Lavoie et al. Sleep Science and Practice (2018) 2:3
https://doi.org/10.1186/s41606-018-0021-3

Sleep Science and Practice

REVIEW Open Access

Sleep and aging

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Abstract: This review describes normal and disordered sleep in the older adult population. Although several distinctive sleep changes across the lifespan are normative, including changes in the amount of time spent in different stages of sleep and a shift in the timing of circadian rhythms, sleep disorders are also common in late life. Sleep-disordered breathing, insomnia, circadian rhythm sleep-wake disorders, and parasomnias occur frequently in older adults and contribute to overall higher rates of poor sleep with advanced age. Assessment and treatment of sleep disorders has been shown to improve functioning and quality of life in older adults; however, the process of diagnosis and intervention is often complicated due to the presence of multiple medical comorbidities, medication side effects, and specific age-related risk factors for sleep disruption. Additional challenges to recognizing, diagnosing, and treating sleep disorders in older adults with dementia and those in long-term care facilities also exist, further complicating the clinical management of sleep disorders in these patients.

Keywords: Sleep, Circadian rhythms, Sleep disorders, Older adults, Dementia, Long-term care

Background

Sleep changes with normal aging

Non-pathological changes in sleep occur across the normal aging process. Older adults experience shorter total sleep time (TST) than younger adults, with total sleep time decreasing until about age 60, then stabilizing through the later decades of life. This may be due to a combination of physiological changes in sleep, changes in sleep related habits, and increased rates of sleep disorders.

Older adults spend a lower percentage of their sleep time in both slow wave (a.k.a., deep sleep) and REM sleep compared to younger adults, and the time it takes to fall asleep increases slightly as well. The number of arousals and total time awake after falling asleep also increases with age; however, older adults do not experience increased difficulty in their ability to return to sleep following arousals compared to younger adults (Ohayon et al. 2004). Additionally, older adults spend more time napping during the day. Melatonin secretion is reduced (Pandi-Perumal et al. 2005), and the circadian rhythm amplitude is dampened in older adults. After around age 20, the circadian rhythm begins progressively advancing (i.e., shifting earlier), with older adults becoming sleepy earlier in the evening and waking earlier in the morning (Roenneberg et al. 2007). Although recent studies show that the rate of subjectively perceived sleep disturbance actually declines across age groups (Grandner et al. 2012), the non-pathological changes in sleep may increase susceptibility to developing sleep disorders such as insomnia (Miner and Kryger 2017).

Sleep disorders in older adults

Sleep disorders, including sleep disordered breathing and insomnia disorder, are common in older adults and contribute to challenges in day-to-day function and maintaining independence. Studies show that treating sleep disorders can lead to improved symptoms in older patients, even in the context of comorbid medical and mental health conditions. Each of these common sleep disorders is discussed below.

Main text

Sleep disordered breathing

Sleep disordered breathing (SDB) occurs when an individual repeatedly stops breathing or experiences a reduction in airflow during sleep. Apneas occur when there is a complete cessation of airflow for at least 10 s, and hypopneas occur when airflow is reduced for at least 10 s and oxygen saturation is decreased. In Obstructive Sleep Apnea (OSA), breathing is inhibited by a narrowing of the upper airway, while in Central Sleep Apnea there is a loss of breathing

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effort. Sleep apnea is typically diagnosed when the average number of breathing disruptions, or apnea-hypopnea index (AHI), is 15 or higher or five or higher with associated symptoms, like excessive daytime sleepiness.

The American Academy of Sleep Medicine (Kapur et al. 2017) provides guidelines for diagnosing OSA. All patients suspected of having OSA, regardless of age, should undergo a comprehensive clinical evaluation including a sleep history that addresses history of snoring, nighttime choking or gasping, witnessed apneas, restlessness, and excessive daytime sleepiness. Patients' respiratory, cardiovascular, and neurologic systems should be physically examined and medical conditions, such as obesity and hypertension, that are associated with increased risk of OSA should be identified. Patients with suspected sleep disordered breathing should undergo polysomnography (PSG). In individuals with an increased risk for moderate to severe OSA, home sleep apnea testing (HSAT) can be performed with a follow-up PSG if the HSAT is not diagnostic for OSA. It is important to consider that older adults may find use of HSAT equipment more challenging, and there is some evidence that older age is associated with an increased likelihood of requiring an in-laboratory PSG due to a technically inadequate HSAT (Zeidler et al. 2015). When certain comorbid disorders are present, including some that may be more common in older age, such as significant cardiorespiratory disease, and certain neuromuscular disorders that impact respiration, in many older patients, PSG should be used rather than HSAT (Kapur et al. 2017).

Untreated sleep apnea is associated with a number of negative health consequences, including increased mortality, hypertension, heart failure, cardiac arrhythmias, cardiovascular events, cognitive impairment, insulin resistance and diabetes, and surgical complications (Aronsohn et al. 2010; Bradley and Floras 2009; Canessa et al. 2011; Kaw et al. 2006; Kendzerska et al. 2014; Marin et al. 2005). The link between sleep apnea and new-onset epilepsy is particularly strong in older adults. Patients with untreated sleep apnea also complain of daytime sleepiness, which impacts safety in certain situations, such as when driving. In many of the comorbid conditions listed above, treating sleep apnea reduces the risk of developing the condition, improves management, and reduces negative health outcomes of the comorbid condition (Park et al. 2011).

In the general population, 9–38% of adults have obstructive sleep apnea defined as AHI ≥ 5, [6–19% of adult women and 13–33% of adult men (Senaratna et al. 2016). When AHI ≥ 15 is used to define disease, the prevalence rates range from 6 to 17% (Senaratna et al. 2016)], and this number rises to 36.5% in older adults (Lee et al. 2014). Sleep apnea is estimated to be approximately 2–4 times more common in older adults than in middle adulthood (Young et al. 2002) and at least mild sleep-disordered breathing (AHI ≥ 5) has been measured as high as 84% in men and 61% in women age 60 and older (Heinzer et al. 2015). In older men, sleep apnea rates are twice as high as in older women (Heinzer et al. 2015).

Positive airway pressure (PAP), either continuous or automatically-adjusting (CPAP and APAP), is the established first-line treatment for obstructive sleep apnea. The positive pressure operates as a splint, maintaining an open airway. Adherence to wearing the PAP mask, which covers a patient's nose and/or mouth, can be improved by experimenting with the variety of available styles to find the one that is best tolerated, and by providing the patient with education about both sleep apnea and PAP therapy. APAP, which automatically adjusts the pressure based on apneas and hypopneas, may be more comfortable to patients who find the sustained pressure generated by traditional CPAP uncomfortable. Behavioral interventions include weight loss (if the patient is overweight) and reducing alcohol intake; however, these have not been systematically studied for older patients. Older adults suffering from pain, anxiety, or difficulty sleeping may be prescribed opioids, sedatives, or hypnotics, but these should be administered with caution as they may worsen sleep disordered breathing.

Insomnia

According to the Diagnostic and Statistical Manual of Mental Disorders (DSM-5) (American Psyhiatric Association, 2013), insomnia is defined by dissatisfaction in quantity or quality of sleep, characterized by difficulty initiating or maintaining sleep or early-morning awakening, that causes significant distress or functional impairment. The sleep disruption must occur at least three nights per week for at least three months for a diagnosis of insomnia disorder. Prevalence rates for insomnia disorder in older adults range from 5 to 8% (Gooneratne and Vitiello 2014), although sleep complaints, which may respond to treatments for insomnia, range from 30 to 60% (McCurry et al. 2007). Insomnia in older adults typically occurs in the context of other medical and psychiatric disorders that are common in older age, including chronic pain and neurological disorders; however, insomnia often represents an independent clinical condition that does not resolve when management of comorbid conditions is optimized. Older adults commonly increase their time in bed after retirement, and this can contribute to the development and maintenance of insomnia when the time in bed is longer than the person's required sleep time. Primary sleep disorders, medications, and psychiatric conditions are often associated with insomnia, and there is evidence that addressing insomnia can improve comorbid symptoms and conditions. Some older adults may use alcohol to "self medicate" to improve sleep or cope with pain, but it increases fragmentation and may contribute to insomnia complaints as well.

To diagnose insomnia, a clinical interview focusing on gathering a sleep history and identifying contributing factors should be completed, and a medical evaluation to identify conditions that exacerbate poor sleep may be warranted. Although not recommended to diagnose insomnia, PSG may be used to rule out other sleep disorders, like sleep apnea, that may contribute to disrupted sleep. Older adults presenting with cognitive impairment may be unreliable historians regarding sleep, and interviewing a caregiver may provide additional useful information. Patients may also be asked to complete a sleep diary for a week or more, recording time in bed, total sleep time, and number and duration of awakenings. Timing of medications taken, substance use, and other factors that interact with sleep can also be recorded to provide a comprehensive picture to the clinician. Actigraphy, a device worn on the wrist which estimates activity and sleep, can provide additional data. It may be less useful in diagnosing insomnia as it does not distinguish well between resting in bed and sleep onset, but it may provide a better clinical picture than relying on subjective sleep report alone, particularly with cognitively impaired or less active patients (Gooneratne and Vitiello 2014; Martin and Hakim 2011).

Identified underlying conditions should be addressed when treating insomnia. Hypnotic agents in older patients are associated with increased adverse effects; although adverse effects are typically reversed when the medication is discontinued. These include drowsiness or fatigue, headache, and gastrointestinal disturbance, and in older adults, hypnotics are associated with increased falls and motor vehicle accidents (Glass et al. 2005). Consideration of the effects of hypnotics on older adults is warranted given changes to metabolism, increased sensitivity to depression of the central nervous system that leads to increased fall risk and confusion, potential worsening of OSA, and contribution to polypharmacy. Long-acting medications should be avoided due to active metabolites and half-life of more than a day. Additionally, because of the risk of abuse, consideration of an individual patient's risk for developing psychological dependence is warranted. Some medications, such as benzodiazapines, disrupt sleep architecture, and others, including many over-the-counter sleep aids, may cause anticholinergic effects and cognitive impairments that are of particular concern in older patients. There is some evidence that melatonin can decrease sleep onset latency and number of nighttime awakenings with few side effects, particularly in older adults with low melatonin production; (Pandi-Perumal et al. 2005) however, there is insufficient data to recommend it as a standard treatment for insomnia disorder in older patients.

First-line treatment for chronic insomnia is non-pharmacologic. Cognitive Behavioral Therapy for Insomnia is an evidence-based treatment for older adults (McCurry et al. 2007). It combines sleep restriction, stimulus control, sleep hygiene, and other behavioral and cognitive techniques. Sleep restriction reduces time in bed to the amount of time the patient is currently sleeping in order to increase sleep drive, decreasing sleep latency and increasing sleep maintenance. After sleep improves, time in bed is progressively increased. Sleep compression is an alternative method that may be appropriate for older adults who are more susceptible to the effects of daytime sleepiness, like those who are at an increased risk for falls. Sleep compression gradually, rather than immediately, reduces time in bed to approximate total sleep time. Stimulus control restricts the use of the bed to sleep and sexual activity, with the intention of strengthening the association between the bed and sleep and weakening the association between the bed and activities incompatible with sleep, including worrying or ruminating about sleep loss. Relevant health and environmental sleep hygiene factors should be targeted in combination with the broader intervention when they are identified as hindering sleep. Making and maintaining changes consistent with these recommendations can be challenging, so motivational techniques may be useful in increasing adherence. Other interventions include addressing inaccurate and unhelpful beliefs about sleep and offering strategies to reduce physiological arousal, including progressive muscle relaxation, guided imagery, and meditation. CBT-I can be used to support a hypnotic medication taper as well.

Another important consideration is the co-occurrence of OSA and insomnia in older patients. In fact, one recent study found that 45% of older adults with insomnia also had moderate-to-severe OSA (Alessi et al. 2016). Importantly, treatment of insomnia with CBT-I was similarly effective in those with mild-to-moderate OSA and those without OSA (Fung et al. 2016). In addition, insomnia is a known risk factor for non-adherence to PAP therapy for OSA (Wickwire et al. 2010). As a result, whenever possible, older adults with OSA and insomnia should receive treatment for both disorders simultaneously.

Circadian rhythm sleep-wake disorders

Circadian rhythm sleep-wake disorders (CRSWD) occur when the timing of sleep is disrupted due to an altered circadian rhythm or a mismatch between an individual's circadian rhythm and required sleep-wake schedule. Age-related neuronal loss in the suprachiasmatic nucleus, reduced production of melatonin, and eye changes that reduce the ability of light to reach the retinal ganglion cells responsible for circadian entrainment contribute to desynchronization of circadian rhythms in older adults. Circadian rhythms become weaker and are less responsive to external stimuli and tend to shift earlier with advancing age. Although these changes are normative, this pattern may have similar negative health consequences as those

experienced by younger individuals with sleep schedules that are misaligned with their endogenous circadian rhythms (Banks et al. 2016), including impaired cognition (Marquie et al. 2015). In some instances, the misalignment may be so significant that it reaches the threshold of an actual sleep disorder. If the misalignment causes excessive sleepiness or insomnia and the individual is significantly distressed by the alterations in sleep, a diagnosis of a CRSWD may be warranted regardless of how much earlier the circadian rhythm is shifted compared to what is typical (Morgenthaler et al. 2007). For older patients with limited daytime commitments, it may be easier for them to adjust their activities to accommodate shifts in circadian timing. As a result, the impact of less-typical sleep timing may, in fact, be reduced in older adults compared to younger adults who have greater occupational and other daytime demands. Evaluation of circadian rhythm sleep disorders should begin with consideration of other conditions that can impact the sleep-wake cycle or appear as a CRSWD. This includes depression, transient health changes, and sedating medications (Kim et al. 2013).

Advanced Sleep-Wake Phase Disorder (ASWPD) is the most common circadian rhythm sleep-wake disorder in older adults, and it occurs when the patient gets sleepy and wakes up earlier than desired on a nightly basis, and cannot correct this "misalignment" on their own. Delayed Sleep Wake Phase Disorder (DSWPD), which is most common and severe in younger adults, can also occur in older adults. DSWPD occurs when the patient is not sleepy until very late at night and has difficulty rising at a socially-acceptable time in the morning. As with ASWPD, the individual typically cannot adjust the timing of sleep on their own. A sleep diary completed over 1–2 weeks can be used to determine sleep-wake patterns and may be used in combination with actigraphy to support the conclusions.

The American Academy of Sleep Medicine Clinical Practice Guidelines makes one recommendation for the treatment of ASWPD, designating evening light therapy as a recommendation (Auger et al. 2015). Evening bright light therapy, either through a light box or outdoor exposure, can help delay sleepiness, moving the sleep schedule later (Kim et al. 2013). To measure response to treatment, sleep diaries or actigraphy may be useful in determining if periods of activity and rest have shifted in the desired direction (Morgenthaler et al. 2007). These guidelines suggest the use of morning light therapy for patients with DSWPD. Cognitive and behavioral interventions may be useful in improving sleep and increasing adherence to light therapy as well. Other treatments, including melatonin administration, sleep-wake scheduling, and sleep- and wake-promoting agents do not have sufficient evidence to be recommended therapies for ASWPD (Auger et al. 2015).

Sleep related movement disorders

Sleep related movement disorders are movements that inhibit sleep and are often simple and stereotyped. Restless Leg Syndrome/Willis-Ekbom disease (RLS/WED) is an irresistible urge to move the legs often accompanied by a "creepy-crawly," burning, itching, or "pins and needles" sensation that is relieved when the legs are moved. Although it is typically experienced in the legs, it can also occur in the trunk or upper extremities. It tends to be worse at rest and increases in intensity in the evenings, making it difficult to fall and stay asleep and contributing to daytime sleepiness. RLS may be idiopathic or secondary to other medical conditions including iron deficiency, peripheral neuropathy, and renal disease. About 10% of the general population report symptoms of RLS, and prevalence rates increase with age. Across the lifespan, RLS is more common in women than men (Bloom et al. 2009). Diagnosis is based on patient report, but a medical history and examination, in particular obtaining a serum ferritin level, is necessary to identify underlying or contributing conditions and to rule-out akathesias, neuropathies, and other conditions which can resemble RLS.

Following initial treatment (Winkelman et al. 2016), interventions consists of management of underlying conditions and appropriate discontinuation of medications that worsen RLS, including SSRIs, TCAs, lithium, and antipsychotics. Subsequently iron supplementation with vitamin C to increase absorption is initiated if the ferritin level is < 50 mcg/L. Treatment continues until the ferritin is greater than 75 mcg/L. If there is no response to iron supplementation or the initial ferritin is >50mcg/L RLS is treated with dopaminergic agents such as pramipexole or ropinirole. Caution needs to taken with these medications as they can induce sleep attacks and compulsive behaviors. Augmentation, the reemergence of RLS symptoms with treatment, can occur with these agents and should be assessed on follow-up visits. Alpha-2-delta calcium channel ligands such as gabapentin, gabapentin enacarbil and pregabalin are also effective therapies for RLS with data showing decreased augmentation with pregabalin (Allen et al. 2014).

Second-line pharmacological treatments for refractory cases include opioids and benzozepines which should be used cautiously in older adults. Because elevated BMI, sedentary lifestyle, caffeine intake, and tobacco use are correlated with RLS, moderate physical exercise and reducing tobacco and caffeine may be indicated (Bloom et al. 2009).

The majority of individuals with RLS also present with periodic limb movements in sleep (PLMS), which are repetitive, stereotyped movements of the big toe and ankle and occasionally of the knee and hip. The movements last for a few seconds and occur about 1–2 times per

minute, typically during the first part of the night. Periodic limb movements in sleep increase with age. These can lead to significant sleep disruption. Periodic Limb Movement Disorder (PLMD) is diagnosed with PSG and is characterized by 15 or more movements per hour of total sleep time in combination with disrupted sleep or daytime fatigue. Patients may benefit from dopaminergic agents, although there is little evidence to support effectiveness, and often the best approach is to identify and treat associated sleep disorders, including RLS and OSA. PLMS are common in individuals taking antidepressants, and evaluation of medication use may be beneficial as well (Bloom et al. 2009).

Parasomnias

Parasomnias are a category of sleep disorders characterized by abnormal experiences that occur during sleep or sleep-wake transitions. Individuals may experience abnormal movements, behaviors, emotions, perceptions, dreams, or physiological arousal. REM Sleep Behavior Disorder (RBD) is the most common parasomnia in older adults and is characterized by vigorous motor behaviors related to dream reenactment. RBD occurs when there is a lack of normal muscle atonia during REM sleep, and risk of injury to patients and bedpartners is high. It is associated with neurological disease, most often Parkinson's Disease, multiple system atrophy, and dementia with Lewy bodies. As idiopathic RBD may precede other symptoms of neurodegenerative disorders, patient counseling is necessary with the physician attuned to the patient's wishes of being informed as well as careful neurological monitoring. RBD is significantly more common in males than females and has a mean age of onset of 60.9 years (Rabadi et al. 2013). RBD is diagnosed with PSG with EEG and EMG to detect loss of muscle atonia during REM sleep in the setting of the proper clinical context and the lack co-morbid condition which initiates the lack of REM atonia, specifically sleep disordered breathing.

Pseudo-RBD, which includes violent movements but is induced by OSA needs to be ruled out. Treatment of RBD is pharmacological and behavioral. Clonazepam is effective, although the potential adverse consequences in older adults must be considered. Although more complex behaviors and mild to moderate limb movements may persist, violent symptoms improve within the first week of administration, and there is little evidence of abuse or tolerance (Gagnon et al. 2006). Melatonin is an alternative therapy which is better tolerated in the older population and is often used as a first line agent in this group (McGrane et al. 2015). Withdrawal from alcohol and barbiturates, caffeine use, and certain medications, including TCAs, monoamine oxidase inhibitors, and SSRIs, may induce or worsen RBD. Modification of medication regimens and reduction of caffeine intake may improve RBD. Patient education and safety measures are a core component of RBD treatment and include instructions to remove dangerous objects from the home, put the mattress on the floor to prevent falling out of bed, and cushion hard surfaces around the bed.

Dementia and long-term care

Prevalence rates for dementia are estimated to be between 5 and 10% in adults 65 years and older (Hugo and Ganguli 2014), and rates increase exponentially until at least age 90 (Jorm and Jolley 1998). Changes in motor functioning, medication side effects, depression, autonomic disorders, pain, and other factors contribute to incidence of sleep disorders in individuals with dementia. Although causation and directionality is not well understood, evidence suggests that treating sleep and circadian rhythm disorders alleviates some symptoms of neurodegenerative disorders (Mattis and Sehgal 2016). Nearly 60% of individuals with dementia present with sleep-disordered breathing and 50% with insomnia. Ninety-percent of patients diagnosed with Lewy body dementia (LBD) or Parkinson's disease (PD) have sleep disturbances, primarily RBD and insomnia (Guarnieri et al. 2012; Dauvilliers 2007). Sleep-disordered breathing is the most common sleep disorder in vascular dementia, and patients with Alzheimer's disease present more commonly with symptoms of insomnia and increased daytime napping (Zhou et al. 2012). A frequently observed pattern across all dementias is the Irregular Sleep-Wake Rhythm Disorder (ISWRD). ISWRD occurs when the circadian rhythm is not synchronized to the sleep-wake cycle. Individuals may be achieving the desired total number of hours of sleep but the sleep occurs in fragmented episodes during the day and night.

Medications taken for dementia may disrupt sleep. For example, acetylcholinesterase inhibitors that slow cognitive decline in AD may increase nighttime arousal and nightmares (Dauvilliers 2007), and medications for PD may impact REM sleep, lead to daytime sleepiness, night-time arousals, increase hallucinations, and confusion (Adler and Thorpy 2005). Antidepressants have been shown to increase or induce both idiopathic and secondary forms of RBD, but bupropion, which has a non-serotonergic mechanism of action, is considered the first-line medication for depressed patients with RBD (Trotti 2010).

Individuals both with and without dementia in long-term care facilities face unique challenges related to sleep (Bloom et al. 2009). Environmental factors, including increased noise and room-sharing, and the variety of staff working with an individual during the night, may contribute to significant sleep disturbance. Individuals in nursing homes are typically exposed to less outdoor light

during the daytime and experience increased light disturbance at night compared to those living in the community. Additionally, there is a reciprocal relationship between sleep and activity level in nursing home residents, as individuals with sleep disturbance have lower activity levels, and lower activity levels are likely to worsen sleep disruption (Garms-Homolova et al. 2010). Because of environmental sleep disruptions, residents in long-term care facilities may make up for missed night-time sleep by sleeping during the day, particularly those predisposed to napping such as individuals with Alzheimer's Disease or those with a low activity level due to medical problems. In turn, the napping is likely to disrupt night-time sleep.

Assessment of sleep disorders in individuals with dementia is complicated by memory deficits and comorbid conditions. As in older adults generally, other physical and mental health conditions and medications may contribute to sleep disturbances. Although depression decreases with age (Fiske et al. 2009) 8–16% of older adults suffer from depression, and insomnia symptoms are present for most adults with depression (Ohayon 2002). Dementia is also associated with depression (Newman 1999). Anti-depressant treatment may be effective in treating insomnia but the side effects, including sedation and dizziness, are of particular concern in older adults with dementia. The impaired cognition characteristic of dementia may impact accurate recall of pertinent history and recording of sleep necessary for assessment. A caretaker or others close to the patient may be better able to recognize the presence of a sleep disorder, but stereotypes that disrupted sleep is a normal part of dementia may hinder identification. When an individual is recognized to have a sleep disorder, assessing caregiver burden may be helpful in identifying how to optimize caregiver support. Depending on the patient's presentation and circumstances, data from sleep diaries may be enhanced by behavioral observations from caregivers or others familiar with the patient's sleep routine. Actigraphy may provide supportive information regarding an individual's sleep/wake cycle as well (Ancoli-Israel et al. 2015).

Given the progressive nature of dementia, behavioral management of sleep disorders may be more effective in the earlier stages of the disease (Dauvilliers 2007) and improved with caregiver assistance; however, because there are few potential downsides to behavioral interventions, these should be considered first-line. As in older adults without dementia, patients should be prescribed a daily routine for bed and wake times. Stimulus control and sleep compression should be implemented. Naps may be planned but should be brief and consistently done at the same time every day. Individuals with ISWRP as well as those with other sleep disorders are likely to benefit from interventions designed to strengthen the circadian rhythm. The American Academy of Sleep Medicine Clinical Practice Guideline (Auger et al. 2015) strongly advises against administration of sleep—promoting medications in this population and notes that melatonin should also be avoided. The guideline does recommend light therapy for elderly individuals with dementia who present with ISWRD.

Bright light therapy in individuals with dementia has been shown to increase sleep efficiency and TST (Zhou et al. 2012; Sloane et al. 2007). Installing bright lights on walls and ceilings may increase adherence and be experienced as more tolerable than sitting in front of a traditional light box for an extended amount of time. Nursing home residents have been shown to benefit from bright light therapy installation targeting morning bright light exposure, "dawn-to-dusk" stimulation, or full day bright light (Deschenes and McCurry 2009). Although one study evaluating home-based bright light therapy did not improve the sleep of individuals with dementia, their caregivers' sleep did improve (Sloane et al. 2015).

OSA is also common in older adults in long-term care settings, and treatment should be offered when patients experience sleep fragmentation or daytime sleepiness as a result (Cooke et al. 2009). While PAP therapy has not been systematically studied in institutional settings, benefits are seen in community-dwelling patients with dementia, and many patients are able to achieve reasonable PAP adherence with the support of a caregiver (Ayalon et al. 2006).

Factors associated with long-term care facilities may be disruptive to sleep, but these facilities are also typically well-equipped to implement structure that improves sleep for individuals with dementia. Offering and encouraging residents to engage in exercise and social interactions and setting up a routine for residents with regularly scheduled meals and activities may improve a number of sleep measures including reducing insomnia and regulating and shifting circadian rhythm (Deschenes and McCurry 2009). One intervention targeting increased outdoor light exposure, decreased time in bed during the day, increased physical activity, a consistent bed time routine, and efforts to reduce night-time noise and light disruptions reduced number of nighttime awakenings and increased the active period of the rest/activity rhythm (Alessi et al. 2005; Martin et al. 2007).

Conclusions

Across the aging process normal changes to sleep occur, including shorter night time total sleep time, decreased time in slow wave and REM sleep, increased sleep-onset latency, and increased arousals following sleep onset. Daytime napping is also increased. Melatonin secretion

is reduced, and the circadian rhythm becomes weaker and advances. Although these changes are non-pathological, sleep apnea, insomnia, circadian rhythm sleep-wake disorders, and parasomnias are frequently observed in this population. Because many sleep disturbances are attributable to underlying conditions and medications in older adults, a medical evaluation and treatment of identified contributing factors is necessary. A thorough sleep history is important in the assessment of all sleep disorders. A sleep diary, supplemented with actigraphy or caregiver report, provides information helpful in diagnosing insomnia and circadian-rhythm disorders, and a sleep study is needed to diagnose sleep apnea, PLMD, and RBD, which must be completed with EEG and EMG. HSAT may be used but may require follow-up PSG, particularly in this population who may have difficulty using HSAT.

PAP therapy, along with behavioral changes specific to the individual's sleep habits, is recommended for sleep apnea. Insomnia is treated with sleep restriction, or sleep compression in individuals susceptible to adverse events resulting from increased daytime sleepiness, stimulus control, sleep hygiene, and other behavioral and cognitive techniques based on the patient's presentation. Few treatments are well-studied in CRSWD in older adults, but evening light therapy may be helpful in delaying circadian rhythms. RLS is treated pharmacologically and may improve with lifestyle changes. There is little evidence to support treatments for PLMD, but identification and treatment of underlying conditions and discontinuation of certain medications may improve symptoms. Behavioral interventions to increase safety in combination with clonazepam or melatonin are the primary treatment approaches to RBD.

In older patients with dementia, sleep disorders occur at a higher frequency but may be difficult to assess. Both dementia and residing in a long-term care facility are associated with increased depression which impacts sleep, and environmental factors in long-term care facilities may additionally disrupt sleep. Interventions tailored to these challenges enhance effectiveness, including working with the patient's caregiver, installing bright room lighting, and encouraging engagement in exercise and social activities offered by the facility.

Abbreviations

AHI: Apnea-hypopnea index; ASWPD: Advanced Sleep-Wake Phase Disorder; CPAP and APAP: Continuous or automatically-adjusting; CRSWD: Circadian rhythm sleep-wake disorders; DSWPD: Delayed Sleep-Wake Phase Disorder; HSAT: Home sleep apnea testing; ISWRD: Irregular Sleep-Wake Rhythm Disorder; LBD: Lewy body dementia; OSA: Obstructive sleep apnea; PAP: Positive airway pressure; PD: Parkinson's disease; PLMS: Periodic limb movements in sleep; PSG: Polysomnography; RBD: REM Sleep Behavior Disorder; RLS: Restless Leg Syndrome; SDB: Sleep disordered breathing; TST: Total sleep time

Acknowledgments

Not applicable.

Funding

None.

Availability of data and materials

Not applicable.

Authors' contributions

CJL contributed to conceptualization of the work and writing of the manuscript. MZ contributed to conceptualization of the work and writing of the manuscript. JLM contributed to conceptualization of the work and writing of the manuscript. All authors read and approved the final manuscript.

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Ethics approval and consent to participate

Not applicable.

Consent for publication

Not applicable.

Competing interests

The authors declare that they have no competing interests.

Publisher's Note

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Received: 3 July 2017 Accepted: 8 February 2018
Published online: 23 February 2018

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