

Sleep and Cognition in Older Adults

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KEYWORDS

• Sleep • Insomnia • Sleep apnea • Cognition • Cognitive function • Age • Aging

KEY POINTS

- Sleep and cognitive functioning both show negative changes with advanced age.
- Although the relationships are uncertain, sleep seems to be related to cognitive functioning within good-sleeping older adults, older adults with insomnia, and older adults with sleep disordered breathing.
- Both insomnia and sleep apnea may be associated with cognitive decline and dementia.
- Treatment of sleep disorders may provide cognitive benefits in late life. Additional research is warranted.

INTRODUCTION

This article reviews the growing literature examining sleep and cognitive functioning in older adults. The main focus is on normal, age-related cognitive changes, as opposed to neurodegenerative disease processes. Age-related cognitive changes are the result of developmental maturation. These cumulative, long-term processes are universal or nearly universal, and are resistant to efforts to reverse the change.^{1,2} Investigation into cognitive aging has found a general cognitive decline experienced with increasing age,^{3–5} which has been shown to be pervasive, affecting many subdomains of cognition, including:

- Reaction time
- Sensory processing
- Attention
- Memory
- Reasoning
- Executive functioning

Although much is known regarding developmental changes in cognitive functioning, comparatively little is known regarding sleep's relationship to late-life cognitive functioning.

Sleep represents an intriguing individual difference variable because it may relate to late-life cognitive functioning. Sleep has shown consistent age-related changes as a result of developmental maturation. Many of these developmental changes parallel the age-related changes observed in cognitive functioning. For example, slow wave sleep (stage N3) and rapid eye movement (REM) sleep both decrease with advanced age.⁶ In addition to these normal, developmentally appropriate changes in sleep, older adults also experience an increased prevalence of both insomnia and sleep disordered breathing (SDB).^{7–9} **Fig. 1** shows general age-related changes in cognitive functioning and general age-related changes in sleep. The parallel changes in sleep and cognition with age, coupled

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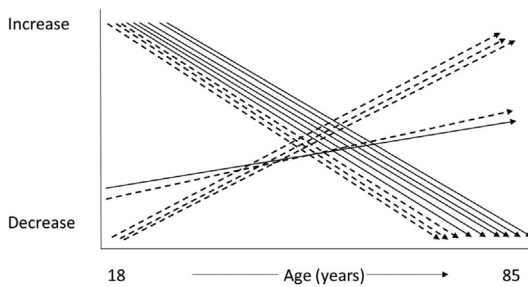


Fig. 1. Normative changes with age in both cognitive functioning and sleep. Solid arrows represent general cognitive changes. Dashed arrows represent general sleep changes. Cognitive abilities that decline with age include processing speed, working memory, long-term memory, attention, reasoning, and executive control. Sleep characteristics that decline with age include total sleep time, slow wave sleep, and REM sleep. Sleep characteristics that increase with age include wake time after sleep onset, and light sleep (stages N1 and N2). Crystallized intelligence and sleep onset latency both showed slight increases with advancing age.

with anecdotal reports of disturbed cognitive abilities following poor sleep, have resulted in research efforts focused on examining sleep and cognition in older adults. This article summarizes the literature for normal-sleeping older adults, older adults with insomnia, and older adults with SDB.

SLEEP AND COGNITION IN NORMAL-SLEEPING OLDER ADULTS

Self-Reported Sleep Duration and Cognition

Several large-scale epidemiologic studies have garnered information regarding habitual sleep duration and/or difficulty and cognitive functioning in older adults. In a study of more than 3000 older adults, long sleep duration was associated with worse overall/global cognitive functioning, whereas no association with short sleep duration and cognitive functioning was observed.¹⁰ In a similar study of more than 5000 adults, sleep duration was associated with verbal fluency and list memory, such that both long and short sleep durations were associated with poorer performance.¹¹ In a sample of community-dwelling older women, sleeping less than 5 hours per night was associated with poorer global cognition and poorer performance across many of the individual indicators of cognitive functioning (ie, verbal memory, verbal fluency, working memory) compared with women sleeping 7 hours or more per night.¹² The investigators of these studies suggest that sleep duration may be related to cognitive

functioning through changes in sleep architecture, fragmentation, quality, and neurologic conditions.^{10,11} The relationship between self-reported retrospective recall of habitual sleep duration and cognitive functioning has been confirmed through meta-analysis showing deleterious effects in both long and short sleepers on multiple domains of cognitive functioning in older adults.¹³

Polysomnography-Measured Sleep and Cognition

Investigation into the relationship between polysomnography (PSG)-assessed sleep and waking cognitive functioning has provided mixed results. It has been reported that longer sleep onset latency is related to poorer verbal memory and executive functioning, whereas greater total wake time is related to lower psychomotor speed and memory in normal-sleeping older adults.¹³ However, in another investigation, slow wave sleep was unrelated to performance on a simple reaction time task, continuous performance task, and attention test in good-sleeping older adults.¹⁴ As such, it seems that additional research is need to further explicate the relationship between PSG-measured sleep and cognitive functioning in older adults without a sleep complaint.

Actigraphy-Measured Sleep and Cognition

It seems that there is a relationship between objective, naturally occurring sleep measured with actigraphy and cognitive performance. In a study of nearly 3000 older community-dwelling women, actigraphy-measured sleep (sleep efficiency, sleep onset latency, wake after sleep onset, and napping) was associated with an increased risk of poorer general cognition and executive performance.¹⁵ However, total sleep time was not related to cognitive functioning, which led the investigators to conclude that "it is disturbance of sleep rather than quantity that affects cognition."¹⁵ In a different but complementary vein, 7 nights of actigraphy were used to compute sleep/wake patterns in 144 community-dwelling older adults. Older adults who displayed many shifts from rest to activity performed worse on composites of executive functioning, memory, and speed than elderly with more consistent rest-activity patterns.¹⁶ The scarcity of research examining actigraphy-measured sleep and cognition in older adults precludes any definitive conclusions being drawn.

Sleep Deprivation and Cognition

In general, short-term total sleep deprivation has a significant deleterious effect across most

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