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Effects of Cognitive Activity on Different Domains of Cognitive Function in Older Adults: A Postprint

Authors: Yin Haiyan, Song Yulei, Xu Guihua, Du Shizheng, Rodin, Zhang Xueqing, Bai Yamei, Bai Yamei

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Abstract

Background Engaging in mental activities such as reading and puzzle games can slow cognitive decline in older adults, but the specific effects of different types of mental activities on cognitive function and various cognitive domains require further investigation.

Objective To investigate the effects of common types of mental activities on cognitive function and various cognitive domains among community-dwelling older adults.

Methods From May to August 2022, community-dwelling older adults from Nanjing, Changzhou, Nantong, and Xuzhou in Jiangsu Province were selected using a stratified convenience sampling method. A General Information Questionnaire and the Montreal Cognitive Assessment (MoCA) were used to conduct face-to-face surveys on sociodemographic data, mental activity frequency, types of mental activities, and cognitive function. Multiple stepwise regression analysis was employed to explore the relationship between mental activities and different cognitive domains of cognitive function.

Results A total of 782 questionnaires were distributed, and 758 valid questionnaires were collected, yielding an effective response rate of 96.93%. Among the 758 older adults, 123 were from Nanjing, 197 from Changzhou, 240 from Nantong, and 198 from Xuzhou. Community-dwelling older adults with mental activity frequency of 1–2 times/week or higher had higher total MoCA scores than those with frequency of <1 time/week ($P<0.05$). Older adults with two or more types of mental activities had higher total MoCA scores than those with one type and those with no mental activities ($P<0.05$); older adults with one type of mental activity had higher total MoCA scores than those with no mental activities ($P<0.05$). The distribution of mental activities among

community-dwelling older adults was as follows: learning new knowledge (170 cases), playing board/card games (228 cases), reading (228 cases), singing (59 cases), puzzle games (57 cases), tutoring grandchildren with homework (42 cases), painting (16 cases), playing musical instruments (47 cases), and practicing calligraphy (30 cases). Multiple linear stepwise regression analysis showed that learning new knowledge, reading, tutoring grandchildren with homework, puzzle games, and playing musical instruments were influencing factors of cognitive function in older adults ($P<0.05$). Learning new knowledge ($B=0.250$), reading ($B=0.590$), puzzle games ($B=0.585$), tutoring grandchildren with homework ($B=0.711$), and playing musical instruments ($B=0.643$) were influencing factors of the visuospatial and executive cognitive domain ($P<0.05$); learning new knowledge ($B=0.219$) was an influencing factor of the abstraction and delayed recall/memory cognitive domains ($B=0.727$) ($P<0.05$); reading ($B=0.095$, 0.207, 0.290, 0.241, 0.377) was an influencing factor of the naming ($B=0.095$), attention ($B=0.207$), language ($B=0.290$), abstraction ($B=0.241$), and delayed recall/memory ($B=0.377$) cognitive domains ($P<0.05$); puzzle games ($B=0.290$) and playing musical instruments ($B=0.278$) were influencing factors of the language cognitive domain ($P<0.05$). Reading entered the regression equation seven times in total, and its standardized regression coefficient for the effect on total MoCA score was 0.225, which was higher than that of other mental activity types.

Conclusion Mental activities such as reading, learning new knowledge, engaging in puzzle games, tutoring grandchildren with homework, and playing musical instruments can maintain or improve cognitive function in community-dwelling older adults, but different types of mental activities have domain-specific effects on cognitive function, which has positive implications for the prevention and intervention of cognitive decline in older adults.

Full Text

Abstract

Background: Intellectual activities such as reading and playing puzzle games can slow cognitive decline in older adults, but the effects of specific activity types on cognitive function and individual cognitive domains require further investigation. **Objective:** To explore the influence of common types of intellectual activities on cognitive function and specific cognitive domains among community-dwelling elderly individuals.

Methods: From May to August 2022, community-dwelling older adults from four cities in Jiangsu Province (Nanjing, Changzhou, Nantong, and Xuzhou) were selected using stratified convenience sampling. Face-to-face surveys were conducted using a general information questionnaire and the Montreal Cognitive Assessment (MoCA) to collect data on sociodemographic characteristics, frequency and types of intellectual activities, and cognitive function. Stepwise multiple regression analysis was used to examine relationships between intellec-

tual activities and different cognitive domains.

Results: A total of 782 questionnaires were distributed, with 758 valid questionnaires returned (effective response rate: 96.93%). The sample included 123 participants from Nanjing, 197 from Changzhou, 240 from Nantong, and 198 from Xuzhou. Older adults who engaged in intellectual activities 1–2 times per week or more had significantly higher total MoCA scores than those who participated less than once per week ($P<0.05$). Participants who engaged in two or more types of intellectual activities had higher total MoCA scores than those who engaged in only one type or no intellectual activities ($P<0.05$), and those who engaged in one type had higher scores than those with no intellectual activities ($P<0.05$). The reported intellectual activities included: learning new knowledge (n=170), playing chess/cards (n=228), reading (n=228), singing (n=59), playing puzzle games (n=57), helping grandchildren with homework (n=42), painting (n=16), playing musical instruments (n=47), and practicing calligraphy (n=30). Stepwise multiple linear regression analysis revealed that learning new knowledge, reading, helping grandchildren with homework, playing puzzle games, and playing musical instruments were significant factors influencing cognitive function ($P<0.05$). Specifically: learning new knowledge (B=0.250), reading (B=0.590), playing puzzle games (B=0.585), helping grandchildren with homework (B=0.711), and playing musical instruments (B=0.643) influenced the visuospatial/executive domain ($P<0.05$); learning new knowledge (B=0.219) influenced abstraction and delayed recall/memory domains (B=0.727) ($P<0.05$); reading (B=0.095, 0.207, 0.290, 0.241, 0.377) influenced naming (B=0.095), attention (B=0.207), language (B=0.290), abstraction (B=0.241), and delayed recall/memory (B=0.377) ($P<0.05$); and playing puzzle games (B=0.290) and playing musical instruments (B=0.278) influenced the language domain ($P<0.05$). Notably, reading was included in seven regression equations, with a standardized regression coefficient of 0.225 for its impact on total MoCA score, higher than all other activity types.

Conclusion: Intellectual activities including reading, learning new knowledge, playing puzzle games, helping grandchildren with homework, and playing musical instruments can maintain or improve cognitive function in community-dwelling older adults. Different types of intellectual activities exhibit domain-specific effects on cognitive function, which has important implications for the prevention and intervention of cognitive decline in elderly populations.

Keywords: Cognition; Cognitive dysfunction; Intellectual activity; Aged; Root cause analysis; Multiple linear model

Introduction

Approximately 50 million people worldwide currently live with dementia, a number projected to reach 152 million by 2050, with particularly rapid increases in low- and middle-income countries [1]. Without effective prevention strategies,

China's dementia prevalence is expected to rise substantially over the next three decades, posing serious threats to older adults' health and lives while creating heavy burdens for caregivers, families, and society [2]. As dementia pathogenesis remains unclear and no curative treatments exist, early identification and intervention for cognitive decline represent critical approaches. Research indicates that intellectual activities such as reading and chess games can reduce dementia risk [3]. To investigate the specific effects of different intellectual activities on cognitive function and domains, our research group conducted a cross-sectional survey across four cities in Jiangsu Province, with results reported herein.

Methods

Study Participants

From May to August 2022, community-dwelling older adults were selected from Nanjing, Changzhou, Nantong, and Xuzhou using stratified convenience sampling. Inclusion criteria were: (1) age $ $60 years; (2) clear consciousness with basic communication abilities and intact vision/hearing to cooperate with neuropsychological assessment; (3) voluntary participation with signed informed consent. Exclusion criteria included: (1) neurological or psychiatric disorders; (2) use of medications affecting cognitive function. The study was approved by the Ethics Committee of Nanjing Hospital of Chinese Medicine (Approval No. KY2022004).

Research Instruments

1. General Information Questionnaire: This included: (1) sociodemographic data: age, sex, years of education, occupation, economic status, marital status, living alone, and health status; (2) physical measurements: height, weight, and BMI (classified as underweight <18.5 kg/m^2, normal 18.5–23.9 kg/m^2, overweight >23.9–27.9 kg/m^2, and obese >27.9 kg/m^2); (3) intellectual activity status, including frequency and types. Frequency was calculated as weekly occurrences, with each session lasting $ $30 minutes counted as one instance. Activity types, determined through literature review and pilot surveys, comprised learning new knowledge, playing chess/cards, reading, singing, puzzle games, helping grandchildren with homework, painting, playing musical instruments, and practicing calligraphy (multiple selections permitted).

2. Montreal Cognitive Assessment (MoCA) Beijing Version: The MoCA Beijing version was used to assess cognitive function across eight domains: visuospatial/executive, naming, memory, attention, language, abstraction, delayed recall, and orientation. Total scores range from 0–30, with higher scores indicating better cognitive function. One point was added for individuals with $ $12 years of education to correct for cultural bias [4-5].

Data Collection and Quality Control

This study employed a questionnaire survey method. All researchers received unified training on questionnaire administration and item interpretation. Face-to-face surveys used standardized instructions to explain the purpose, content, and completion methods, with assistance provided when necessary while avoiding subjective influence. Questionnaires were distributed and collected on-site, with physical measurements taken by researchers. After collection, questionnaires were manually reviewed for completeness and logical consistency; valid questionnaires were those that were complete, logical, and showed no evidence of false responding (e.g., selecting the same option throughout).

Statistical Analysis

Data were double-entered into an Excel 2000 database and analyzed using SPSS 19.0. Categorical data were expressed as frequencies. Normally distributed continuous data were expressed as mean ± standard deviation ($\bar{x}\pm s$), compared between two groups using independent t-tests, among multiple groups using one-way ANOVA with LSD-t tests for pairwise comparisons. Influencing factors were analyzed using stepwise multiple linear regression. Statistical significance was set at $P<0.05$.

Results

General Characteristics

A total of 782 questionnaires were distributed; 24 participants withdrew due to time constraints or personal reasons, yielding 758 valid questionnaires (effective response rate: 96.93%). The sample comprised 123 participants from Nanjing, 197 from Changzhou, 240 from Nantong, and 198 from Xuzhou, with ages ranging from 60–93 years (mean 72.0$±$7.8 years). Detailed sociodemographic data are presented in .

Single-Factor Analysis of Intellectual Activity Frequency and Type Count

Significant differences were found in total MoCA scores across different intellectual activity frequencies and type counts ($P<0.05$). Specifically, older adults who engaged in intellectual activities 1–2 times per week or more had higher total MoCA scores than those participating less than once per week ($P<0.05$). Participants with two or more activity types had higher total MoCA scores than those with one type or no activities ($P<0.05$), and those with one activity type scored higher than those with none ($P<0.05$) .

Single-Factor Analysis of Activity Types and Cognitive Domains

The reported intellectual activities were: learning new knowledge (n=170), playing chess/cards (n=228), reading (n=228), singing (n=59), puzzle games

(n=57), helping grandchildren with homework (n=42), painting (n=16), playing musical instruments (n=47), and practicing calligraphy (n=30).

Learning New Knowledge: Participants who learned new knowledge had significantly higher total MoCA scores and visuospatial/executive, language, and abstraction domain scores than those who did not ($P<0.05$), with no significant differences in other domains ($P>0.05$) .

Reading: Participants who read had significantly higher total MoCA scores and visuospatial/executive, naming, attention, language, abstraction, and delayed recall/memory domain scores than non-readers ($P<0.05$), with no significant difference in orientation ($P>0.05$) .

Singing: Participants who sang had significantly higher total MoCA scores and visuospatial/executive and language domain scores than non-singers ($P<0.05$), with no significant differences in other domains ($P>0.05$) .

Puzzle Games: Participants who played puzzle games had significantly higher total MoCA scores and visuospatial/executive, naming, and language domain scores than non-players ($P<0.05$), with no significant differences in other domains ($P>0.05$) .

Helping Grandchildren with Homework: Participants who helped grandchildren with homework had significantly higher total MoCA scores and visuospatial/executive, delayed recall/memory, and orientation domain scores than those who did not ($P<0.05$), with no significant differences in other domains ($P>0.05$) .

Playing Musical Instruments: Participants who played instruments had significantly higher total MoCA scores and visuospatial/executive, attention, and language domain scores than non-players ($P<0.05$), with no significant differences in other domains ($P>0.05$) .

Practicing Calligraphy: Participants who practiced calligraphy had significantly higher visuospatial/executive and naming domain scores than non-practitioners ($P<0.05$), with no significant differences in total MoCA scores or other domains ($P>0.05$) .

Relationship Between Intellectual Activity Types and Cognitive Function

Using total MoCA score as the dependent variable and learning new knowledge, reading, singing, puzzle games, helping grandchildren with homework, and playing musical instruments as independent variables (coded as 1=yes, 0=no), stepwise multiple linear regression revealed that learning new knowledge, reading, helping grandchildren with homework, puzzle games, and playing musical instruments were significant factors influencing cognitive function ($P<0.05$) .

Separate stepwise multiple linear regression analyses were conducted for each cognitive domain. Results showed that learning new knowledge, reading, puz-

zle games, helping grandchildren with homework, and playing musical instruments influenced the visuospatial/executive domain ($P<0.05$). Learning new knowledge influenced abstraction and delayed recall/memory domains ($P<0.05$). Reading influenced naming, attention, language, abstraction, and delayed recall/memory domains ($P<0.05$). Puzzle games and playing musical instruments influenced the language domain ($P<0.05$) .

Overall, reading entered seven regression equations, learning new knowledge entered four, puzzle games entered three, and both helping grandchildren with homework and playing musical instruments entered two each. Reading's standardized regression coefficient for total MoCA score was 0.225, higher than all other activity types.

Discussion

Close Relationship Between Intellectual Activities and Cognitive Function in Older Adults

This study demonstrated that older adults who engaged in intellectual activities 1–2 times per week or more, and those with multiple activity types, exhibited better cognitive function. According to cognitive reserve theory, intellectual activities enhance cognitive reserve, which reduces cognitive impairment and dementia risk [6-7]. While education strengthens reserve during youth and complex occupations enhance it during adulthood [8-9], these factors become fixed in older age. However, elderly individuals can still reinforce cognitive skills through intellectual activities, reducing sensitivity to neuropathological changes and activating compensatory mechanisms that recruit established brain networks to buffer functional decline after brain injury [10-11]. Although studies show that chess, reading, and other intellectual activities can maintain or improve cognitive function [12-14], few have explored the specific effects of different activity types on distinct cognitive domains.

Reading Significantly Affects Most Cognitive Domains

Reading influenced six cognitive domains—visuospatial/executive, naming, attention, language, abstraction, and delayed recall—and had the greatest impact on total MoCA score among all activities. Reading is a complex intellectual activity involving information input, detection, storage, processing, output, and feedback, engaging perceptual, attentional, memory, and thinking processes [15]. Reading shapes brain structure and function, activating prefrontal regions and altering white and gray matter volumes, with multiple neural activity indices correlating with reading ability [16]. As an economical, accessible, and effective means of protecting cognitive function, reading deserves strong recommendation for older adults.

Learning New Knowledge Protects Visuospatial/Executive, Abstraction, and Delayed Recall/Memory Functions

Learning is a complex brain function. Electroencephalography studies show that theta oscillations represent a neural information processing mechanism in learning, memory, attention, and motivation [17]. Theta oscillations strengthen during learning, with higher frontal theta power associated with better memory outcomes. Hippocampal place cell firing characteristics are also tightly linked to theta rhythms during spatial learning and memory [18]. Alzheimer's disease patients show markedly reduced theta oscillations, but symptoms can improve after theta-frequency stimulation [19]. Additionally, theta-gamma phase-amplitude coupling is most common, with significantly reduced coupling observed in older adults with mild cognitive impairment before clinical symptoms emerge [20-21]. Thus, enhanced theta oscillations and theta-gamma coupling may represent the neural mechanisms underlying better cognitive function in older adults who learn new knowledge.

Playing Musical Instruments and Puzzle Games Maintain Visuospatial/Executive and Language Functions

Older adults who played musical instruments scored higher in visuospatial/executive and language domains. Music activates extensive brain regions, strengthening central executive control of working memory to enhance self-regulation and modulating cortical synchronization in neural networks involved in verbal memory formation [22-23]. Active music therapy through instrument playing promotes release of norepinephrine and acetylcholine, improving neural network function and executive abilities, whereas passive music therapy (e.g., listening) shows no significant effects [24]. Like instrument playing, puzzle games require rapid hand-eye-brain coordination, focused thinking, calculation, reasoning, and quick responses. Continuous external stimulation strengthens dopaminergic and cholinergic neurotransmitter transmission, enhancing cognitive function and slowing brain decline [25-26]. The enjoyable nature of games and music also regulates mood and stress, preventing negative emotion-induced neural damage that leads to cognitive dysfunction [26-27]. The puzzle games reported by participants included mobile games, Sudoku, jigsaw puzzles, and riddles; further research is needed on specific game types and their relationships with cognitive function.

Helping Grandchildren with Homework Protects Visuospatial/Executive Function

Older adults who helped grandchildren with homework showed better visuospatial/executive performance, likely because this activity involves integrated cognitive demands including reading, learning, and calculation. Cognitive stimulation can improve brain network efficiency and neural circuit plasticity, buffering age-related cognitive decline [28]. Additionally, homework assistance represents goal-directed activity that exercises planning, adjustment, implementation, and

monitoring executive functions. Such older adults likely have higher education levels and cognitive reserve, live with younger generations, participate in frequent social activities (e.g., transporting and caring for grandchildren), and thus experience lower rates of social isolation and loneliness, avoiding hypothalamic-pituitary-adrenal axis dysregulation-induced cognitive decline [29].

Limitations

This study found domain-specific effects of different intellectual activity types on cognitive function, providing new insights for preventing and intervening in cognitive decline. However, the cross-sectional design precludes longitudinal analysis of how different activities affect cognitive function over time, and underlying neural mechanisms require further investigation.

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Author Contributions

YIN Haiyan: conceptualization, data collection, data management, formal analysis, original draft writing. SONG Yulei: data management, review and editing. XU Guihua: supervision, funding acquisition. DU Shizheng: statistical analysis. LUO Dan, ZHANG Xueqin: investigation. BAI Yamei: project administration, resources, funding acquisition.

Conflict of Interest

The authors declare no conflicts of interest.

References

[1] LIVINGSTON G, HUNTLEY J, SOMMERLAD A, et al. Dementia prevention, intervention, and care: 2020 report of the lancet commission[J]. Lancet, 2020, 396(10248): 413-446. DOI: 10.1016/S0140-6736(20)30367-6.

[2] WANG Y Q, LIANG J H, JIA R X, et al. Prediction of Alzheimer's disease prevalence in China from 2020 to 2050[J]. Alzheimer's Disease and Related Disorders, 2019, 2(1): 289-298. DOI: 10.3969/j.issn.2096-5516.2019.01.012.

[3] LEE A T C, RICHARDS M, CHAN W C, et al. Association of daily intellectual activities with lower risk of incident dementia among older Chinese adults[J]. JAMA Psychiatry, 2018, 75(7): 697-703. DOI: 10.1001/jamapsychiatry.2018.0657.

[4] CAI M, HU Q R, JIA S H, et al. Strategy for the choice of appropriate mild cognitive impairment screening scales for community-dwelling older adults[J]. Chinese General Practice, 2022, 25(25): 3191-3195. DOI: 10.12114/j.issn.1007-9572.2022.0274.

[5] JIA J P. Chinese guidelines for diagnosis and treatment of dementia and cognitive impairment: 2015 edition[M]. 2nd ed. Beijing: People's Medical Publishing House, 2016: 27-29.

[6] KREMEN W S, ELMAN J A, PANIZZON M S, et al. Cognitive reserve and related constructs: a unified framework across cognitive and brain dimensions of aging[J]. Front Aging Neurosci, 2022, 14: 834765. DOI: 10.3389/fnagi.2022.834765.

[7] KO K, YI D, BYUN M S, et al. Cognitive reserve proxies, Alzheimer pathologies, and cognition[J]. Neurobiol Aging, 2022, 110: 88-95. DOI: 10.1016/j.neurobiolaging.2021.10.005.

[8] GODA A, MURATA S, SHIRAIWA K, et al. Factors influencing the development of mild cognitive impairment in community-dwelling people aged 75 years and older[J]. Geriatrics (Basel), 2021, 6(4): 104. DOI: 10.3390/geriatrics6040104.

[9] CHAN D, SHAFTO M, KIEVIT R, et al. Lifestyle activities in mid-life contribute to cognitive reserve in late-life, independent of education, occupation, and late-life activities[J]. Biol Psychiatry Cogn Neurosci Neuroimaging, 2021, 6(3): 370-379. DOI: 10.1016/j.bpsc.2020.08.013.

[10] WANG L C, XIONG J, YE M Z, et al. Research progress on cognitive reserve and its application in cognitive impairment rehabilitation[J]. Chinese Journal of Rehabilitation Medicine, 2022, 37(5): 685-689. DOI: 10.3969/j.issn.1001-1242.2022.05.021.

[11] YAN R W K, KWOK C P C, KWOK J O T, et al. Increasing participation in habitual intellectual activities on modulating functional connectivity of default mode network among older adults at risk of dementia: study protocol of a randomized controlled trial[J]. Trials, 2022, 23(1): 306. DOI: 10.1186/s13063-022-06250-0.

[12] LI H B, LI C W, WANG A X, et al. Associations between social and intellectual activities with cognitive trajectories in Chinese middle-aged and older adults: a nationally representative cohort study[J]. Alzheimers Res Ther, 2020, 12(1): 115. DOI: 10.1186/s13195-020-00691-6.

[13] FANG L X, SHEN Q. Study on intellectual activities and cognitive function of community elderly[J]. Journal of Nursing, 2017, 32(13): 84-86. DOI: 10.3870/j.issn.1001-4152.2017.13.084.

[14] LYU S J, LIN L, LI H L, et al. Correlation between hobbies and smart product usage with cognitive function among elderly in nursing institu-

tions[J]. Chinese Journal of Practical Nursing, 2018, 34(6): 407-411. DOI: 10.3760/cma.j.issn.1672-7088.2018.06.002.

[15] GAO Y F. The role of executive function in reading comprehension[J]. Public Relations World, 2021(12): 122-123.

[16] XUE H L, XUE G. Research progress on neural mechanisms of individual differences in reading ability[J]. Contemporary Linguistics, 2016, 18(4): 549-567. DOI: 10.1016/j.bandl.2012.10.009.

[17] LU N, XING D Q, SHENG T, et al. Mechanisms and functions of hippocampal neural oscillations[J]. Acta Physiologica Sinica, 2017, 69(5): 647-656. DOI: 10.13294/j.aps.2017.0052.html.

[18] LIU T T, ZHANG Y Y, ZHAO G C, et al. Relationship between theta oscillations and learning and memory in the brain[J]. Journal of Neuroanatomy, 2022, 38(1): 103-106. DOI: 10.16557/j.cnki.1000-7547.2022.01.017.

[19] GARCÍA-ALBA J, RAMÍREZ-TORAÑO F, ESTEBA-CASTILLO S, et al. Neuropsychological and neurophysiological characterization of mild cognitive impairment and Alzheimer's disease in Down syndrome[J]. Neurobiol Aging, 2019, 84: 70-79. DOI: 10.1016/j.neurobiolaging.2019.07.017.

[20] GOODMAN M S, KUMAR S, ZOMORRODI R, et al. Theta-gamma coupling and working memory in Alzheimer's dementia and mild cognitive impairment[J]. Front Aging Neurosci, 2018, 10: 101. DOI: 10.3389/fnagi.2018.00101.

[21] TYLER B, GROVE. Neural oscillatory abnormalities during gaze processing in schizophrenia: evidence of reduced Theta phase consistency and inter-areal Theta-gamma coupling[J]. Biol Psychiatry Cogn Neurosci Neuroimaging, 2021, 6(3): 370-379. DOI: 10.1016/j.bpsc.2020.08.013.

[22] SÄRKÄMÖ T, SIHVONEN A J. Golden oldies and silver brains: deficits, preservation, learning, and rehabilitation effects of music in ageing-related neurological disorders[J]. Cortex, 2018, 109: 104-123. DOI: 10.1016/j.cortex.2018.08.034.

[23] CHEUNG M C, CHAN A S, LIU Y, et al. Music training is associated with cortical synchronization reflected in EEG coherence during verbal memory encoding[J]. PLoS One, 2017, 12(3): e0174906. DOI: 10.1371/journal.pone.0174906.

[24] ZHAO Y R, SHANG S M, WU C. Effects of music training on cognitive function in older adults: a systematic review and meta-analysis[J]. Chinese Journal of Rehabilitation Medicine, 2021, 36(4): 454-461. DOI: 10.3969/j.issn.1001-1242.2021.04.009.

[25] YU X H, XING Y, XU L J, et al. Meta-analysis of the effect of chess and card games on cognitive domains in older adults[J]. Chinese Nursing Management, 2022, 22(10): 1546-1553. DOI: 10.3969/j.issn.1672-1756.2022.10.022.

[26] ZHENG P P, LI D, ZHENG X L, et al. Effects of group puzzle games on emotional state and cognitive function in elderly patients with mild cognitive impairment[J]. Journal of Nursing Management, 2019, 19(7): 530-533. DOI: 10.3969/j.issn.1671-315x.2019.07.018.

[27] SUN D D, SUN D D, SUO J D, et al. Mediating role of depression between social participation and cognitive function in older adults[J]. Chinese Journal of Disease Control & Prevention, 2022, 26(2): 212-217. DOI: 10.16462/j.cnki.zhjbkz.2022.02.015.

[28] LIN L, XIONG M, JIN Y, et al. A review of neuroimaging studies on cognitive reserve during brain aging[J]. Journal of Beijing University of Technology, 2022, 48(7): 794-804. DOI: 10.11936/bjutxb2021040001.

[29] KU M, ZHOU Q X, ZHOU J R, et al. Effect of loneliness on mild cognitive impairment in community-dwelling older adults[J]. Modern Preventive Medicine, 2020, 47(7): 1223-1226.

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Corresponding author: BAI Yamei, Professor, School of Nursing, Nanjing University of Chinese Medicine, Nanjing 210023, China. E-mail: czbym@126.com

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