Review Article
http://mjiri.iums.ac.ir
Medical Journal of the Islamic Republic of Iran (MJIRI)

Med J Islam Repub Iran. 2026 (22 Jul);40.79. https://doi.org/10.47176/mjiri.40.79

Which Domains of Cognition in Older Adults Are Affected by Sleep Duration? A Scoping Review

Narges Kheirollahi[1,2], Nafiseh Ghassab-Abdollahi[3], Saeed Sadigh-Eteghad[4], Seyyed Mohammad Bagher Fazljou[5], Reza Mohammadinasab[6], Nafiseh Rezaei[7], AliHossein Zeinalzadeh[8]*

Received: 10 Nov 2025 Revised: 7 Jun 2026 Accepted: 17 Jul 2026 Published: 22 Jul 2026

Abstract

Background: Over the past decade, research on the impact of sleep duration on cognitive domains in older adults has been emerging; however, a formal synthesis of the focused literature that addresses all cognitive domains has not yet been conducted. Therefore, this review study was conducted to investigate the effects of sleep duration on various cognitive domains in older adults.

Methods: This scoping review was conducted according to Arksey and O'Malley (2005). A systematic search was conducted across three research databases: PubMed, Web of Science, and Scopus, with relevant gray literature also reviewed. Studies that reported on the relationship between sleep duration and cognition among older adults were included in the review. Data were extracted, charted, and synthesized into a narrative. Consistent with the purpose of a scoping review, the methodological quality of the studies was not appraised.

Results: A total of 23 studies published between 2009 and 2024 fulfilled the inclusion criteria. The findings revealed that both excessively long and short sleep durations were strongly linked to impairments in learning, memory, and complex attention. Only a limited number of studies explored all cognitive domains, with none addressing social cognition. Additionally, analyses considering gender differences were notably absent.

Conclusion: This review highlights cognitive domains affected by inadequate sleep in older adults and emphasizes the need for more research on gender-specific differences in sleep duration. It also pointed out a gap in understanding the link between sleep duration and social cognition, emphasizing the need for further studies in this area.

Keywords: Sleep, Sleep Duration, Cognition, Domains of Cognition, Older Adults

Cite this article as: Kheirollahi N, Ghassab-Abdollahi N, Sadigh-Eteghad S, Fazljou SMB, Mohammadinasab R, Rezaei N, Zeinalzadeh AH. Which Domains of Cognition in Older Adults Are Affected by Sleep Duration? A Scoping Review. *Med J Islam Repub Iran.* 2026 (22 Jul);40:79. https://doi.org/10.47176/mjiri.40.79

Introduction

Cognitive domains encompass various mental processes that collectively define human intelligence and functioning. These domains are crucial in shaping how individuals perceive, process, and interact with the world around them. The fifth edition of the Diagnostic and Statistical Manual of Mental Disorders (DSM-5) identifies six key domains of cognitive function, each containing subdomains. These domains include learning and memory, complex attention,

Corresponding author: Dr AliHossein Zeinalzadeh, zeinalzadeha@tbzmed.ac.ir

1. Research Center for Integrative Medicine in Aging, Aging Research Institute, Tabriz, Iran
2. Neurosciences Research Center (NSRC), Tabriz University of Medical Sciences, Tabriz, Iran
3. Department of Geriatric Health, Faculty of Health, Tabriz University of Medical Sciences, Tabriz, Iran
4. Research Deputy, Neurosciences Research Center (NSRC), Tabriz University of Medical Sciences, Tabriz, Iran
5. Department of Persian Medicine, School of Traditional Medicine, Tabriz University of Medical Sciences, Tabriz, Iran
6. Department of History of Medicine, School of Traditional Medicine, Tabriz University of Medical Sciences, Tabriz, Iran
7. Department of Medical Library and Information Sciences, School of Allied Medical Sciences, Hamadan University of Medical Sciences, Hamadan, Iran
8. Social Determinants of Health Research Center, Faculty of Medicine, Tabriz University of Medical Sciences, Tabriz, Iran

Key Messages:

↑*What is "already known" in this topic:*
Understanding the cognitive domains affected by sleep duration in older adults is crucial to promoting their mental health and overall well-being. Sleep plays a critical role in maintaining brain function, and its quality and duration can significantly impact cognitive function, especially in older adults.

→*What this article adds:*
The present scoping review aims to summarize and incorporate previous research findings. This study highlighted the specific cognitive domains that are significantly affected by long or short sleep durations in older adults. This study also revealed that the effect of sleep duration on social cognition in older adults has not been addressed in previous studies.

perceptual-motor function, language, executive functions, and social cognition. Each cognitive domain serves a specific purpose in cognitive processing, with interconnections and interactions between them playing a vital role in shaping overall cognitive function (1).

While cognitive domains are distinct, they often interact and influence each other in complex ways. For instance, attention is essential for memory consolidation, language comprehension relies on perception, and problem-solving skills draw upon executive functions (1).

The importance of sleep for cognitive function has been widely recognized in both scientific research and clinical practice (2). Age-related changes in sleep architecture and quality make the relationship between sleep duration and cognitive function particularly important in older adults (3). The optimal amount of sleep for older adults remains a subject of debate, with recommendations typically ranging from 7 to 9 hours per night (4). However, individual variations exist, and factors such as comorbidities, medication use, and lifestyle choices can influence sleep duration (2). Studies have repeatedly shown a connection between older adults' cognitive decline and insufficient sleep. The findings show an inverted U-shaped relationship between poorer cognitive performance and both excessive and insufficient sleep (5, 6).

In this regard, A 2015 review and meta-analysis, encompassing 35 independent samples (N = 97,264) from 11 cross-sectional and seven prospective cohort studies, revealed notable findings. Cross-sectional studies demonstrated that long sleep duration was significantly linked to poorer performance across multiple cognitive domains, including executive functions, verbal memory, and working memory capacity. On the other hand, prospective cohort studies indicated a significant long-term impact of both short and long sleep durations solely on multi-domain cognitive performance. These results highlighted long self-reported sleep duration as a potential risk factor for cognitive aging (7).

Also, another systematic review and meta-analysis conducted in 2022 examining the impact of sleep disorders on cognitive function in adults analyzed 22 eligible studies, offering moderate to high-quality evidence that an optimal sleep duration of 7 to 8 hours supports cognitive health. Furthermore, the research highlighted that insomnia in older adults significantly impairs various cognitive domains, including working memory, episodic memory, inhibitory control, cognitive flexibility, problem-solving, executive function, perceptual abilities, alertness, complex attention, and sensitivity maintenance (8).

Understanding which cognitive domains are affected by sleep duration in older adults is important for several reasons; Identifying the impact of sleep duration on these cognitive domains can help in developing strategies to promote healthy aging by optimizing sleep patterns (9).

On the other hand, changes in sleep duration have been linked to cognitive impairment and dementia in older adults. By recognizing the cognitive domains affected by inadequate or excessive sleep, healthcare providers can potentially detect early signs of cognitive decline and intervene proactively (10).

Also, knowing which cognitive domains are most affected by short or long sleep duration can guide the development of targeted interventions. Cognitive impairments can significantly impact an older adult's quality of life, affecting their independence and daily functioning. By understanding the relationship between sleep duration and cognitive domains, individuals and caregivers can take steps to improve sleep habits and potentially enhance cognitive function, thereby improving overall quality of life (11). Finding the cognitive domains that older adults' sleep duration affects is crucial for encouraging healthy aging, identifying cognitive decline early, customizing interventions, and enhancing quality of life.

Due to the significance of the subject and the requirement to update data regarding the effects of sleep duration on various cognitive domains in older adults, this scoping review aims to systematically analyze the existing research on the impact of sleep duration on cognitive performance in this population.

Methods

Protocol Design

This scoping review was conducted using the framework recommended by Arksey and O'Malley, organized into five stages: (1) identifying the research question; (2) identifying relevant studies; (3) selecting studies; (4) charting the data; and (5) collating, summarizing, and reporting the results (12).

Stage 1: Identifying the Research Question

The research question of this review was: Which domains of cognitive function in older adults are affected by short and long sleep duration?

Stage 2: Identifying Relevant Studies

This stage of the scoping review process aims to identify the criteria that will be used to select the studies for inclusion in the review. A detailed search strategy was developed and executed by a specialist librarian (NR) across the following databases: Medline (via PubMed), Web of Science, and Scopus. Although a benefit of scoping reviews is the opportunity to explore grey literature, we utilized Google Scholar as a grey source, but ultimately decided to exclude these sources for two reasons. First, the articles we found on Google Scholar had already been retrieved from our selected databases. Second, some of the retrieved articles did not undergo a rigorous peer-review process, which is essential for ensuring the validity and reliability of our findings. We used a combination of keywords and MESH terms. The search terms include "sleep duration", "duration sleep", "sleep quantity", "quantity sleep", "sleep quantities", "total sleep time", "Cognition", "Cognitions", "cognitive function", "cognitive functions", and "Aged", "Elderly", "Aging". Various search terms were combined using Boolean connectors (AND & OR). The detailed search strategy is shown in Appendix 1.

Eligibility Criteria

The PECO framework was utilized to outline the research question and pinpoint relevant search terms. This framework facilitates the inclusion of pertinent evidence in the database by focusing on the research scope and minimizing unnecessary searches (13). The search focused on human studies and articles published in English from January 1998 to September 2024.

Based on the initial scoping process, research in progress, conference proceedings/abstracts, dissertations/theses, or books/book chapters were excluded. Hand searches of reference lists and bibliographies of pertinent articles were conducted to identify additional relevant publications. The inclusion and exclusion criteria used to guide the study selection process for this review are presented in Table 1.

Stage 3: Study Selection

At this stage, the articles identified through the designated search strategy were retrieved. All identified articles were uploaded to The Systematic Review Accelerator (SR-Accelerator), an online tool for managing and screening systematic reviews (14). Duplicate articles were removed automatically in SR-Accelerator.

Two independent reviewers (NK and NG-A) assessed the titles and abstracts for compliance with the eligibility criteria. We also calculated the kappa coefficient (κ) and the percentage of agreement scores to evaluate reliability before reaching any consensus. Inter-rater reliability was determined using $\kappa > 0.7$, signifying a high level of agreement among the reviewers. Disagreements between reviewers were resolved by a third reviewer (AHZ). Articles that failed to meet the eligibility criteria based on their titles were excluded. Studies that focused exclusively on sleep duration in older adults as a component of sleep quality and that considered sleep quality with cognitive domains in older adults in the analyses were also excluded. Any article that could not be assessed for relevance based on the title and abstract was thoroughly evaluated in its full text to determine eligibility.

All eligible articles were retrieved and reviewed, ensuring we could effectively select those for data extraction and synthesis, maintaining the integrity and relevance of our analysis. Two independent reviewers (NK and NG-A) conducted a full-text review, and any selection discrepancies were addressed by a third reviewer (SSE).

Stage 4: Charting the Data

The purpose of data charting in scoping studies is to provide a descriptive summary of the results. For this step, we identified existing classification frameworks that corresponded to the research questions previously outlined. These frameworks formed the basis of our data charting form. The classification frameworks consider the following: first author's name, year, country, number of participants, mean age, type of instrument, questionnaire used to assess sleep duration and cognitive function, and, finally, study outcomes (Tables 2, 3).

Stage 5: Collating, Summarizing, and Reporting the Results

A co-interpretation and classification of exposure types, exposure elements, and outcomes into common themes was performed by three authors (AHZ, SSE, and NK). The main exposures/interventions, their elements, and outcomes were identified by consensus. They are presented in Tables 3, 4, and 5.

Results

A total of 287 articles were identified from the database searches (Figure 1 for PRISMA-ScR flow chart (15).

Following the deduplication of articles, 185 articles remained. All articles were uploaded to an online systematic review management and screening tool, SR-Accelerator, where data management and both screening levels were conducted according to the eligibility criteria. Following the screening of titles and abstracts during screening level 1, based on the predefined eligibility criteria, a total of 50 articles were excluded, leaving 135 articles. After the second level of screening, 112 articles were excluded based on full-text review, leaving 23 articles available for data extraction.

Study Features

Included articles were from China (17,20,23,28,29,38), the United States (19,22,31,33,36,38), the United Kingdom (32), Sweden (21,35), Iran (24), Spain (25), Mexico (27), Japan (33), multinational (16,26,30), and published between 2009 and 2024. The population size included in each article was variable (from N = 78 to N = 34,203), which was dependent on the duration of the study, age groups included, number of countries, and databases used to acquire data (23,26, 28, 29,35). Out of the 23 studies, nine were cross-sectional (16- 18, 20, 25, 27, 33, 34, 36), and twelve were cohort (19, 21-24,26,28,29-32, 37, 38). Average participant age ranged from 62.12 to 95.15 years. All 23 studies assessed sleep duration using self-report methods. Additionally, one study employed polysomnography (22), and three used wrist actigraphy (31, 33, 37) (Table 3). In the included studies (16-38), thirty tools, questionnaires, and

Table 1. Inclusion and exclusion criteria

Inclusion	Exclusion
Population: Participants over 60 years of age of any gender and ethnicity • Exposure or phenomenon of interest: Sleep variables, including night sleep duration and total sleep duration • Outcomes: Any change in cognitive domain performance • Study designs: Observational (cross-sectional, cohort, surveys) • English language • All locations	• Systematic review or meta-analysis, Letters, meetings, or commentaries • Studies that have examined the impact of other sleep characteristics, such as sleep quality, sleep latency, sleep fragmentation, and apnea, regardless of duration, on cognitive domain performance. • Non-English

[DOI: 10.47176/mjiri.40.79]

Table 2. Tools, questionnaires, and tasks used to assess cognitive function in the included studies

No	Tool/questionnaire/ task	Cognitive domains that the tool or questionnaire assesses
1	The Mini-Mental State Examination(MMSE)	Orientation, Concentration, Attention, Verbal memory, Naming, and Visuospatial skills
2	Digit Symbol Substitution Test (DSST)	Motor speed, Attention, and Visuoperceptual functions
3	Logical Memory Delayed Recall test (LMDRt) (Wechsler Memory Scale)	Verbal episodic memory
4	Free and Cued Selective Reminding Test (FCSRT)	Verbal episodic memory
5	The word learning test (WLT)	Episodic verbal learning and memory
6	Word fluency test (WFT)/ verbal fluency(VF)	Attention, Working memory, Semantic memory, Executive functioning, and Language
7	Letter-digit substitution task (LDST)	Visual scanning, Mental flexibility, Sustained attention, Psychomotor speed, and Processing speed
8	Stroop color word test (SCWT/Stroop)	Attention, Processing speed, Cognitive flexibility, and Working memory
9	Figure-Drawing Test (FDT)/Human Figure Drawing (HFD) Test	Visual-spatial skills, Attention. Concentration, and Accurate perception of visual stimuli
10	The Telephone Interview for Cognitive Status(TICS)	Orientation, Concentration, Short-term memory, Language, Praxis, and Calculation
11	The Cognitive Assessment Battery (CAB)	Speed, Attention, Episodic memory, Visuospatial functions, Language, and Executive functions
12	The Paired Associate Learning task (PAL)	Visual learning and memory
13	Visuospatial episodic memory (VSEM)	Attention, Verbal memory
14	The Self-Ordered-Search task (SOS)	Visuospatial working memory
15	Digit Span (DGS)	Verbal short-term and Working memory
16	The Grammatical Reasoning task(GRT) that assesses Verbal Reasoning (VR)	Reasoning
17	Clock drawing test (CDT)	Planning, Organization, Attention, Visuospatial function, Memory, Language, Executive functioning
18	Global cognitive function score (GCS),	Orientation, Attention, Memory, Verbal fluency, Language, and Visuospatial ability
19	The Abbreviated Mental Test score (AMTS)	Orientation, Information, Registration, and 5-minute recall
20	Continuous performance test (CPT)	Sustained attention and vigilance
21	Number (n)-back test	The 0-back test: Attention and Short-term memory The 1-back test: Working memory, Executive function
22	The Cogstate Brief Battery: a computer-based collection of four cognitive tests (The One-Back (ONB) task, The Identification Test (IDN), The One Card Learning (OCL) test, and The Detection Task (DET))	ONB: Working memory. IDN: Visual information processing speed (Attention) OCL: Visual learning and memory DET: Psychomotor speed
23	The short-form California Verbal Learning Test (CVLT)	Memory
24	The Boston Naming Test (BNT)	Long-delayed recall
25	The Trail Making Test B (TMT B)	Executive function
26	The Wechsler Adult Intelligence Scales-Revised (WAIS-R; Digit-Symbol Substitution Test)	Motor speed, Attention, and Visuoperceptual functions
27	The Wechsler Memory Scales-Revised (WMS-R;Number Sequencing and Digit Span Forward and Backward)	Verbal short-term and Working memory
28	The Craft Story 21: Immediate and Delayed Recall	Immediate and delayed recall
29	Short Portable Mental Status Questionnaire (SPMSQ)	Orientation, Memory, and Recall
30	The Montreal Cognitive Assessment (MoCA)	Memory, Executive Functioning, Attention, Language, Visuospatial, and Orientation

tasks were utilized to evaluate cognitive function in older adults. Their titles and the cognitive domains they assess are presented in Table 3. All the tools used in the articles included in the present review are recognized.

Sleep Duration in Older Adults

Among the 23 included studies, only 8 reported the average sleep duration, which ranged from a minimum of 6.4 hours to a maximum of 8.58 hours (16, 20, 22, 25, 26, 33, 34, 37). Across all 23 studies, the most common sleep duration among older participants, both men and women, was between 7 and 9 hours (16-38). In the analysis of sleep duration categorized by length, most studies found that the number and proportions of older women and men were similar and closely aligned, with no significant differences reported (Table 4).

Relationship between Short Sleep Duration and Cognitive Domains

Of the 23 studies included in this review, 14 reported an association between short sleep duration and cognitive domain performance (16-19, 26-28, 30-35). The most commonly used sleep measure was the number of hours of sleep per night, compared with the recommended 7 to 9 hours per night. The results of the studies included in this review showed an association between short sleep duration and decreased performance in the following cognitive domains, including learning and memory (16-19, 26- 28, 30- 32, 35), complex attention (16-18, 20, 27, 28, 31-35), perceptual-motor function (16-18, 20, 27, 28, 31-33), language (16,17, 19, 26, 27, 31), and executive functions (16, 26, 27, 30, 31, 33). None of the included studies have examined the link between short sleep duration and social cognition in older adults (Table 5).

[DOI: 10.47176/mjiri.40.79]

Table 3. Characteristics of the studies included in this review

First author, published year	Country	Type of study	Participants/Mean age±SD	Follow-up year	Assessment: Sleep duration	Assessment: Cognitive performance	Missing data	Controlled confounders	Outcomes (Sleep Duration &Cognition)
Winer et al.2021 (16)	USA Canada Australia Japan	Cross-sectional study	4.417 71.3±4.7	-	Self-reported	MMSE, DSST LMDRT, FCSRT	Not reported	Demographic variables—gender, education, and race/ethnicity—were adjusted for by multiple regression.	Participants with short sleep duration performed significantly worse on the MMSE compared to those who reported normal sleep duration and the Logical Memory Delayed Recall test. They were also less likely to achieve the maximum FCSRT total recall score. However, those with short sleep duration performed better on the FCSRT free recall than those with long sleep duration. Participants with long sleep duration performed significantly worse on the DSST than those who reported normal sleep duration.
Ding al.2020 (17)	China	Cross-sectional study	1.115 73.1±8.8	1	Self-reported	MMSE	Out of 9178 records, 670 (7.3%) had missing values in at least one covariate(depression, BMI, physical activity, alcohol consumption, smoking, or problems with hearing or head trauma) and were excluded. A total of 8508 records were included in the regression analysis.	A logistic regression model adjusted for age, gender, and education was used to examine the association between sleep duration (short, long, normal) and cognitive impairment.	Controlling for age, sex, and education, the adjusted OR for cognitive impairment was 2.78 in those with < 6 hours of sleep and 2.25 in those with > 8 hours of sleep.
Aakre, et al.2023 (18)	UK	Cross-sectional study	8,508 64	-	Self-reported	CAB, PAL VSE, SOS DGS GRT(VR) SWM	Of the 10,175 participants in the dataset, 9178 had responded to the sleep questionnaire. Data were scrutinised for missingness, and outliers were excluded.	Age, gender, and education were adjusted in the multiple linear regression analysis model.	More specifically, short sleep duration was significantly associated with poorer performance on DGS and PAL (and long sleep duration was significantly associated with decreased performance on DS and VR.

Body mass index(BMI),Total sleep time(TST),Mild cognitive impairment(MCI), odds ratio(OR)

[DOI: 10.47176/mjiri.40.79]

Table 3. Cont

First author, published year	Country	Type of study	Participants/Mean age±SD	Follow-up year	Assessment		Missing data	Controlled confounders	Outcomes (Sleep Duration &Cognition)
					Sleep duration	Cognitive performance			
Arévalo et al.2023 (19)	USA	Cohort	Wave 2 952 Wave 4 444	10.5	Self-reported	MMSE WLT, WFT SCWT(Stroop) FDT(HFD) DGS, CDT GCS	Participants with missing sleep and covariate data were excluded from both cross-sectional and longitudinal analyses.	Health behaviors and health conditions associated with cognition, including smoking (current vs past or never); body mass index (BMI, kg/m2) and physical activity were adjusted in the linear regression model	In fully adjusted models, long sleep duration (≥8 hours) was not significantly associated with overall cognitive function, executive function, or MMSE score compared with 7 hours of sleep. A significant interaction between gender × age × sleep duration was observed, indicating that older men with short or long sleep duration had greater declines in overall cognition scores compared to women, younger men, and older men with 7 hours of sleep.
Auyeung et al. 2013 (20)	China	Cross-sectional study	2,947 73.8±4.9	-	Self-reported	MMSE	Were excluded participants with missing sleep data and covariate data in cross-sectional analyses (n = 311 and n =45, respectively) and longitudinal analyses (n = 136 and n =17, respectively).	Were controlled for socio-demographic and cultural factors, including age, sex, education, and language acculturation; and potential behavioral and health confounders including smoking, physical activity, BMI, depressive symptoms, diabetes, heart disease, and the use of antidepressants and sleep aids medication in cross-sectional models.	There was a decrease in mean MMSE score when the sleep duration was prolonged from 7 h to ≧10 h. No trend was observed from sleep duration <4 up to 7.9 h. A lower MMSE score was significantly associated with longer nocturnal sleep duration after adjustment for the covariates.
Behrens et al.2023 (21)	Sweden	Cohort	2311	20	Self-reported	MMSE CDT	Missing data were addressed through list-wise deletion in all analyses.	Linear regression models. Figures represent coefficients (95% confidence intervals). Models adjusted for education, gender, hypertension, hypercholesterolemia, smoking status, symptom of depression and physical inactivity	In the analysis of sleep duration, both long and short sleep were linked to decreased cognitive performance among 60-year-olds. Additionally, longer sleep duration at ages 60, 72, and 78 was associated with poorer cognitive function at age 78. However, no significant relationships were observed between sleep disturbances and performance on the clock drawing test.

[DOI: 10.47176/mjiri.40.79]

Table 3. Cont

First author, published year	Country	Type of study	Participants/Mean age±SD	Follow-up year	Assessment: Sleep duration	Assessment: Cognitive performance	Missing data	Controlled confounders	Outcomes (Sleep Duration &Cognition)
Blackwell Et al.2014 (22)	USA	Cohort	2,822 76.0±5.3	3.4±0.5	Self-reported/ Polysomnography	MMSE GCS	5 missing cognitive data were excluded	This association lost significance after further adjustment for multiple confounders. After adjustment for multiple confounders there were no significant associations seen between subjectively measured sleep and clinically significant cognitive decline. Models were adjusted for age, clinic site, and race (white versus nonwhite). bModels were further adjusted for body mass index, education level, number of depressive symptoms, number of comorbidities, presence of impairment in instrumental activities of daily living, benzodiazepine use, antidepressant use, self-reported health status, physical activity, alcohol consumption, and smoking status.	No associations were seen with self-reported TST and cognitive decline.
Chen et al.2022 (23)	China	Cohort Using data from the (CLHLS) in 2014 and 2018	2,195 83.89±9.63	4	Self-reported	MMSE	Excluding respondents with missing data and those under 60 years old, a total of 2,195 out of 7,192 eligible participants were included in the analyses.	Associations between sleep duration and cognitive impairment were analyzed using restricted cubic spline (RCS) regression. Additionally, logistic regression was employed to calculate the odds ratios, adjusting for potential confounders including age, sex, body mass index (BMI), marital status, household income, residential area, living arrangements, smoking status, and alcohol consumption.	The analysis examined the adjusted relationships between sleep duration and cognitive impairment among individuals with normal cognition at the start of the study. Participants who slept more than 7 hours at the follow-up stage faced a higher risk of developing cognitive impairment, while sleep duration at baseline did not show a significant impact. Additionally, individuals who consistently slept over 7 hours at both baseline and follow-up had approximately a 1.5-fold increased risk of cognitive decline.

[DOI: 10.47176/mjiri.40.79]

Table 3. Cont

First author, published year	Country	Type of study	Participants/Mean age±SD	Follow-up year	Assessment		Missing data	Controlled confounders	Outcomes (Sleep Duration &Cognition)
					Sleep duration	Cognitive performance			
Delbari et al.2024 (24)	Iran	Cohort	3,380	1	Self-reported	MMSE AMTS	Not reported	Age, educational status, physical activity, depression, anxiety, hypertension, diabetes mellitus, and sleep-related variables, daytime sleepiness, sleep-disordered breathing, and all seven domains of the PSQI were adjusted in the logistic regression analysis model.	After adjusting for relevant factors, of all sleep indicators, only sleep duration remained associated with cognition. Furthermore, this result was observed only in literate individuals, and no such association was observed in illiterate individuals. Results showed that a sleep duration of more than 8 h had 66 percent increased odds of having MCI in literate individuals.
Faubel et al.2009 (25)	Spain	Cross-sectional study	3,212 Male 71.6±7.8 Female 72.3±7.6	-	Self-reported	The Mini Examen Cognoscitive (MEC), a version of MMSE	27 participants were excluded for lack of data on confounding factors, and 88 participants were excluded due to incomplete responses to the MEC questionnaire.	Linear regression model adjusted for sex, age, physical activity, tobacco use, alcohol consumption, coffee consumption, educational level, SF-36 mental summary score, SF-36 physical summary score, night-time awakening, intake of anxiolytic medication, number of social ties, medical drug consumption, number of chronic diseases, body mass index, hypertension and antihypertensive treatment.	In both the model adjusted for age and sex and the model additionally accounting for other confounding factors, the prevalence of cognitive impairment steadily rose across sleep duration categories, spanning from 7 to 11 hours. Additionally, after adjusting for age and sex, the prevalence of cognitive impairment was greater among individuals sleeping 10 and 11 hours compared to those sleeping 7 hours. The findings were consistent across sexes. No link was found between short sleep duration (less than 7 hours) and cognitive impairment, neither in the overall sample nor when analyzed separately by sex. In both regression models, the difference in MEC associated with sleeping 11 hours or more was comparable to the effect of a 10-year increase in age. The results remained similar across sexes. No association was observed between short sleep duration (<7 h) and cognitive function.

[DOI: 10.47176/mjiri.40.79]

Table 3. Cont

First author, published year	Country	Type of study	Participants/Mean age±SD	Follow-up year	Assessment: Sleep duration	Assessment: Cognitive performance	Missing data	Controlled confounders	Outcomes (Sleep Duration &Cognition)
Gildner et al.2014 (26)	China Ghana India, Mexico Russian	Cohort Uses nationally representative datasets	34,203 China 12,518 Ghana 4,114 India 6,291 South Africa 3,544 Russia 3,374 Mexico 4,362	-	Self-reported	Immediate and delayed verbal recall, DGS, WFT	Not reported	A linear regression analysis was conducted to investigate how country and sex influence differences in cognitive test results, while taking into account variations in education level.	People who slept less than 6 hours scored significantly lower on cognitive tests compared to those who slept between 6 and 9 hours. Likewise, individuals who slept more than 9 hours also performed worse cognitively than those in the intermediate sleep duration group.
Gildner et al.2019 (27)	Mexico	Cross-sectional study	782 62.12±1.06	4	Self-reported	Immediate and delayed verbal recall, DGS, WFT	Participants those missing one or more of the variables of interest were excluded from regression.	All analyses of Linear regressions controlled for participant sex, age, education level, household setting, number of diagnosed comorbidities, medication use, physical activity level category, gait speed, tobacco and alcohol use, baseline cognitive score, and follow-up interval.	Increased sleep durations were associated with greater negative changes in aspects of cognition. Specifically, a significant inverse relationship between change in sleep duration and the magnitude of change in overall cognitive performance was evident. Likewise, the inverse association between changes in sleep duration and cognitive performance change in backward digit span trended toward significance, and a similar inverse relationship trended toward significance for cognitive performance change in verbal fluency.
Hua et al.2021 (28)	China	Cohort	7,984 64.7±8.4	7	Self-reported	EM, FDT, (TICS)	Three individuals with missing data on covariates were excluded from analysis.	Sleep duration and global cognition in were controlled for the covariates (age, sex, living area, educational level, marital status, current smoking, current drinking, hypertension, dyslipidemia, diabetes, cancer, lung diseases, heart problems, depression, and the number of instrumental activities of daily living (IADLs)) simultaneously.	Short or long sleep duration in the previous wave of the cohort was associated with lower global cognition in the ensuing wave, and lower global cognition in the previous wave was associated with worse (short or long) sleep duration in the subsequent wave.

[DOI: 10.47176/mjiri.40.79]

Table 3. Cont

First author, published year	Country	Type of study	Participants/Mean age±SD	Follow-up year	Assessment		Missing data	Controlled confounders	Outcomes (Sleep Duration &Cognition)
					Sleep duration	Cognitive performance			
Li et al.2021 (29)	China	Cohort	4785	6	Self-reported	The mental status score, Memory score, (TICS-10),	The study used data from the China Health and Retirement Longitudinal Study (CHARLS), and missing data were not reported.	Sex-stratified generalized linear models, controlled for sociodemographic characteristics, lifestyle variables, comorbidity, and health status, were used to evaluate the relationship between sleep duration and cognition.	For the overall population, long sleep duration (>8 h per day) was associated with 0.43 points lower in mental status scores, compared to individuals with normal sleep duration (7–8 h per day). Similarly, compared to individuals with normal sleep duration, long sleep duration was associated with 0.26 points lower in memory scores. No significant association was found between short sleep duration and cognition scores. In men, compared to normal sleep duration, long sleep duration was associated with 0.37 points lower and 0.26 points lower in mental status scores and memory scores, respectively. However, in women, compared to normal sleep duration, the association was significant only between long sleep duration and mental status scores.
Ma et al. 2020 (30)	China UK	Cohort	20, 065 ELSA 9254 64.6±9.8	6	Self-reported	memory, executive function, and orientation	Missing data were excluded.	Linear mixed models were used, with adjustments made for age, sex, body mass index, systolic blood pressure, depression, current smoking status, alcohol use, diabetes, coronary heart disease, stroke, cancer, chronic lung disease, and asthma.	The results derived from the 2 cohorts were comparable. The adjusted least-squares means of the global cognitive z scores among individuals reporting 8h, 10h or more, or 4 hours or fewer of sleep per night were statistically significantly lower than in the reference group (7 hours per night). Similarly, a statistically significant association between longer (8, 9, or ≥10 hours) or shorter (≤4 hours) sleep duration and lower baseline scores in the 3 cognitive domains (memory, executive function, and orientation) was observed, except for that between sleep duration of 9 or 10 hours or more and memory function. Inverted U-shaped associations between baseline sleep duration and the 4 cognitive z-scores were observed after adjusting for covariates. The individuals who slept 10 hours or more per night had the lowest cognitive scores.

[DOI: 10.47176/mjiri.40.79]

Table 3. Cont

First author, published year	Country	Type of study	Participants/Mean age±SD	Follow-up year	Assessment		Missing data	Controlled confounders	Outcomes (Sleep Duration &Cognition)
					Sleep duration	Cognitive performance			
McSorley et al. 2019 (31)	USA	Cohort	555 70.5±6.6	5	Self-reported/ Wrist actigraphy	MoCA	Missing data were excluded.	Linear regression was used to evaluate the relationship between each sleep parameter and MoCA-SA scores at baseline, first adjusting for demographic factors, followed by the inclusion of additional risk factors associated with cognitive impairment.	Those with low actigraph-measured TST (<6 hours) had increased odds of cognitive decline, compared with those sleeping 7–8 hours. In the interaction-by-sex models, evidence showed that the associations between sleep disruption and cognitive decline were more pronounced in men than in women.
Miller et al. 2014 (32)	UK	Cohort	8789	-	Self-reported	memory task, orientation,	The study used data from the English Longitudinal Study of Ageing (ELSA), and missing data were not reported.	Analysis of covariance (ANCOVA) was performed to test the association between sleep quantity and sleep quality, and scores of amnestic and non-amnestic cognitions separately, whilst controlling for the effects of confounding/contributing factors.	In both the younger (50–64 years) and older age groups (65+ years), short sleepers reported more sleep disturbance. There was a significant variation (inverted U-shape) in both amnestic and non-amnestic cognition by sleep quantity in both the younger and older age groups, whereby cognition scores were lower in both short and long sleepers. Following adjustment for potential confounders, in the younger age group, both short (6 hrs per night) and long (8 hrs per night) sleep were associated with lower amnestic and non-amnestic scores. Whereas in the older age group, associations were only significant with long sleep.
Miyata et al. 2013 (33)	Japan	Cross-sectional study	78 72.2±5.9	-	Wrist actigraphy	CPT, Number (n)-back test	Missing data were not reported.	Multiple regression analysis adjusted for age	The accuracy of the 0-back test significantly decreased in participants with TST < 5 h compared with those with TST > 7 h, but there was no significant difference in the accuracy of the 1-back test between the two groups. Sleep duration was independently associated with memory. Short sleep duration adversely affects memory in older adults.

[DOI: 10.47176/mjiri.40.79]

Table 3. Cont

First author, published year	Country	Type of study	Participants/Mean age±SD	Follow-up year	Assessment		Missing data	Controlled confounders	Outcomes (Sleep Duration &Cognition)
					Sleep duration	Cognitive performance			
Mohlenhoff et al. 2018 (34)	USA	Cross-sectional study	3,926 60±13.4	-	Self-reported	The Cogstate Brief Battery	Data were drawn from a large internet-based cohort study called the Brain Health Registry (BHR) and missing data were not reported.	The age, number of years of education, sex, scores on the Geriatric Depression Scale, use of sleep medications, and presence or absence of obstructive sleep apnea were controlled.	Most respondents (88.5%) usually slept between 6 and 9 hours each night. Total sleep time (TST) showed a positive link with age. Those with or without a personal or parental history of memory problems had similar TST. However, individuals worried about their memory slept about 15 minutes less (6.99 hours versus 7.14 hours). Cognitive performance in areas like working memory and attention peaked at around 8.0 hours of sleep and was lower for those who slept significantly more or less. This pattern held true across all ages, with middle-aged individuals generally performing best when they had mid-range TST.
Overton et al. 2024 (35)	Sweden Finland	Cross-sectional and longitudinal	5631	4.16	Self-reported	EM, VF, perceptual speed, executive functioning, GCS	Missing data were excluded.	Use of hypnotics, depressive symptoms, and lifestyle factors were all controlled for in the fully adjusted model.	In the basic models adjusted for demographic factors, participants who slept six hours or less per night performed worse on episodic memory tests compared to those who slept between seven and eight hours. Associations were no longer significant when controlling for depression. The longitudinal analyses showed that participants sleeping 6 hours or less declined faster on tests measuring perceptual speed and executive function. Sleeping for 9 hours or more, compared to participants sleeping for 7 to 8 hours, was associated with a lower level of performance in all cognitive measures. All associations were attenuated to no significance when controlling for cardiovascular conditions. Long sleepers performed worse on measures of perceptual speed. The longitudinal analyses showed poorer test scores over time for perceptual speed for long sleepers in comparison

[DOI: 10.47176/mjiri.40.79]

Table 3. Cont

First author, published year	Country	Type of study	Participants/Mean age±SD	Follow-up year	Assessment: Sleep duration	Assessment: Cognitive performance	Missing data	Controlled confounders	Outcomes (Sleep Duration &Cognition)
Sabeti et al. 2018 (36)	USA	Cross-sectional study	144 95.15±3.45	6 months	Self-reported	MMSE VLT CVLT BNT TMT B	Missing data were not reported.	Multiple linear regression with adjustments for depression, sex, age, education, and sleep medication.	After adjusting for age, sex, education, use of sleep medication, and GDS scores, the amount of sleep was linked to performance on tests measuring overall cognition (MMSE), memory (CVLT), and executive function (TMT B). Individuals who slept more than 8 hours performed worse on the MMSE and TMT B tests compared to those with optimal sleep duration (7–8 hours). However, no significant link was observed between long sleep and performance on the BNT. In contrast, sleeping less than 7 hours showed no significant association with any of the cognitive assessments when compared to the optimal range. The findings indicate that sleeping more than 8 hours at night was linked to lower performance in overall cognition, memory, and executive function, though no such association was found for language skills like naming. When participants were grouped by cognitive status, longer sleep showed a trend toward poorer scores on the MMSE, CVLT, and TMT B among those with normal cognition, but these results were not statistically significant. In contrast, among individuals with cognitive impairment (including CIND and dementia), extended sleep duration was significantly associated with worse performance on the CVLT.
Wiranto et. al. 2024 (37)	USA	Cohort	207 74.9±6.8	6	Self-reported Wrist actigraphy	WAIS-R; Digit Symbol Substitution Test, SCWT, VF, TMT B	There was 14% (n = 29) of missing data in the PSQI variable, which was imputed with multiple imputation chained equations with the mice package in R.	Analysis adjusted for gender, age, clinical dementia rating (CDR), and years of education.	Correlations between sleep parameters and cognitive function in older adults, after adjusting for age, education, and CDR score. Females exhibited stable performance of executive function with up to about 400 minutes of total sleep time, with significant declines in performance when total sleep time was longer. Additionally, a longer total sleep time contributed to lower verbal memory in a slightly non-linear manner. Higher self-reported sleep complaints were associated with poorer executive function in females with normal cognition. In males, a positive linear relationship emerged between sleep efficiency and executive function, while self-reported sleep was not associated with cognitive performance in males with normal cognition.
Zhao et. al. 2021 (38)	China	Cohort	4093 67.8±5.9	-	Self-reported	SPMSQ	Missing data were excluded.	The multivariable adjusted model included age, gender, ethnicity, education level, marital status, smoking history, drinking history, number of chronic diseases and depression as covariates.	Long sleep duration (≥ 9 h) was significantly associated with an increased prevalence of cognitive impairment and cognitive frailty. Multivariate adjustment for age, sex, race, marital status, education level, smoking history, drinking history, number of chronic diseases, and depression only resulted in a small change to the estimated OR in long sleep duration (≥ 9 h). Long sleep duration was independently associated with increased odds of cognitive impairment and cognitive frailty than the control group. Opposed to long sleep duration, the associations between short sleep duration (< 6 h) and cognitive frailty were not observed in either unadjusted or adjusted model.

[DOI: 10.47176/mjiri.40.79]

Table 4. Frequency and average sleep time by sleep duration category and gender reported in included studies

Citation	Mean sleep duration±SD	Short sleep duration (≤6h) N (%)	Normal sleep duration (7-8h) N (%)	Long sleep duration (≥9h) N (%)
Winer et al.2021 (16)	7.1±0.5	1185 (27)	2949 (67)	283 (6.0)
Ding al.2020 (17)	-	T: 184 (16.5)	T:823 (73.8)	T:108 (9.7)
		M: 61 (14.02)	M: 323 (74.25)	M: 51 (11.72)
		F: 123 (18.08)	F: 500 (73.52)	F: 57 (8.38)
Aakre, et al.2023 (18)	-	891 (10.5)	7555 (88.8)	62 (0.7)
Arévalo et al.2023 (19)	-	T: 666 (48.05)	T:267 (19.26)	T:453 (32.68)
		M: 174 (46.4)	M: 72 (19.20)	M: 129 (34.40)
		F: 492 (48.66)	F: 195 (19.28)	F: 324 (32.04)
Auyeung et al. 2013 (20)	T: 7.96 ±1.39		-	
	M: 8.10±1.46			
	F: 7.76 ±1.26			
Behrens et al.2023 (21)	6.98±1.23*		-	
Blackwell et al.2014 (22)	6.4± 1.2	M: 1898 (68.8)	M: 675 (24.5)	M: 185 (6.1)
Chen et al.2022 (23)	-	417 (19.0)	1,266 (57.7)	512 (23.3)
Delbari et al.2024 (24)	-		MCI	
		492 (67.21)	206 (28.14)	34 (4.64)
			CU	
		2443 (58.27)	1385 (33.03)	364 (8.68)
Faubel et al.2009 (25)	T: 8.0 ± 1.9	136 (21.31)	207 (32.44)	295 (46.23)
	M: 8.2 ± 2.0			
	F: 7.9 ± 1.8			
Gildner et al.2014 (26)	China 7.56.		-	
	Ghana 7.73			
	India 7.11			
	South Africa 8.58			
	Russia7.59			
	Mexico7.66			
Gildner et al.2019 (27)	T: 8.0 ± 1.9		-	
	M: 8.2 ± 2.0			
	F: 7.9 ± 1.8			
Hua et al.2021 (28)	-	(<4h)	(4-10h)	(> 10 h)
		3885 (8.63)	40813 (90.75)	247 (0.54)
Li et al.2021 (29)	-	2859 (59.7)	1496 (31.3)	430 (9.0)
Ma et al. 2020 (30)			ELSA	
		T: 5308(49.09)	T: 4661 (43.11)	T: 482 (4.45)
		M: 1256 (30.78)	M: 2570 (44.66)	M: 254 (7.92)
		F: 1824 (35.25)	F: 2995 (57.88)	F: 355 (6.86)
McSorley et al. 2019 (31)	-	230 (41.4)	290 (52.3)	35 (6.3)
Miller et al. 2014 (32)	-	607 (14.7)	3136 (76.0)	386 (9.3)
Miyata et al. 2013 (33)	5.29		-	
Mohlenhoff et al. 2018 (34)	T: 8.18±2.05		-	
	M: 8.03± 2.05			
	F: 8.24± 2.05			
Overton et al. 2024 (35)	-		H70	
		57 (7.33)	676 (86.4)	49 (6.30)
			SNAC-GAS	
		329 (29.5)	666 (59.7)	120 (10.8)
Sabeti et al. 2018 (36)	-		NC	
		19 (21)	48 (54)	22 (25)
			CIND	
		5 (17)	13 (43)	12 (40)
			Dementia	
		0 (0)	1 (9)	10 (91)
Wiranto et. al. 2024 (37)	T: 6.92± 64		-	
	M 6.82± 68.3			
	F 6.99 ± 60.4			
Zhao et. al. 2021 (38)	-	485 (11.9)	2698 (66.0)	910 (22.2)

T(Total), M(Male),F(Female), Minimal cognitive impairment (MCI), Cognitively unimpaired(CU), The China Health and Retirement Longitudinal Study (CHARLS) , The English Longitudinal Study of Ageing (ELSA), The Gothenburg H70 Birth Cohort Studies (the H70 studies), The Swedish National study on Aging and Care in Skåne (SNAC-S) – GÅS, Normal cognition(NC), cognitive impairment no dementia (CIND). *The mean sleep duration in this study was reported based on age group; for presentation in this table, the means were presented as a total mean.** For presentation in the table, the numbers and percentages of reported sleep duration in the studies were summarized as much as possible into 3 columns.

Relationship between Long Sleep Duration and Cognitive Domains

Of the 23 studies included in this review, 19 indicated that longer sleep duration was linked to lower performance across various cognitive domains in older adults(16-18, 20, 21, 23-30, 32, 34-38). In 17 studies, long sleep duration was associated with decreased learning and memory performance (17-18, 20, 21, 23-30, 32, 35-38), and the results of 18 studies showed decreased complex attention following increased sleep duration (16, 17, 20, 21, 23-26, 28-30, 32, 34-38). Similar results were observed in other domains such as perceptual-motor function (16-18, 20, 21, 23-26,

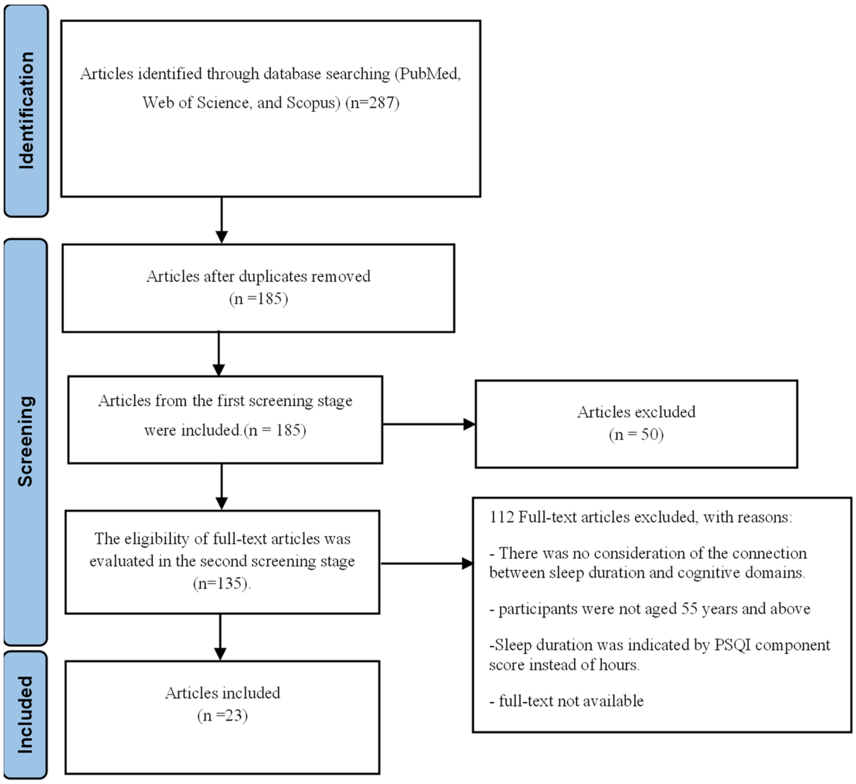

Figure 1. PRISMA-ScR flow chart of article selection

28-30, 32, 35-38), language (17, 20, 21, 23-26, 28, 29, 35, 36), and executive functions (18, 20, 21, 26-28, 30, 35-37). None of the included studies have examined the link between long sleep duration and social cognition in older adults (Table 5).

Inverse U-shaped Relationship

The results of eleven studies indicated an inverted U-shaped relationship between sleep duration and various cognitive function domains (16-18, 26-28, 30, 32, 34, 35).

Gender Differences

Of the total of 23 articles included in this review, 3 articles pointed out in their results gender differences in the effect of nighttime sleep duration on cognitive status and cognitive domains. One study found that older men with short sleep duration or long sleep duration had greater declines in global cognitive function score (GCS), compared to older women and younger men (19). Another study found that for older men, a longer sleep duration was linked to a decrease of 0.37 points in mental status scores and 0.26 points in memory scores when compared to normal sleep duration. In contrast, for older women, a significant association between long sleep duration and mental status scores was observed, but memory scores did not show the same relationship (29). In a study in Spain, although the number of older men who slept more than 10 hours in a 24-hour period was equal to or greater than that of older women, in the same group, the number of older women with MCI was higher than that of older men (26).

The results of a study in Iran showed that 89.2% of illiterate older women in the Iranian study had cognitive impairment, compared to only 10% of illiterate men (24).

Discussion

This scoping review aimed to assess the existing literature on the relationship between sleep duration and cognitive function domains among older adults. The results of 23 included studies showed that sleep characteristics such as short (<6 h) and long (>9 h) sleep duration, compared with moderate sleep duration, were associated with an impairment of cognitive function. Short/long sleep duration had the greatest impact on learning, memory, and complex attention domains.

Sleep Duration among Older Adults

Although it is commonly believed that aging is associated with either shorter or longer sleep durations, the findings of this review indicate that most older adults in the 23 studies from various countries reported sleeping between 7 and 9 hours. Generally, older adults require about the same amount of sleep as younger adults—approximately 7 to 9 hours, as recommended by the National Institute on Aging (39).

In contrast to the common belief that sleep duration decreases with age, this study found that shorter sleep was more prevalent among individuals under 60, while longer

[DOI: 10.47176/mjiri.40.79]

Table 5. The effect of sleep duration on cognitive domains

First author, published year	Sleep duration	Cognition assessment	Short sleep duration						Long sleep duration					
			L&M	CA	P-MF	L	EF	SC	L&M	CA	P-MF	L	EF	SC
Winer et al. 2021 (16)	≤6h 7-8h ≥9h	MMSE, DSST LMDRT, FCSRT	▼	▼	▼	▼	▼			▼	▼			
Ding et al. 2020 (17)	<6h 6-8h >8h	MMSE	▼	▼	▼	▼			▼	▼	▼	▼		
Aakre, et al.2023 (18)	<6h 6-9h >9h	CAB, PAL, VSE, SOS, DGS, GRT(VR) SWM	▼				▼		▼		▼		▼	
Arévalo et al.2023 (19)	<7h 7h ≥8h	MMSE, WLT, WFT SCWT (Stroop) FDT (HFD), DGS, CDT, GCS	▼	▼	▼	▼			No association was seen.					
Auyeung et al. 2013 (20)	-	MMSE	No association was seen.						▼	▼	▼	▼	▼	
Behrens et al.2023 (21)	-	MMSE, CDT	No association was seen.						▼	▼	▼	▼	▼	
Blackwell Et al.2014 (22)	≤ 5 h > 5-7 h > 7-8 h >8h	MMSE, GCS	No association was seen						No association was seen					
Chen et al.2022 (23)	<6h 6-8h >8h	MMSE	No association was seen						▼	▼	▼	▼		
Delbari et al.2024 (24)	<6h 6-8h >8h	MMSE, AMTS	No association was seen						▼	▼	▼	▼		
Faubel et al.2009 (25)	<5h 6 h,7h, 8h,9h, 10h≥11h	The Mini Examen Cognoscitivo (MEC), a version of MMSE	No association was seen						▼	▼	▼	▼		
Gildner et al.2014 (26)	≤5, 6, 7, 8, 9, 10, ≥11 h	Immediate and delayed verbal recall, DGS, WFT	▼	▼	▼	▼	▼		▼	▼	▼	▼	▼	
Gildner et al.2019 (27)	0-6 h > 6-9 h > 9 h	Immediate and delayed verbal recall, DGS, WFT	▼	▼	▼	▼	▼		▼				▼	
Hua et al. 2021 (28)	<4h 4-10h > 10 h	EM, FDT (TICS)	▼						▼	▼	▼	▼	▼	
Li et al.2021 (29)	<7h 7–8h > 8h	The mental status score, Memory score (TICS-10),	No association was seen						▼	▼	▼	▼		
Ma et al. 2020 (30)	≤4h 5h,6h,7h 8h,9h ≥10h	memory, executive function, and orientation	▼	▼	▼		▼		▼	▼	▼		▼	
McSorley et al. 2019 (31)	<6.00 6.00–6.99 7.00–7.99 8.00–8.99 ≥9.00	MoCA	▼	▼	▼	▼	▼		No association was seen.					

L&M (learning and memory), CA(complex attention), P-MF(perceptual-motor function),L(language), EF(executive functions), SC(social cognition). Decrease (▼), Increase (▲).

sleep was more common among those over 75. Although aging naturally affects sleep patterns—such as timing, duration, and structure—these changes are not solely attributable to aging itself. Other contributing factors often associated with aging, including physical and mental health conditions, as well as changes in lifestyle, environment, and social circumstances, can also lead to sleep disturbances (40). One possible explanation is that middle-aged individuals may need to wake up earlier due to work schedules.

Furthermore, differences in light exposure, lifestyles (e.g., diet, exercise and activity level), and work and recreation schedules among regions—such as Mediterranean countries like Spain, France, and the United States —may contribute to the different results, particularly since these factors can influence both sleep duration and cognitive function. Notably, differences in sleep duration across countries should be interpreted within the context of geographic variation (41).

Table 5. Cont

First author, published year	Sleep duration	Cognition assessment	Short sleep duration						Long sleep duration					
			L&M	CA	P-MF	L	EF	SC	L&M	CA	P-MF	L	EF	SC
Miller et al. 2014 (32)	<6h 6-8h >8h	memory task, orientation,	▼	▼	▼				▼	▼	▼			
Miyata et al. 2013 (33)	-	CPT, Number (n)-back test		▼			▼		No associations were seen.					
Mohlenhoff et al. 2018 (34)	-	The Cogstate Brief Battery		▼						▼				
Overton et al. 2024 (35)	<6h 6-8h >9h	EM, VF, perceptual speed, executive functioning, GCS	▼						▼	▼	▼	▼	▼	
Sabeti et al. 2018 (36)	<7h 7-8h >8h	MMSE, VLT, CVLT BNT, TMT B	No associations were seen						▼	▼	▼	▼	▼	
Wiranto et al. 2024 (37)	-	WAIS-R; Digit Symbol Substitution Test, SCWT, VF, TMT B	No associations were seen						▼	▼	▼		▼	
Zhao et al. 2021 (38)	<6h 6-8h >9h	SPMSQ	No associations were seen						▼	▼	▼			

L&M (learning and memory), CA(complex attention), P-MF(perceptual-motor function),L(language), EF(executive functions), SC(social cognition). Decrease (▼), Increase (▲).

Regarding study type, despite the significant relationship between sleep duration and cognition dimensions in both cross-sectional and longitudinal designs, a higher number of cross-sectional studies than longitudinal studies reported the association as statistically significant. Prospective designs are inherently stronger than cross-sectional designs due to their lesser concern for bidirectional effects. It seems that the results should be interpreted with more caution. Therefore, it is necessary to perform subgroup analysis with regard to study design in subsequent systematic reviews to detect potential causal inference.

Sleep Duration and Domains of Cognitive Function

The results of the present study indicate that both short and long sleep durations can affect cognitive function. However, more studies reported a negative impact of long sleep duration on cognitive domains than those highlighting the negative effects of short sleep. Consistent with findings from a previous overview (42), longer sleep duration appears to be associated with an increased risk of cognitive impairment compared to shorter sleep. An inverted U-shaped relationship—previously identified in the literature as a key feature linking sleep duration and cognitive performance in older adults (43)—was observed in 11 of the 23 included studies.

Almost half of the included studies examined the relationship between all five cognitive domains—learning and memory, complex attention, perceptual-motor function, language, and executive functions—and short-term or long-term sleep duration. Among these, the domains of learning and memory, along with complex attention, were most affected by either short or long sleep durations. A systematic review and meta-analysis encompassing thirty-five studies (comprising twenty-six cross-sectional and nine prospective investigations) was conducted. It revealed that extended sleep durations are significantly correlated with diminished performance across various cognitive domains, such as executive functioning, verbal memory, and working memory capacity (44). Some of the discrepancies in this regard may be due to the limited number of prospective cohort studies.

The underlying mechanisms linking both short and long sleep durations to cognitive impairment remain unclear. However, the ways in which long sleep duration may influence cognition are even less understood. While the majority of research has focused on the mechanisms underlying the association between sleep duration and overall cognitive performance, few studies have explored the specific pathways connecting sleep duration to individual cognitive domains.

For short sleep duration, one plausible mechanism is the lack of restorative processes. During sleep, anabolic activity reaches its peak, facilitating repair in both the central nervous system and the entire body. Memory consolidation occurs during sleep, and interruptions to this process can impair it. Animal studies (45, 46) suggest that a minimum amount of uninterrupted sleep is necessary for effective memory consolidation. Additionally, short sleep duration may lead to increased levels of stress hormones, which have been associated with cognitive impairment. Short sleep duration can disrupt circadian rhythms, which are linked to cognitive decline. Research has also shown that sleep deprivation reduces cognitive reserve and diminishes the efficiency of brain networks (47). Shorter sleep duration has been associated with difficulties in maintaining focus, especially when dealing with emotionally negative information. This can manifest as increased distractibility and problems disengaging attention from unwanted stimuli (48).

Several potential explanations have been proposed for the association between long sleep duration and cognitive decline. Long sleep duration may indicate a greater physiological requirement for rest or serve as a compensatory response to poor sleep quality. Supporting this, evidence

[DOI: 10.47176/mjiri.40.79]

links disrupted sleep with cognitive impairments. Additionally, longer sleep durations may be associated with elevated levels of inflammatory markers and psychiatric conditions such as anxiety and depression, which can subsequently contribute to cognitive decline (49, 50). Moreover, a previous study demonstrated a correlation between prolonged sleep latency and greater accumulation of β-amyloid deposits in the prefrontal cortex—a brain region that exhibits β-amyloid deposition during the early stages of Alzheimer's disease development (51).

As mentioned, the relationship between sleep duration and five cognitive domains was investigated across the 23 included studies; however, the domain of social cognition was not assessed in any of them. Social cognition encompasses a range of abilities involving the application of cognitive skills in social contexts, including theory of mind, affect perception, expression, attributional styles, and social knowledge. Successfully managing social interactions appears to demand higher-order cognitive capabilities. Consequently, deficits in these functions are associated with impairments in real-world social functioning and outcomes (52). Since sleep quality can influence overall cognitive performance, exploring the connection between sleep duration and the social cognition domain may be a valuable approach to enhancing social outcomes among older adults (53).

Although all studies examined sleep duration using self-reported questionnaires, many focused specifically on nighttime sleep duration, while only a few measured sleep over a 24-hour period. The timeframe used to assess sleep duration also varied across studies. Some evaluated participants' average or usual sleep without specifying a time frame, while others assessed sleep duration over the previous two nights or an entire week—introducing further inconsistencies in how sleep duration was defined. Daytime sleepiness has been linked to diminished cognitive performance and may contribute to increased total sleep time. Since older adults often have more opportunities to nap due to retirement, reduced work hours, or decreased social engagement, discrepancies between nighttime and 24-hour sleep measurements could affect study outcomes. Measuring both nighttime and daytime sleep can improve comparability across studies. Furthermore, although self-reported questionnaires are a convenient tool—especially for large-scale research—they typically rely on single-item, self-assessed responses, which are prone to inaccuracies and bias. One study demonstrated that individuals tend to overestimate their sleep duration when compared to objective methods across different racial groups (54).

Overall, objective assessments such as polysomnography and actigraphy are considered more valid and reliable for measuring sleep duration than self-reports. A considerable number of confounding factors influence the cognitive health of older adults (55). However, it is not always feasible to account for all confounders affecting cognition within a single study. The included studies adjusted their analyses for a range of cognition-related variables, encompassing demographic characteristics, health behaviors, and health conditions. Nonetheless, only a few studies examined genetic factors such as the number of APOE ε2 and APOE ε4 alleles. Furthermore, none of the included studies accounted for environmental influences, such as the effects of air pollution on cognition. Previous research (56) has demonstrated associations between air pollution exposure and impairments in cognitive domains, including memory, attention, and executive function. Since older adults in different cities and countries are variably exposed to air pollution, adjusting for air pollution as a potential confounding factor in the association between sleep duration and cognitive health could be useful, especially in large prospective studies.

Gender Difference in Sleep Duration and Cognitive Domains

The results of the present study showed that there was no considerable difference in terms of sleep duration between genders. These results are not consistent with prior findings. Studies show that older women generally tend to sleep less than older men. A previous study found that women sleep approximately 20 minutes less than men (56). Older women often report more disturbances and a lower perception of sleep satisfaction, which helps explain the gender gap in sleep duration among older adults. These changes are explained by a mix of biological, hormonal, and psychological factors (57, 58). Additionally, among 23 included articles, only 3 studies addressed gender differences in the relationship between sleep duration and cognitive domains. The results of studies in this area have been conflicting (19, 59-61).

Sleep duration and gender play complex roles in cognitive aging, with women and men showing different vulnerability patterns depending on sleep habits and other background factors. The effect of these factors on health can be due to the biological differences related to sex in male and female populations. Experts across the field agree that incorporating sex and gender into research is crucial for scientific accuracy, better decision-making, minimizing harm, and promoting health equity. However, health studies, including both original research and systematic reviews, often lack consistent analysis and reporting on these aspects (62).

Limitations and Future Studies

This scoping review presents a comprehensive view regarding the association between sleep duration and different domains of cognition while also providing information highlighting gender differences. However, our study also had certain limitations that should be acknowledged. We excluded non-peer-reviewed sources like reports, theses, or conference proceedings. This might result in missing relevant data, especially in rapidly evolving or under-researched areas. In this study, due to resource limitations, we included only English-language studies. In addition to potentially increasing language bias, this could miss regional or cultural perspectives influencing the relationship between sleep duration and cognitive impairment. Notably, geographical and lifestyle differences across countries can directly or indirectly affect the sleep patterns of older adults. Moreover, accounting for geographical differences like light exposure and adjusting for confounding factors such as air pollution are important for accurately measuring sleep duration and understanding its effects on older adults. Earlier research has focused on how sleep duration affects overall cognition, but future studies—especially in labs and with animals—should investigate how it impacts specific cognitive domains, including social cognition, which is vital for older adults' real-world social functioning.

As mentioned, many studies rely on self-reported sleep questionnaires, which often vary in timeframe and overlook daytime naps—an issue for older adults. These methods can be inaccurate, so combining them with objective tools like polysomnography and actigraphy can enhance reliability. Finally, Kong et al., in their overview of systematic reviews (63), reported that the extent of cognitive impairment associated with short and long sleep durations across different cognitive domains is inconsistent. Given the limited research exploring the link between sleep duration and all cognitive domains in older adults—particularly studies that account for gender differences—further investigations, especially those using prospective designs, are warranted. Additionally, future systematic reviews should incorporate gender-based subgroup analyses to better identify gender-specific patterns in the relationship between sleep duration and cognitive domains.

Conclusion

This scoping review assessed the existing literature on the relationship between sleep duration and various cognitive domains in older adults. Notably, both long and short sleep durations were most strongly associated with impairments in learning, memory, and complex attention. Given the limited number of studies examining all cognitive domains—including social cognition—and the lack of analyses addressing gender differences, further primary research is warranted. Additionally, future systematic reviews should incorporate gender-based subgroup analyses to better identify potential differences between males and females.

Acknowledgment

The research team would like to thank the research support from the Center for Integrative Medicine Research in Aging and the Neurosciences Research Center at Tabriz University of Medical Sciences.

Conflict of Interests

The authors declare that they have no competing interests.

Authors' Contributions

NK, AHZ, N G-A, SSA designed AND conducted the study. NK, AHZ, N G-A, SSA, SMBF, and RMN are involved in manuscript writing. All authors approved the manuscript.

Ethical Considerations

Ethics approval was obtained in accordance with the Declaration of Helsinki. Ethical approval was granted by the Ethics Committee of Tabriz University of Medical Sciences (code No. IR.TBZMED.REC.1402.477).

Funding Support

This research is part of a PhD dissertation funded by the Research Center for Integrative Medicine in Aging at Tabriz University of Medical Sciences [grant number 71668].

Data Availability

The data from this study were stored at the Center for Integrative Medicine Research in Aging and the Neurosciences Research Center at Tabriz University of Medical Sciences in Iran. Those interested in accessing this dataset are encouraged to contact the study coordinators, AliHossein Zeinalzadeh(AHZ) and Narges Kheirollahi (NK). They will provide information about data access options in accordance with the relevant agreements.

AI Use Statement

What to include: Declare whether Generative AI or AI-assisted technologies were used in the writing, editing, or data analysis process, specifying the tool and purpose. If no AI tools were used, state: "The authors did not use artificial intelligence or AI-assisted technologies in the preparation of this manuscript."

References

1. American Psychiatric Association. Diagnostic and Statistical Manual of Mental Disorders. Washington DC: American Psychiatric Publishing; 2013.
2. Zimmerman ME, Benasi G, Hale C, Yeung LK, Cochran J, Brickman AM, St-Onge MP. The effects of insufficient sleep and adequate sleep on cognitive function in healthy adults. Sleep Health. 2024 Apr 1;10(2):229-36.
3. Li J, Vitiello MV, Gooneratne NS. Sleep in normal aging. Sleep Med Clin. 2022 Jun 1;17(2):161-71.
4. Chaput JP, Dutil C, Featherstone R, Ross R, Giangregorio L, Saunders TJ, et al. Sleep duration and health in adults: an overview of systematic reviews. Appl Physiol Nutr Metab. 2020;45(10):S218-31.
5. Brewster GS, Varrasse M, Rowe M. Sleep and cognition in community-dwelling older adults: A review of literature. Healthcare 2015 Dec 4 (Vol. 3, No. 4, pp. 1243-1270). MDPI.
6. Mellow ML, Crozier AJ, Dumuid D, Wade AT, Goldsworthy MR, Dorrian J, et al. How are combinations of physical activity, sedentary behaviour and sleep related to cognitive function in older adults? A systematic review. Exp Gerontol. 2022 Mar 1;159:111698.
7. Lo JC, Groeger JA, Cheng GH, Dijk DJ, Chee MW. Self-reported sleep duration and cognitive performance in older adults: a systematic review and meta-analysis. Sleep Med. 2016 Jan 1;17:87-98.
8. Kong J, Zhou L, Li X, Ren Q. Sleep disorders affect cognitive function in adults: an overview of systematic reviews and meta-analyses. Sleep Biol Rhythms. 2023 Apr;21(2):133-42.
9. Sánchez-Izquierdo M, Fernández-Ballesteros R. Cognition in healthy aging. Int J Environ Res. 2021 Feb;18(3):962.
10. Wennberg AM, Wu MN, Rosenberg PB, Spira AP. Sleep disturbance, cognitive decline, and dementia: a review. In Seminars in neurology 2017 Aug (Vol. 37, No. 04, pp. 395-406). Thieme Medical Publishers.
11. Leong RL, Chee MW. Understanding the need for sleep to improve cognition. Annu Rev Psychol. 2023 Jan 18;74(1):27-57.
12. Arksey H, O'Malley L. Scoping studies: towards a methodological framework. Int. J. Soc. Res. 2005; 8:19–32.
13. da Costa Santos CM, de Mattos Pimenta CA, Nobre MRC. The PICO strategy for the research question construction and evidence search. Rev Lat Am Enfermagem. 2007;15:508–11.
14. Clark J, Glasziou P, Del Mar C, Bannach-Brown A, Stehlik P, Scott AM. A full systematic review was completed in 2 weeks

using automation tools: a case study. J Clin Epidemiol. 2020 May 1;121:81-90.
15. Tricco AC, Lillie E, Zarin W, et al. PRISMA extension for scoping reviews (PRISMA-scr): checklist and explanation. Ann Intern Med. 2018;169:467–73
16. Winer JR, Deters KD, Kennedy G, Jin M, Goldstein-Piekarski A, Poston KL, et al. Association of short and long sleep duration with amyloid-β burden and cognition in aging. JAMA Neurol. 2021 Oct 1;78(10):1187-96.
17. Ding G, Li J, Lian Z. Both short and long sleep durations are associated with cognitive impairment among community-dwelling Chinese older adults. Medicine. 2020 Mar 1;99(13):e19667.
18. Aakre JA, Schulz J, Ballard C, Corbett A, Bjorvatn B, Aarsland D, et al. Self-reported sleep fragmentation and sleep duration and their association with cognitive function in PROTECT, a large digital community-based cohort of people over 50. Int J Geriatr Psychiatry. 2023 Nov;38(11):e6022.
19. Arévalo SP, Nguyen-Rodriguez ST, Scott TM, Gao X, Falcón LM, Tucker KL. Longitudinal associations between sleep and cognitive function in a cohort of older Puerto Rican adults: sex and age interactions. J Gerontol: Series A. 2023 Oct 1;78(10):1816-25.
20. Auyeung TW, Lee JS, Leung J, Kwok T, Leung PC, Woo J, Wing YK. Cognitive deficit is associated with phase advance of sleep–wake rhythm, daily napping, and prolonged sleep duration—a cross-sectional study in 2,947 community-dwelling older adults. Age. 2013 Apr;35:479-86.
21. Behrens A, Anderberg P, Berglund JS. Sleep disturbance predicts worse cognitive performance in subsequent years: A longitudinal population-based cohort study. Arch Gerontol Geriat. 2023 Mar 1;106:104899.
22. Blackwell T, Yaffe K, Laffan A, Ancoli-Israel S, Redline S, Ensrud KE, et al. Associations of objectively and subjectively measured sleep quality with subsequent cognitive decline in older community-dwelling men: the MrOS sleep study. Sleep. 2014 Apr 1;37(4):655.
23. Chen WC, Wang XY. Longitudinal associations between sleep duration and cognitive impairment in Chinese elderly. Front Aging Neurosci. 2022 Nov 17;14:1037650.
24. Delbari A, Tabatabaei FS, Jannatdoust P, Azimi A, Bidkhori M, Saatchi M, et al. The Relation of Sleep Characteristics and Cognitive Impairment in Community-Dwelling Middle-Aged and Older Adults: Ardakan Cohort Study on Aging (ACSA). Dement Geriatr Cogn Disord Extra 2024 Apr 29;14(1):29-39.
25. Faubel R, López-GarcÍa E, Guallar-castillÓn P, Graciani A, Banegas JR, RodrÍguez-artalejo F. Usual sleep duration and cognitive function in older adults in Spain. J Sleep Res. 2009 Dec;18(4):427-35.
26. Gildner TE, Liebert MA, Kowal P, Chatterji S, Snodgrass JJ. Associations between sleep duration, sleep quality, and cognitive test performance among older adults from six middle income countries: results from the Study on Global Ageing and Adult Health (SAGE). J Clin Sleep Med. 2014 Jun 15;10(6):613-21.
27. Gildner TE, Salinas-Rodríguez A, Manrique-Espinoza B, Moreno-Tamayo K, Kowal P. Does poor sleep impair cognition during aging? Longitudinal associations between changes in sleep duration and cognitive performance among older Mexican adults. Arch Gerontol Geriat. 2019 Jul 1;83:161-8.
28. Hua J, Zhuang S, Shen Y, Tang X, Sun H, Fang Q. Exploring the bidirectional associations between short or long sleep duration and lower cognitive function: a 7-year cohort study in China. Front Aging Neurosci. 2021 Oct 6;13:727763.
29. Li W, Sun N, Kondracki A, Sun W. Sex, sleep duration, and the association of cognition: findings from the China Health and Retirement Longitudinal Study. Int J Environ Res. 2021 Sep 27;18(19):10140.
30. Ma Y, Liang L, Zheng F, Shi L, Zhong B, Xie W. Association between sleep duration and cognitive decline. JAMA Netw Open. 2020 Sep 1;3(9):e2013573-.
31. McSorley VE, Bin YS, Lauderdale DS. Associations of sleep characteristics with cognitive function and decline among older adults. Am J Epidemiol. 2019 Jun 1;188(6):1066-75.
32. Miller MA, Wright H, Ji C, Cappuccio FP. Cross-sectional study of sleep quantity and quality and amnestic and non-amnestic cognitive function in an ageing population: the English Longitudinal Study of Ageing (ELSA). PLoS One. 2014 Jun 26;9(6):e100991.
33. Miyata S, Noda A, Iwamoto K, Kawano N, Okuda M, Ozaki N. Poor sleep quality impairs cognitive performance in older adults. J Sleep Res. 2013 Oct;22(5):535-41.
34. Mohlenhoff BS, Insel PS, Mackin RS, Neylan TC, Flenniken D, Nosheny R, et al. Total sleep time interacts with age to predict cognitive performance among adults. J Clin Sleep Med. 2018 Sep 15;14(9):1587-94.
35. Overton M, Skoog J, Laukka EJ, Bodin TH, Mattsson AD, Sjöberg L, et al. Sleep disturbances and change in multiple cognitive domains among older adults: a multicenter study of five Nordic cohorts. Sleep. 2024 Mar 1;47(3):zsad244.
36. Sabeti S, Al-Darsani Z, Mander BA, Corrada MM, Kawas CH. Sleep, hippocampal volume, and cognition in adults over 90 years old. Aging Clin Exp. 2018 Nov;30:1307-18.
37. Wiranto Y, Siengsukon C, Mazzotti DR, Burns JM, Watts A. Sex differences in the role of sleep on cognition in older adults. Sleep Adv. 2024;5(1):zpae066.
38. Zhao Y, Lu Y, Zhao W, Wang Y, Ge M, Zhou L, et al. Long sleep duration is associated with cognitive frailty among older community-dwelling adults: results from West China Health and Aging Trend study. BMC Geriatr. 2021 Dec;21:1-8.
39. National Institute on Aging. Sleep and older adults [Internet]. Bethesda (MD): U.S. Department of Health and Human Services; 2020 [cited 2025 Jul 8]. Available from: https://www.nia.nih.gov/health/sleep/sleep-and-older-adults
40. Lavoie CJ, Zeidler M, Martin JL. Sleep and aging. Sleep Sci Pract. 2018. https://doi.org/10.1186/s41606-018-0021-3
41. Faubel R, López-GarcÍa E, Guallar-castillÓn P, Graciani A, Banegas JR, RodrÍguez-artalejo F. Usual sleep duration and cognitive function in older adults in Spain. J Sleep Res. 2009 Dec;18(4):427-35.
42. Kong J, Zhou L, Li X, Ren Q. Sleep disorders affect cognitive function in adults: an overview of systematic reviews and meta-analyses. Sleep Biol. 2023 Jan 12;21(2):133-142. doi: 10.1007/s41105-022-00439-9. PMID: 38469285; PMCID: PMC10900040
43. Chen WC, Wang XY. Longitudinal associations between sleep duration and cognitive impairment in Chinese elderly. Front Aging Neurosci. 2022 Nov 17;14:1037650.
44. Lo JC, Groeger JA, Cheng GH, Dijk DJ, Chee MW. Self-reported sleep duration and cognitive performance in older adults: a systematic review and meta-analysis. Sleep Med. 2016 Jan;17:87-98. doi: 10.1016/j.sleep.2015.08.021. Epub 2015 Sep 25. PMID: 26847980.
45. Walker MP, Stickgold R. Sleep, memory, and plasticity. Annu Rev Psychol. 2006;57:139-66. doi: 10.1146/annurev.psych.56.091103.070307. PMID: 16318592.
46. Rolls A, Colas D, Adamantidis A, Carter M, Lanre-Amos T, Heller HC, et al. Optogenetic disruption of sleep continuity impairs memory consolidation. Proc Natl Acad Sci U S A. 2011 Aug 9;108(32):13305-10. doi: 10.1073/pnas.1015633108. Epub 2011 Jul 25. PMID: 21788501; PMCID: PMC3156195.
47. Medic G, Wille M, Hemels ME. Short-and long-term health consequences of sleep disruption. Nat Sci Sleep. 2017 May 19:151-61.
48. Nota JA, Coles ME. Shorter sleep duration and longer sleep onset latency are related to difficulty disengaging attention from negative emotional images in individuals with elevated transdiagnostic repetitive negative thinking. J Behav Ther Exp Psychiatry. 2018 Mar 1;58:114-22.
49. Mirdha M, Vishwakarma LC. Sleep and Circadian Disruption in Depression and Anxiety Disorders: An Inflammatory Insight. InCircadian Rhythms, Sleep and Inflammation 2025 Jan 1 (pp. 99-112). Cham: Springer Nature Switzerland.
50. Prather AA, Vogelzangs N, Penninx BW. Sleep duration, insomnia, and markers of systemic inflammation: results from the Netherlands Study of Depression and Anxiety (NESDA). J Psychiatr Res. 2015 Jan;60:95-102
51. Wang C, Holtzman DM. Bidirectional relationship between sleep and Alzheimer's disease: role of amyloid, tau, and other factors. Neuropsychopharmacology. 2020 Jan;45(1):104-120
52. Harvey PD, Penn D. Social cognition: the key factor predicting

social outcome in people with schizophrenia? Psychiatry (Edgmont). 2010 Feb;7(2):41-4. PMID: 20376275; PMCID: PMC2848464.
53. Hammer LA, Springfield CR, Tighe CA, Oswalt S, Bonfils KA. Schizotypy Moderates the Relationship Between Sleep Quality and Social Cognition. J Nerv Ment Dis. 2024 Mar 1;212(3):133-40.
54. Jackson CL, Patel SR, Jackson WB 2nd, Lutsey PL, Redline S. Agreement between self-reported and objectively measured sleep duration among white, black, Hispanic, and Chinese adults in the United States: Multi-Ethnic Study of Atherosclerosis. Sleep. 2018 Jun 1;41(6):zsy057.
55. O'Brien E, Hart C, Wing RR. Discrepancies Between Self-Reported Usual Sleep Duration and Objective Measures of Total Sleep Time in Treatment-Seeking Overweight and Obese Individuals. Behav Sleep Med. 2016 Sep-Oct;14(5):539-49.
56. Thompson R, Smith RB, Karim YB, Shen C, Drummond K, Teng C, et al. Air pollution and human cognition: A systematic review and meta-analysis. Sci Total Environ. 2023 Feb 10;859:160234.
57. Guidozzi F. Gender differences in sleep in older men and women. Climacteric. 2015 Sep 3;18(5):715-21.
58. Baker FC, Yűksel D, de Zambotti M. Sex differences in sleep. Sleep disorders in women: A guide to practical management. 2020:55-64.
59. de Souza Medeiros L, Santos FH, Almeida AP, Alves DM, Rocca RR, Tufik S, et al. Sex differences in the cognitive performance in adults: role of impaired sleep. Sleep Sci. 2022 Mar;15(01):17-25.
60. Li W, Sun N, Kondracki A, Sun W. Sex, sleep duration, and the association of cognition: findings from the China Health and Retirement Longitudinal Study. Int J Environ Res. 2021 Sep 27;18(19):10140.
61. Wiranto Y, Siengsukon C, Mazzotti DR, Burns JM, Watts A. Sex differences in the role of sleep on cognition in older adults. Sleep Adv. 2024;5(1):zpae066.
62. Runnels V, Tudiver S, Doull M, Boscoe M. The challenges of including sex/gender analysis in systematic reviews: a qualitative survey. Syst Rev. 2014 Apr 10:3:33. doi: 10.1186/2046-4053-3-33.
63. Kong J, Zhou L, Li X, Ren Q. Sleep disorders affect cognitive function in adults: an overview of systematic reviews and meta-analyses. Sleep Biol. 2023 Jan 12;21(2):133-142. doi: 10.1007/s41105-022-00439-9. PMID: 38469285; PMCID: PMC10900040.

[DOI: 10.47176/mjiri.40.79]

Appendix 1. Search strategy

Database	Search Terms	Date
PubMed	(("sleep duration"[Title/Abstract] OR "duration sleep"[Title/Abstract] OR "sleep quantity"[Title/Abstract] OR "quantity sleep"[Title/Abstract] OR "sleep quantities"[Title/Abstract] OR "total sleep time"[Title/Abstract]) AND "[Date - Publication] AND (("Cognition"[Title/Abstract] OR "Cognitions"[Title/Abstract] OR "cognitive function"[Title/Abstract] OR "cognitive functions"[Title/Abstract] OR "function cognitive"[Title/Abstract] OR "functions cognitive"[Title/Abstract]) AND [Date - Publication]) AND (("Aged"[Title/Abstract] OR "Elderly"[Title/Abstract]) AND (("Aging"[Title/Abstract] OR "biological aging"[Title/Abstract] OR "aging biological"[Title/Abstract] OR "Senescence"[Title/Abstract]) AND [Date - Publication])) AND (1998/1/1:2024/9/18[pdat])	September18, 2024
Scopus	(TITLE-ABS-KEY ("sleep duration" OR "duration sleep" OR "sleep quantity" OR "quantity sleep" OR "sleep quantities" OR "total sleep time") AND TITLE-ABS-KEY ("Cognition" OR "Cognitions" OR "cognitive function" OR "cognitive functions" OR "function cognitive" OR "functions cognitive") AND TITLE-ABS-KEY ("Aged" OR "Elderly") AND TITLE-ABSKEY ("Aging" OR "biological aging" OR "aging biological" OR "Senescence")) AND PUBYEAR > 1997 AND PUBYEAR < 2025	September18, 2024
Web of Science	TI=("sleep duration" OR "duration sleep" OR "sleep quantity" OR "quantity sleep" OR "sleep quantities" OR "total sleep time") AND TI=("Cognition" OR "Cognitions" OR "cognitive function" OR "cognitive functions" OR "function cognitive" OR "functions cognitive") AND TI=("Aged" OR "Elderly") AND TI=("Aging" OR "biological aging" OR "aging biological" OR "Senescence") AND "sleep duration" OR "duration sleep" OR "sleep quantity" OR "quantity sleep" OR "sleep quantities" OR "total sleep time" (Topic) and "Cognition" OR "Cognitions" OR "cognitive function" OR "cognitive functions" OR "function cognitive" OR "functions cognitive" (Topic) and "Aged" OR "Elderly" (Topic) and "Aging" OR "biological aging" OR "aging biological" OR "Senescence" (Topic) AND "sleep duration" OR "duration sleep" OR "sleep quantity" OR "quantity sleep" OR "sleep quantities" OR "total sleep time" (Abstract) and "Cognition" OR "Cognitions" OR "cognitive function" OR "cognitive functions" OR "function cognitive" OR "functions cognitive" (Abstract) and "Aged" OR "Elderly" (Abstract) and "Aging" OR "biological aging" OR "aging biological" OR "Senescence" (Abstract)	September18, 2024

[DOI: 10.47176/mjiri.40.79]