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Original Article

Sleep quality and cognitive function on self-rated health status among the elderly: Findings from the Indonesian family life survey (IFLS-5)

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Abstract

Cognitive decline poses a significant challenge for the elderly population globally. The aim of this study was to determine the prevalence of cognitive function and its associated factors among the elderly in the Indonesian family life survey's fifth wave (IFLS-5) conducted from 2014 to 2015. The study included elderly individuals aged 60 and above, excluding proxy respondents and those with missing data. Various socio-demographic, cognitive function and health-related variables were analyzed, including age, sex, education level, marital status, residence, region, economic status, current employment, self-rated health status, happiness, sleep quality, depression, loneliness, and chronic conditions. Multivariate logistic regression analysis was used to identify the factors associated with cognitive functions among the 2,929 elderly respondents. The results revealed that 44.6% of the respondents reported poor cognitive function. In the unadjusted model, residence (OR: 0.81; 95%CI: 0.70–0.94), region of other islands (OR: 0.66; 95%CI: 0.54–0.81), sleep quality (OR: 0.53; 95%CI: 0.42–0.68), self-rated health status (OR: 1.38; 95%CI: 1.19–1.61), happiness (OR: 1.48; 95%CI: 1.22–1.79), and depression (OR: 1.22; 95%CI: 1.04–1.44) showed significant associations with cognitive function. After adjusting for confounding factors, the association remained significant for residence (OR: 0.77; 95%CI: 0.66–0.89), regions other than Java, Bali, and Sumatra (OR: 0.61; 95%CI: 0.50–0.76), self-rated health (OR: 1.28; 95%CI: 1.09–1.51), happiness (OR: 1.30; 95%CI: 1.06–1.59), and sleep quality (OR: 0.60; 95%CI: 0.47–0.78). These findings emphasize the necessity of interventions aimed at enhancing sleep quality and overall health in order to preserve cognitive function among the elderly, thus potentially improving their quality of life. Implementing comprehensive health programs could significantly enhance the overall quality of life for the aging population, especially the elderly population.

Keywords: Cognitive function, sleep quality, depression, self-rated health, quality of life

Introduction

Cognitive function is an important aspect of an individual's quality of life, especially in the elderly [1]. It encompasses abilities such as thinking, remembering, and decision-making [2].

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Cognitive decline poses significant challenges for the elderly, increasing the risk of diseases such as dementia and Alzheimer's disease [3-5]. Various factors influence cognitive function in the elderly, including social contact [1], social support [5], sleep quality [3,6,7], self-rated health [8,9], depression [10-12], social isolation, loneliness [2,5], and overall well-being [5,13]. Good quality sleep is one of the key factors in maintaining cognitive function [3]. Sufficient and quality sleep plays a role in brain recovery, memory consolidation, and emotional regulation [7]. However, the elderly often experience sleep disturbances such as insomnia and other sleep disorders. Studies have shown that chronic sleep disturbances can contribute to cognitive decline and increase the risk of dementia [14,15]. Some other studies also suggest that poor sleep quality may become more prevalent with decreasing cognitive function [6,16,17], with approximately one-third of the elderly reporting poor sleep quality [8].

The relationship between sleep disturbances and cognitive decline in the elderly remains controversial. A previous study found no significant difference in cognitive function between groups with good and poor sleep quality [8]. Additionally, studies found that older individuals with poor sleep are more likely to experience symptoms of depression rather than cognitive decline, often leading to a higher use of sleeping pills [3,7]. This is supported by previous studies suggesting depressive symptoms can be a risk factor or symptom of cognitive decline [12,18,19]. In the elderly, psychological well-being can be influenced by factors such as loneliness, depression, and lack of social support. Low well-being may negatively impact cognitive function. There is a significant positive relationship between variables of social isolation or loneliness and cognitive function variables [2,5], as well as a substantial improvement in variables such as the quality of life in the elderly [5], social relationships [20], health status [9], and well-being [5,13] with cognitive changes. Therefore, the elderly with good cognitive function tend to view themselves positively [21]. General health, such as chronic diseases like hypertension, diabetes, and cardiovascular diseases, is associated with cognitive decline [9]. Consequently, good health management and prevention of chronic diseases can help maintain cognitive function in the elderly [9].

In Indonesia, the issue of cognitive decline is becoming increasingly relevant alongside the significant rise in the elderly population. According to the Indonesian Central Bureau of Statistics, the elderly population reached approximately 11.75% in 2023 [22]. This figure is expected to continue to rise with the growing older population. Therefore, a deep understanding of factors associated with cognitive function in the elderly becomes increasingly important to support the well-being and quality of life of this population group. Meanwhile, studies on sleep quality, general health, and cognitive function in the elderly are still limited. More in-depth research is needed to explore how geographic diversity, urban versus rural residency, self-rated health, happiness, and sleep quality impact cognitive functioning in the elderly. The aim of this study was to estimate the prevalence of cognitive function and associated factors in the elderly in Indonesia. This will contribute to improving the quality of life of the elderly and reducing the public health burden in Indonesia.

Methods

Data source and design

A cross-sectional study was conducted using secondary data from the fifth wave of the Indonesian family life survey (IFLS-5) in 2014–2015. This dataset is available for researchers who comply with Research and Development (RAND) Corporation guidelines (available at RAND IFLS [23]). The IFLS survey adopted stratified sampling for provinces and rural/urban locations across 13 provinces of the total 27 provinces in 2014–2015. Each of these provinces included enumeration areas (EAs) that were randomly chosen from a nationally representative sample. A total of 321 EAs were randomly chosen, with oversampling of urban EAs and those in smaller provinces to support urban-rural locations. In each EA, households were randomly selected based on the national census records, with 20 households sampled from urban EAs and 30 from rural ones. The survey gathered extensive sociodemographic, economic, and health data, including self-reported health and symptoms. The IFLS-5 (2014–2015) survey consisted of individuals, families, households, and communities tracked for over 20 years, employing a stratified sampling method

for rural and urban locations within these strata, also including additional cognition modules, health, and retirement survey (HRS), personality module, big five index, subjective well-being on positive and negative affect, sleep disturbance and sleep impairment. This represented a total Indonesian population sample size of approximately 83% living in the 13 provinces across 321 EAs. The study focused on the elderly population aged 60 and older, excluding proxy respondents and cases with missing data.

Variables and measurements

The demographic variables included age (60–69, 70–79, and ≥80 years), sex (male or female), educational attainment (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. The economic status was assessed using the question: "Please imagine a six-step ladder where on the bottom step stand the poorest people and on the top step stand the richest people. On which economic step are you today?" Those responded options of "step 1 and 2" being recorded as poor, "step 3 and 4" being recorded as medium, and "step 5 and 6" being recorded as rich.

Additional independent variables assessed in this study included current working status, self-rated health status, happiness, depression, loneliness, participation in local community weighing posts for the elderly (*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 seven 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 for Epidemiologic Studies Depression Scale 10 (CESD-10) [24], which included ten questions about how often participants experienced certain feelings in the past week. Each item was rated on a Likert scale from 0 to 3, resulting in a total score ranging from 0 to 30. Participants with scores greater than 10 were classified as having depression, while those with scores less than 10 were classified as not having depression. Loneliness was evaluated with the question, "How often did you feel lonely in the past week?" with response options "Rarely" or "Some of the time" recorded as low and "Occasionally" or "Most of the time" recorded as high. Community participation in the village over the past 12 months was assessed through two activities: (1) "Community weighing post for the elderly," recorded as "Yes" or "No," and (2) "Religious activities (prayer groups)" also recorded as "Yes" or "No." Chronic conditions such as hypertension and diabetes were assessed by doctors. Smoking behavior was assessed with the question, "Have you ever chewed tobacco, smoked a pipe, or smoked cigarettes?" and the responses were "Yes" or "No."

The dependent variable in this study was the cognitive functioning of the elderly. It was assessed with the questions, "How would you rate your memory at present? The possible responses were "Excellent," "Very good," "Good," "Fair," or "Poor." For the analysis, responses with "Fair" or "Poor" were recorded as poor, while "Excellent," "Very good," and "Good" were recorded as good.

Data collection

The IFLS-5, conducted in 2014–2015, employed a rigorous methodology to ensure the reliability and representativeness of the data collected. The survey encompassed approximately 83% of the national population and utilized stratified sampling to include both urban and rural areas. Trained surveyors conducted face-to-face interviews in participants' homes, gathering extensive data on demographics, health, economic status, and family dynamics. The emphasis on elderly respondents (aged 60 and older) included assessments of cognitive function, physical health, and social participation, alongside modules focusing on depression, sleep quality, and overall well-being. The survey was conducted over several months, with interview durations varying according to household size and the level of detail provided in responses. This methodology facilitated

comprehensive data collection across a wide array of factors, thereby enhancing the validity of the findings.

Statistical analysis

The Chi-squared test was used to compare characteristics between good and poor cognitive function. The multivariate logistic regression analysis was employed to identify significant factors associated with cognitive function among the elderly. 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 (SPSS Inc., Chicago, USA).

Results

Characteristics of respondents

A total of 2,929 elderly respondents were included in this study, as presented in **Table 1**. Approximately 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, 15% and 74.9% engaged in community weighing post for the elderly and religious activities, respectively. Out of all respondents, 28.7% had chronic conditions such as hypertension, 6.8% had diabetes, and 44.6% were smokers. Concerning cognitive function, 44.6% of respondents reported having poor cognitive function.

Univariate analysis assessing factors associated with cognitive function in elderly

Univariate analyses using the Chi-squared test revealed that type of residence, region, self-rated health status, happiness status, sleep quality, and the presence of depression were significantly associated with cognitive function among the elderly (**Table 1**).

Table 1. Characteristics of the respondents and univariate analysis showing factors associated with cognitive function (n=2,929)

Variables	Frequency (%)	Cognition function (n (%))		*p*-value
		Good (n=1622)	Poor (n=1307)	
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)	
Educational attainment 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				<0.001**
Java and 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)	
Economy status				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)	

Variables	Frequency (%)	Cognition function (n (%))		*p*-value
		Good (n=1622)	Poor (n=1307)	
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				<0.001**
Healthy	1845 (63.0)	1077 (36.8)	768 (26.2)	
Unhealthy	1084 (37.0)	545 (18.6)	539 (18.4)	
Happiness				<0.001**
Happy	2415 (82.5)	1379 (47.1)	1036 (35.4)	
Unhappy	514 (17.5)	243 (8.3)	271 (9.3)	
Sleep quality				<0.001**
Poor	305 (10.4)	127 (4.3)	178 (6.1)	
Good	2624 (89.6)	1495 (51.0)	1129 (38.5)	
Depression				0.014*
No	2106 (71.9)	1196 (40.8)	910 (31.1)	
Yes	823 (28.1)	426 (14.5)	397 (13.6)	
Loneliness				0.226
Low	2432 (83.0)	1359 (46.4)	1073 (36.6)	
High	497 (17.0)	263 (9.0)	234 (8.0)	
Engagement with community weighing post for the elderly				0.411
Yes	439 (15.0)	251 (8.6)	188 (6.4)	
No	2490 (85.0)	1371 (46.8)	1119 (38.2)	
Engagement with 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 hypertension				0.581
Yes	841 (28.7)	459 (15.7)	382 (13.0)	
No	2088 (71.3)	1163 (39.7)	925 (31.6)	
Having diabetes				0.620
Yes	198 (6.8)	113 (3.9)	85 (2.9)	
No	2731 (93.2)	1509 (51.5)	1222 (41.7)	
Smoking				0.953
Yes	1307 (44.6)	723 (24.7)	584 (19.9)	
No	1622 (55.4)	899 (30.7)	723 (24.7)	

* Statistically significant at p=0.05
** Statistically significant at p=0.001

Multivariate analysis assessing factors associated with cognitive function in the elderly

Our unadjusted model indicated that being unhealthy (OR: 1.38; 95%CI: 1.19–1.61), being unhappy (OR: 1.48; 95%CI: 1.22–1.79), and having depression (OR: 1.22; 95%CI: 1.04–1.44) were associated with poor cognitive function (**Table 2**). Moreover, those 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) and experiencing good sleep quality (OR: 0.53; 95%CI: 0.42–0.68), were significantly associated with cognitive function (**Table 2**).

In the adjusted model, most associations remained significant, except for depression. Those living in urban residences (OR: 0.77; 95%CI: 0.66–0.89), on islands other than Java, Bali and Sumatra (OR: 0.61; 95%CI: 0.50–0.76), and experiencing good sleep quality (OR: 0.60; 95%CI: 0.47–0.78), were more likely to have good cognitive function, while being unhealthy (OR: 1.28; 95%CI: 1.09–1.51), and being unhappy (OR: 1.30; 95%CI: 1.06–1.59) were associated with poor cognitive function (**Table 2**). These findings indicate that while several demographic and health-related factors influence cognitive function in the elderly, urban living and regional differences play a notable role.

Table 2. Factors associated with poor cognitive function among the elderly

Variables	Categories	Unadjusted results			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	-	-

Variables	Categories	Unadjusted results			Adjusted results		
		OR	95%CI	*p*-value	OR	95%CI	*p*-value
Education level	Female	1.01	0.88–1.17	0.806	0.95	0.76–1.19	0.702
	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 and 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	<0.001**	0.61	0.50–0.76	<0.001**
Economy status	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	<0.001**	1.28	1.09–1.51	0.003*
Happiness	Happy	1.00	-	-	1.00	-	-
	Unhappy	1.48	1.22–1.79	<0.001**	1.30	1.06–1.59	0.012*
Sleep quality	Poor	1.00	-	-	1.00	-	-
	Good	0.53	0.42–0.68	<0.001**	0.60	0.47–0.78	<0.001**
Depression	No	1.00	-	-	1.00	-	-
	Yes	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 for the elderly	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
Hypertension	Yes	1.00	-	-	1.00	-	-
	No	1.04	0.89–1.22	0.581	0.98	0.82–1.16	0.821
Diabetes	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

* Statistically significant at p=0.05
** Statistically significant at p=0.01

Discussion

Our analysis revealed significant associations between poor cognitive function and several factors, including residence, region, self-rated health status, happiness, sleep quality, and depression. These associations remained significant even after adjusting for other variables. Notably, 44.6% of our respondents exhibited poor cognitive function, a prevalence consistent with findings from a previous study on older adults in Malaysia [25]. However, this prevalence is higher than that of the elderly in China [26].

Our findings highlight the significant influence of residence and region as key demographic factors associated with poor cognitive function. To the best of our knowledge, no prior studies have explored cognitive function disparities based on residence and region in Indonesia. However, studies from other countries consistently showed that elderly individuals living in urban areas tend to have a lower prevalence of poor cognitive function compared to their rural counterparts; this pattern has been observed in China [27], Canada [28], and Chicago [29]. 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 [30].

Furthermore, our study revealed that the elderly residing outside Java, Bali, and Sumatra could 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 access to natural surroundings, which collectively contribute to enhanced physical and mental well-being [31]. Moreover, close-knit communities enable the elderly 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 even after conducting appropriate adjustments. This study aligns with previous studies highlighting the correlation between self-rated health status and cognitive function [32,33]. Negative perceptions of health among the elderly may potentially give rise to mental illnesses such as stress and depression. These conditions align with the findings of previous studies which demonstrate a disruption in cognitive function and an increased risk of cognitive impairment [34,35]. Particularly, depression can lead to social isolation and reduced motivation to partake in physical and mental activities, consequently exacerbating cognitive decline.

Psychological well-being is a multifaceted concept that includes elements such as happiness, life satisfaction [15,33], and emotional well-being, which have been found to play critical roles in the cognitive function of the elderly [25]. Unhappiness is associated with an increased risk of mental health disorders, which in turn can lead to cognitive decline among the elderly [36-38]. 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 [39]. Furthermore, unhappiness often disrupts sleep patterns [3,16], leading to poor sleep quality in the elderly and thus hampering 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 [24]. As a result, elderly individuals with poor sleep quality are at a higher risk of experiencing cognitive decline, including memory loss and concentration difficulties [3,40]. While poor sleep quality does not directly cause cognitive impairment, it exacerbates existing vulnerabilities, particularly in the aging population [41]. Thus, it is essential to address sleep issues early, as improving sleep quality can support cognitive health and delay decline.

Several limitations need to be considered in this study on factors influencing cognitive function in the elderly. Firstly, the generalizability of the 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 the elderly. 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

This study presents a prevalence rate of 44.6% for poor cognitive function within the elderly population. The existing body of literature supports the notion that a multitude of factors influence cognitive function in older adults. Prior to adjustment, residence, region, sleep quality, self-rated health status, happiness, and depression were found to be significant factors associated with cognitive function. After controlling for other variables, residence, region, self-rated health, happiness, and sleep quality maintained their significant associations with cognitive function. Further research is warranted to deepen our comprehension of the intricate interactions among

these factors. This knowledge can subsequently inform the development of targeted interventions designed to promote cognitive health within the elderly population. Adopting a holistic approach that encompasses various dimensions of older adults' lives is anticipated to augment their quality of life and independence as they age.

Ethics approval

The questionnaires and procedures of the IFLS-5 received approval from the Institutional Review Board (IRB) at both the RAND Corporation, California, United States and Universitas Gadjah Mada (UGM), Yogyakarta, Indonesia [42]. 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

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.

How to cite

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