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Age and Quality of Sleep: A Narrative Review of Normative, Epidemiological, Mechanistic, and Interventional Evidence

Dr Darshana Nariya

Department of Physiotherapy, SPB Physiotherapy College, Veer Narmad South Gujarat University, Surat, India

Abstract: ***Background: Sleep quality changes systematically across the lifespan, and older adults experience well-documented alterations in sleep architecture, continuity, and subjective quality. Given the rapid growth of the global older population, clarifying the relationship between age and sleep quality carries substantial clinical and public health relevance. Aim: This review synthesized evidence on how age influences sleep quality, drawing on 20 purposively selected studies identified through a structured PubMed and Cochrane Library search strategy targeting age- and sleep-quality-related terms. Methods: A Narrative review approach was used, prioritizing systematic reviews and meta-analyses, with single-reviewer selection consistent with narrative-review conventions rather than exhaustive dual screening of the full search yield. Included studies represented six sub-themes: normative age-related changes in sleep architecture, sleep quality in cognitively healthy versus impaired aging, prevalence of poor sleep quality and insomnia, circadian mechanisms, the relationship between sleep quality and frailty or comorbidity, and non-pharmacological interventions. Results: Sleep efficiency, total sleep time, and slow-wave sleep declined with advancing age, while sleep latency, nocturnal awakenings, and lighter sleep increased; most change occurred before age 60. Cross-sectional studies estimated poor sleep quality in roughly 20–45% of community-dwelling older adults, and insomnia prevalence ranged from approximately 12–20% using strict diagnostic criteria to substantially higher using symptom-based definitions. Circadian amplitude attenuation and phase advance were implicated as underlying mechanisms alongside reduced sleep homeostatic pressure. Cognitive behavioral therapy for insomnia showed consistent efficacy in older adults across multiple outcomes. Conclusion: Age was robustly associated with declining sleep quality through combined structural, circadian, and homeostatic mechanisms, though substantial measurement heterogeneity limited precise cross-study comparison. Future research would benefit from standardized outcome measures and broader lifespan coverage beyond the older-adult-dominant literature base.***

Keywords: Sleep quality; Aging; Insomnia; Circadian rhythm; Older adults; Cognitive behavioral therapy

1. Introduction

Sleep is a biological necessity that supports cognitive function, emotional regulation, cardiometabolic health, and immune function. “Sleep quality” is a multidimensional construct encompassing subjective satisfaction with sleep as well as objective parameters such as sleep efficiency, continuity, and architecture. It is most commonly assessed using validated instruments such as the Pittsburgh Sleep Quality Index (PSQI) for subjective report, or polysomnography (PSG) and actigraphy for objective measurement.

Age is among the most consistently identified correlates of sleep quality. Foundational work synthesizing decades of polysomnographic research established that sleep undergoes substantial restructuring from childhood through old age [1], and subsequent narrative and systematic reviews have elaborated on the clinical, mechanistic, and population-level dimensions of this relationship [2]. With the global population of adults aged 60 and older projected to continue rising sharply, understanding how sleep quality changes with age- and what can be done to preserve it- has direct relevance for healthy aging policy, geriatric clinical practice, and preventive medicine.

This review was undertaken to synthesize current evidence addressing the question: how does age influence sleep quality, and through what mechanisms? Narrative reviews accelerate evidence synthesis by streamlining methods (e.g., single-reviewer screening, narrower scope), trading some methodological rigor for timeliness. This review follows that model, drawing on a purposively selected set of 20 high-relevance studies- systematic reviews, meta-analyses, and key primary studies- to cover six sub-themes: (1) normative age-related changes in sleep architecture, (2) sleep quality in healthy versus cognitively impaired aging, (3) prevalence of poor sleep quality and insomnia across age groups, (4) circadian mechanisms underlying age-related sleep changes, (5) associations between sleep quality and frailty or comorbidity, and (6) non-pharmacological interventions for older adults.

2. Materials & Methods

A narrative review methodology was applied given the time-sensitive nature of the topic. A structured search strategy was developed combining two concept blocks: (1) age/aging (MeSH terms including Aging, Age Factors, Aged, and Aged 80 and over, combined with free-text synonyms such as “older adult”, elderly, and geriatric) and (2) sleep quality (MeSH terms including Sleep Quality, Sleep, and Sleep Wake Disorders, combined with free-text terms such as “sleep quality”, “sleep disturbance”, insomnia, PSQI, and polysomnograph). These concepts were combined using Boolean AND logic and applied to PubMed/MEDLINE and the Cochrane Library.

The unrestricted search returned over 29212 records in PubMed and 29451 in Cochrane Library, reflecting the breadth of literature in which age and sleep are both mentioned without necessarily being the central focus of the

study. Given the time constraints of a narrative review, exhaustive screening of this yield was not feasible. Instead, twenty studies were purposively selected to represent the major recurring sub-themes identified across the literature, with systematic reviews and meta-analyses prioritized over single primary studies wherever available, consistent with evidence hierarchies used in narrative review practice. Selection and data extraction were performed by a single reviewer without independent duplicate screening or formal risk-of-bias assessment; this trade-off, recognized as inherent to the narrative review format, is discussed further in the Limitations subsection.

Table 1: Summary of Included Studies

	Study (Author, Year)	Design	Population	Key Finding
1	Ohayon et al., 2004	Meta-analysis (PSG/actigraphy)	65 studies; n=3,577; ages 5–102	Sleep efficiency, TST, SWS decline with age; latency, WASO, stage 1–2 increase
2	Li, Vitiello & Gooneratne, 2018	Narrative review	Older adults	Synthesizes neuroendocrine, comorbidity, and lifestyle contributors to age-related sleep change
3	Hood & Amir, 2017	Narrative review (mechanistic)	N/A	~30-min sleep loss per decade from the 4th decade; SCN degeneration implicated
4	Casagrande et al., 2022	Systematic review	71 studies; healthy older adults, MCI, AD	Sleep quality worse in MCI/AD than healthy aging; REM, efficiency, latency most affected
5	Ravyts & Dzierzewski, 2024	Systematic review	14 studies (9 cross-sectional, 5 longitudinal)	Cross-sectional sleep indicators linked to healthy aging; longitudinal evidence mixed
6	Canever et al., 2024	Systematic review & meta-analysis	252 studies; ~995,544 participants; 36 countries	Poor sleep quality prevalence ~40%; obstructive sleep apnea most common (46%)
7	Wang et al., 2020	Cross-sectional	n=2,195; age ≥65	Poor sleep quality prevalence 33.8%; higher in women
8	Zhang et al., 2020	Cross-sectional	n=3,911; older adults	Prevalence 21.0%; rural–urban gap (22.3% vs. 15.9%)
9	Cheraghi et al., 2025	Cross-sectional	n=403; older adults	Prevalence 44.7%; stress independently associated
10	Endomba et al., 2023	Systematic review & meta-analysis	Older adults (DSM criteria)	Pooled insomnia prevalence 19.6%
11	van Straten et al., 2025	Meta-analysis	47 studies; general population	Pooled insomnia prevalence 12.4% (interview) / 16.3% (self-report)
12	Nguyen, George & Brewster, 2019	Narrative review	Older adults	Insomnia prevalence 17–74.8% depending on definition used
13	Zeng et al., 2020	Meta-analysis	Observational studies; general population	Insomnia prevalence 22.0%; women higher odds (OR=1.58)
14	Myers & Badia, 1995	Narrative review (mechanistic)	N/A	Circadian amplitude attenuation and phase advance with age
15	Duffy, Zitting & Chinoy, 2015	Narrative review	Older vs. younger adults	~1-hour phase advance in melatonin, cortisol, and temperature rhythms
16	Li, Tan & Zhao, 2024	Mathematical modeling review	N/A	Aging reduces circadian amplitude and shortens period
17	de Souza et al., 2025	Systematic review	17 studies; older adults	Poor sleep quality/duration independently associated with frailty
18	Amato et al., 2024	Systematic review	9 studies; older adults	Poor sleep quality associated with reduced medication adherence
19	Huang et al., 2022	Systematic review & meta-analysis	14 studies; older adults with insomnia	CBT-I improves sleep efficiency, latency, WASO, and total sleep time
20	McLaren et al., 2023	Systematic review	Older adults	Behavioral components alone show effectiveness in older populations

3. Result

3.1 Normative Age-Related Changes in Sleep Architecture

The foundational evidence base for age-related sleep change comes from a meta-analysis of 65 studies and 3,577 subjects aged 5 to 102 years, which found that total sleep time, sleep efficiency, REM latency, and percentage of slow-wave sleep decline with age, while sleep latency, wake after sleep onset, and stage 1–2 sleep increase [1]. Notably, most of this change occurs before approximately age 60; after that point, sleep efficiency continues to decline but other parameters largely plateau. A subsequent narrative review building on this meta-analysis characterized the clinical picture of normal aging as involving advanced sleep timing, shortened nocturnal sleep duration, increased daytime napping, and more frequent nocturnal awakenings, attributing these changes to a combination of neuroendocrine alterations, comorbidity, medication use, and lifestyle/environmental factors [2]. Estimates cited in this literature suggest a loss of roughly 30 minutes of consolidated sleep per decade beginning in the fourth decade of life [3].

3.2 Sleep Quality in Healthy versus Cognitively Impaired Aging

A systematic review of 71 studies comparing sleep quality in healthy older adults, individuals with mild cognitive impairment (MCI), and individuals with Alzheimer's disease (AD) found that pathological aging was associated with greater impoverishment of sleep than healthy older age, using both subjective and objective measures; REM sleep, sleep efficiency, sleep latency, and sleep duration were the

parameters most consistently compromised in MCI and AD [4]. A complementary systematic review of 14 studies examining sleep and "healthy aging" as a broader construct found that positive sleep indicators were cross-sectionally associated with a greater likelihood of healthy aging, though the smaller number of longitudinal studies produced mixed and inconclusive results, highlighting a need for more prospective research in this area [5].

3.3 Prevalence of Poor Sleep Quality and Insomnia Across Age Groups

A large systematic review and meta-analysis pooling 252 studies and nearly one million participants across 36 countries estimated that poor sleep quality affects approximately 40% of community-dwelling older adults worldwide, making it the second most common sleep problem after obstructive sleep apnea (46%), ahead of insomnia (29%) and excessive daytime sleepiness (19%) [6]. Regional cross-sectional studies using the PSQI report similarly wide but somewhat lower prevalence estimates: 33.8% among rural Chinese older adults [7], 21.0% in Hebei province, China, with a notable rural–urban gap (22.3% vs. 15.9%) [8], and 44.7% among older adults in western Iran, where stress was independently associated with poor sleep quality [9]. This variability likely reflects differences in measurement thresholds, cultural context, and population characteristics rather than a single "true" prevalence figure.

Insomnia-specific estimates also vary substantially by diagnostic approach. A meta-analysis using strict DSM criteria in older populations specifically found a pooled prevalence of 19.6% [10], broadly consistent with a 2025 general-population meta-analysis reporting pooled prevalences of 12.4% (interview-based DSM diagnosis) and 16.3% (self-report DSM criteria) [11]. Symptom-based definitions, which do not require full diagnostic criteria, yield much higher estimates—one narrative review of insomnia in older adults cites ranges from 17% to over 70% depending on the definition and population studied [12]. Sex differences are also consistently reported: a meta-analysis of observational studies found the pooled prevalence of insomnia in the general population to be 22.0%, with women having significantly higher odds than men (OR = 1.58) [13], a pattern also reflected in the age-specific prevalence studies above.

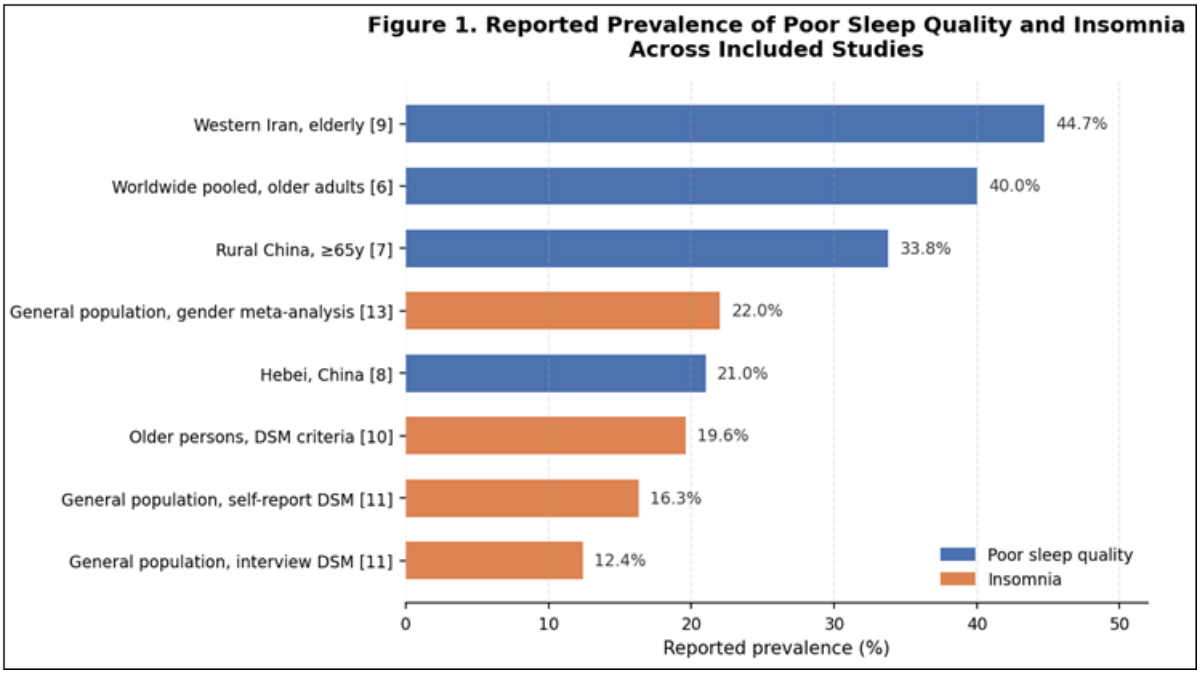

Figure 1: Reported prevalence of poor sleep quality (blue) and insomnia (orange) across included studies, illustrating substantial cross-study heterogeneity driven largely by measurement approach and diagnostic threshold.

3.4 Circadian Mechanisms Underlying Age-Related Sleep Changes

A substantial body of mechanistic work links age-related sleep decline to changes in the circadian timing system. An early influential review described the characteristic aging-related circadian signature as attenuation of rhythm amplitude, phase advance, shortening of period, and desynchronization between rhythms, attributing these changes to age-related alterations in the retina, suprachiasmatic nucleus (SCN), and pineal gland, alongside behavioral factors such as reduced physical activity and light exposure [14]. A later, more clinically oriented review similarly emphasized that older adults experience an advanced circadian phase- evident in body temperature, melatonin, and cortisol rhythms roughly one hour earlier than in younger adults- which manifests behaviorally as earlier sleep onset and earlier waking [15]. More recent mathematical-modeling work has reinforced that aging reduces circadian amplitude and shortens circadian period, mechanistically explaining the common "early to bed, early to rise" pattern seen in older populations [16], while broader reviews of the "aging clock" note that SCN degeneration underlies much of this circadian dysregulation and contributes to cumulative sleep loss across the lifespan [3].

3.5 Sleep Quality, Frailty, and Clinical Comorbidity

Poor sleep quality in older adults is not merely a quality-of-life concern but is linked to downstream clinical outcomes. A PROSPERO-registered systematic review of 17 studies found that poor sleep quality was independently associated with pre-frailty and frailty, and that both short (≤5 hours) and long (≥9 hours) sleep duration were likewise associated with frailty, although sleep-onset (but not sleep-maintenance) insomnia showed the clearest independent association [17]. A separate systematic review examining sleep quality and medication adherence found that poorer sleep quality was significantly associated with reduced medication adherence in older adults, a relevant finding given the high prevalence of polypharmacy in this population [18].

3.6 Non-Pharmacological Interventions for Older Adults

Cognitive behavioral therapy for insomnia (CBT-I) is the most extensively evaluated non-pharmacological intervention in this population. A meta-analysis of 14 studies found that CBT-I produced significant improvements in sleep efficiency, sleep onset latency, wake after sleep onset, and total sleep time among older adults with insomnia [19], supporting its position as a first-line, non-pharmacological treatment option preferred over sedative-hypnotic medications in this age group. A follow-up systematic review isolating the behavioral (as opposed to cognitive) components of CBT-I similarly found evidence of effectiveness specifically within older populations, reinforcing that even simplified, behaviorally focused protocols may be sufficient to produce benefit [20], which has practical implications for treatment delivery in settings with limited access to full CBT-I programs.

4. Discussion

Taken together, these 20 studies describe a consistent, multi-level picture: age is associated with measurable declines in sleep quality that are structural (reduced slow-wave sleep, more fragmented sleep architecture) [1], circadian (attenuated amplitude, phase advance) [3], and clinically consequential (associations with frailty, medication non-adherence, and cognitive decline) [4,17,18]. The relationship is not linear across the full lifespan—the steepest architectural changes occur before age 60, with sleep efficiency continuing to decline gradually thereafter, while other parameters plateau [1].

A recurring theme across the prevalence literature is substantial cross-study heterogeneity, illustrated in Figure 1. Estimates of poor sleep quality in older adults range from roughly 21% to 45% depending on country, setting, and measurement instrument [6-9], and insomnia prevalence estimates vary even more widely- from approximately 12% using strict interview-based diagnostic criteria [11] to around 20–22% in older-adult and gender-stratified meta-analyses [10,13], to over 70% when broad symptom-based definitions are used [12]. This heterogeneity complicates direct comparison across studies and suggests that future primary research would benefit from greater standardization of outcome definitions and thresholds, an issue also noted within several of the included systematic reviews themselves [6,11].

Mechanistically, circadian system changes- particularly suprachiasmatic-nucleus-mediated amplitude attenuation and phase advance [3,14-16]- appear to be a common thread linking many of the phenomena described in the prevalence and architecture literature, offering a biologically coherent explanation for why age-related sleep changes cluster together (earlier bedtimes, more fragmented sleep, reduced deep sleep) rather than occurring independently [2]. This mechanistic convergence also supports the rationale for circadian-focused interventions (e.g., light therapy, melatonin) alongside behavioral approaches such as CBT-I [19], although this review's included evidence base for interventions was limited to CBT-I [19,20] and did not extensively cover circadian-based treatments.

Clinically, the association between poor sleep quality and frailty [17], medication non-adherence [18], and cognitive impairment [4] underscores that sleep quality assessment should arguably be a routine component of geriatric care rather than an incidental finding, particularly given that CBT-I- a low-risk, non-pharmacological intervention- shows consistent efficacy in this population [19,20].

5. Limitations

This review has several limitations inherent to the narrative review format. First, study selection was performed by a single reviewer without independent dual screening or formal risk-of-bias assessment, meaning selection bias cannot be excluded despite efforts to prioritize systematic reviews and meta-analyses. Second, the 20 included studies were purposively selected to represent recurring sub-themes rather than derived from exhaustive screening of the full record search yield; a formal systematic review would require full screening against pre-specified inclusion/exclusion criteria. Third, the evidence base is skewed heavily toward older adults (60+); relatively little evidence on sleep quality in children, adolescents, or younger adults was incorporated, limiting this review's ability to speak to the full lifespan trajectory implied by its title. Finally, no formal quality appraisal (e.g., AMSTAR-2 for systematic reviews, Newcastle-Ottawa Scale for observational studies) was applied to the included sources, which a full systematic review would typically require.

6. Conclusion

Current evidence robustly supports an association between advancing age and declining sleep quality, operating through structural changes in sleep architecture, circadian system dysregulation, and downstream clinical consequences including frailty and reduced medication adherence. Cognitive behavioral therapy for insomnia remains the best-supported non-pharmacological intervention for older adults. However, wide variability in prevalence estimates across studies- driven largely by differences in measurement approach—along with an evidence base concentrated disproportionately on older adults rather than the full lifespan, indicates a need for future research using standardized outcome measures and broader age coverage.

This rapid review should be treated as a preliminary synthesis; a full systematic review with formal dual screening, risk-of-bias assessment, and complete-lifespan search scope is recommended before drawing definitive conclusions for clinical or policy purposes.

Declaration by Authors

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