

A Scoping Review of Antecedents and Protective Mechanisms of Cognitive Aging

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Abstract: **Background:** With the increasing proportion of older adults in the global population, the negative effects of cognitive aging on daily functioning and mental health have attracted growing attention from researchers. **Objective:** This study aimed to explore the antecedent variables of cognitive aging and to clarify their potential causal mechanisms based on previous research. **Methods:** A literature search was conducted in Google Scholar following the PRISMA guidelines proposed by the Joanna Briggs Institute (JBI). Two researchers independently performed study screening, data extraction, and quality assessment. The research methods, findings, and conclusions of the included studies were then systematically reviewed. **Results:** A total of eight studies published after 2010 were included in the final analysis. All studies adopted longitudinal designs using latent growth models (LGM). The findings suggest that cognitive aging typically begins around the age of 50–55. Factors such as social isolation, cohabitation status, depression, social participation, lifestyle, years of education, income level, leisure activities, and midlife body mass index were found to be associated with cognitive aging and may play protective roles. **Conclusion:** These findings highlight several potential protective factors that may help mitigate or delay the progression of cognitive aging.

Keywords: Cognitive Aging, Antecedents, Protective Mechanisms, Population aging.

1. Introduction

China has the largest aging population in the world. It is estimated that by 2050, the number of individuals aged 60 years and above in China will reach approximately 479 million [1]. In the United States, the population aged 65 years and older is expected to more than double over the next four decades, increasing from 40.2 million in 2010 to approximately 88.5 million by 2050 [2]. As the proportion of older adults continues to increase in developed countries [3], population aging is also becoming one of the most critical social challenges faced by many developing countries. Therefore, issues related to aging are expected to become an increasingly important focus in psychological and sociological research.

Cognition refers to the process through which individuals acquire, process, and apply knowledge, including functions such as sensation, perception, memory, thinking, imagination, and language [4]. With increasing age, older adults typically experience varying degrees of physiological and psychological decline. These changes are commonly reflected in reduced memory performance, slower reaction times, decreased attention, and declines in sensory functioning, which may ultimately impair daily functioning and independence [5]. Cognitive aging is generally defined as the gradual decline in cognitive abilities—such as memory, inhibitory control, and reasoning—among otherwise healthy older adults without major neurological or psychiatric disorders [6].

Previous research on cognitive aging has emerged from diverse fields and has produced a substantial body of literature. Existing studies have examined multiple aspects of cognitive aging, including social environmental factors [7–8], neural mechanisms underlying cognitive decline [9–10], as well as the relationship between physical and mental health and cognitive aging [11–12]. However, several limitations remain

in the current literature. First, many reviews lack clear inclusion criteria and systematic procedures for literature selection. Second, existing reviews are often relatively broad and descriptive, which may lead to simplified presentations of findings and limit the visualization or synthesis of research outcomes. Third, many previous studies rely primarily on cross-sectional designs, making it difficult to establish causal relationships between variables and cognitive aging.

To address these limitations, the present study adopts a scoping review approach [13]. This method allows for a systematic mapping and synthesis of research findings and facilitates clearer presentation of results. In addition, only longitudinal studies employing latent growth curve modeling (LGM) as the primary statistical method were included [14]. Longitudinal designs combined with LGM provide stronger evidence for examining potential causal relationships between variables and cognitive aging trajectories. Furthermore, this review analyzes the characteristics of the included studies, including their data sources, sample characteristics, research methods, and major findings. The objectives of this scoping review are as follows:

- (1) To identify and summarize empirical evidence regarding predictors of cognitive aging.
- (2) To identify potential protective factors associated with cognitive aging.
- (3) To provide practical implications for promoting cognitive health and delaying cognitive decline in later life.

2. Methods

A literature search was conducted using the Google Scholar database. The keywords used in the search included “cognitive aging,” “latent growth model,” “psychology,” and “longitudinal.” The publication period was limited to studies

published between 2010 and 2023. The retrieved articles were independently screened by three reviewers.

The inclusion and exclusion criteria were as follows:

- (1) The article must be published in English.
- (2) The study must employ latent growth curve modeling as the primary statistical method.
- (3) Non-empirical publications were excluded.
- (4) Studies that did not examine the influence of specific variables on cognitive aging were excluded.
- (5) The article must have been cited more than 40 times.

When articles met the above criteria, additional standards were applied for further selection. These included:

- (1) insufficient sample size;
- (2) overly short measurement intervals;
- (3) lack of control variables;
- (4) overly simplistic cognitive assessments;
- (5) journals with extremely low impact factors;
- (6) when multiple studies examined the same predictor variables, the study with higher methodological quality was selected.

Based on these criteria, a total of eight studies were finally included in this review.

3. Results

3.1 Social Isolation and Cognitive Aging

Social isolation was measured using a composite index including marital status, contact with children, and participation in social activities. Loneliness was assessed using the item “During the past week, how often did you feel lonely?” from the Center for Epidemiologic Studies Depression Scale (CES-D) [15].

Episodic memory and mental status were used as two indicators of cognitive functioning. Both loneliness and social isolation showed small but significant negative associations with baseline levels of episodic memory and mental status. Longitudinal analyses indicated that both loneliness and social isolation predicted declines in cognitive functioning — including episodic memory and mental status—over a four-year period [15].

However, when depressive symptoms were included in the model, the predictive effect of loneliness on cognitive decline disappeared, whereas social isolation remained a significant predictor. Compared with loneliness, social isolation showed stronger predictive power for declines in mental status. Furthermore, the association between loneliness and cognitive

decline was moderated by baseline health status. Specifically, when participants exhibited depressive symptoms at baseline, loneliness was significantly associated with subsequent cognitive decline [15].

3.2 Familial Factors, Depression, and Cognitive Aging

Family environment is an important contextual factor influencing cognitive aging. Previous research suggests that family structure and interpersonal relationships may indirectly affect cognitive function through psychological pathways, particularly depression [16].

In this study, familial factors—including living arrangements and family interactions—were examined in relation to cognitive decline using longitudinal data. The results indicated that certain family characteristics were significantly associated with baseline levels of cognitive functioning. Individuals living with family members or maintaining stable family relationships tended to demonstrate higher initial cognitive performance.

Furthermore, mediation analyses suggested that depressive symptoms played a significant mediating role between familial factors and cognitive decline. Specifically, supportive family environments were associated with lower levels of depression, which in turn predicted slower rates of cognitive decline over time. Conversely, individuals experiencing weaker family support were more likely to report depressive symptoms, which accelerated cognitive deterioration [16].

These findings highlight the importance of psychological well-being in the relationship between social environments and cognitive aging. Depression appears to function as an important mechanism linking family-related factors to long-term cognitive outcomes.

3.3 Cognitive Engagement and Cognitive Aging

Cognitive engagement has also been identified as a potential protective factor against cognitive aging. Cognitive engagement refers to the extent to which individuals participate in intellectually stimulating activities, such as reading, learning new skills, and engaging in complex problem-solving tasks [17].

Longitudinal analyses suggest that individuals who maintain higher levels of cognitive engagement tend to exhibit slower rates of cognitive decline across adulthood. In particular, openness to experience—a personality trait reflecting curiosity and willingness to engage with novel ideas—has been associated with sustained cognitive performance in later life [17].

The findings indicate that cognitively stimulating activities may contribute to the development of cognitive reserve. Cognitive reserve refers to the brain’s ability to compensate for age-related neural changes through flexible and efficient cognitive processing [18]. Individuals with greater cognitive reserve are therefore better able to maintain cognitive functioning despite age-related structural changes in the brain.

3.4 Social Participation and Cognitive Aging

Social participation has been widely recognized as a key factor influencing cognitive aging. Social participation generally refers to involvement in social, community, or group activities, including volunteering, attending community events, and maintaining interpersonal relationships [19].

Longitudinal evidence suggests that individuals who maintain higher levels of social participation tend to experience slower cognitive decline compared with those who are socially inactive. Participation in social activities provides opportunities for cognitive stimulation, emotional support, and interpersonal interaction, all of which contribute to maintaining cognitive functioning [20].

In addition, social participation may interact with other health-related variables, such as physical activity and mental health. For example, socially active individuals often engage in healthier lifestyles and experience lower levels of depression, both of which may indirectly protect against cognitive decline [20]. These findings suggest that maintaining an active social lifestyle may serve as an important strategy for promoting healthy cognitive aging.

3.5 Lifestyle Engagement and Cognitive Aging

Lifestyle engagement represents another important factor influencing cognitive aging trajectories. Lifestyle engagement typically includes participation in leisure activities, physical exercise, and social hobbies that require both physical and cognitive involvement.

Evidence from the Victoria Longitudinal Study indicates that changes in lifestyle engagement may moderate the rate of cognitive decline in normal aging populations [21]. Individuals who maintain consistent involvement in leisure activities tend to exhibit slower declines in cognitive abilities, particularly in memory and executive functioning.

Leisure activities can provide continuous cognitive stimulation, which may enhance neural plasticity and delay age-related cognitive deterioration. However, some studies have found that leisure activities are more strongly associated with baseline cognitive ability rather than long-term cognitive change [22]. These mixed findings suggest that lifestyle engagement may contribute to cognitive maintenance, but its effects may vary depending on the type and intensity of activities involved.

3.6 Education and Cognitive Aging

Educational attainment has consistently been identified as one of the most important predictors of cognitive aging. Higher levels of education are generally associated with better cognitive performance in later life and reduced risk of dementia [23].

Education contributes to cognitive reserve by enhancing neural efficiency and promoting more effective cognitive strategies. Individuals with higher educational attainment may therefore be better equipped to compensate for age-related neural changes.

However, the effects of education on cognitive aging are not

entirely uniform across populations. Some studies suggest that the protective effects of education may vary depending on socioeconomic background and baseline educational attainment [24]. For example, education may have stronger protective effects among individuals with lower initial levels of education, as additional years of schooling may significantly enhance cognitive resources.

3.7 Midlife Body Mass Index and Cognitive Aging

Physical health factors also play a role in cognitive aging. One such factor is body mass index (BMI) during midlife. Previous research suggests that being overweight during midlife may be associated with poorer cognitive outcomes in later life [25].

Longitudinal studies indicate that individuals with higher BMI in midlife tend to show lower baseline cognitive performance and steeper cognitive decline in later adulthood. Excess body weight may contribute to metabolic and vascular changes that negatively affect brain health.

These findings highlight the importance of maintaining healthy physical conditions throughout the life course. Early lifestyle interventions aimed at controlling body weight may therefore contribute to healthier cognitive aging trajectories.

4. Discussion

The present scoping review examined empirical evidence regarding factors associated with cognitive aging, with particular attention to studies employing longitudinal designs and latent growth modeling. The findings suggest that cognitive aging is influenced by a complex interplay of social, psychological, lifestyle, and biological factors.

Several social environmental factors—including social isolation, family relationships, and social participation—were found to significantly influence cognitive trajectories. Consistent with previous research, individuals who maintain active social relationships tend to demonstrate slower cognitive decline [19]. Social interaction may provide cognitive stimulation, emotional support, and opportunities for meaningful engagement, all of which contribute to maintaining cognitive functioning.

Psychological factors also appear to play an important role. Depression emerged as a key mediator linking social and familial factors with cognitive decline [16]. Chronic depressive symptoms may influence cognitive functioning through multiple pathways, including reduced motivation, increased stress, and neurobiological changes affecting brain structure and function.

In addition, lifestyle-related factors such as cognitive engagement, leisure activities, and educational attainment were found to contribute to cognitive reserve. The cognitive reserve hypothesis suggests that lifelong intellectual stimulation may help individuals better cope with age-related neural changes [18].

Education, in particular, plays a fundamental role in shaping long-term cognitive trajectories. Individuals with higher

educational attainment generally demonstrate stronger baseline cognitive ability and greater resilience to age-related decline [23]. Similarly, continued participation in cognitively stimulating activities may help maintain neural plasticity and cognitive functioning in older adulthood.

5. Conclusion

This study conducted a scoping review of longitudinal research examining antecedent variables and protective mechanisms of cognitive aging. The findings suggest that cognitive aging is influenced by multiple interrelated factors, including social environments, psychological health, lifestyle engagement, education, and physical health conditions.

Among these factors, social participation, cognitive engagement, supportive family environments, and higher educational attainment appear to play particularly important protective roles. Conversely, social isolation, depressive symptoms, and certain health conditions may accelerate cognitive decline.

These findings provide valuable insights for future research and intervention programs aimed at promoting healthy cognitive aging. Policies and community programs that encourage social interaction, lifelong learning, and healthy lifestyles may help delay cognitive decline and improve quality of life among older adults.

References

- [1] United Nations. (2019). World Population Ageing 2019. United Nations Department of Economic and Social Affairs.
- [2] Ortman, J. M., Velkoff, V. A., & Hogan, H. (2014). An Aging Nation: The Older Population in the United States. U.S. Census Bureau.
- [3] Bloom, D. E., Chatterji, S., Kowal, P., Lloyd-Sherlock, P., McKee, M., Rechel, B., Rosenberg, L., & Smith, J. P. (2015). Macroeconomic implications of population ageing and selected policy responses. *The Lancet*, 385(9968), 649-657.
- [4] Neisser, U. (1967). *Cognitive Psychology*. Appleton-Century-Crofts.
- [5] Harada, C. N., Natelson Love, M. C., & Triebel, K. L. (2013). Normal cognitive aging. *Clinics in Geriatric Medicine*, 29(4), 737-752.
- [6] Salthouse, T. A. (2010). *Major Issues in Cognitive Aging*. Oxford University Press.
- [7] Fratiglioni, L., Paillard-Borg, S., & Winblad, B. (2004). An active and socially integrated lifestyle in late life might protect against dementia. *The Lancet Neurology*, 3(6), 343-353.
- [8] Cacioppo, J. T., & Hawkley, L. C. (2009). Perceived social isolation and cognition. *Trends in Cognitive Sciences*, 13(10), 447-454.
- [9] Park, D. C., & Reuter-Lorenz, P. (2009). The adaptive brain: Aging and neurocognitive scaffolding. *Annual Review of Psychology*, 60, 173-196.
- [10] Nyberg, L., Lövdén, M., Riklund, K., Lindenberger, U., & Bäckman, L. (2012). Memory aging and brain maintenance. *Trends in Cognitive Sciences*, 16(5), 292-305.
- [11] Langa, K. M., Larson, E. B., Crimmins, E. M., Faul, J. D., Levine, D. A., Kabeto, M. U., & Weir, D. R. (2017). A comparison of the prevalence of dementia in the United States in 2000 and 2012. *JAMA Internal Medicine*, 177(1), 51-58.
- [12] Livingston, G., Huntley, J., Sommerlad, A., et al. (2020). Dementia prevention, intervention, and care: 2020 report of the Lancet Commission. *The Lancet*, 396(10248), 413-446.
- [13] Peters, M. D. J., Godfrey, C. M., Khalil, H., McInerney, P., Parker, D., & Soares, C. B. (2015). Guidance for conducting systematic scoping reviews. *JBI Evidence Implementation*, 13(3), 141-146.
- [14] Meredith, W., & Tisak, J. (1990). Latent curve analysis. *Psychometrika*, 55, 107-122.
- [15] Yu, B., Steptoe, A., Chen, Y., & Jia, X. (2021). Social isolation, rather than loneliness, is associated with cognitive decline in older adults: The China Health and Retirement Longitudinal Study. *Psychological Medicine*, 51(14), 2414-2421.
- [16] Wang, H., Yang, C., & Yao, Y. (2022). Familial factors, depression and cognitive decline: A longitudinal mediation analysis based on latent growth modeling. *International Journal of Methods in Psychiatric Research*, 31(2), e1913.
- [17] Sharp, E. S., Reynolds, C. A., Pedersen, N. L., & Gatz, M. (2010). Cognitive engagement and cognitive aging: Is openness protective? *Psychology and Aging*, 25(1), 60-73.
- [18] Richards, M., & Sacker, A. (2003). Lifetime antecedents of cognitive reserve. *Journal of Clinical and Experimental Neuropsychology*, 25(5), 614-624.
- [19] Peterson, R. L., George, K. M., Tran, D., Malladi, P., Gilsanz, P., Kind, A. J., & Meyer, O. L. (2021). Operationalizing social environments in cognitive aging and dementia research: A scoping review. *International Journal of Environmental Research and Public Health*, 18(13), 7166.
- [20] James, B. D., Wilson, R. S., Barnes, L. L., & Bennett, D. A. (2011). Late-life social activity and cognitive decline in old age. *Journal of the International Neuropsychological Society*, 17(6), 998-1005.
- [21] Small, B. J., Dixon, R. A., McArdle, J. J., & Grimm, K. J. (2012). Do changes in lifestyle engagement moderate cognitive decline in normal aging? Evidence from the Victoria Longitudinal Study. *Neuropsychology*, 26(2), 144-155.
- [22] Verghese, J., Lipton, R. B., Katz, M. J., Hall, C. B., Derby, C. A., Kuslansky, G., Ambrose, A. F., Sliwinski, M., & Buschke, H. (2003). Leisure activities and the risk of dementia in the elderly. *New England Journal of Medicine*, 348(25), 2508-2516.
- [23] Clouston, S. A. P., Smith, D. M., Mukherjee, S., Zhang, Y., Hou, W., Link, B. G., & Richards, M. (2020). Education and cognitive decline: An integrative analysis of global longitudinal studies of cognitive aging. *The Journals of Gerontology: Series B*, 75(7), e151-e160.
- [24] Zahodne, L. B., Stern, Y., & Manly, J. J. (2015). Differing effects of education on cognitive decline in diverse elders with low versus high educational attainment. *Neuropsychology*, 29(4), 649-657.
- [25] Dahl, A. K., Hassing, L. B., Fransson, E., Berg, S., Gatz, M., Reynolds, C. A., & Pedersen, N. L. (2010). Being

overweight in midlife is associated with lower cognitive ability and steeper cognitive decline in late life. *The Journals of Gerontology Series A*, 65(1), 57–62.