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Relationship Between Socioeconomic Status and Depression in Older Adults: The Roles of Cognitive Function and Sleep Quality

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Background: Socioeconomic status (SES) is an important social factor associated with a wide range of health outcomes, but this relationship could be influenced by individual's intrinsic factors. The aim of this study was to examine the relationship between SES and depressive symptoms, the mediating role of cognitive function, and the moderating role of sleep quality in community-dwelling older adults.

Methods: A total of 1000 community-dwelling older adults were recruited for the cross-sectional study. Socioeconomic factors, cognitive function, sleep quality, and related covariates were investigated or assessed. Mediating and moderating effects were analyzed using R 4.2.2 and SPSS 25.0 software.

Results: The results showed that SES was negatively associated with depressive symptoms (β=−0.234, $p<0.001$) and positively associated with cognitive function (β=0.566, $p<0.001$) after controlling for covariates; cognitive function played a partial mediating role between SES and depressive symptoms, and the indirect effect was β=−0.09 (95% CI: −0.129~ −0.06, $p<0.001$), accounting for 38.5% of the total effect; and sleep quality positively moderated the mediating effect of cognitive function on relationship between SES and depressive symptoms ($\beta_{sleep\ \times cognition}$ =−0.015, $p<0.05$).

Conclusion: Depressive symptoms in community-dwelling older adults are affected by their SES and cognitive function. Improving individual cognitive ability and sleep quality can effectively reduce depression in community-dwelling older adults with low SES.

Keywords: socioeconomic status, depressive symptoms, cognitive function, sleep quality, cross-sectional study

Introduction

Depression is a common mental disorder that severely limits psychosocial functioning, and has been become a major public health problem worldwide.[1] It is estimated that approximately 3.8% of the population experience depression, including 5.0% of adults and 5.7% of older adults over 60 years old.[2] According to a national study in China, the weighted 12-month prevalence of depression in adults was up to 3.6%, and the lifetime prevalence reached 6.8%.[3] Depressive symptoms, such as persistent sadness, irritability, emptiness or fatigue, are more common in adults, with an average 20.22% in the healthy Chinese population and a 31.3% in people with chronic diseases.[4]

According to the results of the Global Burden of Diseases, Injuries, and Risk Factors Study, depression is one of the most disabling mental disorders.[5] Another serious danger of depression is that it can lead to an increased risk of suicide.[6,7] Depressive symptoms that do not meet the criteria for depression can occur in a variety of short-term contexts and are associated with significant emotional distress, future mental illness and impaired daily functioning. Depression/depressive symptoms increase with age and are more common in older people, with prevalence reaching its peak in later life.[8–10] One 4 year of follow-up study reported 22.3% of incidence of depressive symptoms in community-dwelling older adults in China.[11] Moreover, depression/depressive symptoms in later life have specific characteristics and the more serious consequences, not only negatively affecting physical health and increasing the risk of suicide, cardiovascular

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disease and co-morbidity,[12] but also accelerating the aging process, leading to deterioration in physical and cognitive functioning, the quality of life and even mortality.[13,14] However, understanding of the pathophysiology of depression is still incomplete and no single model or mechanism can currently satisfactorily explain all aspects of this disorder.[1] Therefore, identification of biological and psychosocial risk factors for depression may be more useful for effective management and intervention.

Depression in later life is the result of a complex interaction of social, psychological, and biological factors.[15,16] As one of the most important social factors, socioeconomic status (SES), a comprehensive concept of the social and economic factors that influence the positions of individual within the structure of a society, has been identified as both a cause and an effect of many mental disorders.[17] Three main variables of SES, including educational qualification, occupational status, and income levels, have been widely investigated in research on health-related inequality.[18] Epidemiological research shows that there is a gradient in the relationship between SES and mental health, with lower SES and more frequent mental health problems.[19–21] Specifically, anxiety and mood disorders such as depression are more likely to be influenced by socioeconomic inequality,[22,23] and lower SES is correlated with an increased likelihood of depression.[24] Some characteristics of low SES, such as poverty, unemployment, material deprivation, limited access to education, reduced economic prospects, have been identified as the psychosocial risk factors that have long-term effects on mental health outcomes,[25] and individuals with these characteristics are particularly vulnerable to depressive symptoms/ depression.[26,27] However, it is clear that the effects of SES on individual mental health outcomes are complex and non-static, and may be moderated by biological, social and psychological factors across the life course.[28]

Studies have shown that depression increases the risk of cognitive impairment in older adults.[29,30] In turn, cognitive impairment has an important impact on depression.[31] Age-related cognitive decline in older adults can affect their ability to lead an active and productive lives, and further lead to a decrease in interpersonal contact with those around them, increasing the likelihood of depression.[32] Cognitive impairment and depression often coexist in the elderly population and reciprocally increase disease risk, and their bidirectional relationship can be explained by the psycho-immune-neuroendocrine network model, in which they may share the same pathophysiological subnetworks, such as neuroinflammation, hypothalamic-pituitary-adrenal axis overactivity and impaired neurotrophic support.[33] There is a growing body of evidence that the SES component, such as income, wealth, and education, is an important determinant of cognitive health in older adults and individuals with low SES have a higher risk of developing dementia and cognitive impairment.[19,34,35] Previous studies have also found that the experience of socioeconomic adversity, especially in early adulthood, can disrupt the structural and functional brain networks involved in affect and cognition, leading to an increased risk of psychopathology (eg, depressions).[36,37] As a result, cognitive ability may be involved in the process of SES on the psychopathology of depression. In other words, cognition may mediate the relationship between the SES and depression in older adults.

However, the relationships between the SES, cognition and depression are complex. As one of the factors closely related to cognition and psychology, sleep has important regulatory functions for mental health and plays a crucial role in brain maturation and synaptome architecture, as well as in the development and maintenance of cognitive and mental health.[38,39] Sleep deprivation and sleep disorder, especially insomnia, can promote allostatic overload and neurotoxins accumulation in brain tissue, impairing brain neuroplasticity and stressing immune pathways, contributing to cognitive and mental disorders.[40] The prevalence of sleep disorder increases dramatically with advancing age,[41] and studies have shown that sleep deprivation or sleep disorder in older adults was significantly correlated with a high risk of depression.[42–44] Existing studies have also found that poor sleep quality is a major contributor to cognitive impairment in patients with depression, which has been linked to changes in pro-inflammatory cytokines and synaptic plasticity.[45,46] Therefore, sleep quality may play a moderating role in the relationship between cognitive function and depression in older adults.

Drawing on the literature reviewed about, although previous studies paid attention to the relationship between SES, cognitive impairment, sleep disorder and depression; cognition may play an important role in linking SES and affective processes through related brain function, whereas sleep has a regulatory effect on cognitive and mental health by brain repair.[47–49] Moreover, it is unclear that the mediating and moderating roles of cognitive function and sleep quality on relationship between SES and depression in older adults.

Methods

Research Model

To investigate the underlying mechanisms of SES and depression in community-dwelling older adults. Specifically, we developed a moderated mediation model to test the following hypothesis (Figure 1):

Hypothesis 1. SES negatively predicts depression in community-dwelling older adults.

Hypothesis 2. SES significantly predicts depression through the mediating role of cognitive function.

Hypothesis 3. Cognitive function significantly predicts depression through the moderating effect of sleep quality.

Participants and Procedures

A total of 1000 community-dwelling older adults were recruited from the community in Shanghai, China, by the convenience sampling method. Eligible participants were aged 60 years and older, had lived in their current location for more than 5 years, and gave informed consent. Face-to-face interviews were conducted to collect variable information after obtaining informed consent. Data were collected between 1 November 2022 and 1 May 2023. After excluding 21 participants who refused to complete the survey, a total of 979 eligible older adults were included.

Measures

Socioeconomic Status

SES was commonly reflected by these indicators, such as education level, occupation, income, wealth, and deprivation.[50] The socioeconomic indicators in this study were mainly involved three socioeconomic factors (ie, income, educational attainment and occupational experience before retirement). To reflect the lifetime exposures of community-dwelling older individual to socioeconomic conditions, this study identified the retirement pension, education and training experience, and occupational complexity as the indicators of income, educational attainment and occupational experience of each participant. Due to the well-established pension insurance system of Shanghai, most of the community-dwelling older adults in Shanghai had a fixed pension, and the retirement pension is generally calculated according to the individual's social pension contributions paid during their working life, and the individual's pension contributions are positively proportional to their wage income. For this reason, the retirement pension can be used as an indicator to assess the economic level of the elderly before their retirement. Educational attainment in this study was measured by a combined score of years of formal education and vocational courses or training, with each year of primary, secondary and high

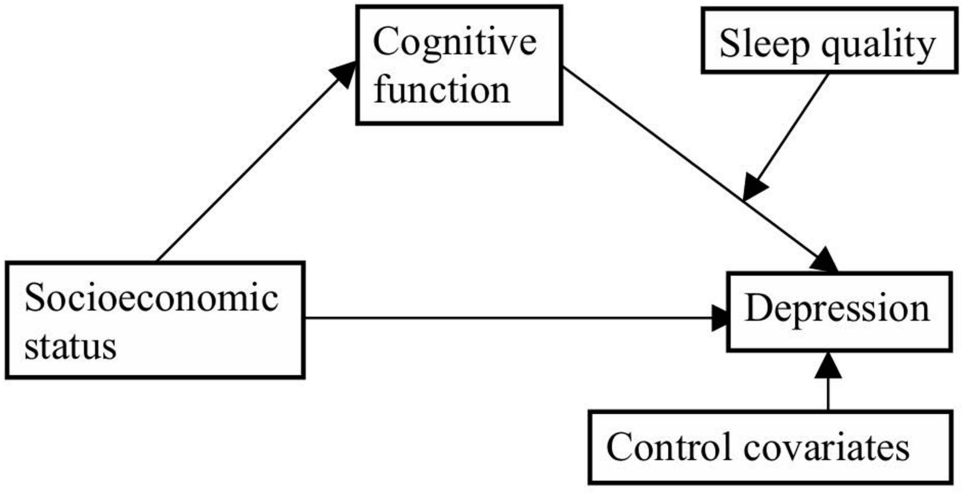

Figure 1 The proposed moderated mediation model.

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school given 1 point if successfully completed, and the vocational course or training given 0.5 points for each 6-month course. Occupational complexity was calculated as the score of the product of the level and years of occupational exposure in adulthood, and was used as a proxy for occupational experience.[51] The level of occupational exposure was divided into six categories, from one to six, according to the type of work activity: low-skilled manual work, skilled manual work, skilled non-manual, technical work, professional work, and highly intellectual work. The raw values of the income, education and occupation indicators were first standardized, then an index of each indicator was calculated using the principal component analysis, and the weights of the first component given by the eigenvectors of the correlation matrix were used as the corresponding weight to calculate the SES index, and finally they were summed to form an overall index representing SES, with higher values indicating a higher level of SES. In this study, the full range of the SES index was calculated from −7.53 to 9.5 with a mean value of zero and an SD of 2.03.

Depressive Symptoms

Participants' depressive symptoms were assessed using the Chinese version of the 15-item Geriatric Depression Scale (GDS-15). This scale consists of 15 items with a satisfactory reliability and validity.[52] For each item, participants were asked to answer "yes" or "no" according to their personal circumstances, with scores of 1 and 0 respectively. The total score ranges from 0 to 15, with scores above 5 suggesting the presence of depression symptoms and higher scores indicating a greater degree of depression.

Cognitive Function

Cognitive function of the participants was assessed using the Montreal Cognitive Assessment (MoCA) scale (Beijing version). The MoCA scale consists of eight sub-dimensions of cognitive function, each of which assesses respectively the visuospatial/executive function, naming, memory, attention, verbal fluency, abstraction, delayed recall and orientation. The maximum score on the MoCA scale is 30 points, with the higher scores indicating better cognitive functioning.[53]

Sleep Quality

Sleep quality in this study was assessed using the Chinese version of the Pittsburgh Sleep Quality Index (PSQI) with a Cronbach's alpha coefficient of 0.713.[54] The PSQI consists of 19 self-rated questions covering seven factors: subjective sleep quality, sleep latency, sleep duration, sleep efficiency, sleep disturbances, use of sleep aids, and daytime functioning. Each factor is scored from 0 to 3 based on the questions answered. The total score for all factors ranges from 0 to 21. A total score above 5 indicates poor sleep quality, with the higher scores indicating worse sleep quality.

Covariates

Participants' demographic characteristics (eg, age, sex, height, weight, marital status, place of residence), lifestyle (eg, smoking, drinking), and health status (eg, chronic diseases) were assessed using a self-designed questionnaire. Body mass index (BMI) was calculated as body weight (kg) divided by the square of height (m). Nutritional status was assessed using the Chinese version of the Mini Nutritional Assessment Short Form (MNA-SF).[55] The definition and assignment of the variables are shown in Table 1.

Table 1 Variable Definition and Assignment

Variables	Variable Definition and Assignment
Dependent variable	
Depressive symptoms	GDS scores. Value range: 0–15
Independent variable	
SES index	An overall index based on the principal component analysis

(*Continued*)

Table 1 (Continued).

Variables	Variable Definition and Assignment
Mediating and moderating variables	
Cognitive function	MoCA scores. Value range: 0–30
Sleep quality	PSQI Scores: value range: 0–21
Covariates	
Age	1=60-65 years old; 2=66-75 years old; 3=71-75 years old; 4=more than 75 years old.
Sex	1=male; 2=female
Marital status	1=married and living with a spouse; 2=separated (widowed or divorced)
Smoking status	1=current smoking; 2=never or quit smoking
Drinking status	1=current drink; 2=never or occasional drinking
BMI (kg/m^2)	1=less than 24; 2=more than or equal to 24.
Nutritional status	MNA scores: 1=less than 12 scores; 2=more than and equal to 12
Co-morbidities	1=none; 2=one chronic disease; 3=more than two diseases

Statistical Analysis

IBM SPSS Statistics software (version 25) and the R statistics 4.2.2 program were used for all the statistical analyses, and the difference was considered statistically significant with a 95% confidence interval (95% CI) or $P<0.05$ on both sides. Missing data were imputed using the multiple imputation method based on the fully conditional specification. Continuous variables were described as either means± standard deviation (SD) or median (interquartile range). Categorical variables were presented as frequencies and percentages (%). For continuous data, comparisons were conducted using the independent samples *t*-test or F-test if the distribution was normal, otherwise using the Mann–Whitney *U*-test. Categorical data were compared using the chi-squared test. Pearson correlation coefficients were used to assess the relationship between depression, SES, cognitive function and sleep quality. Multiple regression analysis was performed to calculate the mediating effect of cognitive function on the relationship between SES and depression, and bootstrapping and sensitivity were used to verify the significance of the indirect effect and the robustness of the results. Hierarchical regression analysis was conducted to examine the moderating effect of sleep quality on the relationship between cognitive ability and depression.

Results

Analysis for Common Method Bias

The Harman single-factor test with the untwisted principal component factor method was used to analyze the potential common method bias for all variables in the current data. The results showed that the first factor explained 17.57% of the variance, which is less than the critical threshold of 40%. Therefore, it can be shown that there was no significant common method bias in the current research data.

Baseline Characteristics of Samples

Of the 979 eligible participants, 57.4% of them were female. The average age of participants was 69.9 years (SD=6.75 years). Table 2 shows the comparison of depressive scores (SDS scores) in different characteristics of demographic and covariate variables among participants. Age, BMI, marital status, smoking and nutritional status significantly influenced participants' SDS scores. Correlational analysis showed that the SES index and cognitive function (MoCA scores) were negatively correlated with depressive scores, while sleep quality (PISQ scores) was positively correlated with depressive scores (Table 3).

Test of Mediating Effect

After controlling age, gender, marital status, BMI, smoking status and MNA, the first regression analysis showed that SES significantly positively predicted cognitive function ($\beta=0.566$, $p<0.001$); the second regression analysis showed SES

Table 2 Participants' Characteristics and Comparison of Depressive Scores (n=979)

Characteristics		N (%)	SDS (Scores) Mean (SD)	P value
Gender	Male	413 (42.4)	5.51±3.51	
	Female	564 (57.6)	5.14±3.57	0.101
Age (years)	<=65	288 (29.4)	4.61±3.24	
	66~70	336 (34.3)	5.07±3.39	
	71~75	169 (17.3)	5.78±3.72	
	>75	185 (18.9)	6.34±3.87	<0.001
BMI (kg/m^2)	<24	586 (59.9)	5.57±3.66	
	≥24	374 (38.2)	4.84±3.35	0.002
Marital status	Married	848 (86.6)	5.09±3.44	
	Separated	131 (13.4)	6.68±3.97	<0.001
Smoking	Yes	177 (18.1)	5.84±3.59	
	No or quit	802 (81.9)	5.18±3.53	0.028
Drinking	Yes	154 (15.7)	5.57±3.77	
	No or quit	825 (84.3)	5.25±3.51	0.329
Co-morbidities	None	163 (16.6)	4.90±3.42	
	1	375 (38.3)	5.40±3.57	
	≥2	242 (24.7)	5.37±3.49	0.280
Nutrition status (MNA, scores)	<=12	167 (17.1)	5.0 (2.68~9.0)	
	>12	812 (82.9)	4.0 (2.0~8.0)	0.017

Table 3 Descriptive Statistical Results and Correction Analysis Between Dependent and Moderating Variables (Pearson Correlation Coefficient)

Variables	Mean (SD) Median (25%~75%)	Depressive Symptom	SES Index	Cognitive Function	Sleep Quality
Depressive symptom (SDS, scores)	5.30 (3.55)	1			
SES index	0 (2.03)	−0.154**	1		
Cognitive function (MoCA, scores)	20.01 (5.46)	−0.300**	0.237**	1	
Sleep quality (PSQI scores)	4.65 (2.99)	0.121**	−0.022	−0.171**	1

Note: **p<0.01.

significantly negatively predicted depressive symptoms (β=−0.234, p<0.001); the third regression analysis also showed that cognitive function significantly negatively predicted depressive symptoms (β=−0.159, p<0.001), and the negatively predictive effect of SES on depressive symptoms remained significant (β=−0.144, p<0.001), and indicating that cognitive function serves as a partial mediator between SES and depressive symptoms in community-dwelling older adults (Table 4). Further, to test the indirect effect, the Bootstrap analysis showed that the total effect estimate was β=−0.233 (95% CI: −0.336~ −0.130, P<0.001); the average direct effect estimate (ADE) was β=−0.143 (95% CI: −0.246~ −0.04, P=0.006); the average causal mediation effect estimate (ACME) of cognitive function was β=−0.09 (95% CI: −0.128~ −0.056, P<0.001), accounting for 38.5% of the total effect (Figure 2A). This indicated that cognitive function has a significant partial mediation effect between SES and depression. Sensitivity analysis showed that the sensitivity parameter ρ was less than −0.3, the ACMEs of cognitive function would have a positive value contrary to this study result, indicating that the mediation model is robust (Figure 2B).

Test of the Moderating Effect

To examine the moderating effect of sleep quality on the relationship between cognitive function and depressive symptoms, we used Model 14 from Hayes's PROCESS macro for SPSS. The results obtained after controlling for age, gender, marital

Table 4 Mediation Effect Test (N=979)

Dependent Variable	Independent Variable	R^2	F	β	SE	t
Cognitive function	SES	0.133	20.85***	0.566	0.082	6.915***
Depression	SES	0.082	12.051***	−0.234	0.055	−4.278***
Depression	SES	0.134	18.274***	−0.144	0.055	−2.644***
	Cognitive function			−0.159	0.021	−7.541***

Notes: Control variables: Age, gender, Marital status, BMI, smoking status, MNA. ***p<0.001.

status, BMI, smoking status and MNA are presented in Table 5. The interaction effect between cognitive function and sleep quality on depressive symptoms was significant (β=−0.015, p<0.05), with the index of moderated mediation being −0.009 (95% CI: −0.018~ −0.001), indicating that sleep quality had a significant moderating effect on the relationship between cognitive function and depressive symptoms. Johnson-Neyman analysis showed that the slope of cognitive function is significant (p<0.05) when the range of observed value of PSQI is from 0 to 16 scores (Figure 3A).

To further examine the moderating effect of sleep quality on the relationship between cognitive function and depressive symptoms, participants were divided into two groups according to 5 scores of PSQI: (normal sleep and poor sleep). The predictive effect of cognitive function on depressive symptoms was then examined separately in each group. As shown in Figure 3B, among community-dwelling older adults with a normal sleep, cognitive function had a significantly negatively predictive effect on depressive symptoms (β=−0.14, p<0.001.) for community-dwelling older adults with poor sleep quality, cognitive function also significantly negatively predicted depressive symptoms (β=−0.216, p<0.001), and the effect was strengthened.

Discussion

This study found the negative relationship between socioeconomic status and depressive symptoms in community-dwelling older adults, as well as the mediating role of cognitive function and the moderating effect of sleep quality. The results indicated that community-dwelling older adults with higher SES perceived higher cognitive function and lower depressive symptoms, while cognitive function partially mediated the relationship between SES and depressive symptoms, but this effect could be moderated by sleep quality.

Consistent with previous research, the present study confirmed that the SES can predict cognitive function, with individuals from higher SES having better cognitive function.[56,57] Higher socioeconomic conditions across life stages were independently and cumulatively associated with better neural or cognitive outcomes, as reflected by increased cortical thickness, grey matter volume, fractional anisotropy and network segregation in adults.[58,59] In addition,

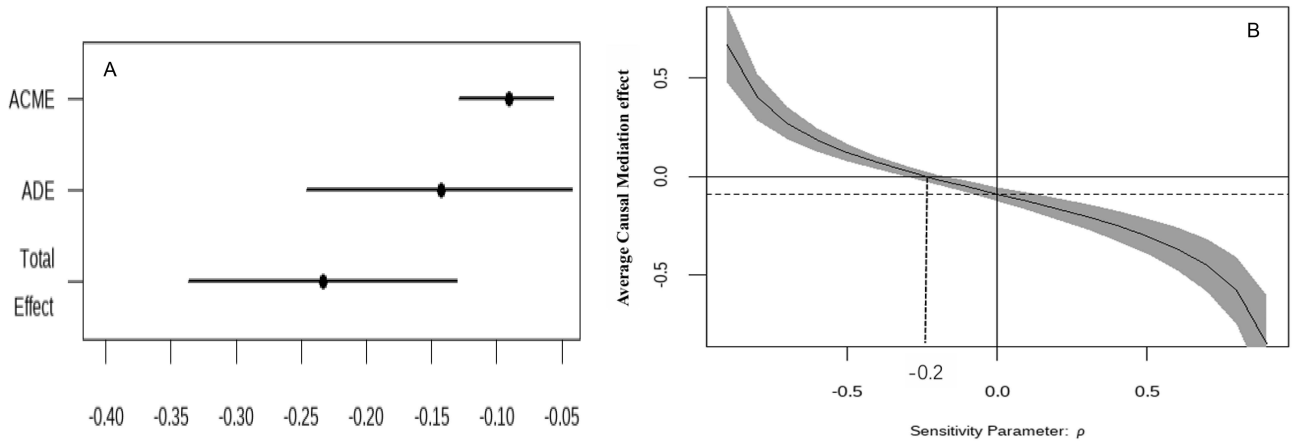

Figure 2 (**A**) Cognitive function mediates the relationship between SES and depression. (**B**) Sensitivity analysis of the ACME of cognitive function.
Abbreviations: ACME, average causal mediation effect; ADE, average direct effect.

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Table 5 Moderation Effect Test (N=979)

Dependent Variable	Independent Variable	R^2	F	β	SE	t
Depression symptoms		0.142	15.606***			
	SES			−0.146	0.054	−2.685**
	Cognitive function			−0.082	0.036	−2.214
	Sleep quality			0.361	0.128	2.832**
	Sleep quality×cognitive function			−0.015	0.006	−2.450*

Notes: Control variables: Age, gender, Marital status, BMI, smoking status, MNA. **p<0.01, *p<0.05, ***p<0.001.

individuals with greater economic resources were better able to purchase important products related to cognitive or brain development, such as nutritious foods, enriching learning opportunities, etc.[60] Educational attainment has a positive effect on cognitive function, and that the number of years of formal education completed by individuals is positively correlated with their cognitive function in adulthood and is predictive of a lower risk of dementia in later life, and that educational attainment influences cognitive function in later life primarily by contributing to individual differences in cognitive ability that emerge in early adulthood but persist into old age.[34]

Moreover, our study identified a mediating role for cognitive function in the relationship between SES and depressive symptoms among community-dwelling older adults. Previous studies have suggested that SES is a direct correlate of depression.[20] Socioeconomic difficulties can limit older adults' social life, opportunities to participate in sociocultural activities and access to community resources, and can further impact older adults' self-esteem, self-efficacy and sense of mastery, thereby increasing their vulnerability to managing negative emotions; while all negative emotional experiences are closely related to depression.[61] This study discerned a direct association between SES and the depressive symptoms of community-dwelling older adults. It was also found that SES indirectly influenced the depressive symptoms through the cognitive function, and individuals with higher SES had higher MoCA scores for cognitive function, indicating a reliance on cognitive function that subsequently impacted their level of depression. This may be because cognitive function is more closely linked to older adults' social participation. Cognitive function, particularly executive function and episodic memory, is positively correlated with social participation, and older adults with better cognitive function have higher levels of the social participation.[62] While high levels of social participation can improve older adults' self-esteem, sense of control, and perceived availability of support, which is beneficial for the mental health.[63] Studies have also shown that older adults with high levels of social participation are less likely to experience depressive symptoms.[64,65] While a recent study reported that enhancing social participation in older adults may be helpful not only to improve their cognitive function, but also to reduce depressive symptoms.[66]

The present study also found that sleep quality played a moderating role between cognitive function and depressive symptoms in community-dwelling older adults. Specifically, compared to individuals with poor sleep quality, those with

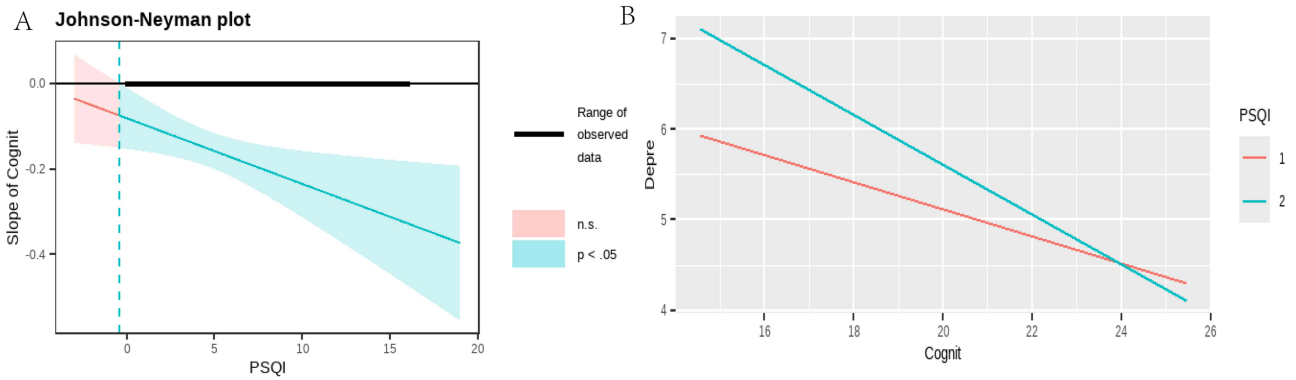

Figure 3 The moderating role of sleep quality on cognitive function and depressive symptoms. (**A**) Plot of Johnson-Neyman analysis; (**B**) The moderating role of sleep quality, 1=normal sleep (PSQI<=5 scores), 2=poor sleep (PSQI>5 scores).

normal sleep quality show a more positive effect of cognitive function on depressive symptoms. Sleep is known to play an important role in the development and maintenance of both brain and cognitive function, and sleep disorders may disrupt neuronal pathways and facilitate Aβ deposition that mediate cognitive decline.[67,68] While high quality sleep can restore physical, mental, and cognitive loss of function, as well as improve the psychological resilience to negative emotions.[69] In addition, individuals with high sleep quality may be more effective in utilizing cognitive skills to solve their emotional problem. In contrast, those with poor sleep quality cannot effectively deploy adaptive cognitive emotion regulation strategies, which are though processes that an individual voluntarily engages in to regulate emotional experiences by using a range of executive functions (eg, memory updating, flexible task switching and inhibition of prepotent responses), leading to mental health problems.[70] Existing studies have revealed that low SES is associated with poor sleep quality, with lower SES indicating shorter total sleep duration, longer sleep latency and more sleep fragmentation.[71] Thus, improving sleep quality can effectively enhance their cognitive function and be beneficial in controlling or preventing depressive symptoms in older adults with low SES.

There are several limitations to this study. Firstly, SES is a comprehensive concept representing the positions of an individual within the structure of a society. Although the three most common indicators (education, occupational complexity and income) have been widely used to measure an individual's SES, the use of these three indicators as a proxy for SES still has a limitation because SES remains a difficult concept to quantify. Additionally, the findings about associations between SES indicators and cognition or sleep quality may be subject to temporal bias due to the cross-sectional design of this research. Second, it was a cross-sectional study to investigate the mechanism of SES on depression in community-dwelling older adults. The cross-sectional study can explain complex models, as long as the data collected are reliable and valid. However, it is difficult to explain the possible causal relationship because of the limitations of this design. Third, although the common method bias did not reach a significant level, the self-reported data collection method may introduce reporting bias. Moreover, failure to collect certain confounders in this study, such as physical activity, medication use, and social support, may also introduce potential confounding bias. Lastly, the subjects of this study were only recruited from a few communities in Shanghai city, which limited the representativeness of the sample. In the future, investigations need to be extended through longitudinal and multicenter studies to better understand the complex interactions between SES, cognitive function, sleep quality, and depression in community-dwelling older adults.

Conclusion

The present study showed that the SES was negatively associated with the depressive symptoms in community-dwelling older adults, but this relationship may be influenced by an individual's cognitive function and sleep quality. Community-dwelling older adults with lower SES were more susceptible to cognitive decline and therefore more likely to experience depressive symptoms, which may be moderated by an individual's sleep quality. Therefore, efforts to reduce socio-economic inequality among community-dwelling older adults are important given its impact on multiple mental health outcomes, while public health services aimed primarily at improving cognitive function and sleep quality are also an important strategy for addressing depression in older adults with low socioeconomic status.

Ethics Approval and Consent to Participate

This study was approved by ethics committees of Shanghai University of Medicine and Health Sciences (No. 2022-ZGH-013). This study was conducted in accordance with the declaration of Helsinki. Each participant gave a written informed consent.

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Author Contributions

All authors made a significant contribution to the work reported, whether that is in the conception, study design, execution, acquisition of data, analysis and interpretation, or in all these areas; took part in drafting, revising or critically reviewing the article; gave final approval of the version to be published; have agreed on the journal to which the article has been submitted; and agree to be accountable for all aspects of the work.

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Disclosure

The authors declare no competing interests for this work.

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