

Sleep, health, and aging

Bridging the gap between science and clinical practice

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Problems with sleep are common with advancing years and occur in over half of adults age 65 and older. It has been estimated that insomnia affects about a third of the older population in this country. This inability to have restful sleep at night results in excessive daytime sleepiness, attention and memory problems, depressed mood, falls, and lowered quality of life. Other factors associated with aging, such as disease, changes in environment, or concurrent age-related processes also may contribute to problems of sleep. Data indicate that age by itself does not predict incident complaints of insomnia, even in the presence of lowered sleep efficiency and decreased proportion of slow-wave sleep. Rather, the prevalence of insomnia and other sleep disorders is high in the geriatric population due to the associated comorbidities common in late life. It is now evident that disturbance in sleep can also lead to adverse changes in functioning of a number of body systems.

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Sleep is a complex blend of physiological and behavioral processes. It is active, complex, and highly regulated by many structures in the nervous system and involves many different neuronal groups. Although we do not yet understand why we sleep, we know that sleep is essential.

Sleep is composed of two funda-

mentally different states, rapid eye movement sleep or dreaming sleep (REM) and non-rapid eye movement sleep (NREM). NREM consists of four stages. Stage 1 NREM is the lightest level of sleep, with stages 2, 3, and 4 getting progressively deeper. Most deep sleep (stages 3 and 4) occurs in the first third of the night, and most REM sleep in the

last third of the night. Sleep is typically organized into 90-minute cycles of NREM/REM sleep—this cycling and the distribution of sleep stages is known as sleep architecture. Our current understanding of the regulation of the human sleep-wake cycle indicates that sleep and wake behaviors are generated by a complex interaction of sleep homeostatic and endogenous circadian processes, as well as environmental factors. The sleep-wake cycle appears to be controlled by two processes: a circadian drive for wakefulness located in the suprachiasmatic nucleus of the hypothalamus and a wake-dependent increase in sleep propensity, probably situated within the classical pontine and thalamic sleep system and the hypothalamic preoptic area.

As we age, sleep architecture changes, with the amounts of deep sleep decreasing, so that older adults spend more of the night in lighter, stage 2 sleep than younger adults. With this change in architecture, sleep complaints increase. Despite spending more time in bed, older adults complain of waking up more often during the night (sleep fragmentation), experiencing less total sleep time, taking longer to fall asleep (sleep latency that can lead to the complaint of insomnia), being less satisfied with sleep, being more tired during the day, and taking more naps (figure 1).

An estimated 57% of adults age 60 and older have a sleep complaint: 24% have sleep apnea (much of which is un-

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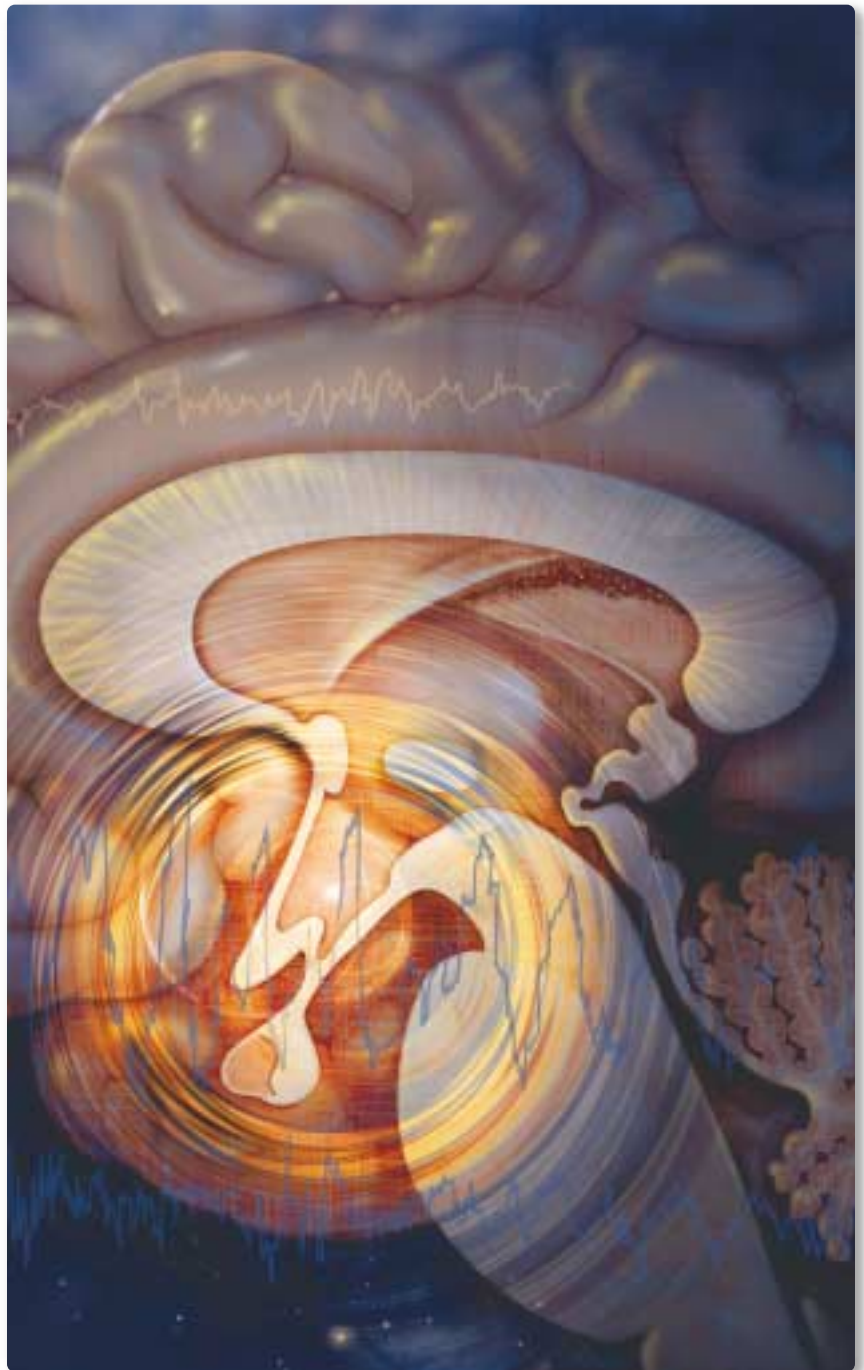
diagnosed), 45% have periodic leg movements in sleep (PLMS), 29% have insomnia, 19% are affected by early morning arousal, and 10 to 12% complain of restless legs syndrome (RLS).¹⁻⁴ Insomnia, that is, difficulty falling asleep and staying asleep, for example, increases with age.^{1,5} Consequences of disordered sleep affecting the aging population include:

- excessive daytime sleepiness
- attention and memory problems
- depressed mood
- nighttime falls
- overuse of hypnotic drugs and over-the-counter medications
- possible adverse interactions with comorbid conditions (eg, sleep apnea and cardiovascular disease)
- lower quality of life.

Many organ systems show declining function with age, most typically at rates of 0.5% to 0.65% per year⁶ and polysomnographic measures of sleep are no exception. But aging is not synonymous with sleep complaints. Foley et al reported that the prevalence of insomnia is dramatically lower in patients with the fewest comorbidities (for example, people with insomnia who are not depressed) and highest in those with multiple self-reported health conditions and poor health status.⁷ New, or incident, complaints of insomnia increase approximately 5% per year after age 65 in the general population but increase by only about 1% per year in the healthiest older individuals. Thus, the cause of insomnia appears to be due to coexisting conditions, usually medical and psychiatric disease. Vitiello et al examined data from carefully screened, healthy older adults. They found that in the absence of coexisting medical and psychiatric diseases, the prevalence of insomnia in the older population can be very low.⁸ Thus, the absence of coexisting medical and psychiatric diseases in late life predicts healthy sleep with little insomnia.

Sleep, morbidity, and mortality

Sleepiness and insomnia are symptoms of sleep disorders, markers of disease



The human sleep-wake cycle appears to be regulated by two processes: a circadian drive for wakefulness in the suprachiasmatic nucleus of the hypothalamus and a wake-dependent increase in sleep propensity in the classical pontine and thalamic sleep system and the hypothalamic preoptic area.

Illustration for Geriatrics by Alexandra Baker

(sleep disorders and other disorders), and predictors of increased mortality. In 1983, Wingard and Berkman showed that death rate is related to sleep time.⁹ Both men and women who slept less than 6 hours per night and more than 9 hours per night had higher overall

mortality rates and higher rates of heart disease and cancer. Other authors have also noted a relationship between sleep duration and mortality.¹⁰ It is not known whether heart disease, cancer, and their treatments cause sleep patterns to change, or whether abnormal

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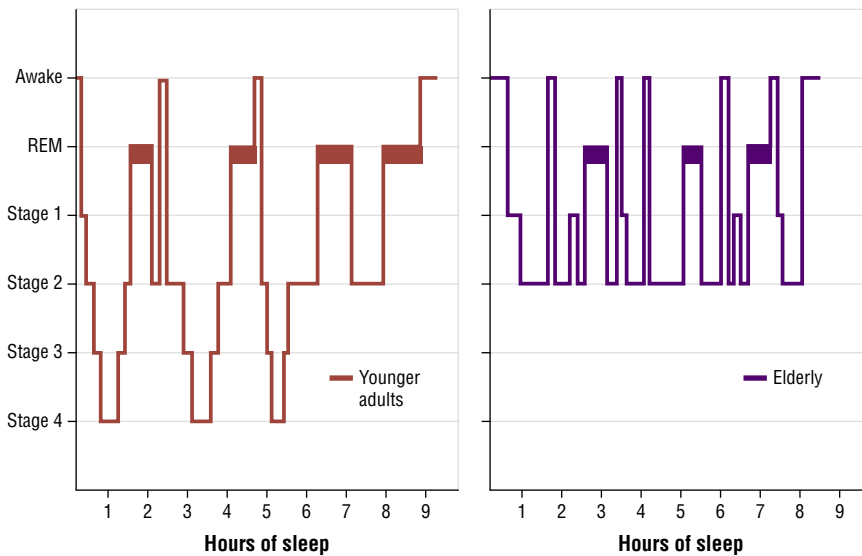


Figure. Histograms depict normal sleep patterns for younger adults, older adults.

Source: Ancoli-Israel S. All I want is a good night's sleep. St. Louis, MO: Mosby-Year Book, Inc. 1996. Reprinted with permission.

pect of cancer causes the sleep problems has not been investigated. The psychological stress of receiving a cancer diagnosis may be the cause or perhaps pain resulting from chemotherapy and radiation therapy, local and metastatic pain, depression, changes in cytokine levels, or some other factor not yet identified.

Sleep and common geriatric syndromes

Nocturia. Nocturia is a common cause of poor sleep in older adults. Poor sleep was reported by over 60% of women ages 40 to 64 who awakened to void three or more times a night.¹⁸ Studies that inquire specific reasons for nighttime awakening have reported that nocturia was by far the most common reason for failure to maintain sleep.¹⁹ Interestingly, recent preliminary data have shown that patients with sleep-disordered breathing whose RDI exceeds 25 events per hour awaken 2.6 times a night to void, relative to those with lower levels of RDI.²⁰ Therefore, sleep disordered breathing could be responsible for much of the nocturia experienced by older persons during the night.

Incontinence. Incontinence is one of the major reasons older individuals are eventually institutionalized. Research on the issue of incontinence in nursing home patients and its association with sleep-disordered breathing is ongoing.²¹ Preliminary results have shown that some incontinence episodes can be linked to apneic events in sleep. These data also suggest that sleep disordered breathing might contribute to nocturnal incontinence in nursing home patients by mechanical factors such as diaphragmatic displacement exerting pressure on the detrusor.

Falls. Falling is a major geriatric syndrome in which disturbed sleep may play a role and a significant source of morbidity, especially in the long-term care setting. A common, costly problem among the geriatric population, falling can result in a variety of serious injuries and even death (table 1).

Table 1 Consequences of falls

Cost

\$10 billion annually (estimated)

Incidence

Community: one-year prevalence of 30%

Long-term care: 1.5 falls per bed per year

Injuries

4 to 6% hip fractures

2 to 10% major injuries requiring hospitalization

30 to 50% minor injuries

Fatalities

2 to 3 % fatalities

Multifactorial etiology

- balance, gait
- transient ischemic attack
- syncope
- carotid sinus syndrome
- medications
- specific diseases: Parkinson's
- arthritis
- environmental factors

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in observational studies, according to several longitudinal and case control studies from around the world. In these studies, napping, that is, sleeping during the day outside of the normal sleep period, has usually been associated with adverse outcomes, such as depression,¹² mortality,¹³ and MI/stroke,¹⁴ though some studies have not reported such negative relationships.¹⁵ Still other studies have suggested that napping can improve daytime performance in older adults.¹⁶

Sleep can cause diseases and diseases can interfere with normal sleep.

According to one recent study, 30 to 50% of newly diagnosed cancer patients have problems with sleep, and 23 to 44% of patients have insomnia years after the cancer is diagnosed. In breast cancer patients, an estimated one-third of insomnia is due to the cancer itself or its treatment.¹⁷ What as-

sleep time causes the pathology. Daytime sleepiness also is associated with increased mortality.¹¹

There are no interventional data that determine the long-term effects of sleepiness and napping in older persons. Sleepiness and napping during the day have been linked with poor outcomes

continued

One common issue concerns psychotropic medications, which are sometimes used specifically for sleep problems. An important study published in 1988²² found that the risk of falls is 28 times higher for adults receiving psychotropics, many undoubtedly receiving these in the evening or at bedtime (table 2). More recent data suggest that even benzodiazepines with short elimination half-lives may be associated with falls specifically occurring at night.²³ However, neither these studies, nor other studies of falls, take into account that disturbed sleep per se may lead patients to arise from bed (eg, to void, or to avoid the frustration of lying in bed awake) and ultimately be the cause of nocturnal falls. In fact, results of a community-based survey found that when such sleep complaints were taken into account, the effects of medications were minimal in accounting for falls. The implications of this study are that falls may be more likely to occur when individuals cannot sleep and that nocturnal psychotropic usage may be a proxy for night awakenings and bathroom trips.²⁴

Sleep consolidation in long-term care

Disrupted sleep with few long sleep periods at night are very common in the long-term care setting. While observing nursing home patients around-the-clock, researchers found that the percentage of sleep time tends to be higher during the nocturnal hours, but never approaches 90% of the time.²⁵ Conversely, patients were asleep frequently during the daytime hours. These data can be verified with polysomnographic and actigraphic data. In fact, actigraphic data have shown that nursing home patients are rarely asleep for a full hour and rarely awake for a full hour throughout the day and night.²⁶⁻²⁸

Low lighting in nursing homes and noise are some of the factors responsible for poor sleep consolidation, as are interruptions by staff, such as waking and turning the patient to avoid bedsores.²⁹ Nursing home staff should be

encouraged to keep patients in bright environments during the day and to keep the environment dark and quiet at night.

After sunset, awakenings following episodes of sleep more often are accompanied by agitation, compared with awakenings from sleep during the daytime (13% vs. 6.5%, $p < .05$).³⁰ However, not all agitation occurs in the evening.³¹ Staff-induced awakenings at night are associated with greater agitation during the daytime.³² Some agitation also has been associated with sleep-disordered breathing.³³

Guidelines for incontinence care (U.S. Dept. of Health and Human Services) strongly recommend repositioning patients to avoid bedsores caused by wetness. However, Schnelle et al showed that nearly two-thirds of all demented nursing home residents spontaneously shift their body position (shoulder and hip) at least once per hour of sleep with an average of 6.1 shoulder and 7.0 hip movements per hour.³⁴ The implications of these findings are that even severely demented nursing home patients are capable of spontaneous changes in body position, which would otherwise obviate the need to awaken them during the night.

Other causes of sleep disorders

More often than not, sleep disturbances in older adults are secondary to medical or psychiatric disorders. Medical conditions, such as arthritis and malignancies, can cause pain; neurological disorders, such as restless legs, dementia, and Parkinson's disease, can disrupt sleep; many organ system disorders (angina pectoris, congestive heart failure, asthma, chronic obstructive pulmonary disease, gastroesophageal reflux, incontinence, and benign prostatic hyperplasia) can cause

Table 2 Risk factors for falls in a community population

Risk factor	Adjusted odds ratio (95% CI)
Cognitive impairment	5.0(1.8-13.7)
History of stroke	3.0(1.5-6.1)
Arthritis	1.8(1.0-3.1)
Balance/strength	3.8(2.2-6.7)
Gait	1.9(1.0-3.7)
Psychotropics/sedatives	28.3(3.4-239.4)


Source: Adapted from Tinetti ME, Speechley M, Ginter SF. Risk factors for falls among elderly persons living in the community. *N Engl J Med* 1988; 319(26):1701-7. Used with permission.

discomfort and difficulty sleeping. Depression and anxiety can cause insomnia. These conditions can be secondary to personal loss, bereavement, social change, retirement, and relocation. Depressed adults who are not treated are more likely to develop insomnia, and adults with unresolved insomnia are more likely to develop depression.

The medications used to treat many of these disorders also cause sleep problems. CNS stimulants, beta-blockers, bronchodilators, calcium channel blockers, corticosteroids, decongestants, stimulating antidepressants, and thyroid hormones can all cause insomnia. Other drugs, such as alcohol, caffeine, and nicotine, also disturb sleep. Adjusting the dose or time of day the medication is taken often will improve sleep. In addition, the dosage and administration time of many sedating medications, such as the longer acting hypnotics, antihypertensives, antihistamines, tranquilizers, and some of the antidepressants may need adjustment to avoid daytime sleepiness.

Conclusion

Although sleep architecture does change with age resulting in older adults spending more time in lighter sleep, much of the sleep disturbance seen in this population is a function of medical and psychiatric illness and the medications used to treat them. Healthcare professionals

need to be more cognizant of the fact that sleep disturbance is not a function of age per se, but rather a function of the other consequences of aging. 

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