

## Path Analysis of the Impact of Childhood Socioeconomic Status on Midlife and Late-Life Cognitive Function: Postprint

**Authors:** Huang Xiaotong, Wang Qiong, Liu Chen, HOU Xiaochun, Xu Xinrui, Wu Bingyi, Yang Xiao, Yang Xiao

**Date:** 2023-08-29T00:00:00+00:00

### Abstract

**Background:** The impact of childhood experiences on health in mid-to-late life has become a research focus, yet its effects on and pathways to cognitive function in mid-to-late life remain unclear.

**Objective:** From a life-course perspective, this study analyzes the influence of childhood socioeconomic status on cognitive function in mid-to-late life and explores strategies for promoting cognitive function.

**Methods:** Utilizing data from the China Family Panel Studies (CFPS) 2010, 2012, and 2020, this study constructed a multiple mediation effects model to examine the mediating pathways through which childhood socioeconomic status influences cognitive function in mid-to-late life.

**Results:** This study included a total of 1,034 middle-aged and elderly adults, with a mean age of 62.33 years. Their childhood socioeconomic status score was  $(0.000 \pm 0.797)$ , *individual education level score was*  $(1.970 \pm 1.111)$ , *social participation score was*  $(1.150 \pm 0.967)$ , *mid-to-late-life cognitive score was*  $(0.000 \pm 1.000)$ . *Childhood socioeconomic status was positively correlated with mid-to-late-life cognitive function* ( $P < 0.05$ ), *and negatively correlated with depression status* ( $P < 0.05$ ). *Regression results showed that, after controlling for age, gender, urban/rural residence, chronic diseases, mid-to-late-life cognitive function was not significant* ( $\beta = 0.054, t = 1.400, P = 0.162$ ), *while education level, social participation, and depression status significantly affected mid-to-late-life cognitive function* ( $\beta = 0.335, t = 11.622, P < 0.05; \beta = 0.064, t = 2.166, P < 0.05; \beta = -0.019, t = -3.154, P < 0.05$ ). Mediation effect test results indicated that the simple mediation effects of education level and social participation between childhood socioeconomic status and mid-to-late-life cognitive function were statistically significant (95%CI=0.141~0.223; 95%CI=0.001~0.019), the chain mediating effect of education level and social participation was statistically significant (95%CI=0.001~0.017), and the chain

mediating effect of education level and depression status was statistically significant (95%CI=0.001~0.008).

**Conclusion:** Education level represents a resource pathway through which childhood socioeconomic status influences mid-to-late-life cognitive function; social participation constitutes a conditional pathway; and depression status is a risk factor affecting mid-to-late-life cognitive function. Based on life course theory, attention should be paid to the influence of childhood socioeconomic status from individual, family, and social perspectives to formulate strategies for promoting cognitive function in mid-to-late life.

## Full Text

### A Path Analysis of the Effect of Childhood Socioeconomic Status on Cognitive Function in Middle-aged and Older Adults

HUANG Xiaotong<sup>1</sup>, WANG Qiong<sup>2</sup>, LIU Chen<sup>2</sup>, HOU Xiaochun<sup>2</sup>, XU Xinrui<sup>2</sup>, WU Bingyi<sup>2</sup>, YANG Xiao<sup>1\*</sup>

<sup>1</sup>School of Nursing, Weifang Medical University, Weifang 261053, China

<sup>2</sup>School of Management, Weifang Medical University, Weifang 261053, China

*Corresponding author: YANG Xiao, Associate professor; E-mail: yx0204@163.com*

## Abstract

**Background:** The impact of childhood experiences on health in middle-aged and older adults has become a research focus, yet the specific effects and pathways of childhood experiences on cognitive function in this population remain unclear. **Objective:** To analyze the effect of childhood socioeconomic status on cognitive function in middle-aged and older adults from a life-course perspective and to explore strategies for promoting cognitive function in this population. **Methods:** This study utilized data from the China Family Panel Studies (CFPS) conducted in 2010, 2012, and 2020 to construct a multiple mediation model examining the mediating pathways through which childhood socioeconomic status influences cognitive function in middle-aged and older adults. **Results:** A total of 1,034 middle-aged and older adults were included, with a mean age of 62.33 years. The mean scores were: childhood socioeconomic status ( $0.000 \pm 0.797$ ), education level ( $1.970 \pm 1.111$ ), social participation ( $1.150 \pm 0.967$ ), depression status ( $5.960 \pm 4.681$ ), and cognitive function ( $0.000 \pm 1.000$ ). Childhood socioeconomic status was positively correlated with education level, social participation, and cognitive function ( $P < 0.05$ ), and negatively correlated with depression status ( $P < 0.05$ ). Regression results showed that, after controlling for age, gender, urban/rural residence, chronic disease status, and medical service utilization, childhood socioeconomic status had no significant direct effect on cognitive function ( $\beta = 0.054$ ,  $t = 1.400$ ,  $P = 0.162$ ), while

education level, social participation, and depression status significantly affected cognitive function ( $\beta = 0.335$ ,  $t = 11.622$ ,  $P < 0.05$ ;  $\beta = 0.064$ ,  $t = 2.166$ ,  $P < 0.05$ ;  $\beta = -0.019$ ,  $t = -3.154$ ,  $P < 0.05$ ). Mediation analysis revealed statistically significant simple mediating effects of education level and social participation (95%CI = 0.141–0.223; 95%CI = 0.001–0.019), as well as significant chain mediating effects of education level and social participation (95%CI = 0.001–0.017) and education level and depression status (95%CI = 0.001–0.008). **Conclusion:** Education level serves as a resource pathway, social participation as a conditional pathway, and depression status as a risk factor in the relationship between childhood socioeconomic status and cognitive function in middle-aged and older adults. Based on life-course theory, interventions should address childhood socioeconomic influences at individual, family, and societal levels to develop cognitive promotion strategies for middle-aged and older adults.

**Keywords:** Middle aged; Aged; Cognitive dysfunction; Childhood socioeconomic status; CFPS database; Mediation analysis

---

## 1. Introduction

Cognitive function refers to the brain's capacity to process, store, and retrieve information, representing a physiological indicator closely linked to disability status among China's elderly population [1]. Cognitive dysfunction impairs perception, memory, attention, and thinking, thereby affecting learning and decision-making abilities in daily life [2]. Due to its typically progressive nature, middle-aged and older adults constitute a high-risk population for cognitive dysfunction. Beyond reducing quality of life, cognitive dysfunction affects family members' mental health and creates substantial economic burdens. Moreover, it impacts mortality risk, with individuals experiencing rapid cognitive decline facing a 75% higher mortality risk than those with normal cognitive function [3].

Cognitive function is influenced by multiple factors, including socioeconomic status, lifestyle behaviors, and demographic characteristics. Research indicates that socioeconomic factors independently affect cognitive function in middle-aged and older adults [4] and further influence cognition through social activities [5] and psychological states [6]. Education level represents the primary socioeconomic factor significantly affecting cognitive function in this population.

Current research on cognitive function in middle-aged and older adults has several limitations. Most studies rely on cross-sectional data to examine associated factors or use longitudinal data to explore cognitive trajectories. With deepening life-course research, scholars increasingly recognize that health status in middle-aged and older adults may originate in childhood experiences, though studies have focused primarily on childhood adversity [7]. Research on early-life influences on cognitive function has concentrated on intrafamilial childhood factors [8], analyzing direct effects while neglecting multiple indirect pathways.

Therefore, this study applies life-course theory to investigate the effects and pathways of childhood socioeconomic status on cognitive function in middle-aged and older adults, providing empirical evidence for cognitive improvement strategies.

## 2. Methods

### 2.1 Study Subjects

Data were obtained from the China Family Panel Studies (CFPS), a longitudinal survey conducted by the Institute of Social Science Survey at Peking University that collects individual, household, and community-level data to track social, economic, demographic, educational, and health changes in China. The sample covers 25 provinces/municipalities/autonomous regions with a target sample size of 16,000 households, including all family members. Given variable requirements, primary data came from the 2020 survey, but childhood socioeconomic information was limited, so childhood data from 2010 and 2012 were matched 1:1 using personal ID numbers. Adults aged 45 years and older were selected. Due to telephone-based data collection in CFPS 2020, the cognitive function sample was relatively small. After excluding samples with missing key variables, 1,034 valid samples were obtained.

### 2.2 Observation Indicators

The dependent variable was cognitive function in middle-aged and older adults. CFPS provides two types of cognitive ability test scores: crystallized intelligence and fluid intelligence. The 2020 CFPS data primarily used fluid intelligence tests, including memory and number series reasoning. Memory test raw scores ranged from 0–10, while number series reasoning scores ranged from 409–584. The memory test used word recall methods, including immediate and delayed recall. Following previous research [9], this study averaged the two memory tests, added the number series reasoning score, and standardized the result to a continuous variable with mean = 0 and standard deviation = 1 for model inclusion.

The core independent variable was childhood socioeconomic status. Common socioeconomic status indicators include education, income, and occupation. Following Wang et al. [10], childhood socioeconomic status was constructed using principal component analysis of five variables: self-rated childhood family economic status, parental education, household registration type at age 12, and International Socioeconomic Index (ISEI) scores. The KMO test was 0.652, and Bartlett's test was  $< 0.05$ . Self-rated childhood family economic status ranged from 1–5, with higher scores indicating better status. Parental education levels (illiterate/semi-illiterate, primary school, junior high, senior high/technical school, college, bachelor's, master's, doctoral) were coded 1–8. Household registration at age 12 coded non-agricultural and resident registration as 1 and agricultural as 0. Occupation was converted to ISEI based on International

Standard Classification of Occupations codes and divided into four strata by 25th, 50th, and 75th percentiles: 19–31, 32–39, 40–45, and 46–90, corresponding to lower, lower-middle, upper-middle, and upper socioeconomic status [11], coded 1–4. These were aggregated into a common factor as a continuous variable.

Mediating variables included adult education level, social participation, and depression status. Education level used the highest completed education, coded 1–8 as above, with higher scores indicating higher education. Social participation was measured by four dummy variables: exercise, internet use, social group membership, and political participation [12], summed to create a composite score. Depression was measured using the Center for Epidemiologic Studies Depression Scale (CES-D), comprising eight items. Responses to negative items (“I felt life couldn’t continue,” “I felt sad,” “I felt lonely,” “My sleep was poor,” “I felt everything was effortful,” “I felt depressed”) were coded 0–3 for “almost never” to “most of the time.” Positive items (“I felt happy,” “I felt joyful”) were reverse-coded. Total scores ranged 0–24, with higher scores indicating more severe depression.

Control variables included gender, age, urban/rural residence, medical service utilization (using the logarithm of total medical expenditure), and chronic disease status.

### 2.3 Statistical Methods

SPSS 25.0 was used for statistical analysis. Measurement data were expressed as ( $\bar{x} \pm s$ ) and count data as percentages. Descriptive statistics and Pearson correlation analysis were performed. The SPSS PROCESS macro by Hayes was used for mediation effect analysis and testing.  $P < 0.05$  was considered statistically significant.

## 3. Results

### 3.1 Descriptive Analysis

The 1,034 middle-aged and older adults had a mean age of 62.33 years, with 504 males (48.7%) and 530 females (51.3%); 460 were urban residents (44.5%) and 574 were rural residents (55.5%); 270 had chronic diseases (26.1%) and 764 did not (73.9%). Mean scores were: childhood socioeconomic status ( $0.000 \pm 0.797$ ), education level ( $1.970 \pm 1.111$ ), social participation ( $1.150 \pm 0.967$ ), depression status ( $5.960 \pm 4.681$ ), and cognitive function ( $0.000 \pm 1.000$ ).

### 3.2 Correlation Analysis

Childhood socioeconomic status was positively correlated with education level, social participation, and cognitive function ( $P < 0.05$ ) and negatively correlated with depression status ( $P < 0.05$ ). Education level was positively correlated with social participation and cognitive function ( $P < 0.05$ ). Social participation

was positively correlated with cognitive function ( $P < 0.05$ ). Depression status was negatively correlated with childhood socioeconomic status, education level, social participation, and cognitive function ( $P < 0.05$ ) (Table 1 ).

### 3.3 Multiple Mediation Model Analysis

After controlling for age, gender, urban/rural residence, chronic disease status, and medical service utilization, multiple mediation analysis was conducted with childhood socioeconomic status as the independent variable, cognitive function as the dependent variable, and education level, social participation, and depression status as mediators. Regression results showed that childhood socioeconomic status positively predicted education level and social participation ( $\beta = 0.538$ ,  $P < 0.05$ ;  $\beta = 0.129$ ,  $P < 0.05$ ). Education level positively predicted social participation and cognitive function ( $\beta = 0.236$ ,  $P < 0.05$ ;  $\beta = 0.335$ ,  $P < 0.05$ ) and negatively predicted depression status ( $\beta = -0.397$ ,  $P < 0.05$ ). Social participation positively predicted cognitive function ( $\beta = 0.064$ ,  $P < 0.05$ ). Depression status negatively predicted cognitive function ( $\beta = -0.019$ ,  $P < 0.05$ ) (Table 2 ).

Path analysis revealed that the direct effect of childhood socioeconomic status on cognitive function was not significant (95%CI = -0.022–0.129). However, significant simple mediating effects were found for education level (95%CI = 0.141–0.223) and social participation (95%CI = 0.001–0.019), accounting for 69.23% and 3.08% of the total effect, respectively. The mediating effect of depression status was not significant (95%CI = -0.001–0.017). Additionally, significant chain mediating effects were identified for education level and social participation (95%CI = 0.001–0.017, 3.08% of total effect) and for education level and depression status (95%CI = 0.001–0.008, 1.54% of total effect) (Table 3 , Figure 2 [Figure 2: see original paper]).

## 4. Discussion

### 4.1 Education Level as a Resource Pathway

This study found that childhood socioeconomic status influences cognitive function directly through education level and indirectly through education's effects on social participation and depression status. Research demonstrates that individual education level is closely related to childhood socioeconomic status [13]. Parental education, a key indicator of childhood socioeconomic status, exhibits intergenerational transmission. Individuals with higher childhood socioeconomic status had parents who could provide superior educational resources, enabling higher educational attainment [14], whereas those with lower childhood socioeconomic status faced greater educational barriers. Education level, influenced by childhood socioeconomic status, serves as a crucial condition for obtaining social resources and positively affects cognitive function. Guo et al. [15] used longitudinal data to examine the relationship between education and cognitive impairment prevalence trends, with results consistent with this study. Higher

education improves socioeconomic status and healthcare utilization while fostering better lifestyle habits and thinking patterns that benefit cognitive function. Additionally, education may enhance cognitive reserve through increased control and conceptualization abilities [16]. In summary, education level is a protective factor for cognitive function and plays an important mediating role between childhood socioeconomic status and cognitive function.

#### **4.2 Social Participation as a Conditional Pathway**

Social participation is central to “active aging.” This study found that childhood socioeconomic status positively affects cognitive function through social participation. Lower childhood socioeconomic status may limit adult income, time, and productive resources, reducing opportunities for social interaction. International research shows that childhood socioeconomic status is associated with social group participation in older age, with lower status linked to significantly reduced participation rates [17]. Social participation positively influences cognitive function, consistent with Liu et al. [18]. Potential mechanisms include: (1) social participation enhances self-worth and well-being, maintaining positive psychological states that delay cognitive decline [18]; and (2) social participation helps maintain social networks, providing social support and enhancing social adaptation [19]. Furthermore, Shi and Liu [20] demonstrated that social isolation negatively affects cognitive function, indirectly confirming the protective effect of social participation. These findings suggest that increasing social participation rates among middle-aged and older adults can mitigate negative effects of early-life experiences and protect cognitive function.

#### **4.3 Depression Status as a Risk Factor**

This study found a chain mediating effect of education level and depression status between childhood socioeconomic status and cognitive function. Specifically, childhood socioeconomic status negatively predicts depression through education level, thereby affecting cognitive function. Depression impacts physical health and quality of life and represents a major type of psychological disorder. Previous research indicates that depression impairs the ability to regulate negative emotions, with limited cognitive resources in older adults being consumed by intense emotions and resulting in cognitive deficits [21]. Physiologically, depression may impair memory, information processing, and decision-making abilities [22]. However, the relationship between depression and cognitive dysfunction remains debated, with similarities in clinical presentation and pathological mechanisms. Some research considers cognitive dysfunction a clinical feature of major depression that significantly increases relapse risk [23]. In this study, the effect of childhood socioeconomic status on depression was mediated by education level, possibly because education provides economic and healthcare resources that protect against depression, consistent with Csajbók et al. [24]. However, the direct effect of childhood socioeconomic status on depression differed from some literature, possibly due to regional specificity. These findings indicate that

depression status is a risk factor for cognitive function, and improving depression in middle-aged and older adults is crucial for cognitive enhancement.

Based on these findings, we propose the following recommendations: adopt a life-course perspective focusing on children from low socioeconomic backgrounds to increase attention to childhood socioeconomic factors; advocate for the importance of education and promote compulsory education with equitable resource allocation; actively implement psychological assessments and depression screening; and strengthen mental health support for middle-aged and older adults. Governments should plan and construct age-friendly public facilities to meet diverse social participation needs and enhance social adaptation.

This study has limitations. Due to the pandemic, most samples were collected via telephone interviews, resulting in a relatively small cognitive function sample. Additionally, childhood variables were based on retrospective surveys, introducing potential recall bias. Future research should further explore the effects and pathways of childhood socioeconomic status on cognitive function in middle-aged and older adults.

In summary, education level, social participation, and depression status mediate the relationship between childhood socioeconomic status and cognitive function in middle-aged and older adults. A life-course perspective addressing individual, family, and societal levels can inform cognitive promotion strategies.

## Acknowledgments

We thank the Institute of Social Science Survey at Peking University for providing CFPS data.

## Author Contributions

HUANG Xiaotong, WANG Qiong, and WU Bingyi conceptualized and designed the study. HUANG Xiaotong drafted the manuscript. HUANG Xiaotong and LIU Chen collected and organized data. HOU Xiaochun revised the English. HUANG Xiaotong and XU Xinrui performed statistical analysis. HUANG Xiaotong revised the manuscript. HUANG Xiaotong and WANG Qiong ensured quality control. YANG Xiao took overall responsibility for the article.

This article has no conflicts of interest.

**Funding:** 2021 China Disabled Persons' Federation Research Project (21&ZC014); 2022 Shandong Provincial Natural Science Foundation Project (ZR2022MG007)

**Citation:** HUANG XT, WANG Q, LIU C, et al. A path analysis of the effect of childhood socioeconomic status on cognitive function in middle-aged and older adults [J]. Chinese General Practice, 2023. [Epub ahead of print].

**Editor:** ZHAO Yuecui

**Received:** 2023-04-25; **Revised:** 2023-08-10

*Note: Figure translations are in progress. See original paper for figures.*

*Source: ChinaXiv — Machine translation. Verify with original.*