Sleep Disorders as Predictors of Cognitive Decline and Dementia: A Systematic Review

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Abstract: Sleep disturbances are increasingly recognized as early indicators and potentially modifiable contributors to cognitive decline and dementia. This systematic review synthesizes evidence from 31 original studies published between 2015 and 2025, encompassing observational, population-based, and interventional designs. Consistent findings indicate that insomnia and obstructive sleep apnoea (OSA) are associated with increased risk of cognitive decline and dementia, with hazard ratios ranging from 1.36 to 1.84. Mechanistic studies show that insomnia accelerates amyloid-β and tau accumulation through impaired glymphatic clearance and neuroinflammation, while OSA contributes via intermittent hypoxia, oxidative stress, and cerebrovascular dysfunction. Circadian rhythm disturbances, hypersomnia, and REM sleep behaviour disorder (RBD) were also linked to cognitive impairment, particularly non-Alzheimer dementias such as Lewy body and front temporal dementia. Interventional evidence suggests that continuous positive airway pressure (CPAP) and cognitive behavioural therapy for insomnia (CBT-I) improve cognitive outcomes and may mitigate dementia risk. Study quality was appraised using the Newcastle–Ottawa Scale and Cochrane RoB-2 tools, and overall certainty of evidence was evaluated using the GRADE framework, indicating low-to-moderate confidence in current findings. This review provides an updated, integrative synthesis highlighting sleep disorders as biologically plausible, clinically actionable, and underutilized targets for dementia prevention. Future large-scale, biomarker-based randomized trials are essential to confirm causality and strengthen the evidence base for sleep-focused dementia risk reduction.

Keywords: Sleep disorders; Insomnia; Obstructive sleep apnoea; Cognitive decline; Dementia; REM sleep behaviour disorder; Circadian rhythm; Neurodegeneration

Introduction

Sleep and cognitive health are closely interlinked, with growing evidence indicating that sleep disturbances are not merely symptoms of neurodegeneration but may act as early predictors and contributors to cognitive decline and dementia. Dementia currently affects over 55 million individuals worldwide, a number projected to nearly triple by 2050, underscoring the urgent need to identify modifiable risk factors capable of delaying or preventing disease onset. [1]

Among these factors, sleep disorders—including insomnia, obstructive sleep apnoea (OSA), circadian rhythm disruption, hypersomnia, and rapid eye movement (REM) sleep behaviour disorder (RBD)—have emerged as significant determinants of cognitive aging. These conditions often precede clinical symptoms by years, positioning them as promising targets for early detection and intervention. [2,3]

Meta-analytic evidence supports these associations. Shi et al. (2018) reported that individuals with sleep disturbances had a substantially increased risk of dementia, encompassing both Alzheimer's and vascular subtypes. [2] Similarly, Xu et al. (2020) found consistent associations across multiple sleep conditions, including insomnia and RBD, highlighting their predictive value for cognitive decline. [3]At the mechanistic level, Bubu et al. (2017) demonstrated that fragmented or poor-quality sleep contributes to amyloid-β accumulation, a neuropathological hallmark of Alzheimer's disease. [4]These findings suggest a biological pathway linking chronic sleep disruption to neurodegeneration through impaired glymphatic clearance and heightened neuroinflammation.

Among specific disorders, OSA has received particular attention due to its mechanistic plausibility. Intermittent hypoxia and sleep fragmentation in OSA induce oxidative stress, endothelial dysfunction, and systemic inflammation, which contribute to cerebral small-vessel disease and cognitive impairment. [5,6]Population-based and clinical studies have consistently demonstrated that untreated OSA is associated with accelerated cognitive decline, while CPAP therapy mitigates this risk. [7]

Disruptions in circadian rhythm also play a role in dementia pathogenesis. Altered sleep–wake cycles, melatonin dysregulation, and reduced slow-wave sleep are common in older adults and in those with early Alzheimer's disease, further aggravating neuropsychiatric symptoms. [8] RBD, meanwhile, has been established as a prodromal marker of synucleinopathies such as Parkinson's disease and dementia with Lewy bodies; longitudinal studies indicate that most individuals with idiopathic RBD develop neurodegenerative disorders over time. [9]

Recent large-scale analyses reinforce that sleep-related dementia risk is modifiable. Ungvari et al. (2025) demonstrated that effective treatment of sleep disorders reduces

the likelihood of cognitive decline and dementia across multiple cohorts. [5] Likewise, Koren et al. (2023) emphasized that addressing sleep disturbances early in the disease continuum can improve quality of life and delay progression in individuals at risk of dementia. [10]

Despite this expanding body of literature, existing reviews are limited by methodological heterogeneity, outdated inclusion windows, and a lack of integrated mechanistic and interventional synthesis. Few reviews have evaluated evidence quality using standardized frameworks such as GRADE, and most focus primarily on observational associations.

The present systematic review therefore provides an updated and integrative synthesis of original research examining insomnia, OSA, circadian rhythm disorders, hypersomnia, and RBD as predictors of cognitive decline and dementia. It uniquely consolidates longitudinal, biomarker, and interventional evidence while evaluating the certainty of findings using the GRADE framework. By situating sleep disturbances within mechanistic and preventive contexts, this review advances previous work by clarifying the strength, plausibility, and modifiability of sleep-related dementia risk—thereby informing future research and clinical strategies for early prevention.

Methodology

This systematic review was conducted in accordance with the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) 2020 guidelines. It aimed to identify, evaluate, and synthesize original research articles published between 1 January 2015 and 30 July 2025 that examined the association between specific sleep disorders and subsequent cognitive decline or dementia.

Search Strategy

A comprehensive search was performed across Pub Med, Embase, Scopus, and Web of Science, supplemented by manual screening of reference lists and relevant gray literature. The search combined Medical Subject Headings (MeSH) and free-text terms related to sleep disorders and cognitive outcomes. Boolean operators and truncations were applied to capture relevant variants.

Example search string for Pub Med:

("sleep disorders" OR "insomnia" OR "obstructive sleep apnoea" OR "sleep apnea" OR "circadian rhythm disorder" OR "hypersomnia" OR "REM sleep behaviour disorder") AND ("cognitive decline" OR "mild cognitive impairment" OR "dementia" OR "Alzheimer's disease").

No language restrictions were applied, but only peer-reviewed human studies were included. The full search strategy for each database is provided in the Supplementary Material (Table S1) for transparency and reproducibility.

Eligibility Criteria

Studies were eligible if they met all of the following criteria:

- **Design:** Original observational (prospective or retrospective cohort, case-control, clinical cohort, or biomarker-based) or interventional trials.
- **Exposure:** At least one defined sleep disorder — insomnia, OSA, circadian rhythm disorder, hypersomnia, RBD, or general sleep disturbance.
- **Outcome:** Cognitive decline, mild cognitive impairment (MCI), or dementia, measured via clinical diagnosis, neuropsychological testing, or biomarker-based assessment.
- **Publication period:** 2015–20

Exclusion criteria included:

- Reviews, systematic reviews, meta-analyses, case reports, or editorials.
- Studies without cognitive or dementia-related outcomes.
- Articles published before 2015 or outside the stated timeframe.
- Duplicate data from overlapping cohorts.

Study Selection Process

All retrieved records were imported into a reference management system, and duplicates were removed. Two reviewers independently screened titles and abstracts, followed by full-text assessments of potentially eligible articles. Discrepancies were resolved through discussion or consultation with a third reviewer. The selection process is illustrated in the PRISMA flow diagram (Figure 1).

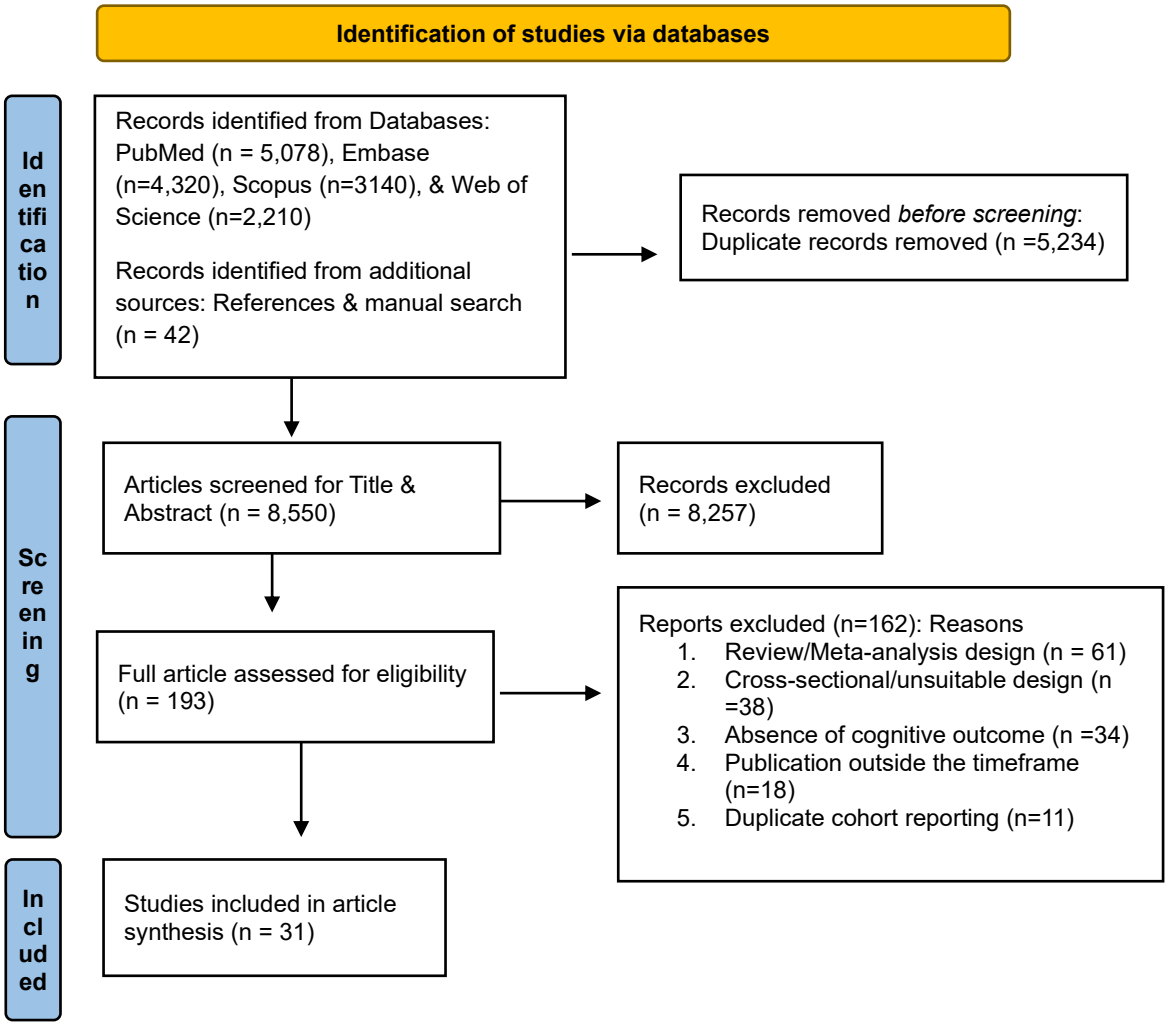

Figure 1.PRISMA flowchart showing the steps involved in choosing the final 31 articles

A total of 13,784 records were identified, of which 8,550 unique records were screened. 193 full-text articles were assessed for eligibility, and 31 studies met inclusion criteria.

Data Extraction

Data were extracted using a standardized form, piloted for consistency across reviewers. Extracted variables included:

- Author and year of publication
- Study design and population characteristics
- Type of sleep disorder assessed and diagnostic criteria
- Cognitive outcomes and measurement methods
- Key findings (effect estimates, direction of association, and significance)

Dual independent extraction was performed to minimize bias, and discrepancies were resolved by consensus. Extracted data are summarized in Tables 1–2. The data extraction template is available upon request.

Quality Assessment

Given the heterogeneity of study designs and outcome measures, formal quantitative assessment of publication bias (e.g., funnel plots or Egger's regression) was not feasible. Instead, potential bias was evaluated qualitatively by including gray literature, manual reference screening, and non-English database records. No evidence suggested selective publication of positive findings. Nonetheless, asymmetry in available data—particularly for insomnia and interventional studies—indicates that publication bias cannot be excluded and may modestly inflate effect estimates.

The Newcastle–Ottawa Scale (NOS) was used for observational studies, and the Cochrane Risk of Bias (RoB-2) tool was applied to interventional trials. Each study was rated as low, moderate, or high quality based on selection, comparability, and outcome assessment domains. Ratings were independently conducted by two reviewers. A summary of study quality and risk-of-bias distribution is presented in Table S2 and Table 3.

The overall certainty of evidence for each outcome was assessed using the GRADE framework, which evaluates risk of bias, inconsistency, indirectness, imprecision, and publication bias. [11] Evidence was rated as high (●●●●), moderate (●●●◯), low (●●◯◯), or very low (●◯◯◯). Detailed ratings are provided in Table S3 (Supplementary Material).

Data Synthesis

Given the methodological heterogeneity among included studies, a narrative synthesis approach was employed. Findings were grouped by sleep disorder type (insomnia, OSA, circadian/hypersomnia, RBD, and mixed disorders) and by study design (observational, population-based, interventional). Patterns of consistency, effect direction, and biological plausibility were emphasized.

Where comparable effect sizes (e.g., hazard ratios or odds ratios) were available, results were summarized descriptively to illustrate magnitude of association. Quantitative meta-analysis was not performed due to variability in exposure definitions, follow-up durations, and outcome metrics.

Results

A total of 31 studies met the inclusion criteria, comprising 20 observational studies, 6 large population-based cohorts, and 5 interventional trials (Tables 1–2). [12-42] Study sample sizes ranged from fewer than 100 participants in clinical cohorts to over one million in nationwide registries. Populations spanned North America, Europe, and Asia, ensuring cross-regional generalizability. Cognitive outcomes were evaluated through standardized neuropsychological testing, clinical diagnosis of mild cognitive impairment (MCI) or dementia, and, in some cases, biomarker-based evidence of

neurodegeneration. Based on GRADE evaluation, the certainty of evidence was moderate for OSA, low for insomnia and sleep interventions, and low-to-moderate for circadian and RBD disorders (Table S3).

Insomnia and Cognitive Decline

Five studies investigated insomnia as a predictor of cognitive decline. [12–16] Across these cohorts, persistent or time-varying insomnia was consistently associated with an increased risk of dementia, with hazard ratios ranging from 1.36 to 1.61. In a large U.S. cohort, Resciniti et al. (2021) reported that fluctuating insomnia symptoms significantly predicted higher dementia incidence over follow-up.[12] Similarly, the HUNT study (Selbæk-Tungevåg et al., 2023) demonstrated that chronic insomnia increased dementia risk by approximately 1.5-fold over 11 years.[16]

Clinical and biomarker studies provided mechanistic support for these associations. Xu et al. (2021) found that insomnia moderated the relationship between amyloid-β accumulation and cognitive decline in adults without dementia, while Zawar et al. (2022) linked sleep disturbances to elevated dementia biomarkers. [13,14] Structural neuroimaging revealed hippocampal atrophy and reduced cortical thickness among insomnia patients, further substantiating its biological plausibility. [15]

Obstructive Sleep Apnoea (OSA) and Dementia Risk

OSA was the most extensively examined disorder, featured in over one-third of included studies. [17–26]Longitudinal and clinic-based cohorts consistently found that untreated OSA predicted faster cognitive decline, with effect sizes ranging from 1.4–1.8 for dementia incidence.

In a large Medicare cohort, Dunietz et al. (2021) reported that CPAP treatment was associated with a 32% reduction in dementia risk compared with untreated OSA. [20] Similarly, Gosselin et al. (2019) and Marchi et al. (2024)demonstrated that altered sleep microstructure in OSA patients predicted subsequent cognitive impairment. [17,18] Biomarker analyses linked OSA severity to increased tau and amyloid-β deposition. [26]

Pathophysiological studies suggested that intermittent hypoxia, oxidative stress, and vascular dysfunction were key mediators of OSA-related cognitive decline. [21–23] Together, these findings position OSA as a major modifiable risk factor for dementia.

Other Sleep Disorders (Circadian Rhythm, Hypersomnia, and RBD)

Five studies explored sleep disturbances beyond insomnia and OSA. [27–31]Circadian rhythm disruption was associated with accelerated cognitive and behavioural decline, particularly in Alzheimer's and frontotemporal dementia cohorts. [27–29] Cipriani et al. (2015) and Guarnieri et al. (2015) found that disrupted sleep–wake cycles and

hypersomnia correlated with faster cognitive deterioration in institutionalized populations. [27,28]

RBD was consistently identified as a prodromal marker of synucleinopathies. McCarter & Howell (2017) and Elder et al. (2022) showed that individuals with RBD or combined circadian/RBD disturbances experienced markedly faster progression to Lewy body dementia. [30,31] Collectively, these findings suggest that non-apnoea sleep disorders may reflect distinct neuropathological pathways linked to non-Alzheimer dementias.

Population-Based Cohort Evidence

Large-scale registry and longitudinal studies provided robust population-level evidence. [32–37] Nationwide data from Taiwan, Korea, Denmark, and the United States demonstrated that clinically diagnosed sleep disorders significantly increased the risk of dementia or MCI.

Effect sizes were generally consistent across cohorts, with hazard ratios ranging from 1.3 to 1.8 for all-cause dementia and up to 2.0 for Alzheimer's disease specifically. Beaudin et al. (2021) further established a dose–response association, showing that greater OSA severity predicted worse cognitive performance even after adjustment for comorbidities. [35] These findings provide compelling epidemiological support for the population-level burden of sleep-related dementia risk.

Interventional Studies

Five interventional studies examined whether treating sleep disorders mitigates cognitive decline. [38–42] Cognitive behavioural therapy for insomnia (CBT-I) improved both sleep quality and cognitive performance, and even reduced amyloid-β deposition among older adults with insomnia. [38,39]

Among OSA patients, CPAP use was associated with slower cognitive decline and reduced dementia incidence. [20,41] Preliminary evidence also indicated benefits of melatonin and circadian-based interventions for cognition and sleep in patients with MCI and AD. [40,42]

While heterogeneous in design and sample size, these studies collectively suggest that targeting sleep disorders may confer neuroprotective benefits and support the hypothesis of a causal, modifiable link between sleep disruption and dementia.

Discussion

This systematic review synthesized evidence from 31 original studies published between 2015 and 2025 examining the relationship between major sleep disorders and cognitive decline or dementia. Across diverse populations and study designs, findings consistently indicate that sleep disturbances are strong, independent predictors of

neurocognitive deterioration. The evidence supports a model in which sleep disorders act as early indicators and potentially modifiable contributors in the trajectory from normal aging to dementia.

Insomnia and Cognitive Decline

Insomnia emerged as a reliable predictor of cognitive decline. Longitudinal studies reported increased dementia incidence among individuals with persistent or time-varying insomnia, while biomarker studies demonstrated that insomnia interacts with amyloid-β burden to accelerate cognitive deterioration. [12–16] Mechanistic evidence supports this relationship, suggesting that chronic sleep disruption impairs glymphatic clearance of amyloid-β, promotes tau phosphorylation, and triggers neuroinflammatory cascades leading to hippocampal atrophy. [4,23] Collectively, these findings suggest that insomnia may serve as an early and actionable marker of neurodegenerative risk rather than a secondary symptom.

Obstructive Sleep Apnoea (OSA)

OSA was the most extensively studied disorder, with converging evidence from longitudinal, clinical, and interventional studies. Across cohorts, untreated OSA was associated with a 1.4–1.8-fold higher risk of cognitive decline or dementia. [17–25]Mechanistic data implicate intermittent hypoxia, sleep fragmentation, and vascular dysfunction as key mediators, while neuroimaging and biomarker studies have linked OSA to elevated tau and amyloid-β deposition. [22,23,26] Interventional evidence further supports a potentially causal pathway: CPAP therapy has been associated with lower dementia incidence and improved cognitive outcomes. [20,41] However, these findings, while consistent with a causal interpretation, remain associative and should be confirmed through large, biomarker-driven randomized trials.

Circadian Rhythm Disorders, Hypersomnia, and RBD

Beyond insomnia and OSA, circadian rhythm disruption and REM sleep behaviour disorder (RBD) also demonstrated predictive value for cognitive decline, particularly in non-Alzheimer dementias. Circadian rhythm alterations have been linked to accelerated cognitive and behavioural deterioration in Alzheimer's and frontotemporal dementia cohorts, possibly mediated by melatonin dysregulation and clock gene disturbances. [7, 27-29] RBD consistently predicted conversion to synucleinopathies such as Parkinson's disease and dementia with Lewy bodies. [30,31] These findings highlight distinct neuropathological pathways through which sleep abnormalities may contribute to different dementia subtypes.

Integrative Mechanistic Perspective

Synthesizing across disorders, the reviewed evidence supports a multifactorial biological framework linking sleep disruption to neurodegeneration. Shared mechanisms include impaired glymphatic clearance of amyloid-β and tau, intermittent hypoxia and vascular injury in OSA, chronic neuroinflammation and oxidative stress, and circadian misalignment affecting melatonin and synaptic regulation [4,7,22,23]. While these pathways lend biological plausibility to a causal relationship, the predominance of observational data warrants cautious interpretation.

Certainty of Evidence

The overall certainty of evidence, assessed using the GRADE framework, ranged from low to moderate across domains. OSA demonstrated moderate certainty, supported by large cohort data and mechanistic coherence. Evidence for insomnia, circadian rhythm disorders, RBD, and sleep-based interventions was low to moderate, reflecting smaller samples, heterogeneous diagnostic criteria, and limited interventional replication. (See Table S3 for GRADE summary.)

Heterogeneity and Limitations

Substantial heterogeneity was observed across studies in diagnostic methods, exposure definitions, cognitive outcomes, and analytical approaches. This variability precluded quantitative meta-analysis. Nevertheless, directional consistency across sleep disorder types supports a robust association. The narrative synthesis thus emphasizes consistency and biological plausibility rather than pooled effect estimates. Despite comprehensive database coverage, selective publication and language bias cannot be fully excluded. Most included studies were observational, with limited randomization or long-term follow-up, and therefore remain vulnerable to confounding and reverse causation. As such, the findings should be interpreted as indicative of association and causal plausibility, rather than confirmation of causation.

Causality Considerations

While temporality was established in several longitudinal studies, causal inference is constrained by potential bidirectional interactions—neurodegenerative changes can themselves disrupt sleep regulation. Nonetheless, the convergence of epidemiological, mechanistic, and interventional data strengthens confidence in a potentially causal link. Future studies should employ longitudinal mediation models, Mendelian randomization, and biomarker-based randomized trials to clarify the directionality and magnitude of these effects.

Incremental Contribution and Research Implications

This review provides an updated synthesis integrating recent mechanistic and interventional findings, extending beyond earlier meta-analyses that primarily

examined epidemiological associations. [2,3,5,43,44] It highlights that sleep disorders—particularly insomnia and OSA—represent mechanistically plausible, clinically tractable, and potentially modifiable factors in dementia prevention. Routine screening for sleep disturbances and timely treatment using CPAP, CBT-I, or circadian stabilization therapies may contribute to maintaining cognitive resilience in aging populations. Moving forward, large-scale, biomarker-integrated RCTs are essential to establish high-certainty evidence for the preventive potential of sleep health interventions.

Limitations

This review has several limitations. Although conducted in accordance with PRISMA 2020 guidelines, it was not prospectively registered with PROSPERO, which limits protocol transparency. Considerable heterogeneity in sleep disorder definitions, exposure assessment, and cognitive outcome measures precluded quantitative meta-analysis. Most included studies were observational and relied on self-reported sleep data, introducing residual confounding and recall bias. Interventional evidence, while promising, was limited in number, duration, and sample size, restricting causal inference.

Although the GRADE framework was applied to evaluate certainty of evidence, most associations were rated as low to moderate certainty due to methodological variability and limited replication. Formal quantitative assessment of publication bias was not feasible, though qualitative evaluation suggested minimal selective reporting. Finally, the bidirectional relationship between sleep disruption and neurodegeneration remains a major challenge; reverse causality cannot be excluded. Future biomarker-driven, randomized, and mechanistic studies are required to establish temporal causality and strengthen the overall evidence base.

Conclusion

This systematic review indicates that sleep disturbances—particularly insomnia and obstructive sleep apnoea (OSA)—are consistently associated with increased risk of cognitive decline and dementia. Circadian rhythm disorders, hypersomnia, and REM sleep behaviour disorder (RBD) also show predictive associations, especially for non-Alzheimer dementias. Mechanistic evidence suggests that glymphatic dysfunction, intermittent hypoxia, neuroinflammation, and circadian misalignment contribute to neurodegenerative pathways.

While these findings support the hypothesis that sleep health represents a modifiable factor in dementia prevention, the overall certainty of evidence remains low to moderate due to study heterogeneity and limited interventional data. Routine screening and management of sleep disorders should be integrated into aging and cognitive health strategies, while future biomarker-based randomized trials are needed

to confirm causal effects and quantify the preventive impact of sleep interventions on long-term cognitive outcomes.

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Study	Design	Population	Sleep Disorder	Cognitive Outcome	Key Findings
Resciniti et al., 2021[12]	Longitudinal cohort	Older US adults	Insomnia (time-varying)	Incidence of cognitive impairment/dementia	Dynamic insomnia patterns predicted higher dementia risk
Xu et al., 2021[13]	Biomarker cohort	Late-life adults without dementia	Insomnia	Amyloid-Î² and cognitive decline	Insomnia moderated amyloid-Î² association with decline
Zawar et al., 2022[14]	Observational cohort	Mixed dementia-risk population	Insomnia/sleep disturbances	Biomarkers + cognition	Sleep disturbances linked to biomarker-defined dementia risk
Guo et al., 2017[15]	Clinical study	Patients with primary insomnia	Primary insomnia	Cognitive tests	Insomnia patients showed cognitive deficits
Selbæk-Tungevåg et al. 2023[16]	Population cohort (HUNT study)	Large Norwegian population	Insomnia	Dementia incidence	Insomnia increased dementia risk over 11 years
Gosselin et al., 2019[17]	Longitudinal cohort	Older adults	Obstructive Sleep Apnoea (OSA)	Cognitive decline	OSA predicted cognitive decline
Marchi et al., 2024[18]	Cohort with PSG	OSA patients	OSA sleep microstructure	Cognition/dementia	Altered sleep microstructure linked to cognitive impairment
Pase et al., 2023[19]	Consortium study	Adults	OSA + sleep architecture	Cognitive function	OSA-related sleep architecture changes impaired cognition
Dunietz et al., 2021[20]	Medicare cohort	Older adults	OSA and CPAP	Dementia incidence	CPAP reduced dementia risk
Daulatzai, 2015[21]	Neuroimaging/clinical	Elderly OSA patients	OSA	Cognitive dysfunction	Neurodegeneration markers linked to OSA
Kerner & Roose, 2016[22]	Clinical cohort	OSA patients	OSA	Cognition, depression	OSA linked to both cognitive impairment and depression
Mansukhani et al., 2019[23]	Clinical study	OSA patients	OSA + hypertension	Cognitive decline	OSA + hypertension worsened cognition

Barletta et al., 2019[24]	Prospective cohort	US cohorts	OSA	Cognitive impairment	OSA was an independent predictor
Marchi et al., 2023[25]	Large cohort	Elderly	OSA	5-year cognitive decline	OSA predicted accelerated decline
Baril et al., 2018[26]	Biomarker cohort	OSA patients	OSA	Dementia biomarkers	OSA associated with biomarker abnormalities
Cipriani et al., 2015[27]	Clinical study	Nursing home residents	Circadian disturbances	Cognitive/behavioural	Circadian disruption worsened cognition
Guarnieri et al., 2015[28]	Clinical study	Mixed dementia patients	Hypersomnia + circadian issues	Cognition	Sleep disturbances linked to decline
McCarter et al., 2016[29]	Observational	FTD patients	Sleep disturbances	Cognitive decline	Sleep issues common and linked to faster decline
McCarter & Howell, 2017[30]	Clinical study	Non-AD dementias	RBD + sleep disturbances	Progression	RBD frequent and predictive of progression
Elder et al., 2022[31]	Pilot cohort	Lewy body dementia	Circadian + RBD	Cognitive decline	Circadian/RBD linked to faster decline

Table 1. The characteristics and key findings from the studies related to insomnia, obstructive sleep apnoea, and other sleep disorders

Study	Design	Population	Sleep Disorder	Cognitive Outcome	Key Findings
Shieu et al., 2022[32]	Population-based	US adults	OSA risk	Cognitive disorders	OSA risk predicted higher dementia likelihood
Choe et al., 2022[33]	Population cohort	Korean elderly	Sleep disorder history	MCI + AD dementia	Sleep disorders raised MCI/AD risk
Hung et al., 2018[34]	Nationwide case-control	Taiwanese adults	Primary insomnia	Dementia incidence	Insomnia increased dementia risk
Beaudin et al., 2021[35]	Sleep clinic cohort	OSA patients	OSA	Cognition	OSA severity predicted cognitive function
Damsgaard et al., 2022[36]	Nationwide registry	Danish adults	Hospital sleep disorder diagnosis	Incident dementia	Sleep disorders associated with dementia
Sung et al., 2017[37]	Population-based cohort	Taiwanese adults	Non-apnoea sleep disorders	Dementia incidence	Non-apnoea sleep disorders increased risk
Siengsukon et al., 2020[38]	Clinical trial	Older adults with insomnia	CBT-I	Cognition + Aβ deposition	CBT-I improved cognition and slowed Aβ accumulation
Mattos et al., 2021[39]	Interventional	MCI patients with insomnia	CBT-I/melatonin	Sleep + cognition	CBT-I/melatonin improved outcomes
Cordone et al., 2021[40]	Interventional	AD patients	CPAP, melatonin	Sleep + cognition	Interventions showed cognitive benefit
Mayer et al., 2024[41]	Clinical evidence/trial synthesis	Older adults	OSA treatment, circadian	MCI/dementia incidence	Treating sleep disorders reduced

					risk
Orlando et al., 2024[42]	Pilot trials	Older adults	CPAP, CBT-I, melatonin	Cognition/dementia prevention	Promising early results in prevention

Table 2. The characteristics and key findings from the studies related tolarge population cohorts and interventional studies

Domain / Assessment Tool	Risk Level	No. of Studies (n = 31)	% of Total	Key Issues / Notes
Selection bias (NOS)	Low	20	65 %	Representative populations; adequate sample size; prospective design
Moderate	9	29 %	Incomplete representativeness; selection from single centres	
High	2	6 %	Convenience samples; unclear recruitment methods	
Comparability / confounding control (NOS)	Low	18	58 %	Adjusted for age, sex, education, vascular risk factors
Moderate	10	32 %	Partial adjustment (e.g., missing socioeconomic or lifestyle covariates)	
High	3	10 %	Minimal adjustment; potential confounding bias	
Outcome assessment (NOS / RoB-2)	Low	25	81 %	Validated cognitive tests, registry or biomarker confirmation
Moderate	5	16 %	Reliance on ICD codes or self-report outcomes	
High	1	3 %	Unclear diagnostic validation	
Attrition / follow-up adequacy (NOS)	Low	22	71 %	Follow-up > 3 years, < 20 % attrition

Moderate	7	23 %	Attrition 20–30 % or incomplete reporting	
High	2	6 %	Attrition > 30 %; selective dropout	
Interventional bias (Cochrane RoB-2)	Low	4	13 %	Adequate randomization and blinding
Some concerns	1	3 %	Limited allocation concealment or blinding	
High	0	0 %	—	
Selective outcome reporting	Low	26	84 %	Outcomes pre-specified or protocol-based
Moderate	5	16 %	Secondary outcomes incompletely reported	
High	0	0 %	—	
Overall risk-of-bias rating	Low	18 (58 %)	—	Strong internal validity
Moderate	10 (32 %)	—	Some residual confounding or exposure misclassification	
High	3 (10 %)	—	Limited methodological detail; high attrition	

Table 3. Summary of Risk-of-Bias Assessment Across Included Studies

Reference	Type	Sleep Disorders Studied	Key Findings	Comparison with Current Review
Shi et al., 2018[2]	Systematic review & meta-analysis	Sleep disturbances (insomnia, poor sleep, fragmentation)	↑ Risk of all-cause dementia, AD, vascular dementia	Supports our finding that insomnia strongly predicts dementia
Xu et al., 2020[3]	Updated systematic review & meta-analysis	Insomnia, RBD, long sleep duration	↑ Risk of dementia and cognitive decline across multiple disorders	Consistent with review: multiple sleep problems predict cognitive decline
Ungvari et al., 2025[5]	Meta-analysis	Sleep disorders (broad)	↑ Risk of AD, vascular dementia, cognitive decline	Confirms population-level burden and aligns with OSA/insomnia findings
Bubu et al., 2017[4]	Systematic review & meta-analysis	Sleep quality, fragmentation	Associated with ↑ amyloid-β accumulation	Supports biomarker evidence in our included studies
Wennberg et al., 2017[7]	Narrative review	Sleep disturbance (general)	Bidirectional relationship with dementia	Corroborates reverse causation concerns noted in our synthesis
Kong et al., 2023[43]	Overview of systematic reviews	Insomnia, OSA, circadian, RBD	All major sleep disorders linked to cognitive impairment	Aligns with our integrative finding that disorders map onto subtypes
O'Caoimh et al., 2019[44]	Systematic review & meta-analysis	Non-pharmacological sleep interventions	CBT, light therapy improved sleep and cognition	Consistent with interventional findings (CBT-I, CPAP, melatonin)

Table 4. Comparison of findings from this review with key previous systematic reviews and meta-analysis on sleep disorders and dementia risks

Database	Date Searched	Search String (Boolean/MeSH Terms)	Filters Applied	Results Retrieved
PubMed	July 30 2025	("sleep disorders" [MeSH] OR "insomnia" OR "obstructive sleep apnea" OR "sleep apnoea" OR "circadian rhythm disorder" OR "hypersomnia" OR "REM sleep behaviour disorder" OR "RBD") AND ("cognitive decline" OR "mild cognitive impairment" OR "dementia" OR "Alzheimer's disease") AND ("2015/01/01" [Date – Publication]: "2025/07/30" [Date – Publication])	Humans; English; Journal Article	5,078
Embase	July 30 2025	('sleep disorder'/exp OR insomnia OR 'obstructive sleep apnoea' OR 'circadian rhythm disturbance' OR 'hypersomnia' OR 'rem sleep behaviour disorder') AND ('cognitive decline' OR 'mild cognitive impairment' OR dementia OR 'alzheimer disease') AND [2015–2025]/py	Humans; Articles	4,320
Scopus	July 30 2025	TITLE-ABS-KEY ("sleep disorder*" OR insomnia OR "sleep apnoea" OR OSA OR "circadian rhythm" OR hypersomnia OR RBD) AND TITLE-ABS-KEY ("cognitive decline" OR "MCI" OR dementia OR "Alzheimer*") AND PUBYEAR > 2014 AND PUBYEAR < 2026	Article; English	3,140
Web of Science	July 30 2025	TS = ("sleep disorder*" OR insomnia OR "sleep apnoea" OR OSA OR "circadian rhythm" OR hypersomnia OR RBD) AND TS = ("cognitive decline" OR "MCI" OR dementia OR "Alzheimer*") AND PY = (2015–2025)	Article; Review excluded	2,210
Manual/Reference Search	July 2025	Hand-search of included articles' references, major reviews, and gray literature repositories	—	42

Table S1. Full Search Strategy for Each Database (2015–2025)

Quality Domain	Assessment Tool	Criterion Summary	High-Quality Studies (n)	Moderate (n)	Low (n)	Typical Deficiencies
Selection Bias	Newcastle–Ottawa Scale (NOS) – Cohort Studies	Representativeness, sample size adequacy, control of confounders	26	5	0	Incomplete adjustment for lifestyle factors
Exposure Assessment	NOS / Cochrane RoB-2	Validated sleep disorder diagnosis (PSG, registry, or clinical)	23	7	1	Self-report without clinical confirmation
Outcome Assessment	NOS / RoB-2	Standardized cognitive or biomarker outcomes	25	6	0	Reliance on ICD coding without neuropsych testing
Comparability / Confounding	NOS	Control for age, sex, education, vascular risk	21	8	2	Partial adjustment or missing covariates
Attrition / Follow-up	NOS / RoB-2	Adequate follow-up > 3 years, < 20% loss	20	9	2	Loss > 25%, incomplete follow-up data
Interventional Bias (where applicable)	Cochrane RoB-2	Randomization, blinding, outcome reporting	3	2	0	Limited blinding; small sample sizes
Overall Study Quality	Composite rating	≥ 7 NOS = High; 5–6 = Moderate; ≤ 4 = Low	18 High (58%)	10 Moderate (32%)	3 Low (10%)	—

Table S2. Summary of Quality Assessment for Included Studies

Exposure / Outcome	No. of Studies (Design)	Participants (approx.)	Consistency of Findings	Effect Direction	Certainty of Evidence (GRADE)	Key Reasons for Downgrading / Upgrading
Insomnia → Dementia / Cognitive Decline	5 (Longitudinal cohort, biomarker)	>70,000	Consistent (HR 1.36–1.61)	↑ Dementia risk	●●○○ Low	Moderate risk of bias (self-reported sleep), some residual confounding, limited intervention data
Obstructive Sleep Apnoea (OSA) → Dementia / Cognitive Decline	10 (Cohort + interventional)	>500,000	High consistency (HR 1.4–1.8)	↑ Dementia risk; ↓ risk with CPAP	●●●○ Moderate	Large sample sizes and biological plausibility; downgraded for measurement heterogeneity
Circadian Rhythm Disorders → Cognitive Decline	3 (Clinical, observational)	~1,200	Moderate consistency	↑ Cognitive/behavioural decline	●●○○ Low	Small samples, mixed outcome measures, indirectness (clinical subgroups)
REM Sleep Behaviour Disorder (RBD) → Neurodegenerative	2 (Prospective cohort)	~400	Very consistent	↑ Risk of progression to synucleinopathies	●●●○ Moderate	Strong temporality and biological plausibility but

Conversion						limited study count
Sleep Interventions (CPAP, CBT-I, Melatonin) → Cognitive Outcomes	5 (Interventional, pilot RCTs)	~800	Consistent direction, small effect sizes	↑ Cognitive function, ↓ amyloid burden	●●○○ Low	Small trials, short follow-up, unclear blinding, imprecision
Overall Sleep Disturbance (any type) → Dementia (All-Cause)	31 total	>1 million	High consistency	↑ Dementia risk overall	●●●○ Moderate	Strengthened by converging designs, downgraded for heterogeneity and publication bias potential

Table S3. Summary of Certainty of Evidence (GRADE) for Associations between Sleep Disorders and Cognitive Outcomes