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Sleep in the Aging Population

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Synopsis

There are normal changes to sleep architecture throughout the lifespan. There is not, however, a decreased need for sleep and sleep disturbance is not an inherent part of the aging process. Sleep disturbance is common in older adults because aging is associated with an increasing prevalence of multimorbidity, polypharmacy, psychosocial factors affecting sleep, and certain primary sleep disorders. It is also associated with morbidity and mortality. Since many older adults will have several factors from different domains affecting their sleep, these complaints are best approached as a multifactorial geriatric health condition, necessitating a multifaceted treatment approach.

Keywords

Aging; insomnia; sleep disorders; multimorbidity; polypharmacy; geriatric syndromes

Introduction

Sleep is an important component for health and wellness across the lifespan. The number of people in the United States who are 65 years or older is steadily increasing, and is expected to double over the next 25 years to about 72 million. By 2030, roughly 1 in 5 people in this country will be over the age of 65.¹ Sleep complaints are common among older adults, and as this segment of the population grows, so too will the prevalence of sleep disturbances. However, sleep problems are not an inherent part of the aging process. There are changes to sleep architecture over the lifespan that are not, in themselves, pathologic, but can be viewed as making older adults more vulnerable to sleep disturbances.² It is the consequences of aging, in the form of medical and psychiatric comorbidity, medication and substance use, psychosocial factors, and primary sleep disorders that put older adults at risk for sleep disturbance. The increasing prevalence of multimorbidity (i.e. having at least two concurrent

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diseases in the same individual)³ among older adults means that sleep disorders might arise from multiple different domains. Thus, sleep disturbance in this age group should be considered a multifactorial geriatric health condition (previously referred to as a geriatric syndrome),⁴ requiring consideration of multiple risk factors and a comprehensive treatment approach.

1. Normal Age-Related Changes to Sleep-Wake Physiology

Physicians addressing sleep complaints in older adults are commonly asked about how much sleep is enough. The National Sleep Foundation recommends 7-8 hours of sleep for adults aged 65 and older.⁵ This recommendation is supported by evidence that older adults sleeping anywhere from 6-9 hours have better cognition, mental and physical health, and quality of life compared to older adults with shorter or longer sleep durations. Thus, the need for sleep is not reduced in older adults, but the ability to get the required sleep may be decreased due to normal changes in sleep architecture through the lifespan.⁶

Age-related changes in sleep physiology have been well-documented using polysomnography (see Table 1). Most age-dependent changes in sleep parameters occur by age 60 years,⁷ with the exception of sleep efficiency. Sleep efficiency (percentage of time spent asleep while in bed), on the other hand, continues to show an age-dependent decline beyond age 90 years. Older adults also have a decline in total sleep time, with corresponding decreases in the percentage of time in slow wave sleep (SWS or N3) and rapid eye movement (REM) sleep.⁷ SWS and REM sleep are thought to promote metabolic and cognitive recovery, and to enhance learning and memory, respectively.² Older adults also have an increase in time awake after sleep onset (WASO).⁷ While the number of arousals from sleep increase in healthy older adults, evidence suggests they do not have greater difficulty falling back to sleep.⁸ There is an increase in sleep latency (the time it takes to fall asleep) up to age 60, with no clear age effect beyond that point.⁷

Circadian rhythms also change over the lifespan. These rhythms are 24-hour intrinsic physiological cycles that are involved in control of sleep-wake and many other physiologic processes (e.g. blood pressure, bone remodeling, release of certain hormones).⁹ Aging is associated with a phase advance, resulting in an earlier onset of sleepiness in the evening and earlier morning awakening.¹⁰ Daytime wakefulness is affected by phase advance, with older adults being more alert in the morning and more somnolent in the evening. While napping is common in older adults, results with regard to the benefit or harm of this practice are mixed. Some studies show beneficial and potentially protective effects of napping in later life, while others show it to be a risk factor for morbidity and mortality.¹¹ There is some evidence to suggest that naps are protective for mortality if nighttime sleep duration is short, but are associated with increased mortality risk if nighttime sleep duration is longer than nine hours.¹²

2. Sleep Complaints in Older Adults

Epidemiology

Major sleep complaints include insomnia and drowsiness. Insomnia symptoms consist of difficulties with initiating or maintaining sleep (including early morning awakening).¹³ Drowsiness has to do with the propensity for sleep and is often established by napping behavior.¹⁴ Many large studies documenting the epidemiology of sleep complaints in older adults have shown that insomnia symptoms and drowsiness are common in this age group. The Established Populations for Epidemiologic Studies of the Elderly (EPESE) included 9,282 community-dwelling adults aged 65 and older, and found that 43% of participants reported difficulty with sleep onset or maintenance, while 25% reported napping.¹⁵ The National Sleep Foundation's 2003 Sleep in America Poll confirmed the prevalence of these symptoms, stating that 46% of community-dwelling adults aged 65-74 reported insomnia symptoms, while 39% of people in this age group reported napping. These prevalence rates increased to 50% and 46%, respectively, in participants aged 75-84 years.¹⁶ It is estimated that 40-70% of older adults have chronic sleep problems, and up to 50% of cases are undiagnosed.⁶

The major sleep complaint will depend on the cause of the sleep disturbance. Insomnia symptoms are common in people using activating medications or substances, in those with comorbid medical or psychiatric illness, or restless leg syndrome. Daytime drowsiness can result from sedating medications, chronic medical illness or obstructive sleep apnea (OSA). With respect to OSA, while drowsiness and snoring are the most common complaints, older adults may also complain of choking or gasping on awakening, observed apneas, morning headache, nocturia, wandering or confusion.^{17,18}

Consequences of poor sleep

Sleep complaints, whether related to insomnia symptoms or drowsiness, have important consequences in older adults. Beyond being distressing for the subject, these symptoms predict poor physical and mental health-related quality of life.¹⁹ In longitudinal studies, insomnia complaints have been associated with many different detrimental outcomes, including poor self-reported health status, cognitive decline, depression, disability in basic activities of daily living, poorer quality of life and higher risk of institutionalization.^{2,17} Insomnia is also associated with impaired physical function and increased fall risk.^{11,17} Daytime drowsiness has also been associated with harmful outcomes in longitudinal studies, including cardiovascular disease, falls, and death.² Healthy older adults who have sleep latencies greater than 30 minutes, sleep efficiencies below 80%, or REM sleep percentage below 16% or greater than 25% of total sleep are at increased mortality risk, even after controlling for age, gender and baseline medical burden.²⁰

3. Pathological and Psychosocial Factors Affecting Sleep in the Aging Population

Pathological factors

While aging *per se* does not lead to sleep pathology, the aging process is commonly associated with multiple pathological problems that can affect sleep. Older adults commonly suffer from pain syndromes, arthritis, digestive disease, heart disease, lung disease, renal and urologic diseases, and cancer, all of which can contribute to sleep disturbance through specific symptoms or because of complications or anxiety associated with these diseases.²¹ Psychiatric illness is as important as medical comorbidity in its effect on sleep, and has long been recognized to significantly and independently increase risk for insomnia in older adults.^{21,22} Sleep disruption features prominently in many psychiatric conditions, including depression and anxiety, which are common in older adults.²¹ Sleep disturbance and depression are intertwined, as insomnia may be a result of depression but also increases the risk of developing depression in older adults.²³

More so than the impact that a single condition has on sleep problems, one of the major issues leading to a higher risk of sleep problems in older adults is the *accumulation* of comorbidities. More than one in four Americans is living with two or more chronic conditions, and the prevalence of multiple chronic conditions increases with age.²⁴ A recent report of fee-for-service Medicare beneficiaries found that the rate of two or more chronic conditions was 62% for those aged 65-74 years and increased to 82% for those aged 85 years and older.²⁵ In fact, this situation has become so common that there has been a shift from looking at comorbidity (which focuses on the effect of a single co-occurring disease with respect to an index disease) to *multimorbidity*. Multimorbidity refers to the coexistence of two or more chronic medical conditions in the same person.²⁵ However, a more nuanced definition takes into account both number and severity of conditions, and considers the link between multimorbidity and cognitive and physical dysfunction, as well as psychosocial factors.³

With a rising number of health problems, the likelihood of sleep complaints increases. This was demonstrated in the 2003 National Sleep Foundation survey, which showed that among people aged 65 years and older without comorbid illness, 36% reported a sleep problem. This percentage increased to 52% among people with one to three comorbid conditions, and to 69% among people with 4 or more comorbid conditions.¹⁶ The cumulative effects of multiple chronic conditions on sleep complaints is not surprising considering that single diseases are known to affect sleep quality in older adults- if one is bad, more than one is likely to be worse.

Medications and substance use

Medication use is another factor that may increase risk for sleep disturbances in older adults. The use of prescription medications, over-the-counter medications and dietary supplements is on the rise in this age group. A recent study of a nationally representative sample of community-dwelling adults aged 62-85 years found that 88% used at least 1 prescription medication, 38% used over-the-counter medications, and 64% used dietary supplements.²⁶

Different classes of medications commonly used in older adults can directly impact sleep through multiple mechanisms. One such effect is increased daytime drowsiness, as can be seen with antihistamines, anticholinergic and anticonvulsant medications, and opiates. Medications can be activating or stimulating, as is the case with pseudoephedrine, beta agonists, corticosteroids, certain antidepressants, methylphenidate or selegiline. Other medications can exacerbate primary sleep disorders or directly influence sleep architecture. For example, restless leg syndrome (RLS) and periodic limb movements of sleep (PLMS) can worsen with use of certain antidepressants, while sleep disordered breathing can worsen with use of opiates or benzodiazepines.²¹ With respect to sleep architecture, certain beta blockers have been shown to suppress melatonin secretion and increase sleep fragmentation. Others can worsen parasomnias, induce REM sleep behavior disorder, or change the amount of time spent in REM sleep.²¹ A final factor to consider is whether a medication might be interfering with sleep by worsening other conditions or causing sleep disruptive symptoms. Several examples of such effects include medications that worsen heart failure, have diuretic effects, create bothersome coughing, or cause nocturnal hypoglycemia.

Polypharmacy may also contribute to heightened risk for sleep disturbance in older adults. While it is generally defined as the use of multiple medications, there is no consensus definition about the number of medications that constitutes polypharmacy.²⁷ In epidemiologic studies, polypharmacy is frequently defined as taking five or more medications. A 2003 survey of Medicare beneficiaries found that 46% of those surveyed met this definition for polypharmacy.²⁸ This condition is increasingly common as age-related comorbidities increase, putting older adults at risk for drug-drug and drug-disease interactions.^{26,29} Polypharmacy may be compounded by the cascade effect, which refers to the use of medications to treat side effects caused by other medications.²¹

Substance use merits consideration in the older adult with sleep disruption, especially with respect to alcohol, caffeine, and tobacco consumption. While acute consumption of alcohol may decrease sleep latency, it can increase arousal, leading to sleep that is of poorer quality and shorter duration. Alcohol can also exacerbate sleep disordered breathing by decreasing pharyngeal muscle tone.²¹ The stimulating effects of caffeine can increase sleep latency and number of arousals, leading to shorter sleep duration.²¹ Tobacco consumption has been associated with insomnia in several studies. Nicotine is a potential mediator of this effect, as it may promote wakefulness via an effect on central nervous system acetylcholine transmission.²¹ However, a causal relationship has not been established.³⁰

Psychosocial factors

Psychosocial factors can impact sleep in older adults in multiple ways. Particularly relevant are the effects of caregiving, social isolation, loss of physical function, and bereavement.

Caregiving is common to the process of aging. Recent evidence from the National Alliance for Caregiving indicates that 43.5 million adults in the United States provided unpaid care to an adult or child in the prior year, and that approximately 1 in 5 of these caregivers was 65 years of age or older.³¹ Providing intensive assistance can result in psychological stress, physical strain, and erratic schedules, all of which may contribute to diminished sleep quality and disruptions in normal sleep patterns. In addition, caregiving is associated with

depressed mood as well as erosion of physical health in the caregiver, further increasing the risk for sleep disturbance.^{31,32} This can be a vicious cycle, as poor sleep can further erode physical health. Poor overnight sleep in caregivers has also been associated with reduced quality of life, increased inflammatory markers,³² and is one of the strongest factors leading to institutionalization of a care recipient with dementia.³³

Rates of social isolation increase after retirement and because 28.3% of adults aged 65 and older live alone.³⁴ Isolation can impact sleep through its effect on sleep hygiene and zeitgebers (see below). Sleep hygiene refers to a set of behavioral and environmental recommendations that are intended to promote sleep. These recommendations include avoiding caffeine or alcohol, getting regular exercise, and maintaining a regular sleep schedule while avoiding daytime naps.³⁵ However, the loss of a regular schedule and decreased social contact can lead to loneliness, inactivity, and boredom, potentially promoting behaviors, like napping and irregular bedtimes, that are counter to the promotion of healthy sleep. Zeitgebers are cues from the environment that entrain circadian rhythms to a 24-hour cycle length, promoting normal sleep-wake habits. Zeitgebers may be light-based, but also include exercise, scheduled meals, and other social cues.³⁶ For socially isolated older adults, there may be inadequate exposure to zeitgebers, leading to irregular sleep-wake patterns. Previous evidence has shown that reports of insomnia and drowsiness were higher in older adults who felt socially isolated,¹⁶ while activity and satisfaction with social life protected those aged 65 and older against insomnia symptoms.³⁷

Loss of physical function is common among older adults. In 2009, 30% of Medicare enrollees aged 65 and over reported needing assistance with basic activities of daily living.³⁸ While this loss has many implications for the health of older adults, it also affects their level of activity and exposure to zeitgebers. Thus, its effects on sleep are similar to those described for social isolation. In the National Sleep Foundation survey, older adults with decreased physical function (defined as difficulty walking one-half mile without help and/or difficulty walking a flight of stairs without help) were more likely to report insomnia symptoms (66% vs. 44%) and daytime sleepiness (28% vs. 12%).¹⁶ Loss of physical function has also been significantly associated with the development of insomnia symptoms.¹⁵

Bereavement, the experience of losing a loved one to death,³⁹ is another factor that may contribute to sleep disturbance in older adults. A recent study found that over 70% of older adults experienced bereavement over a 2.5-year period.⁴⁰ Bereavement is experienced more often in older adults because the loss of a spouse, siblings or friends is common in this age group.^{40,41} The grief experienced from such a loss has been associated with worsening health and functional impairment in older adults,⁴¹ as well as an increased risk for the development of mood and anxiety disorders and substance abuse.³⁹ Importantly, bereavement in older adults has also been associated with increased loneliness and social isolation.⁴¹ Thus, as with the other psychosocial factors mentioned above, worsening health, psychiatric illness and social isolation play a role in increasing the risk for sleep disturbance in bereavement. Multiple studies have shown an association between bereavement and sleep disturbance.^{15,42,43} Older adults are at higher risk for complicated grief after bereavement, a condition in which grief symptoms are more severe and prolonged. The physical and mental

health consequences of complicated grief are more severe than those associated with acute grief, and sleep impairment may be worse in these individuals.⁴¹

4. Sleep Disorders in Older Adults

Insomnia

A diagnosis of Insomnia Disorder is made clinically via a complaint of dissatisfaction with sleep quality and/or quantity, difficulty initiating or maintaining sleep, waking up too early and/or nonrestorative or poor sleep, with a negative impact on daytime functioning and occurring at least three nights a week for more than three months.⁴⁴ The majority of insomnia diagnoses in older adults result from “comorbid insomnia”.⁴⁵ This designation emphasizes the coexistence of insomnia with other medical and psychiatric comorbidities, and acknowledges that it may not be possible to determine whether insomnia is a cause or consequence of coexisting illnesses. As described above, multimorbidity, polypharmacy and substance use, and psychosocial factors are common with the aging process and put older adults at risk for a diagnosis of insomnia.

The epidemiology of insomnia in older adults has been the subject of many studies, but summarizing the results is difficult since insomnia is defined differently in these studies. Some look only at insomnia symptoms (e.g. difficulty initiating or maintaining sleep, complaints of non-restorative sleep) with or without inclusion of criteria on frequency or severity of symptoms, while others look at insomnia diagnosis but use different diagnostic criteria. It is widely accepted that insomnia symptoms increase with advancing age, with prevalence rates approaching 50% in adults aged 65 and above.¹³ Annual incidence rates for insomnia symptoms have been estimated to be 3-5%,^{15,22} while remission rates may be as high as 50% over three years.¹⁵ With respect to insomnia diagnosis, prevalence has been estimated to be around 5%.⁴⁶ It is thought that prevalence of insomnia diagnosis increases after 45 years of age but may remain the same in individuals after 65 years of age.¹³ There are different theories about why the discrepancy between insomnia symptoms and diagnosis exists. Some authors have postulated that insomnia symptoms may be better tolerated or the daily demands less for older adults.⁴⁷ Others point to a “paradox of well-being” bias in questionnaires, in which older adults are less likely to report dissatisfaction or distress because their actual state of health exceeds the expected level.^{11,48}

Obstructive sleep apnea

Obstructive sleep apnea (OSA) increases with advancing age, with prevalence estimates differing depending on the definition used. Using a definition of 10 or more apneas and/or hypopneas per hour of sleep, OSA prevalence estimates in older adults may be as high as 70% in men and 56% in women. This is in contrast to prevalence estimates in the general adult population of 15% in men and 5% in women.¹⁷ While it is more common, this condition frequently goes undiagnosed because the phenotype of OSA can look very different in older adults. After the age of 60, the prevalence of OSA is equivalent in males and females, obesity is no longer a significant risk factor, and witnessed apneas and snoring are not as frequently reported.⁴⁹ Older adults are also more likely to present with more sleep-related complaints, including daytime sleepiness and nocturia.⁵⁰

Older adults are at risk for OSA for several reasons. With aging there is loss of tissue elasticity as well as sarcopenic muscle wasting.^{11,49} There are also structural changes to the upper airway, including lengthening of soft palate and upper airway fat pad deposition.¹¹ These age-related changes increase the tendency for oropharyngeal collapse. In addition, ventilatory control instability may predispose older adults to apneic events.¹¹

The negative consequences of OSA in older adults include excessive daytime sleepiness, decreased quality of life, neurocognitive impairment, nocturia, and worsening of cardiovascular disease, particularly hypertension, heart failure and stroke. Diabetes mellitus and depression have also been found to be more common in older adults with OSA. The impact of untreated OSA in older adults on mortality is not clear.¹⁷ However, older adults have similar adherence rates to treatment,^{17,49} so there is no clear reason not to treat older adults with OSA.

Restless Leg Syndrome and Periodic Limb Movements of Sleep

Restless Leg Syndrome (RLS) and Periodic Limb Movements of Sleep (PLMS) increase in prevalence and severity with advancing age and have the potential to cause sleep complaints. RLS is a sensorimotor disorder characterized by unpleasant sensations in the limbs that cause an urge to move, especially in the evening. PLMS is a disorder characterized by repetitive episodes of stereotypic limb movements caused by muscle contractions during sleep.¹⁷ In epidemiologic studies, the prevalence of RLS in older adults ranges from 9-20%, while PLMS is estimated to be present in 4-11% of older adults.⁵¹ Of persons with RLS, 80% will have PLMS. However, PLMS occurs in the absence of RLS approximately 70% of the time.² These disorders can contribute to insomnia complaints through disruption of sleep onset or maintenance, as well as contributing to daytime drowsiness.

REM Sleep Behavior Disorder

REM sleep behavior disorder (RBD) is a disorder resulting from a lack of the normal atonia seen in REM sleep. As a result, subjects with RBD are able to act out dreams in a way that can be violent and injurious. The majority of cases occur in older adults in the sixth or seventh decade of life, and the disorder is more common in men.¹⁷ While it may be idiopathic, RBD is associated with a neurodegenerative disorder in 48-73% of cases. Subjects with RBD may complain of sleep disruption or vivid dreams.⁵²

5. Treatment of Sleep Disturbances in Older Adults

As we have seen in this chapter, sleep disturbance is highly pervasive among older adults due to multiple factors common to the aging process. These include medical and psychiatric comorbidity, polypharmacy and substance use, psychosocial factors (such as caregiving, social isolation, and loss of physical function), and sleep disorders. With rates of multimorbidity increasing in older adults, it is likely that multiple processes in different domains are contributing to their sleep disturbance. Thus, sleep disturbance in this age group should be approached as a multifactorial geriatric health condition.^{2,4} The implication of this designation is that evaluation of sleep disturbance requires consideration of multiple risk factors and a multifaceted treatment approach. Similar approaches have been used in other

multifactorial geriatric health conditions, including falls and delirium, and have successfully decreased occurrence of these events.^{53,54}

Conclusion

In conclusion, there are normal changes to sleep architecture throughout the lifespan. There is not, however, a decreased need for sleep and sleep disturbance is not an inherent part of the aging process. Sleep disturbance is common in older adults because aging is associated with an increasing prevalence of multimorbidity, polypharmacy, psychosocial factors affecting sleep, and certain primary sleep disorders. It is also associated with morbidity and mortality, making evaluation and management of sleep disturbance in older adults an important focus. Since many older adults will have several factors from different domains affecting their sleep, these complaints are best approached as a multifactorial geriatric health condition, necessitating a multifaceted treatment approach.

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Key Themes

1. With normal aging, there are changes to sleep architecture, including decreases in total sleep time, sleep efficiency, slow wave sleep, and rapid eye movement sleep, and an increase in wake after sleep onset.
2. While sleep disturbance is common with aging, it is not an inherent part of the aging process. Medical, psychiatric, and psychosocial factors overshadow age as a risk factor for sleep disturbance.
3. Sleep disturbance in older adults is associated with increased morbidity and mortality.
4. The evaluation and management of sleep disturbances in older adults is best approached as a multifactorial geriatric health condition, arising from impairments in multiple different domains.

Table 1
Age-Related Changes to Sleep Architecture

	Decreased	Increased
Sleep Parameter	<ul style="list-style-type: none">• Total sleep time• Sleep efficiency• Slow wave sleep• Rapid eye movement sleep	<ul style="list-style-type: none">• Time awake after sleep onset (WASO)• Number of arousals from sleep• Sleep latency