for provinces and rural or urban locations. This study encompassed 13 out of 27 provinces in 1993, representing approximately 83% of the total population (21). Enumeration areas (EAs) were randomly selected from the nationally representative sample, with 321 EAs chosen randomly across 13 provinces. The data analysis focuses on older adults of 60 or older, with 4,236 participants meeting this criterion. Thus, after excluding proxy respondents and cases with missing data, the analysis included 2,929 older adult individuals.

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Variables and Measurements

The demographic variables included age (60 ~ 69, 70 ~ 79, and ≥ 80 years), sex (male or female), education level (none or elementary, high school or higher), marital status (married, divorced, or widow), residence (rural or urban), region (Java & Bali, Sumatra and other islands), and economic status (poor, median, and rich).

The independent variables in this study were currently working, self-rated health status, happiness, depression, loneliness, participation in community weighing post-lansia (Posyandu Lansia), religious activity, presence of chronic conditions such as hypertension and diabetes, and smoking behavior. Current working status was assessed with the question "Are you currently working?" with response options "Yes or No." Self-rated health status was evaluated with the question, "In general, how would you rate your health?" and recorded as healthy or unhealthy. Happiness was assessed with the question, "How would you rate your happiness these days?" and recorded as happy or unhappy. Sleep quality was measured with the question, "In the past 7 days, how would you rate the quality of your sleep?" with response options "very poor or poor" recorded as poor and "fair, good, or very good" recorded as good. Depression was assessed using the Center of Epidemiological Studies Depression Scale-10 (CESD-10), with a score of ≥ 10 indicating depression. Loneliness was evaluated with the question, "How often did you feel lonely in the past week?" with response options grouped as low (rarely or some of the time) or high (occasionally or most of the time). Community weighing post-lansia (Posyandu Lansia) and religious activity were assessed with questions regarding their occurrence in the village in the last 12 months (Yes or No). Chronic conditions such as hypertension and diabetes were assessed by doctors (yes or no). Smoking behavior was assessed with the question, "Have you ever chewed tobacco, smoked a pipe, or smoked cigarettes?" categorized as "Yes or No." Cognitive functioning was the dependent variable, assessed with the question, "How would you rate your memory at present? Would you say it is excellent, very good, good, fair or poor?" and recoded as good or poor.

Statistical Analysis

The data were analyzed using univariate and multivariate techniques. A univariate analysis assessed participants' basic characteristics using frequency (n) and percentage (%). A bivariate analysis of the respondents' characteristics and level of cognitive function was conducted with a chi-square test to compare characteristics between good and poor among older adults. All the tests were bilateral at $p < 0.05$. The multivariate logistic regression analysis was used to identify significant factors associated with cognitive function among older adults in the overall sample. The 95% confidence interval (CI) was used to report the percentage of the odds ratio (OR). Data was analyzed using the Statistical Package for Social Science (SPSS) software version 25.0 for Windows (IBM Corp., Armonk, NY, USA).

Results

Characteristics of study participants

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Table 1 presents an overview of the characteristics of the 2,929 respondents. Within the sample, 67.1% were aged between 60 and 69 years, 51.6% were female, and 56.6% had completed elementary education or had no formal education. Additionally, 64.9% were married, 58% lived in urban areas, and 70.3% resided in the regions of Java and Bali. In terms of health status, 63.0% considered themselves to be in good health, 82.5% reported feeling happy, and 65.9% were currently employed. Regarding sleep quality, 89.6% reported having good sleep quality, 28.1% experienced symptoms of depression, and 17% reported feeling high levels of loneliness. Furthermore, 74.9% engaged in religious activities, 28.7% had chronic conditions such as hypertension, 6.8% had diabetes, and 44.6% were smokers. With respect to cognitive function, 44.6% of participants reported having poor cognitive function. Bivariate analysis revealed that only residence and region were significantly associated with cognitive function. Cognitive function demonstrated a positive correlation with good health, happiness, and high sleep quality among older individuals.

Table 1. Frequency distribution and cognitive function (N = 2,929)

Variables	Frequency N (%)	Cognition Function N (%)		*p-value*
		Good 1622 (55.4%)	Poor 1307 (44.6%)	
Age (Years)				0.274
60 – 69	1966 (67.1)	1109 (37.9)	857 (29.3)	
70 – 79	821 (28.0)	438 (15.0)	383 (13.1)	
≥ 80	142 (4.8)	75 (2.6)	67 (2.3)	
Sex				0.806
Male	1417 (48.4)	788 (26.9)	629 (21.5)	
Female	1512 (51.6)	834 (28.5)	678 (23.1)	
Education Level				0.393
None or Elementary	1657 (56.6)	929 (31.7)	728 (24.9)	
High School or Higher	1272 (43.4)	693 (23.7)	579 (19.8)	
Marital Status				0.543
Married	1900 (64.9)	1066 (36.4)	834 (28.5)	
Divorced	925 (31.6)	501 (17.1)	424 (14.5)	
Widow	104 (3.6)	55 (1.9)	49 (1.7)	
Residence				0.006*
Rural	1231 (42.0)	645 (22.0)	586 (20.0)	
Urban	1698 (58.0)	977 (33.4)	721 (24.6)	
Region				0.000*
Java & Bali	2059 (70.3)	1110 (37.9	949 (32.4)	
Sumatra	364 (12.4)	190 (6.5)	174 (5.9)	
Other islands	506 (17.3)	322 (11.0)	184 (6.3)	
Status Economy				0.330
Poor	955 (32.6)	512 (17.5)	443 (15.1)	
Median	1751 (59.8)	980 (33.5)	771 (26.3)	
Rich	223 (7.6)	130 (4.4)	93 (3.2)	
Currently Working				0.053*
Yes	1931 (65.9)	1094 (37.4)	837 (28.6)	
No	998 (34.1)	528 (18.0)	470 (16.0)	
Self-rated Health Status				0.000*
Healthy	1845 (63.0)	1077 (36.8)	768 (26.2)	
Unhealthy	1084 (37.0)	545 (18.6)	539 (18.4)	
Happiness				0.000*
Happy	2415 (82.5)	1379 (47.1)	1036 (35.4)	
Unhappy	514 (17.5)	243 (8.3)	271 (9.3)	
Sleep Quality				0.000*
Poor	305 (10.4)	127 (4.3)	178 (6.1)	
Good	2624 (89.6)	1495 (51.0)	1129 (38.5)	
Depression				0.014*
Yes	823 (28.1)	426 (14.5)	397 (13.6)	
No	2106 (71.9)	1196 (40.8)	910 (31.1)	
Loneliness				0.226
Low	2432 (83.0)	1359 (46.4)	1073 (36.6)	
High	497 (17.0)	263 (9.0)	234 (8.0)	
Community Weighing Post Lansia (Posyandu Lansia)				0.411
Yes	439 (15.0)	251 (8.6)	188 (6.4)	
No	2490 (85.0)	1371 (46.8)	1119 (38.2)	
Religious Activity				0.639
Yes	2195 (74.9)	1221 (41.7)	974 (33.3)	
No	734 (25.1)	401 (13.7)	333 (11.4)	
Having Chronic Condition "Hypertension"				0.581
Yes	841 (28.7)	459 (15.7)	382 (13.0)	
No	2088 (71.3)	1163 (39.7)	925 (31.6)	
Having Chronic Condition "Diabetes"				0.620
Yes	198 (6.8)	113 (3.9)	85 (2.9)	
No	2731 (93.2)	1509 (51.5)	1222 (41.7)	
Smoking Behavior				0.953
Yes	1307 (44.6)	723 (24.7)	584 (19.9)	
No	1622 (55.4)	899 (30.7)	723 (24.7)	

Note: * $p < 0.05$.

Multivariate analysis

The multivariate logistic regression analysis in Table 2 illustrates the association between various factors and poor cognitive function among older adults. In Model 1 (unadjusted), poor cognitive function has a significant relationship with being unhealthy (OR=1.38; 95% CI=1.19-1.61), being

unhappy (OR=1.48; 95% CI=1.22-1.79), experiencing poor sleep quality (OR=0.53; 95% CI=0.42-0.68), and having depression (OR=1.22; 95% CI=1.04-1.44). Moreover, residing in urban areas (OR=0.81; 95% CI=0.70-0.94) and living on islands other than Java, Bali, and Sumatra (OR=0.66; 95% CI=0.54-0.81) are significantly associated with cognitive function. In Model 2 (adjusted), most associations remain significant, except for depression. Urban residence (OR=0.77; 95% CI=0.66-0.89), living on other islands (OR=0.61; 95% CI=0.50-0.76), being unhealthy (OR=1.28; 95% CI=1.09-1.51), and being unhappy (OR=1.30; 95% CI=1.06-1.59) continue to exhibit significant associations with poor cognitive function. These findings indicate that while several demographic and health-related factors influence cognitive function in older adults, urban living and regional differences play a notable role.

Table 2. Multivariate logistic regression

Variables	Categories	Model 1: Unadjusted Results			Model 2: Adjusted Results		
		OR	95% CI	*p-value*	OR	95% CI	*p-value*
Age (Years)	60 – 69	1.00	-	-	1.00	-	-
	70 – 79	1.13	0.96-1.33	0.139	1.08	0.91-1.28	0.366
	≥ 80	1.15	0.82-1.62	0.405	1.10	0.77-1.58	0.571
Sex	Male	1.00	-	-	1.00	-	-
	Female	1.01	0.88-1.17	0.806	0.95	0.76-1.19	0.702
Education Level	None or Elementary	1.00	-	-	1.00	-	-
	High School or Higher	1.06	0.92-1.23	0.393	1.12	0.96-1.30	0.144
Marital Status	Married	1.00	-	-	1.00	-	-
	Divorced	1.08	0.92-1.26	0.330	1.06	0.88-1.27	0.518
	Widow	1.13	0.76-1.69	0.520	1.16	0.77-1.76	0.458
Residence	Rural	1.00	-	-	1.00	-	-
	Urban	0.81	0.70-0.94	0.006*	0.77	0.66-0.89	0.001*
Region	Java & Bali	1.00	-	-	1.00	-	-
	Sumatra	1.07	0.85-1.33	0.546	1.01	0.80-1.27	0.927
	Other islands	0.66	0.54-0.81	0.000*	0.61	0.50-0.76	0.000*
Status Economy	Poor	1.00	-	-	1.00	-	-
	Median	0.90	0.77-1.06	0.239	1.01	0.86-1.20	0.847
	Rich	0.82	0.61-1.11	0.206	0.84	0.62-1.14	0.266
Currently Working	Yes	1.00	-	-	1.00	-	-
	No	1.16	0.99-1.35	0.053	1.14	0.97-1.34	0.104
Self-rated Health Status	Healthy	1.00	-	-	1.00	-	-
	Unhealthy	1.38	1.19-1.61	0.000*	1.28	1.09-1.51	0.003*
Happiness	Happy	1.00	-	-	1.00	-	-
	Unhappy	1.48	1.22-1.79	0.000*	1.30	1.06-1.59	0.012*
Sleep Quality	Poor	1.00	-	-	1.00	-	-
	Good	0.53	0.42-0.68	0.000*	0.60	0.47-0.78	0.000*
Depression	Yes	1.00	-	-	1.00	-	-
	No	1.22	1.04-1.44	0.014*	1.13	0.94-1.36	0.184
Loneliness	Low	1.00	-	-	1.00	-	-
	High	1.12	0.92-1.36	0.226	0.95	0.76-1.19	0.701
Community Weighing Post Lansia (Posyandu Lansia)	Yes	1.00	-	-	1.00	-	-
	No	1.09	0.88-1.33	0.411	1.12	0.90-1.38	0.289
Religious Activity	Yes	1.00	-	-	1.00	-	-
	No	1.04	0.88-1.23	0.639	1.00	0.84-1.19	0.969
Hipertension	Yes	1.00	-	-	1.00	-	-
	No	1.04	0.89-1.22	0.581	0.98	0.82-1.16	0.821
DM	Yes	1.00	-	-	1.00	-	-
	No	0.92	0.69-1.24	0.620	0.96	0.63-1.16	0.335
Smoking Behavior	Yes	1.00	-	-	1.00	-	-
	No	0.99	0.86-1.15	0.953	1.01	0.82-1.25	0.862

Note: * $p < 0.05$; OR: Odd Ratio; AOR: Adjusted Odd Ratio

Discussion

The primary objective of this study is to examine the various factors associated with cognitive function in older adults, including demographic variables as control factors. The data utilized for this investigation was obtained from the IFLS-5 2014 to 2015 dataset. Our analysis yielded significant associations between several factors and poor cognitive function: residence, region, self-rated health status, happiness, sleep quality, and depression. These associations maintained their significance even after adjustments were made for other variables. Notably, the prevalence of poor cognitive function among our study participants was 44.6%, which aligns with the findings of a previous study conducted on older individuals in Malaysia (Foong *et al.*, 2018). However, this prevalence is higher than that of older adults in China (Zhu *et al.*, 2017).

The results of our investigation underscore the significance of residence and region as influential demographic characteristics associated with poor cognitive function. It is important to note that, to the best of our knowledge, there has been a lack of prior studies examining cognitive function disparities based on residence and region in Indonesia. Existing research conducted in other countries consistently indicates that older adults residing in urban areas tend to exhibit a lower prevalence of poor cognitive function compared to their rural counterparts. This pattern has been observed in China (Luo *et al.*, 2019), Canada (Quick *et al.*, 2022), and Chicago (Guo *et al.*, 2022). One plausible explanation for this discrepancy is that urban-dwelling older individuals have greater access to social activities and healthcare resources. These environments provide opportunities for physical and cognitive engagement and social interactions, which may help mitigate the risk of cognitive decline (Tian *et al.*, 2024).

Furthermore, our study reveals that senior citizens residing outside of Java, Bali, and Sumatra potentially lead a more wholesome lifestyle and enjoy a stronger connection with nature. This phenomenon can be explained by lower levels of air pollution and improved accessibility to natural surroundings, which collectively contribute to enhanced physical and mental well-being. Moreover, close-knit communities enable older individuals to engage in more meaningful social interactions. Regarding subjective measures such as self-rated health status, happiness, and sleep quality, our findings indicate significant associations with cognitive function after conducting appropriate adjustments. This study aligns with previous research conducted by Alarcão *et al.* (2020); and Komura *et al.* (2023), highlighting the correlation between self-rated health status and cognitive function. Negative perceptions of health among older adults may potentially give rise to mental illnesses such as stress and depression. These conditions can disrupt cognitive function and heighten the likelihood of cognitive impairment, as observed in studies conducted by Ailshire *et al.* (2017); and Zuelsdorff *et al.* (2020). Particularly, depression can lead to social isolation and reduced motivation to partake in physical and mental activities, consequently exacerbating cognitive decline.

Psychological Well-Being (PWB) encompasses a composite measure that includes happiness and life satisfaction (Zhu *et al.*, 2022; Komura *et al.*, 2023) and emotional well-being, which have been found to play critical roles in the cognitive function of older adults (Foong *et al.*, 2018). Unhappiness is associated with an increased risk of mental health disorders, which in turn can lead to cognitive decline among older adults (Routledge *et al.*, 2017; Ramírez-Luzuriaga *et al.*, 2021; Torregrosa-Ruiz *et al.*, 2021). However, there are divergent findings in the aforementioned studies, as no consistent association between happiness and the rate of cognitive change over time was observed across cognitive tasks. This suggests that happiness may not be a reliable predictor of the rate of cognitive decline over time (Zhu *et al.*, 2024). Furthermore, unhappiness often disrupts sleep patterns (Kang *et al.*, 2017; Nakakubo *et al.*, 2017), possibly due to poor sleep quality in older adults, hampers the brain's rejuvenation process. This process is crucial for maintaining optimal cognitive function. Sleep disturbances, such as insomnia, can interfere with the quality of rest and disrupt the deep sleep phases, which are critical for memory consolidation and brain recovery. Consequently, older adults with poor sleep quality are more vulnerable to cognitive decline and cognitive issues such as decreased memory and concentration disturbance.

Several limitations need to be considered in research on factors influencing cognitive function in older adults. Firstly, the generalizability of results may be compromised due to limited sample sizes. Secondly, inconsistent outcomes may arise from the use of different measurement methods. Additionally, confounding effects from unidentified co-factors may affect the analysis. It is also necessary to note that cross-sectional studies cannot establish a causal relationship between the studied factors and cognitive function in older adults. Furthermore, respondent bias may occur if participants possess characteristics that do not represent the target population. Variability in cognitive function among older individuals is also a significant consideration, while limitations in data collection may restrict the diversity of data. Additionally, it is crucial to consider other variables, such as social contact and social support. The present study assessed cognitive function using only one question in the memory domain. Therefore, future research should strive to comprehensively measure cognitive function by incorporating all domains of cognitive performance.

Conclusion

The study highlights a prevalence rate of 44.6% which relates to poor cognitive function among the older adult population. Existing research supports the notion that cognitive function in older adults is influenced by various factors, underscoring the multifaceted nature of the aging process. Notably, self-rated health status, happiness, and sleep quality were all associated with cognitive function in both models examined. Further investigation is warranted to deepen our understanding of the interplay between these factors. Additionally, this knowledge can be leveraged to devise intervention strategies to promote cognitive health in the older adult population. Adopting a comprehensive approach that accounts for the various dimensions of older adults' lives is anticipated to enhance their quality of life and independence during aging.

Ethics approval

The questionnaires and procedures of the IFLS-5 received approval from the Institutional Review Board (IRB) at both the RAND Corporation in the United States and Universitas Gadjah Mada (UGM) in Indonesia (Sikoki *et al.*, 2016). All participants provided written informed consent during the initial interview before their involvement. Strict measures were implemented to ensure the anonymity and confidentiality of all participants' records.

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Competing interests

The author (s) declared no potential conflicts of interest to this article's research, authorship, or publication. "All the authors declare that there are no conflicts of interest."

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Underlying data

Derived data supporting the findings of this study are available from the corresponding author on request.

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