



Published in final edited form as:

Clin Geriatr Med. 2008 February ; 24(1): 39–vi.

SLEEP DISTURBANCES IN LONG-TERM CARE

Jennifer L. Martin, PhD¹ and Sonia Ancoli-Israel, PhD²

1 Research Health Scientist, VA Greater Los Angeles Healthcare System, Geriatric Research, Education and Clinical Center, and Assistant Research Professor, University of California, Los Angeles School of Medicine; Multicampus Program in Geriatric Medicine and Gerontology, Los Angeles, California

2 Professor, University of California, San Diego, Department of Psychiatry, and VA San Diego Healthcare System, Department of Psychiatry, San Diego, California

SYNOPSIS

Nighttime sleep disruption is characteristic of long-term care residents, is typically accompanied by daytime sleepiness and may be caused by a multitude of factors. Causal factors include medical and psychiatric illness, medications, circadian rhythm abnormalities, sleep disordered breathing and other primary sleep disorders, environmental factors and lifestyle habits. There is some suggestion that these factors are amenable to treatment; however, further research on the implementation of treatments within the long-term care setting is needed. Additional work is also needed to understand the administrative and policy factors that might lead to systemic changes in how sleep is viewed and sleep problems are addressed in long-term care settings.

A growing number of older adults reside in long-term care facilities. In this setting, residents commonly suffer from nighttime sleep disruption, which is often accompanied by daytime sleepiness and may be caused by a multitude of factors. Importantly, sleep disturbance is associated with negative health outcomes, including risk for falling, and elevated mortality risk among long-term care residents. A number of factors contribute to sleep disturbance in the long-term care setting including medical and psychiatric illness, medications, circadian rhythm abnormalities, sleep disordered breathing and other primary sleep disorders, environmental conditions (e.g., noise and light) and lifestyle habits. Based on research with older adults in the community and work conducted within long-term care settings, there is some suggestion that these factors are amenable to nonpharmacological treatments. Further research on the broad implementation of treatments for sleep problems within the long-term care setting is still needed. Additional work is also needed to understand the administrative and policy factors that might lead to systemic changes in how sleep is viewed and sleep problems are addressed in long-term care settings.

Keywords

long; term care; dementia; circadian rhythms; sleep disorders

Jennifer L. Martin, PhD, VA Sepulveda GRECC (11E), 16111 Plummer Street, North Hills, CA 91343, Phone: (818) 895-9311, FAX: (818) 895-9519, E-mail: jennifer.martin@va.gov, Sonia Ancoli-Israel, PhD (corresponding author), Department of Psychiatry UCSD, 9500 Gilman Drive, La Jolla, CA 92093-0603, Phone: (858) 642-3828, FAX: (858) 552-7536, Email: sancoliisrael@ucsd.edu.

Publisher's Disclaimer: This is a PDF file of an unedited manuscript that has been accepted for publication. As a service to our customers we are providing this early version of the manuscript. The manuscript will undergo copyediting, typesetting, and review of the resulting proof before it is published in its final citable form. Please note that during the production process errors may be discovered which could affect the content, and all legal disclaimers that apply to the journal pertain.

INTRODUCTION

As the number of older adults increases, the long-term and rehabilitative care needs of this growing segment of the population are often met in long-term care facilities. In 1999, approximately 5% of U.S. adults over age 65 resided in long-term care facilities. The typical long-term care resident is white (88%), widowed (63%), female (75%) and over age 75 (86%). Nearly all residents (97%) require assistance in one or more basic activities of daily living (e.g., toileting, bathing, dressing). Residents are most commonly admitted from acute care hospitals (44%) or directly from their home (32%). The average length of stay in a long-term care facility is 2.4 years, and the most common reasons for discharge are death (27%) and acute hospital admission (28%), generally due to deteriorating health or acute medical emergency. Only 29% of residents are discharged because they recover or are sufficiently stabilized to return home.^{1,1} Over 90% of long-term care residents receive nursing and medical services, assistance with medications and/or assistance with personal care needs.¹

SLEEP/WAKE PATTERNS IN LONG-TERM CARE RESIDENTS

Nearly any visitor to a long-term care facility will see evidence of sleep/wake pattern disturbance among residents. Among long-term care residents, self-reported difficulties with sleep are even more common and more severe than among older adults living at home in the community. Residents are commonly asleep intermittently at all hours of the day, even during mealtime periods. Although older community-dwelling adults are more likely to take naps than younger adults, the typical long-term care resident shows a pattern of wakefulness that is frequently interrupted by brief periods of sleep. This daytime “wake fragmentation” is oftentimes accompanied by nighttime “sleep fragmentation.” While it is impossible to determine which is causal and which is symptomatic, clearly nighttime wakefulness can lead to increased daytime sleeping, and vice versa. This vicious cycle can lead to extreme disruption of sleep/wake patterns. This is likely due, in part to changes in sleep associated with dementia, which is common in the long-term care setting as well (see Table 1). Research using either behavioral observations of sleep or wrist actigraphy (an objective estimate of sleep, measured using wrist movements) has shown that the sleep of long-term care residents is distributed across the 24-hour day rather than being consolidated to the nighttime hours. Residents rarely are asleep or awake for a continuous hour during the day or night.^{2,3}

Some of the consequences of poor sleep, such as irritability, poor concentration and memory, slower reaction time, decreased performance may all be assumed to be part of dementia. These symptoms, however, may also be a result of poor nighttime sleep and high levels of daytime sleepiness. For example, new research suggests that, in community dwelling older women, short sleep at night, poor sleep efficiency (percent of the night spent asleep) and increased napping during the day are all associated with increased risk of falls⁴ as well as increased risk of shorter survival.^{5,6} Sleep has also been associated with negative outcomes in the nursing home setting.⁷

Although the specific causes of sleep pattern disruption vary from person to person, there are several common causes of sleep difficulties in the long-term care setting. These include primary sleep disorders, medical conditions, psychiatric disorders, medications/polypharmacy, and circadian rhythm disruption. Environmental factors (e.g., noise and light during the night, low daytime indoor illumination, little time spent outdoors) and behavioral factors (e.g., physical inactivity, extended time spent in bed) also appear to contribute to the disruption of long-term care residents’ sleep/wake patterns.

PRIMARY SLEEP DISORDERS IN LONG-TERM CARE RESIDENTS

No large-scale epidemiological studies have been conducted to examine the prevalence of primary sleep disorders in long-term care facilities. One could assume, however, that sleep disorders that increase in prevalence with advancing age are at least as common among patients in long-term care facilities as in older adults in community settings (e.g., sleep disordered breathing (SDB), restless legs syndrome (RLS), periodic limb movement disorder (PLMD), REM sleep behavior disorder (RBD)). In addition, these sleep disorders are even more common among individuals with certain dementing illnesses than among older adults without dementia (see Table 2). The absence of true prevalence information in the long-term care setting is, in part, due to the difficulty in conducting polysomnographic sleep recordings with long-term care residents, especially among individuals with dementia or extreme frailty.

Sleep disordered breathing (SDB) is a condition in which airflow during respiration is interrupted. This can occur because the airway collapses during sleep or because central nervous system signaling is impaired. These respiratory events can involve a complete cessation of airflow (apnea) or a partial reduction in airflow (hypopnea). Events are considered clinically significant when they last at least 10 seconds and occur 15 or more times per hour of sleep. This can lead to decreased oxygen saturation and interruption of nighttime sleep. Both of these can contribute to negative consequences such as increased risk for cardio- and cerebrovascular disease, cognitive difficulties, depression, and impaired performance. Depending upon the precise criteria used, $\frac{1}{2}$ to $\frac{3}{4}$ of long-term care residents have at least mild SDB. In the long-term care setting, research shows that SDB has been associated with cognitive impairment, agitated behaviors and increased mortality risk.^{8,9}

SDB is generally treated with continuous positive airway pressure (CPAP). This treatment is not curative; however, it is highly effective in reducing the number of respiratory events. CPAP involves wearing a mask over the nose, which is connected via a hose to a machine that generates positive air pressure. This pressure acts as a splint to hold the airway open. While CPAP has not been evaluated for use with long-term care residents, recent findings suggest that Alzheimer's disease patients living at home with a caregiver have the same level of compliance with CPAP as general sleep disorders clinic patients.¹⁰ Anecdotally, we have observed some residents of nursing homes who used CPAP prior to institutionalization who choose to continue to use CPAP while in the nursing home. This suggests that CPAP should still be considered the treatment of choice among individuals in the long-term care setting who suffer from SDB, and residing in long-term care should not by itself preclude treatment of SDB.¹¹

Restless legs syndrome (RLS) is a disorder in which an individual experiences an uncomfortable sensation in the legs while at rest. This discomfort, often difficult to describe, is relieved with movement of the legs. RLS symptoms often grow worse late in the day and can lead to difficulties falling asleep. RLS increases in prevalence with age, and individuals with RLS sometimes report that their symptoms grow worse as they get older. This condition has not been studied in long-term care; however, it may be a possible cause of motor restlessness and perhaps wandering among residents with RLS and dementia.

Periodic limb movement disorder (PLMD) is a related condition in which the legs jerk or kick during sleep. These movements can lead to fragmentation of nighttime sleep, which can contribute to daytime sleepiness. Treatments for both RLS and PLMD are pharmacological and typically involve the use of dopaminergic agents. There are two FDA approved agents for the treatment of RLS: ropinerole (Requip) and pramipexole (Mirapex). These agents have not been studied in the long-term care setting.

REM sleep behavior disorder (RBD) is a condition in which the central nervous system mechanisms that cause muscle paralysis during REM sleep cease to function properly and the sleeper “acts out” dreams. In the long-term care setting, this condition has not been studied; however, RBD is most common among older men and among individuals with certain dementing illnesses (see Table 2). The main concern associated with RBD is patient safety. Individuals can fall out of bed or engage in dangerous behavior during the night as a result of acting out dream-related behaviors while asleep. The treatment of choice for RBD is clonazepam (Klonopin), which is effective in about 90% of patients. Treatment also involves securing the sleep environment to insure safety.

To date, no studies have systematically examined treatment of SDB, RLS, PLMD or RBD in long-term care residents, and the safety and efficacy of these treatment, particularly among residents with severe dementia is unknown. In general, treatment of primary sleep disorders in long-term care residents should closely parallel the treatment of frail older adults in the community. The risk/benefit ratio of each treatment should be considered. Key foci of treatment should be improvements in functional status, cognition and/or quality of life. Clearly, further research on the treatment of primary sleep disorders in long-term care is needed.

MEDICATIONS, MEDICAL ILLNESSES, AND PSYCHIATRIC DISORDERS

As noted above, long-term care residents are frequently in poor physical health; many suffer from dementia, depression or both; and nearly all take multiple medications to manage medical and psychiatric conditions. On average, residents of long-term care facilities take 5–8 different medications every day, and many take more than 10 medications per day.^{3,12} Given that most residents use many medications, it is extremely likely that one or more of these medications impact nighttime sleep, daytime alertness or both. Some specific medications can be particularly problematic when taken near bedtime, such as diuretics or stimulating agents (e.g., sympathomimetics, bronchodilators). Also, use of sedating medications during the daytime (e.g., antihistamines, anticholinergics, sedating antidepressants) can contribute to daytime drowsiness, leading to daytime sleeping and further disrupting sleep/wake patterns. Some medications used in the treatment of depression, Parkinson’s disease and hypertension can impair sleep or cause nightmares as well. At times, changing the timing of administration of a medication can ameliorate sleep difficulties, particularly if sleep difficulties started or were exacerbated when the medication was first administered.

Residents of long-term care facilities are also likely to suffer from a number of medical conditions. Examples of common medical conditions among long-term residents that may contribute to sleep difficulty include pain (e.g., from arthritis), paresthesias, nighttime cough, dyspnea (from cardiac or pulmonary illness), gastroesophageal reflux and incontinence/frequent nighttime urination. While many of these are chronic conditions that cannot be treated directly, management of symptoms should consider both daytime functioning and nighttime sleep quality.

There is increasing evidence of sleep abnormalities with neurological illnesses (e.g., Alzheimer’s disease, Parkinson’s disease), many of which are common among long-term care residents. In the long-term care setting, residents are often in the late stages of these neurological illnesses. Research suggests demented patients generally have more sleep disruption, lower sleep efficiency, more light sleep, less deep sleep and perhaps less REM sleep compared to nondemented older people (see Table 1).¹³ “Sundowning”, the term used to describe a worsening of confusion and behavior problems in the evening or night in people with dementia, may have an underlying neurological basis and is associated with circadian rhythm disruption.¹² The sleep abnormalities, excessive daytime sleepiness and parasomnias (e.g., REM sleep behavior disorder) associated with Parkinson’s disease may be related to the

pathology of the disorder and/or to its medication treatment. Problems may be even more common among long-term care residents with advanced disease.¹⁴

CIRCADIAN RHYTHM DISRUPTION

Circadian rhythm disruption also contributes to sleep problems in long-term care residents. In older adults, circadian rhythms may be blunted in amplitude and can be shifted to abnormal times, and circadian rhythms are commonly altered among individuals with dementia (see Table 1). In one study, long-term care residents had less stable circadian rhythms of activity compared to older people living at home, regardless of cognitive status.¹⁵ Other studies have found a relationship between circadian rhythm disturbance and degree of dementia.¹⁶ Circadian activity rhythm abnormalities have also been associated with shorter survival in long-term care residents.^{17,18}

In addition to the often-cited advance (i.e., shift to an earlier time) of circadian rhythms commonly seen in older adults, environmental factors also affect circadian rhythms in the long-term care setting. In particular, exposure to bright light is the strongest synchronizer and stabilizer of circadian rhythms, and daytime light levels in long-term care facilities are quite low, with residents seldom taken outdoors. Typically, long-term care residents are exposed to only a few minutes of bright light each day – even less than older adults living in the community.¹⁹ Since light exposure is the strongest known *zeitgeber* (time cue) in humans, this lack of daytime light may contribute to circadian dysregulation. Long-term care residents also spend extended periods in bed and are physically inactive during the daytime, which also contributes to their circadian rhythm abnormalities. While physical activity has a weaker influence on circadian rhythms than light, it still plays an important role.

This disruption of circadian rhythms in the long-term care setting also contributes to fragmentation of sleep and wakefulness. This is because circadian rhythms exert a strong influence on the timing of sleep, and weak circadian rhythms or rhythms that are shifted to inappropriate times are likely to cause sleep problems. Circadian rhythm disturbances are best treated with timed exposure to bright light, and a number of studies have found that exposure to bright light strengthens and stabilizes circadian rhythms.^{20–22}

LONG-TERM CARE FACILITIES AT NIGHT

Long term care facilities are more similar to in-patient hospital settings than to home environments. Typically, residents share rooms, and the nighttime environment is not conducive to sleep due to frequent noise and light interruptions, which occur several times per hour, on average.²³ Long-term care residents must endure these interruptions on an extended, nightly basis. Research has shown that much of the noise produced in the facility is caused by staff, often while they provide incontinence and other personal care to residents.^{23,24} In addition to noise, nighttime exposure to room-level light has the potential to suppress endogenous melatonin, disrupt sleep and shift circadian rhythms.²⁵

PHARMACOLOGICAL TREATMENT OF SLEEP PROBLEMS

Extensive long-term care reforms enacted with the Omnibus Budget Reconciliation Act (OBRA) of 1987 (which became effective in 1991) included limits on the use of psychoactive medications in the long-term care setting. Although OBRA regulations specifically target antipsychotic medications, the interpretive guidelines that accompany these regulations also limit the use of anxiolytic agents and sedative-hypnotics, but not antidepressants. Use of regulated psychoactive medications must be documented in the medical record as necessary to treat a specific condition, with daily dose limits, requirements for monitoring treatment and adverse reactions, and attempts at dose reductions and discontinuation (if possible). The

guidelines also provide options for using psychoactive medications outside of the stated limits when such use is clearly clinically indicated. Since the OBRA guidelines were implemented, research has shown substantial decreases in the use of antipsychotics among long-term care residents, with no change in the use of sedative-hypnotics or anxiolytics, and an increase in the use of antidepressants.²⁶

There are a number of FDA approved agents for the treatment of insomnia, and a number of additional medications that are commonly used “off label” to manage sleep problems. In 2005, the NIH State-of-the-Science Conference on Insomnia concluded that the newer shorter acting non-benzodiazepine hypnotics were more effective and safer than older, longer acting benzodiazepines. In addition, the NIH clearly stated that all antidepressants have potentially significant adverse effects, raising concerns about the risk–benefit ratio when these medications are used to treat sleep problems in the absence of depression. Barbiturates and antipsychotics also have significant risks, and thus their use in the treatment of chronic insomnia was not recommended. In addition, there is no systematic evidence of efficacy and there are significant concerns about the risks of antihistamines (H1 receptor antagonists) when used to treat sleep disturbances.⁹ The conclusions of the NIH panel were based primarily on studies conducted in younger and older adults, and not in older adults with dementia or those living in long term care facilities. Although there are published reports on the efficacy and safety of the shorter acting non-benzodiazepines in older adults in the community,^{27,28} research is still needed in the long term care setting to establish the safety and efficacy of these newer medications.

When considering pharmacological therapy for sleep problems among long-term care residents, it is important to consider the possibility that these medications can increase risk of some adverse outcomes. There are a number of studies that have found a relationship between the use of sleeping pills and falls.^{29–31} It remains unclear however, how much of this relationship may be accounted for by the underlying sleep problems precipitating the hypnotic use in the first place. One recent study using administrative nursing home data in the Minimum Data Set (MDS) found that an indication of insomnia, but not an indication of hypnotic use was associated with increased fall risk after controlling for many (but not all) fall risk factors documented on the MDS.³² These findings, however, must be interpreted with caution since there are no data to support the accuracy of the insomnia or hypnotic use items on the MDS and there is evidence that documentation of falls using this method is substandard.³³ Another important consideration is that nearly all of this work included primarily individuals using older-generation benzodiazepine medications. Research is needed in the long-term care setting to examine the safety and efficacy of the newer non-benzodiazepines, and in particular, to examine the relation between insomnia and risk of falls vs. use of these medications and risk of falls.

A second critical consideration is that, given the large number of medications long-term care residents already use, there is a potential for drug interactions and/or altered drug metabolism. Finally, use of pharmacological agents for sleep problems should not be viewed as a substitute for addressing any other underlying causes of sleep disturbance such as, for example, sleep apnea, nighttime noise, inadequate control of pain or circadian rhythm disturbances.

NON-PHARMACOLOGICAL TREATMENT OF SLEEP PROBLEMS

The NIH State-of-the-Science Conference on Insomnia also concluded that cognitive behavioral therapy (CBT) is as effective as prescription medications for brief treatment of chronic insomnia, with indications that beneficial effects of CBT (in contrast to those produced by medications) may last well beyond termination of treatment.³⁴ While it could be difficult to conduct CBT with patients with dementia due to cognitive limitations, several groups of

investigators have undertaken studies to test the effectiveness of other nonpharmacological interventions to improve sleep in the long-term care setting, and have found some success.

Several studies have tested timed exposure to bright artificial light as a means of improving sleep/wake patterns. As mentioned above, bright light exposure impacts circadian rhythms. It can also increase alertness levels during and immediately after exposure. In randomized-controlled trials, long-term care residents exposed to bright light showed improved sleep relative to participants who received placebo interventions.^{21,22,35,36} Researchers have also examined the effectiveness of supplemental melatonin (a hormone, typically secreted at night, that is closely linked to sleep), but results are mixed. Several aspects of the use of melatonin to improve sleep in long-term care residents, specifically, administration timing, dose, and preparation (acute vs. sustained release) are not clear. A few studies have attempted to increase daytime activity levels, and results are, again, mixed. Some studies show sleep improves, while others show minimal or no changes in sleep.³⁷ Studies have also attempted to reduce nighttime noise and light in resident rooms. These studies have shown that it is extremely difficult to change the long-term care environment, and despite considerable efforts by researchers, the environment remains quite noisy at night.^{35,37,38}

An alternative approach is to use multi-component interventions to address both internal physiological causes of sleep disturbance and external environmental factors. One such study tested a short-term (5-day) intervention combining daytime light exposure and physical activity, a structured and regularly-timed bedtime routine, reduced time in bed during the day plus provision of nighttime nursing care in a manner that minimizes disruption to sleep.³⁵ This intervention was successful in reducing daytime sleepiness, and residents who received the intervention were more socially engaged and physically active during the day than residents receiving usual care; however, nighttime noise and light were not significantly reduced, and there was minimal effect on nighttime sleep. There were also improvements seen in rest-activity rhythms with this intervention.²⁰ Significant improvements in sleep in the long-term care setting likely require multiple factors be addressed simultaneously, perhaps for long periods of time (i.e., weeks or months) in order for substantial improvements in sleep to be achieved and maintained.

One final area for intervention, which has largely been overlooked, is working at the facility level to change staff training, policies and caregiving practices that impact resident sleep. We have conducted qualitative research in this area and have found that nightshift staff are well aware of the difficulties associated with disrupted resident sleep in terms of caregiving; however, many also felt that they needed to be “busy” during the nighttime hours, checking on residents regularly (often with lights on) and providing required nighttime care. The addition of sleep-promoting practices and the removal of unnecessary sleep-disruptive activities by staff may lead to meaningful changes for all residents in a facility. Real change will require administrators and other staff to buy into the notion that sleep is important and that encouraging better quality sleep/wake patterns is beneficial to both residents and staff over the long-term.

CONCLUSION

In summary, nighttime sleep disruption is characteristic of long-term care residents, is typically accompanied by daytime sleepiness and may be caused by a multitude of factors. Causal factors include medical and psychiatric illness, medications, circadian rhythm abnormalities, SDB and other primary sleep disorders, environmental factors and lifestyle habits. There is some suggestion that these factors are amenable to treatment; however, further research on the implementation of treatments within the long-term care setting is needed. Specifically further research is needed to determine whether treating SDB and other primary sleep disorders is feasible and results in functional or quality of life improvements among long-term care

residents. Additional work is also needed to understand the administrative and policy factors that might lead to systemic changes in how sleep is viewed and sleep problems are addressed in long-term care settings.

Acknowledgements

Supported by NIA UCLA Claude Pepper Older Americans Independence Center (5 P60 AG010415), NCI CA112035 CBCRP 11IB-0034, M01 RR00827 and the Research Service of the Veterans Affairs San Diego Healthcare System

References

1. Gabrel CS. National Center for Health Statistics. Characteristics of elderly nursing home current residents and discharges: data from the 1997 national nursing home survey. *Vital Health Stat* 2000;312.
2. Bliwise DL, Bevier WC, Bliwise NG, Edgar DM, Dement WC. Systemic 24-hour behavior observations of sleep and wakefulness in a skilled-care nursing facility. *Psychol and Aging* 1990;15:16–24.
3. Jacobs D, Ancoli-Israel S, Parker L, Kripke DF. Twenty-four hour sleep-wake patterns in a nursing home population. *Psychol and Aging* 1989;4(3):352–356.
4. Stone KL, Schneider JL, Blackwell T, et al. Impaired sleep increases the risk of falls in older women: a prospective actigraphy study. *Sleep* 2004;27:A125.
5. Stone KL, Blackwell T, Cummings SR, Ensrud KE, Bauer DC, Hillier TA, Ancoli-Israel S. Rest-activity rhythms predict risk of mortality in older women. *Sleep abstract* 2006;(suppl 29):A54.
6. Dew MA, Hoch CC, Buysse DJ, et al. Healthy older adults' sleep predicts all-cause mortality at 4 to 19 years of follow-up. *Psychosom Med* 2003;65:63–73. [PubMed: 12554816]
7. Dale MC, Burns A, Panter L, Morris J. Factors affecting survival of elderly nursing home residents. *Int J Ger Psych* 2001;16:70–76.
8. Ancoli-Israel S, Klauber MR, Kripke DF, Parker L, Cobarrubias M. Sleep apnea in female patients in a nursing home: increased risk of mortality. *Chest* 1989;96(5):1054–1058. [PubMed: 2805836]
9. Cohen-Zion M, Stepnowsky C, Marler M, Shochat T, Kripke DF, Ancoli-Israel S. Changes in cognitive function associated with sleep disordered breathing in older people. *J Am Geriatr Soc* 2001;49:1622–1627. [PubMed: 11843994]
10. Ayalon L, Ancoli-Israel S, Stepnowsky C, et al. Treatment adherence in patients with Alzheimer's disease and obstructive sleep apnea. *American Journal of Geriatric Psychiatry* 2006;14:176–180. [PubMed: 16473983]
11. Gehrman PR, Martin JL, Shochat T, Nolan S, Corey-Bloom J, Ancoli-Israel S. Sleep disordered breathing and agitation in institutionalized adults with Alzheimer's disease. *American Journal of Geriatric Psychiatry* 2003;11:426–433. [PubMed: 12837671]
12. Martin J, Marler MR, Shochat T, Ancoli-Israel S. Circadian rhythms of agitation in institutionalized patients with Alzheimer's Disease. *Chronobiol Intl* 2000;17:405–418.
13. Bliwise DL. Review: Sleep in normal aging and dementia. *Sleep* 1993;16:40–81. [PubMed: 8456235]
14. Friedman JH, Chou KL. Sleep and fatigue in Parkinson's disease. *Parkinsonism and Related Disorders* 2004;10:S27–S35. [PubMed: 15109584]
15. Van Someren EJW, Hagebeuk EEO, Lijzenga C, et al. Circadian rest activity rhythm disturbances in Alzheimer's disease. *Biol Psychiatry* 1996;40:259–270. [PubMed: 8871772]
16. Gehrman PR, Marler M, Martin JL, Shochat T, Corey-Bloom J, Ancoli-Israel S. The relationship between dementia severity and rest/activity circadian rhythms. *Neuropsychiatric Disease and Treatment* 2005;1:155–163. [PubMed: 18568061]
17. Gehrman PR, Marler M, Martin JL, Shochat T, Corey-Bloom J, Ancoli-Israel S. The timing of activity rhythms in patients with dementia is related to survival. *Journal of Gerontology: Medical Sciences* 2004;59A:1050–1055.
18. Bliwise DL, Hughes ML, Carroll JS, Edgar DM. Mortality predicted by timing of temperature nadir in nursing home patients. *Sleep Research* 1995;24:510.
19. Shochat T, Martin J, Marler M, Ancoli-Israel S. Illumination levels in nursing home patients: effects on sleep and activity rhythms. *J Sleep Res* 2000;9:373–380. [PubMed: 11386204]

20. Martin JL, Marler MR, Harker JO, Josephson KR, Alessi CA. A multicomponent nonpharmacological intervention improves activity rhythms among nursing home residents with disrupted sleep/wake patterns. *Journal of Gerontology: Medical Sciences* 2007;62A:67–72.
21. Ancoli-Israel S, Martin JL, Kripke DF, Marler M, Klauber MR. Effect of light treatment on sleep and circadian rhythms in demented nursing home patients. *J Am Geriatr Soc* 2002;50:282–289. [PubMed: 12028210]
22. Ancoli-Israel S, Gehrman PR, Martin JL, et al. Increased light exposure consolidates sleep and strengthens circadian rhythms in severe Alzheimer's disease patients. *Behavioral Sleep Medicine* 2003;1:22–36. [PubMed: 15600135]
23. Schnelle JF, Ouslander JG, Simmons SF, Alessi CA, Gravel MD. The nighttime environment, incontinence care, and sleep disruption in nursing homes. *J Am Geriatr Soc* 1993;41:910–914. [PubMed: 8409176]
24. Schnelle JF, Cruise PA, Alessi CA, Al-Samarrai N, Ouslander JG. Sleep hygiene in physically dependent nursing home residents. *Sleep* 1998;21:515–523. [PubMed: 9703592]
25. Boivin DB, James FO. Phase-dependent effect of room light exposure in a 5-h advance of sleep-wake cycle: implications for jet lag. *J Biol Rhythms* 2002;17:266–276. [PubMed: 12054198]
26. Lantz MS, Giambanco V, Buchalter EN. A ten-year review of the effect of OBRA-87 on psychotropic prescribing practices in an academic nursing home. *Psychiatric Services* 1996;47:951–955. [PubMed: 8875659]
27. Ancoli-Israel S, Richardson GS, Mangano RM, Jenkins L, Hall P, Jones WS. Long-term use of sedative hypnotics in older patients with insomnia. *Sleep Med* 2005;6:107–113. [PubMed: 15716214]
28. Contronco A, Gareri P, Lacava R, Cabodi S. Use of zolpidem in over 75-year-old patients with sleep disorders and comorbidities. *Arch Gerontol Geriatr* 2004;9:93–96.
29. Campbell AJ, Borrie MJ, Spears GF. Risk factors for falls in a community-based prospective study of people 70 years and older. *J Gerontol* 1989;44(4):M112–M117. [PubMed: 2738307]
30. Ray WA, Thapa PB, Gideon P. Benzodiazepines and the risk of falls in nursing home residents. *J Am Geriatr Soc* 2000;48:682–685. [PubMed: 10855607]
31. Schneeweiss S, Wang PS. Claims data studies of sedative-hypnotics and hip fractures in older people: exploring residual confounding using survey information. *J Am Geriatr Soc* 2005;53:948–954. [PubMed: 15935016]
32. Avidan AY, Fries BE, James ML, Szafara KL, Wright GT, Chervin RD. Insomnia and hypnotic use, recorded in the minimum data set, as predictors of falls and hip fractures in Michigan nursing homes. *J Am Geriatr Soc* 2005;53:955–962. [PubMed: 15935017]
33. Martin JL, Alessi CA. Limited validity of MDS items on sleep and hypnotic use in predicting falls and hip fracture among nursing home residents. *J Am Geriatr Soc* 2006;54:1150–1152. [PubMed: 16866697]
34. National Institutes of Health. Manifestations and management of chronic insomnia in adults. *Sleep* 2005;28:1049–1057. [PubMed: 16268373]
35. Alessi CA, Martin JL, Webber AP, Kim EC, Harker JO, Josephson KR. Randomized controlled trial of a nonpharmacological intervention to improve abnormal sleep/wake patterns in nursing home residents. *J Am Geriatr Soc* 2005;53:619–626.
36. Van Someren EJW, Kessler A, Mirmiran M, Swaab DF. Indirect bright light improves circadian rest-activity rhythm disturbances in demented patients. *Biol Psychiatry* 1997;41:955–963. [PubMed: 9110101]
37. Alessi CA, Yoon EJ, Schnelle JF, Al-Samarrai NR, Cruise PA. A randomized trial of a combined physical activity and environmental intervention in nursing home residents: Do sleep and agitation improve? *J Am Geriatr Soc* 1999;47:784–791. [PubMed: 10404920]
38. Schnelle JF, Alessi CA, Al-Samarrai NR, Fricker RD, Ouslander JG. The nursing home at night: effects of an intervention on noise, light and sleep. *J Am Geriatr Soc* 1999;47:430–438. [PubMed: 10203118]
39. Petit, D.; Montplaisir, J.; Boeve, BF. Alzheimer's disease and other dementias. In: Kryger, MH.; Roth, T.; Dement, WC., editors. *Principles and Practice of Sleep Medicine*. 4. Philadelphia: Elsevier Saunders; 2004. p. 853-62.

Table 1

Changes in sleep and circadian rhythms in dementing illnesses.

	Alzheimer's disease ³⁹	Dementia with Lewy Bodies	Parkinson's disease with dementia	Vascular dementia
Subjective sleep quality		✓		
↓ subjective sleep quality			✓	
↑ time to fall asleep			✓	
↑ Daytime sleepiness			✓	
Sleep architecture		✓		✓
↑ awakenings	✓	✓	✓	✓
↑ light sleep (stage 1/2)	✓			
↓ deep sleep (stage 3/4)	✓			
Δ REM sleep				
24-hour sleep patterns		✓	✓	✓
↑ sleep/wake fragmentation	✓	✓		
↑ daytime napping				
Circadian rhythms				
↓ circadian rhythm amplitude	✓			
Delayed circadian rhythms	✓			

↑=increase; ↓=decrease; Δ=change.

Table 2

Sleep disorders to consider in dementing illnesses.

	Sleep disorders
Alzheimer's disease	Sleep Disordered Breathing
Dementia with Lewy Bodies	Restless Legs Syndrome REM behavior disorder Periodic Limb Movement Disorder
Parkinson's disease with dementia	Restless Legs Syndrome REM Behavior Disorder Periodic Limb Movement Disorder Sleep Disordered Breathing
Vascular dementia	Sleep Disordered Breathing