Sleep and Aging: Prevalence of Disturbed Sleep and Treatment Considerations in Older Adults

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Although sleep patterns change with age, it is the change in the ability to sleep that precipitates sleep complaints in older adults. Waking not rested, waking too early, trouble falling asleep, daytime napping, nocturnal waking, and difficulty initiating or maintaining sleep are among the chief sleep complaints of older adults. The consequences of poor sleep include difficulty sustaining attention, slowed response time, difficulty with memory, and decreased performance. Both medical and psychiatric conditions as well as the medications used to treat them lead to sleep complaints in older adults. Circadian rhythm disturbances and primary sleep disorders may also result in sleep complaints. Appropriate treatment may be dictated by severity of symptoms and concurrent medications. Efficacious pharmacologic interventions are the nonbenzodiazepine hypnotics zolpidem, zaleplon, and eszopiclone. Two new agents, ramelteon, which was recently approved by the U.S. Food and Drug Administration for use in adults with insomnia, and immediate release and modified release indiplon, which is currently under investigation, have been effective in clinical trials. Cognitive-behavioral therapy alone and in combination with medication have been effective in improving sleep in older adults. Sleep disturbance is not a natural consequence of aging, but rather a treatable condition.

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Aging itself is not a cause of sleep problems. To better understand both the relationship between sleep and the aging process and the consequences of poor sleep in the older adult, questions must be addressed about changes in sleep with age, prevalence and incidence of sleep complaints (particularly insomnia), factors contributing to poor sleep, and appropriate pharmacologic and behavioral treatment.

SLEEP AND AGING

Certain aspects of sleep and sleep architecture change with age. A recent meta-analysis[1] of 65 studies and 3577 subjects ranging in age from 5 to 102 years identified age-related changes across the life span in healthy individuals. Sleep latency, percentage of stage 1 and stage 2 sleep, and wake after sleep onset increased with age. Sleep efficiency (the amount of sleep given the amount of time in bed), the percentage of slow-wave sleep, the percentage of rapid eye movement (REM) sleep, and REM sleep latency all decreased with age. However, the meta-analysis also found that most of these age-related sleep changes began occurring in the early- and mid-adult years and became relatively constant in healthy adults over the age of 60.

In fact, older adults report sleeping slightly more than younger adults and report having a more consistent sleep pattern. A comparison of data collected by the National Sleep Foundation in 2002[2] on 701 younger adults, 18 to 54 years old, and in 2003[3] on 1506 older adults, 55 to 84 years old, indicated that on weeknights, younger adults reported sleeping 6.7 hours and older adults reported sleeping 7.0 hours. The difference between these age groups in weeknight hours of sleep was not substantial. On weekends, however, younger adults reported sleeping 7.6 hours, which allowed them to make up for the sleep they missed during the week. Older adults, on the other hand, reported sleeping 7.1 hours on weekends, which indicated a fairly consistent sleep pattern.

In those adults who do not sleep well at night, difficulty sustaining attention, slowed response time, difficulty with memory, and decreased performance are typical consequences. The effect and importance of slowed response time are illustrated when one considers the time it takes

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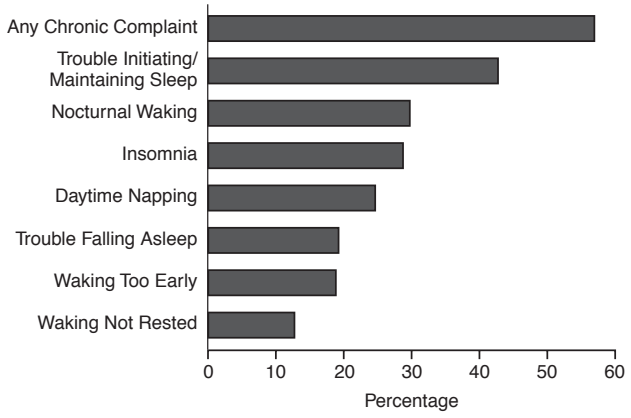
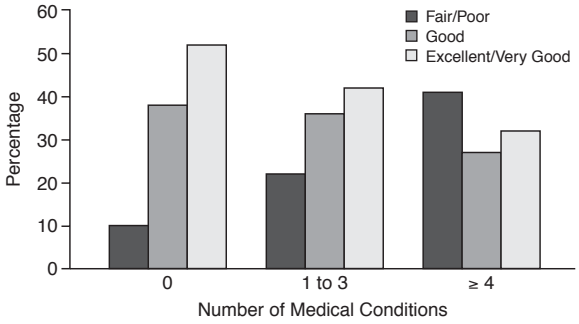
Figure 1. Sleep Complaints in Older Adults (N = 9282; mean age = 74 years)[a]



[a]Data from Foley et al.[4]

Figure 2. Levels of Self-Perceived Quality of Sleep by Number of Medical Conditions[a]



[a]Adapted with permission from Foley et al.[7]

a driver to slam on the car brakes to avoid hitting a child running out into the street. In the older adult, these sequelae may be mistaken for dementia, which adds a layer of complexity to the diagnosis and treatment of poor or insufficient sleep and primary sleep disorder.

PREVALENCE AND INCIDENCE OF SLEEP COMPLAINTS IN OLDER ADULTS

A review[4] of the epidemiology of sleep complaints of more than 9000 older adults in 3 communities using baseline and 3-year follow-up data from the National Institute on Aging's Established Populations of Epidemiologic Studies of the Elderly (EPESE)[5] project showed that about 57% of older adults reported at least 1 chronic sleep complaint. Initiating and maintaining sleep was chief among these complaints (Figure 1).

Further analysis[6] of the follow-up data from this study indicated that the prevalence of insomnia in older adults increased with depressed mood, respiratory symptoms, fair to poor health, or a physical disability. Of the 1943 subjects with chronic insomnia at baseline, 48% no longer had symptoms at follow-up. Remission of symptoms was not attributed to gender, age, income, or education, but rather an association was found between insomnia and persons who had been widowed or had a chronic or new health problem. Improved self-perceived health was associated with decreased symptoms of insomnia. As physical disability in the elderly decreases, the prevalence of insomnia tends to decrease. Further, the data did not support a model of incident insomnia caused by aging.

FACTORS THAT CONTRIBUTE TO COMPLAINTS OF INSOMNIA AND OTHER SLEEP DISTURBANCES IN OLDER ADULTS

Many factors contribute to insomnia and sleep disturbances in the older adult. These factors include medical and psychiatric illnesses, medications and the problems of polypharmacy in the elderly, changes in circadian rhythms, and a higher prevalence of specific primary sleep disorders.

Medical and Psychiatric Illnesses

Medical disorders can cause insomnia. These include disorders of pain, such as arthritis and malignancies; neurologic disorders, such as restless legs syndrome, dementia, and Parkinson's disease; psychiatric disorders, such as depression or anxiety; and organ system failure, such as angina, congestive heart failure, asthma, chronic obstructive pulmonary disease, gastroesophageal reflux, or incontinence. Since the prevalence of many medical and psychiatric conditions increases with age, it becomes important to suspect them as possible causes of sleep disturbances and insomnia in this older population.

Analysis[7] of the results of the 2003 National Sleep Foundation Sleep in America Survey[3] indicated that sleep disturbances and chronic disease in older adults are comorbid conditions. Respondents were asked if they had been told by a doctor that they have any of the following common medical conditions: hypertension, arthritis, enlarged prostate, heart disease, depression, diabetes, cancer, osteoporosis, lung disease, memory problems, or stroke. Subjects who reported having a medical problem were more likely to report difficulty with sleep than healthy subjects. In every case, having a medical disorder increased the likelihood of sleeping fewer than 6 hours a night, having insomnia, or being excessively sleepy during the day. In addition, as the number of medical conditions increased, the likelihood of having difficulties with sleep increased (Figure 2). With older patients, medical problems must be considered at the same time as sleep problems.

Table 1. Drugs Associated With Insomnia

Central nervous system stimulants
Dextroamphetamine
Methylphenidate
Mixed amphetamine salts
Pemoline
Antihypertensives
α-Blockers
β-Blockers
Methyldopa
Reserpine
Respiratory medications
Albuterol
Theophylline
Chemotherapy
Decongestants
Phenylpropanolamine
Phenylephrine
Pseudoephedrine
Hormones
Corticosteroids
Thyroid medications
Psychotropics
Atypical antidepressants
Monoamine oxidase inhibitors
Selective serotonin reuptake inhibitors
Other noncontrolled substances
Alcohol
Caffeine
Nicotine

Medications and Polypharmacy

Medications (both over the counter and prescription) used to treat medical or psychiatric conditions in older adults also carry a risk of causing sleep problems, particularly insomnia (Table 1). Many older adults take at least 1 medication and many take multiple medications, placing them at greater risk for having sleep problems. For some patients, adjusting the dose or the time of day that the medication is taken can improve sleep.

Circadian Rhythm Disturbances

Benjamin Franklin described a common sleep pattern in the older adult when he coined the phrase that begins "early to bed, early to rise." Most adults get sleepy around 10:00 or 11:00 at night, go to bed, sleep for about 7 or 8 hours, waking at 6:00 or 7:00 in the morning. This pattern is due, in part, to changes in core body temperature. At night, people experience a drop in core body temperature, which causes sleepiness; as morning approaches, their core body temperature rises, which causes them to wake up.

Due to an advancing sleep phase, many older adults tend to get sleepy earlier in the evening. If these older adults went to bed when they first experienced sleepiness, i.e., at 6:00, 7:00, or 8:00 p.m., they would sleep their full 7 or 8 hours, waking at 2:00, 3:00, or 4:00 in the morning when their core body temperature rises. However, most older adults force themselves to stay up later in the evening, not going to bed until perhaps 9:00, 10:00 or 11:00 p.m.; yet they still wake up at 4:00 in the morning when their core body temperature rises. Although they have been in bed sleeping for only about 5 or 6 hours, they cannot get back to sleep because their sleep cycle is complete. This may result in their being tired during the day and taking an afternoon nap. Because of the homeostatic process, which suggests that one has to be awake a certain amount of time before he or she is sleepy enough to fall asleep, that nap may allow them to stay alert later into the evening, but they still wake up in the early morning hours. This begins a cycle of getting up too early in the morning and not getting enough sleep at night and, consequently, needing to nap during the day.

Another scenario that occurs with an advanced sleep phase is that the older adult will fall asleep in the early evening while watching television or reading, thus napping for half an hour or longer. When they wake up, they get ready for and go to bed but are suddenly unable to fall asleep. These adults may complain of both difficulty falling asleep and staying asleep because they still wake up in the early morning hours. These insomnia complaints may be secondary to advanced sleep phase and poor sleep hygiene.

Discussing sleep patterns and habits with older adults who complain of sleep problems is very important. Some older adults may describe symptoms of advanced sleep phase but be happy with this pattern. Since no comorbidity is associated with advanced sleep phase, no treatment is indicated in those who do not complain. Older adults who are dissatisfied with advanced sleep phase, however, may benefit from bright light therapy.

By adjusting the timing and the brightness of light, some aspects of sleep in older adults can be improved. For advanced sleep phase, bright light exposure should occur as late in the day as possible, ideally, between 7:00 and 9:00 p.m. As the best source of bright light is the sun, older adults should be encouraged to spend time outdoors in the late afternoon or early evening while the sun is still shining. When natural sunlight is unavailable, bright light boxes are excellent substitutes because they can be placed on the dinner table or on top of the television where they can provide the needed light in the evening. In addition, blocking morning bright light is important as it will advance sleep even more, resulting in being sleepy even earlier in the evening and waking even earlier in the morning.

Primary Sleep Disorders

Periodic limb movements in sleep (PLMS) and restless legs syndrome (RLS) are sleep disturbances that appear to become more severe with age. PLMS is characterized by kicking or periodic leg jerks that cause brief awakenings or arousal. RLS is characterized by uncomfortable sensations in the legs that can be relieved only by moving the legs.

Among older adults, the prevalence of these disorders is high.[8,9] A study[9] of randomly selected elderly subjects aged 65 years and older (N = 420) reported that about 45% had

mild PLMS resulting in at least 5 leg kicks per hour of sleep. The prevalence of RLS in the older adult is about 20%.[8,10]

If insomnia is being caused by restless legs or leg kicks, treatment is different than the general treatment of insomnia. PLMS and RLS are treatable with ropinirole or with the off-label use of other dopamine agonists, such as pergolide or pramipexole.[11,12] Ropinirole, pergolide, and pramipexole reduce both the number of the kicks and the number of awakenings. Levodopa/carbidopa also reduces the number of kicks and awakenings, but may increase the restlessness in the morning hours. Doses appropriate to an elderly population should be used, and adverse events should be monitored.

TREATING SLEEP DISTURBANCES IN OLDER ADULTS

About 20% of older adults who responded to the 2003 National Sleep Foundation poll[3] indicated that they took something to help with sleep at least a few nights per week. Eleven percent reported taking a prescription medication, 6% used over-the-counter medications, and 6% used alcohol to help them sleep. Recognizing the cause of sleep disturbances, whether medical or psychiatric conditions and/or the medications used to treat them, circadian rhythm changes, or primary sleep disorders such as PLMS and RLS, aids in selecting appropriate treatment or combination of treatments.

Over-the-counter drugs, including antihistamines, herbals, and melatonin; prescription drugs such as benzodiazepines, sedating antidepressants, and the newer selective benzodiazepine receptor agonists; and cognitive-behavioral therapy (CBT), are among treatments currently being used.

Over-the-Counter Substances

The advantages of using over-the-counter medications (e.g., diphenhydramine and other antihistamines) are that they are readily available, typically are less expensive than prescription drugs, and are *perceived* as being safer than prescription sleeping pills. However, studies[13–18] of the efficacy of the H_1-receptor antagonists that are still on the market in patients with sleep problems have yielded inconclusive results. In addition, these studies were observational, patient self-report or physician evaluation, and none included an objective measure of sleep.

Tolerability to the sedating effects of H_1-receptor antagonists may develop quickly.[19] In patients with narrow angle glaucoma, antihistamines should be avoided as they may increase intraocular pressure.[20] Along with the antihistamine effects, these drugs have anticholinergic effects.[20] Side effects include dry mouth, constipation, urinary retention, residual sedation and grogginess, decrements in cognitive functioning, impotence, vomiting, depression, malaise, weakness, headaches, and gastrointestinal distress.[15,21,22] For example, in one study[23] diphenhydramine (25 to 50 mg) was given to cognitively intact elderly (aged ≥ 70 years) inpatients who had been hospitalized for a variety of health concerns. Patients who received diphenhydramine demonstrated increased incidence of delirium, inattention, disorganized speech, altered consciousness, abnormal psychomotor activity, altered sleep-wake cycles, and agitation—symptoms readily associated with dementia. As older adults are particularly vulnerable to the effects of diphenhydramine, it should be used with great caution in this population.

In summary, the advantages of the H_1-receptor antagonists are that they are easily available and inexpensive. The disadvantages of the H_1-receptor antagonists are that studies of efficacy have not been consistent, resulting in limited supporting evidence on efficacy in treating insomnia, the potential for residual effects, no well-defined effective dose, and a poorly defined half-life.[19,24,25] The recent National Institutes of Health (NIH) State-of-the-Science conference on insomnia in adults[26] concluded that although antihistamines (H_1-receptor antagonists, such as diphenhydramine) are the most commonly used over-the-counter treatments for chronic insomnia, there is no systematic evidence for efficacy and there are significant concerns about risks of these medications.

Prescription and Investigational Drugs

A number of drugs with new mechanisms of action may be effective in treating elderly patients with insomnia (Table 2). Zolpidem and zaleplon at low doses have been approved by the U.S. Food and Drug Administration (FDA) for the treatment of insomnia in the elderly, while eszopiclone was recently approved for long-term use, although there are no published double-blind long-term studies in the elderly. Ramelteon was recently approved by the FDA for insomnia and has also been approved for long-term use. The data show that all these drug options appear to be effective in older adults. The key in using them is to consider the patient's complaints and match them to the characteristics of the hypnotic agent.

Nonpharmacologic Interventions

Nonpharmacologic interventions are also very effective in treating patients with sleep complaints. Behavioral therapy teaches patients to modify maladaptive sleep habits by going to bed and getting up at set times, reducing autonomic and cognitive arousal, altering dysfunctional beliefs and attitudes about sleep, and practicing good sleep hygiene. Through cognitive therapy, patients learn to challenge dysfunctional beliefs, such as "If I don't sleep exactly 8 hours, I absolutely can't function during the day." Patients can begin to alter their perception of their sleep behavior and consciously change unrealistic beliefs and expectations.[36–38]

Table 2. A Review of Medications That Promote Sleep in Elderly Adults With Transient or Chronic Insomnia

Study	Medication	Mechanism of Action	Recommended Dose	Effect	Safety Profile
Scharf et al[27] (1991) Roger et al[28] (1993)	Zolpidem	Benzodiazepine receptor agonist	5 mg	↑ total sleep time ↓ time to sleep onset ↓ number of awakenings	Dose-dependent side effects, usually mild or moderate severity; most common were headache and drowsiness. Headache reported more frequently with placebo than zolpidem; drowsiness reported more frequently in zolpidem groups than placebo group.[27] Versus triazolam, zolpidem-treated patients reported fewer CNS effects (nightmares, agitation, drowsiness), although overall incidence was low despite elderly population.[28] No rebound insomnia.
Ancoli-Israel et al (1999,[29] 2005[30])	Zaleplon	Benzodiazepine receptor agonist	5 mg	↓ time to sleep onset	Common adverse events included headache, pain, somnolence, and rhinitis, but the frequency of these effects did not differ significantly from placebo.[29] Additional adverse events include infection, backache, bronchitis/pharyngitis, rhinitis, and dizziness.[30] No rebound effects.
Krystal et al[31] (2003)	Eszopiclone (Schedule IV)	Benzodiazepine receptor agonist	2 mg	↑ total sleep time ↓ time to sleep onset ↓ wake after sleep onset ↓ nap time	Most adverse events in both placebo and eszopiclone groups were mild or moderate; most common effects were unpleasant taste, headache, infection, pain, nausea, and pharyngitis. Duration of effects was the same or shorter with eszopiclone, versus placebo.
Roth et al[32] (2005) Roth et al[33] (2005)	Ramelteon	Melatonin receptor agonist	8 mg	↑ total sleep time ↓ sleep latency	No rebound; no withdrawal. No different from placebo on adverse event rates.
Scharf et al[34] (2003)	Indiplon IR (not FDA approved)	GABA-A receptor agonist	5 mg	↑ total sleep time ↓ time to sleep onset ↓ time to persistent sleep	Well tolerated up to 20 mg/d with no serious adverse events and next-day residual effects similar to placebo.
Walsh et al[35] (2003)	Indiplon MR (not FDA approved)	GABA-A receptor agonist	20 mg	↑ total sleep time ↑ sleep efficiency ↓ time to sleep onset ↓ time to persistent sleep	No next-day residual effects compared with placebo.

Abbreviations: CNS = central nervous system, FDA = U.S. Food and Drug Administration, GABA = γ-aminobutyric acid, IR = immediate release, MR = modified release.
Symbols: ↓ = decreased, ↑ = increased.

A disadvantage of CBT is that administration typically takes 6 to 8 sessions, making it difficult to integrate into any primary care or psychiatric practice. To counter that problem, Edinger and Sampson[39] tested the effectiveness of an abbreviated CBT (ACBT) comprised of two 25-minute sessions in 20 primary care patients (mean age = 51 years) who met criteria for chronic primary insomnia. The results included reductions in subjective sleep disturbances and insomnia symptoms. Half of the patients reported that wake time after sleep onset was reduced by about 50%, and at final outcomes assessment, about 55% of patients who entered the study with pathologic scores on the Insomnia Symptom Questionnaire had achieved normalized scores.

Since CBT has been shown to be effective in older adults, ACBT is likely to be effective in an older population. The NIH State-of-the-Science conference on insomnia in adults[26] also concluded that behavioral and CBTs have demonstrated efficacy in randomized control trials and have been found to be as effective as prescription medications for the brief treatment of chronic insomnia. Moreover, there are indications that the beneficial effects of CBT, in contrast to those produced by medications, may last well beyond the termination of treatment.

Combination Therapy

Combining medication with CBT is an effective method of treating older patients with sleep complaints. An 8-week, randomized, placebo-controlled trial[40] was conducted in 78 older patients (mean age = 65 years) with chronic and primary insomnia. Patients were randomly assigned to CBT, temazepam (7.5 to 30 mg/day), a combination of CBT and temazepam, or placebo. Pretreatment and posttreatment polysomnograms and subjective reports showed that all 3 active treatments were effective at 8 weeks, but at 3-, 12-, and 24-month follow-ups, only the 2 groups treated with CBT maintained their clinical gains. Combination therapy, then, appears to be the most effective treatment in the long term.

CONCLUSION

Aging itself is not a cause of sleep problems. Several different factors associated with aging, however, may contribute to or cause sleep problems in older adults. Older adults

who have difficulty initiating and maintaining sleep typically describe their sleep disturbance as insomnia, but this insomnia is often related to medical or psychiatric conditions or the medications used to treat them. Changes in sleep patterns may also be caused by other problems or conditions. For example, advanced sleep phase caused by shifts in circadian rhythms leads to experiencing sleepiness early in the evening along with early awakenings, which may result in napping and reduced total sleep time if the older adult does not go to bed early enough. Primary sleep disorders may also be the cause of sleep disturbances, as the prevalence of PLMS and RLS is high among older adults.

Several pharmacologic options, both over-the-counter and prescription substances, are available to treat older adults with sleep disturbances; however, there are no studies suggesting that the over-the-counter substances are either safe or effective. Benzodiazepine receptor agonists have been effective at increasing total sleep time, reducing sleep latency, and decreasing wake time after sleep onset. New options for treating transient or chronic insomnia include the γ-aminobutyric acid (GABA)-A receptor agonist indiplon, which is under investigation, and the recently approved melatonin receptor agonist ramelteon. Drugs should be carefully prescribed at lower doses in older adults and monitored for safety, due to slowed drug metabolism in older people.

Nonpharmacologic interventions should also be considered when treating older adults. Sleep hygiene counseling, bright light therapy, CBT, and combination therapy can be effective in older adults.

In conclusion, recognizing that many different underlying factors contribute to sleep complaints in the elderly improves the ability to treat these problems appropriately in order to help older adults sleep better at night and function better during the day.

Drug names: albuterol (Proventil, Ventolin, and others), dextroamphetamine (Dexedrine, Dextrostat, and others), diphenhydramine (Benadryl, Simply Sleep, and others), eszopiclone (Lunesta), levodopa/carbidopa (Sinemet, Stalevo, and others), methyldopa (Aldoril and others), methylphenidate (Focalin, Ritalin, and others), mixed amphetamine salts (Adderall and others), pemoline (Cylert and others), pergolide (Permax and others), phenylephrine (Promethazine, Cyclomydril), pramipexole (Mirapex), pseudoephedrine (Novafed, Sudafed, and others), ramelteon (Rozerem), reserpine (Serpalan and others), ropinirole (Requip), temazepam (Restoril and others), theophylline (Elixophyllin, Theolair, and others), zaleplon (Sonata), zolpidem (Ambien).

Disclosure of off-label usage: The author has determined that, to the best of her knowledge, diphenhydramine is not approved by the U.S. Food and Drug Administration for the treatment of insomnia; levodopa/carbidopa, pergolide, and pramipexole are not approved for the treatment of restless legs and periodic limb movements; and indiplon is not approved for use in the United States.

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