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Rest-Activity Patterns in Institutionalized Older Korean Adults with Dementia

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Rest-Activity Patterns in Institutionalized Older Korean Adults with Dementia

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DISSERTATION

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[redacted]

Dedication

To my parents, Yoon Hwa Song and Jong Ho Kim,

for their constant support and unconditional love.

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Dissertation Overview

This dissertation is organized into to five chapters that comprise three publishable papers. The first chapter introduces background and common sleep problems in older adults with dementia. It also addresses theoretical framework that explains sleep mechanism, risk factors of impaired sleep, and its outcome.

The second chapter, entitled “Sleep in Older Adults with Dementia” was submitted to the *Journal of Neuroscience Nursing*. This chapter presents a critical review of the literature that includes sleep characteristics, correlates of sleep, interventions used in treating sleep disturbances in this population, and implications for nursing practice. First, the background and significance of sleep problems in older persons with dementia are described. Normal sleep characteristics, such as the physiology of sleep and sleep change by aging, are briefly summarized followed by characteristics of sleep and circadian rhythms in older adults with dementia. Factors related to sleep in persons with dementia, such as gender, medications, and light exposure, are addressed. Commonly used interventions, applicable to nursing practice, are described.

The third chapter of this dissertation, “Assessing Environmental Risk Factors Related to Sleep Problems in Institutionalized Older Adults with Dementia: A Case Study Approach” was submitted to *Neurocase*. This paper is a single, case-study design of four cases. Before planning interventions for individuals with dementia who reside in institutions, such as nursing homes, health care providers must assess and identify sleep problems and their causal factors. Different characteristics of sleep disturbances are addressed, and potential factors affecting sleep, particularly institutional environmental factors, are discussed in each case.

The fourth chapter of this dissertation, “Rest-Activity Patterns in Institutionalized Older Korean Adults with Dementia: A Pilot Study” was accepted for publication to the *Journal of Gerontological Nursing*. The paper examines the characteristics of objectively measured rest-activity patterns in 12 older Korean adults with dementia who reside in a nursing home and an assisted nursing facility. The paper also explores factors related to rest-activity patterns, such as type of setting.

Finally, chapter 5 of this dissertation summarizes key findings from the previous three chapters. Limitations of the study and directions for future research are discussed with the theoretical framework.

Abstract

Rest-Activity Patterns in Institutionalized Older Korean Adults with Dementia

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Most of the knowledge on sleep in older adults with dementia is based on studies conducted in the United States and other Western countries. Sleep research worldwide of other populations with dementia is meager by comparison. The aim of this dissertation is to increase knowledge on sleep in older persons with dementia by studying a Korean population and to suggest effective interventions.

Literature on sleep in older adults with dementia was reviewed to identify their sleep characteristics and sleep-related factors and to discuss nursing interventions. Two data-based studies were conducted on a pilot study. A prospective observational study was performed with a convenience sample of 12 older Korean adults with dementia who reside in institutions. The first study examined environmental factors for the effective management of sleep problems in four cases. The second study investigated sleep characteristics, including rest-activity rhythms in institutionalized older Korean adults with dementia, and explored associated factors.

Older Korean adults with dementia who reside in institutions experienced fragmented sleep due to frequent nocturnal awakenings and spent extended time napping. The type of institution was a significant factor in rest-activity patterns. Further study with

large sample sizes is clearly needed to determine which institutional factors affect sleep and rest-activity patterns in various settings.

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Chapter 1

The Study Problem

Statement of the Problem

A recent Delphi consensus study estimates that 24 million people have dementia, a population that will double worldwide every 20 years to 42 million by 2020 and 81 million by 2040 (Ferri et al., 2005). Because of these alarming projections, the health-related problems of older adults with dementia are receiving more attention.

Sleep disturbances, which negatively affect persons with dementia and their caregivers, are one of the most prominent problems facing this population and must be accounted for when planning treatment of dementia. Sleep problems result in poor quality of life in persons with dementia (Kuhn, Edelman, & Fulton, 2005), cause poor sleep in their caregivers (Creese, Bedard, Brazil, & Chambers, 2008), and compel families to institutionalize affected family members (Donaldson, Tarrier, & Burns, 1998; Pollak & Perlick, 1991).

Common sleep problems include increased sleep fragmentation, longer sleep onset latency, decreased sleep efficiency, and decreased nighttime slow wave sleep (Ancoli-Israel, 2005). And, nocturnal sleep disturbances often result in increased daytime napping (Ancoli-Israel et al., 1997). These sleep problems are more common and more severe in institutionalized older adults with dementia than would be expected based on increased age or dementia alone.

Although research on sleep in institutionalized persons with dementia has experienced significant growth over the past decade (Ancoli-Israel et al., 1997; Bliwise, Bevier, Bliwise, Edgar, & Dement, 1990; Fetveit & Bjorvatn, 2006; Paavilainen et al., 2005), the factors that influence sleep disturbance in settings like nursing homes, skilled nursing facilities, and communities have not been thoroughly investigated. Primary data on sleep in the older adult population with dementia, as a foundation for interventions, are lacking. In the United States and other countries, the sleep characteristics of older people with dementia in minority populations are unknown despite their increasing numbers. Because of the limitations of past studies and our current understanding of common sleep problems, this dissertation aims to increase knowledge of sleep in institutionalized older adults with dementia and of nursing management of their sleep problems.

Defining Sleep

Over the past few decades, researchers have advanced varied definitions of sleep. For example, sleep has been characterized as "a state marked by bouts of lessened consciousness, lessened movement of the skeletal muscles, and slow-down metabolism" (Zisapel, 2007, p. 1174). In nursing research, Lee (1997) defined sleep as "a period of diminished responsiveness to external stimuli that alternates with wakefulness on a daily basis" (p. 614). Carskadon and Dement (2005) defined sleep as "a reversible behavioral state of perceptual disengagement from and unresponsiveness to the environment" (p. 13). Greatly diminished recall or continuity of mental activity accompanies human sleep, but this is rapidly reversible, distinguishing sleep from coma or torpor (McGinty & Beahm, 1984). In summary, sleep is not simply an inactive or passive state that is the opposite of wakefulness but is instead a complex state that involves physiologic and behavioral processes.

Theoretical Framework

Sleep disturbances in older adults with dementia are not just the consequence of aging or dementia. Rather, they are the result of complex physiobiological processes that are influenced by many factors, such as psychosocial and environmental conditions. Thus, a single theory cannot explain the complexity of sleep in older adults with dementia.

A new conceptual framework of impaired sleep in older adults with dementia was derived from four theories related to sleep and dementia: the flip-flop circuit model of sleep-wakefulness regulation, the two-process model of sleep regulation, the conceptual model of impaired sleep, and the need-driven compromised-behavior model. In the discussion that follows, these four theories are summarized and the synthesized conceptual framework of impaired sleep in older adults with dementia is presented, along with key concepts and their relationships.

The Flip-Flop Circuit Model of Sleep-Wakefulness Regulation

In 1916, Baron Constantin von Economo, a Viennese neurologist, made the first observation on regions of the brain that regulate sleep and wakefulness. He predicted that different regions promote either sleep or wakefulness in patients who have encephalitis lethargica and present wtih excessive sleepiness (von Economo, 1930). After the Second World War, accelerated research identified the pathway that regulates wakefulness. However, the basic neuronal circuitry that causes wakefulness was only clearly defined in the 1980s and 1990s, and the pathways that regulate sleep only began to emerge in recent decades (Saper, Chou, & Scammell, 2001). Saper et al. (2001) suggested a physiological mechanism called the *flip-flop circuit model of sleep-wakefulness regulation* to explain the relationships between the pathways for sleep and wakefulness: the ascending reticular activating system for wakefulness and the ventrolateral preoptic nucleus for sleep.

The ascending reticular activating system (ARAS) for wakefulness. This model has two major branches. The first is an ascending pathway to the thalamus that activates the thalamic relay neurons that are important for transmitting information to the cerebral cortex (Saper, Scammell, & Lu, 2005). The principle origin of upper brainstem input to the thalamic-relay nuclei and to the reticular nucleus of the thalamus is a pair of acetylcholine-producing cell groups: the pedunculopontine and laterodorsal tegmental nuclei (PPT/LDT; Saper et al., 2005). The neurons in the PPT/LDT are active during wakefulness and REM sleep but are less active during NREM sleep.

The activity of the second branch of the ARAS originates from monoaminergic neurons in the upper brainstem and caudal hypothalamus (Saper et al., 2005): noradrenergic locus coeruleus neurons (LC), serotoninergic dorsal and median raphe nuclei (Raphe), dopaminergic ventral periaqueductal grey matter (vPAG), and tuberomammillary nucleus (TMN). Neurons in these cell groups fire more rapidly during wakefulness than during NREM sleep and show no activity during REM sleep (Fuller, Gooley, & Saper, 2006). Additionally, the input to the cerebral cortex is increased by lateral hypothalamic peptidergic neurons (containing orexin/hypocretin or melanin-concentrating hormone) and basal forebrain neurons (containing acetylcholine or γ–aminobutyric acid). Lateral hypothalamic neurons that contain orexin/hypocretin are active during wakefulness; the lateral hypothalamic neurons that contain melanin-concentrating hormone have similar projections to the orexin neurons but are active mostly during REM sleep, at which time they are thought to inhibit the ascending monoaminergic systems (Fuller et al., 2006). Many basal forebrain neurons have been shown to be active during wakefulness and REM sleep (M. G. Lee, Hassani, Alonso, & Jones, 2005).

The role of the ventrolateral preoptic nucleus for sleep. The ventrolateral preoptic nucleus (VLPO) in the anterior hypothalamus sends outputs to the monoaminergic cell groups (i.e., the TMN, Raphe, and vPAG) that are involved in arousal in the hypothalamus and brainstem. The VLPO also stimulates cholinergic cell groups (i.e., the PPT/LDT) and neurons in lateral hypothalamus (i.e., perifornical orexin neurons). The neurons in the VLPO, which include galanin and γ–aminobutyric acid, are active mainly during sleep and consist of two groups: (a) the VLPO cluster, which is associated with transitions between arousal and NREM sleep and more heavily innervates the histaminergic neurons; and (b) extended VLPO, which provides the main output from the VLPO to the locus coeruleus, and the raphe nuclei, which are thought to be important in gating REM sleep (Saper et al., 2005).

The flip-flop switch. The interaction between the VLPO and the ARAS components has been shown to be mutually inhibitory (Fuller et al., 2006). When VLPO neurons fire rapidly during sleep, they inhibit the monoaminergic cell groups, thus disinhibiting and reinforcing their own firing. Similarly, when monoamine neurons fire at a high rate during wakefulness, they inhibit the VLPO, thereby disinhibiting their own firing (Saper et al., 2001). Saper and colleagues (2001) call this a *flip-flop switch*, a term electrical engineers use for a type of circuit. The two halves of a flip-flop circuit create a bistable feedback loop by strongly inhibiting each other, with two possible stable patterns of firing and a tendency to avoid intermediate states (Saper et al., 2001). Orexin neurons are considered to play an important role in this circuit (Salin-Pascual, Gerashchenko, Greco, Blanco-Centurion, & Shiromani, 2001; Selbach & Haas, 2006; Zeitzer et al., 2003). Like a finger pressing a flip-flop switch, they might promote wakefulness and prevent inappropriate switching into sleep (Saper et al., 2001). However, large influences, such as the circadian sleep drive or the accumulated homeostatic need for sleep, might gradually shift this bistability (Saper et al., 2005).

The Two-Process Model of Sleep Regulation

The original biological model of sleep regulation was established by Borbély (1982). Subsequently, Dann and colleagues proposed a quantitative version of the two-process model (Daan, Beersma, & Borbély, 1984). In more recent publications, Borbély and Achermann, (1999, 2005) describe the two-process model and related models, models of the NREM-REM sleep cycle, and combined models. This section of the paper will address the original two-process model developed by Borbély (1982) and Daan et al. (1984).

Derived from existing empirical data by experimental tests, the original two-process model is considered to be a middle-range theory. Its purpose is to understand the mechanisms of sleep and wakefulness. Two basic processes underlie sleep regulation: (a) the homeostatic process (Process S), which is manifested by an increase in sleep propensity during wakefulness and a decrease during sleep; and (b) the circadian process (Process C), which modulates the upper and lower thresholds. According to Borbély's model (1982), the combined action of the homeostatic and circadian processes determines the onset and termination of a sleep episode.

The homeostatic process (Process S). This process refers to the sleep-wake dependent aspect of sleep regulation. In other words, the longer a person is active, the deeper is his or her sleep (Daan et al., 1984); the homeostatic Process S rises during waking and declines during sleep (Borbély, Dijk, Achermann, & Tobler, 2001). Its mechanisms counteract deviations of sleep from an average reference level by increasing sleep propensity when sleep is curtailed or absent and reducing sleep propensity in response to excess sleep (Borbély et al., 2001).

The circadian process (Process C). This process corresponds to the circadian component of sleep propensity. The circadian process involves a near 24-hour biological clock that regulates the timing of sleep. This process is primarily independent of sleep and waking because it is assumed to be controlled by a circadian oscillator that is not affected by the occurrence of waking and sleep (Borbély, 1982). In this model, the suprachiasmatic nucleus is a powerful region, which contains the endogenous circadian pacemaker and thus drives Process C. Borbély (1982) did not target a specific circadian oscillator. Daan et al. (1984), however, addressed the significant role of the master circadian clock. In mammals, the suprachiasmatic nucleus, located in the anterior hypothalamus, serves as a master circadian clock that regulates endogenously generated circadian rhythms (Hofman, 2004; Ralph, Foster, Davis, & Menaker, 1990). It receives neural input from the retina via the retinohypothalamic tract, which relays synchronizing light-dark information to the biological clocks in the suprachiasmatic nucleus region (Turek, 1998). Through its efferent, it may generate or synchronize physiological oscillations, including temperature and hormones (Daan et al., 1984).

The interaction of Processes S and C. Although Processes S and C are generated by separate mechanisms, they both influence sleep and, therefore, their interaction should be specified (Achermann, 2004). Upper (H) and lower (L) thresholds are involved in the interaction of the two processes. Sleep propensity increases monotonically during wakefulness until it reaches H, at which point sleep is initiated (Daan et al., 1984). Sleep propensity declines monotonically during sleep until it reaches L, when sleep is terminated (Daan et al., 1984).

The Conceptual Model of Impaired Sleep

The conceptual model of impaired sleep, which describes sleep loss in the context of health and illness, considers impaired sleep to be a potential health problem and includes biopsychosocial health outcomes as responses to sleep loss. Developed inductively by the Nursing Task Force of the Association of Professional Sleep Societies, the initial purpose of this conceptual framework was to suggest the causal factors of impaired sleep and its negative impact on health for nursing students, nurse educators, researchers, practice nurses, and advanced practice nurses (K. A. Lee et al., 2004).

This model consists of three principle concepts: sleep deprivation, sleep disruption, and adverse health outcomes. It describes the factors that influence sleep deprivation and sleep disruptions and identifies the outcomes that result from these two kinds of sleep loss. Sleep deprivation, which is an inadequate amount of sleep, can result from self-imposed sleep restriction, poor sleep hygiene, circadian phase desynchronosis, developmental adaptations across the lifespan, and grief and bereavement. By contrast, sleep disruption is fragmented sleep, often a result of health-related conditions such as neuron-endocrine disease, immobility, poor nutrition, and other illnesses. Sleep disruption also occurs when one’s sleeping environment is suddenly altered or when a person experiences stress in his or her environment, whether it is in the bedroom, home, hospital, or community. The relationships between disrupted sleep and noxious stimuli in the environment are addressed (e.g., disruptive situations in the home or work place, loud traffic in urban neighborhoods, or noisy or restless bed partners). Finally, the model describes adverse health outcomes resulting from sleep loss due to deprivation, disruption, or both. The health outcomes from sleep loss are categorized as physiological, cognitive-behavioral, emotional, or social responses. For example, sleep loss affects children's behavior and academic performance in the classroom, adults' performance in the workplace, and cognitive functioning in older adults.

The Need-Driven Compromised-Behavior Model

The need-driven compromised-behavior model (NDB) model is a midrange theory of dementia behaviors that was developed to better understand the constellation of behaviors that accompany dementia-producing illnesses (Algase et al., 1996a). This theory considers a person with dementia to have a unique background (i.e., gender, personality, and education) and several dynamic environmental triggers that are likely to precipitate behavioral symptoms. The purpose of this theory is quite specific: to identify behavioral symptoms that accompany dementia and to provide direction for intervention with these behaviors to enhance quality of life.

The three concepts involved in this theory include background factors, proximal factors, and dementia behaviors. Each concept can be further divided into subconcepts as follows: (a) background factors: dementia-compromised functions, health states, demographic variables, and psychosocial variables; (b) proximal factors: physiological need states, psychosocial need states, the physical environment, and the social environment; and (c) dementia behaviors: physically nonaggressive behaviors, physically aggressive behaviors, problematic vocalizations, and problematic passivity. Dementia behaviors have been viewed as expressions of unmet needs or goals (Algase et al., 1996b). They reflect the interaction of relatively stable individual characteristics (background factors) and more changeable environmental triggers (proximal factors) that precipitate specific behaviors.

Although the NDB model does not address nursing actions as such, it offers direction for the development of intervention theory. First, the model identifies proximal factors that produce a need state. When these factors are identified, targeted intervention can be developed. Second, background factors offer a profile of individual's strengths, weaknesses, and usual copying styles. Anderson (1998) suggests that this information is needed to plan interventions because variation in personal characteristics is one of the most important variables in determining differentiated treatment outcomes.

The Conceptual Framework of Impaired Sleep in Older Adults with Dementia

The conceptual framework of impaired sleep in older adults with dementia (see Figure) is designed to identify those factors that influence the regulation of sleep and wakefulness, to outline effects that occur after impaired sleep, and to suggest theory-based nursing practice to prevent or improve impaired sleep in older persons with dementia.

First, the mechanism underlying sleep and wakefulness was derived from two models: the flip-flop circuit model (Saper et al., 2001) and the two-process model of sleep-wakefulness regulation (Borbély, 1982). Numerous cell groups (i.e., monoaminergic neurons, lateral hypothalamic peptidergic neurons, basal forebrain neurons, and ventrolateral preoptic nucleus) in the brainstem, hypothalamus, and basal forebrain contribute in regulating sleep and producing wakefulness in the flip-flop circuit model of sleep-wakefulness regulation. Interaction between homeostatic and circadian processes also influences sleep and wakefulness according to the two-process model of sleep regulation. Sleep tendency increases during wakening and declines during sleep in the homeostatic process. Circadian process determines timing of sleep onset and termination. In this process, circadian pacemaker in the suprachiasmatic nucleus regulates circadian rhythms, such as sleep-wake, melatonin, and other hormones.

Dementia and the aging process likely influence the brain region related to sleep. Although no clear neurological map showing the relationship between the mechanism of sleep and dementia and aging process has been devised, the loss or damage of neuronal pathways in the suprachiasmatic nucleus likely contributes to sleep disturbance in persons with dementia (Paniagua & Paniagua, 2008; Stopa et al., 1999). The decreased concentrations of hypothalamic neurotransmitters, such as serotonin, noradrenaline, and dopamine (Wallin et al., 1991) in the dementia process, particularly in Alzheimer's disease, suggest that this disequilibrium may be important for certain circadian symptoms (e.g., changes in sleep-wake rhythms). Aging is also associated with decreased neuronal activity in the suprachiasmatic nucleus (Swaab, Fliers, & Partiman, 1985; Van Someren, 2000).

The many causal factors that influence sleep in older adults with dementia were derived from the conceptual model of impaired sleep (K. A. Lee et al., 2004) and the need-driven compromised-behavior model (Algase et al., 1996b). They include dementia-related factors (cognitive status and problematic behavior), health state (general health, medications, and other medical illnesses), demographic factors (gender, race-ethnicity, and education), psychosocial factors (personality, depression, and behavioral response to stress), social environment (staff mix, staff stability, ward ambiance, and presence of others), and physical environment (light exposure, sound, and heat). Moreover, other potentially important factors (sleep accommodation [e.g., bed, futon, or chair] and bedroom assignment [e.g., single room or shared room]) may influence the mechanism of sleep-wakefulness regulation even though these were not identified in the theories.

Finally, impaired sleep may occur when dementia and the aging process combine with other causal factors to change the normal sleep-wake mechanism. Impaired sleep, influenced by unbalanced mechanisms of sleep-wakefulness regulation, results in adverse health outcomes, which can be categorized as physiological, cognitive-behavioral, emotional, and social responses. An increase in the risk of comorbidities, such as hypertension or depression, may occur. Fatigue, risk of falls, excessive daytime sleepiness, and impairments in memory and concentration could occur as cognitive-behavioral outcomes. Emotional outcomes include mood change and loss of motivation. Social outcomes comprise decreased social engagement, change in interpersonal relationships, especially with family members, and institutionalization due to caregiver stress.

To prevent sleep problems or adverse health outcomes, nursing interventions (e.g., sleep hygiene and the education of caregivers) can be initiated before patients exhibit symptoms of impaired sleep. Intervening causal factors may be the key to preventing impaired sleep. For example, interventions using bright light exposure may decrease sleep disturbances in dementia persons (Ancoli-Israel et al., 2003; Ancoli-Israel, Martin, Kripke, Marler, & Klauber, 2002; Dowling et al., 2007; Dowling et al., 2005). Tailoring interventions to individuals may also be efficient for sleep improvement. This modified and synthesized conceptual framework will be useful in illuminating yet unexplored facets of the sleep problems of older adults with dementia.

References

Achermann, P. (2004). The two-process model of sleep regulation revisited. *Aviation Space and Environmental Medicine, 75*, A37-43.

Algase, D., Back, C., Kolanowski, A., Whall, A., Berent, S., Richards, K., et al. (1996a). Need-driven dementia-compromised bahavior: An alternative view of disruptive behavior. *American Journal of Alzheimer's Disease, 11*, 10-19.

Algase, D., Back, C., Kolanowski, A., Whall, A., Berent, S., Richards, K., et al. (1996b). Need-driven dementia-compromised behavior: An alternative view of disruptive behavior. *American Journal of Alzheimer's Disease, 11*, 10-19.

Ancoli-Israel, S. (2005). Sleep disturbances among patients with dementia. *Clinical Geriatrics*, 13-16.

Ancoli-Israel, S., Gehrman, P., Martin, J. L., Shochat, T., Marler, M., Corey-Bloom, J., et al. (2003). Increased light exposure consolidates sleep and strengthens circadian rhythms in severe Alzheimer's disease patients. *Behavioral Sleep Medicine, 1*, 22-36.

Ancoli-Israel, S., Klauber, M. R., Jones, D. W., Kripke, D. F., Martin, J., Mason, W., et al. (1997). Variations in circadian rhythms of activity, sleep, and light exposure related to dementia in nursing-home patients. *Sleep, 20*, 18-23.

Ancoli-Israel, S., Martin, J. L., Kripke, D. F., Marler, M., & Klauber, M. R. (2002). Effect of light treatment on sleep and circadian rhythms in demented nursing home patients. *Journal of the American Geriatrics Society, 50*, 282-289.

Anderson, K. (1998). Utility of the five-factor model of personality in psychotherapy aptitude treatment interaction research. *Psychotherapy Research, 8*, 54-70.

Bliwise, D. L., Bevier, W. C., Bliwise, N. G., Edgar, D. M., & Dement, W. C. (1990). Systematic 24-hr behavioral observations of sleep and wakefulness in a skilled-care nursing facility. *Psychology and Aging, 5*, 16-24.

Borbély, A. A. (1982). A two process model of sleep regulation. *Human Neurobiology, 1*, 195-204.

Borbély, A. A., Dijk, D.-J., Achermann, P., & Tobler, I. (2001). Process underlying the regulation of the sleep-wake cycle. In J. S. Takahashi, F. W. Turek & R. Y. Moore (Eds.), *Handbook of Behavioral Neurobiology* (Vol. 12, pp. 457-479). New York: Plenum Publishers.

Carskadon, M. A., & Dement, W. C. (2005). Normal Human Sleep: An Overview. In M. H. Kryger, T. Roth & W. C. Dement (Eds.), *Principles and Practice of Sleep Medicine* (4th ed., pp. 13-23). Philadelphia: Elsevier Saunders.

Creese, J., Bedard, M., Brazil, K., & Chambers, L. (2008). Sleep disturbances in spousal caregivers of individuals with Alzheimer's disease. *International Psychogeriatrics, 20*, 149-161.

Daan, S., Beersma, D. G. M., & Borbély, A. A. (1984). Timing of human sleep: Recovery process gated by a circadian pacemaker. *American Journal of Physiology, 246*, R161-178.

Donaldson, C., Tarrier, N., & Burns, A. (1998). Determinants of career stress in Alzheimer's disease. *International Journal of Geriatric Psychiatry, 13*, 248-256.

Dowling, G. A., Burr, R. L., Van Someren, E. J., Hubbard, E. M., Luxenberg, J. S., Mastick, J., et al. (2007). Melatonin and Bright-Light Treatment for Rest-Activity

Disruption in Institutionalized Patients with Alzheimer's Disease. *Journal of the American Geriatrics Society*.

Dowling, G. A., Hubbard, E. M., Mastick, J., Luxenberg, J. S., Burr, R. L., & Van Someren, E. J. (2005). Effect of morning bright light treatment for rest-activity disruption in institutionalized patients with severe Alzheimer's disease. *International Psychogeriatrics, 17*, 221-236.

Ferri, C. P., Prince, M., Brayne, C., Brodaty, H., Fratiglioni, L., Ganguli, M., et al. (2005). Global prevalence of dementia: a Delphi consensus study. *Lancet, 366*, 2112-2117.

Fetveit, A., & Bjorvatn, B. (2006). Sleep duration during the 24-hour day is associated with the severity of dementia in nursing home patients. *International Journal of Geriatric Psychiatry, 21*, 945-950.

Fuller, P. M., Gooley, J. J., & Saper, C. B. (2006). Neurobiology of the sleep-wake cycle: sleep architecture, circadian regulation, and regulatory feedback. *Journal of Biological Rhythms, 21*, 482-493.

Hofman, M. A. (2004). The brain's calendar: neural mechanisms of seasonal timing. *Biological Reviews of the Cambridge Philosophical Society, 79*, 61-77.

Kuhn, D., Edelman, P., & Fulton, B. (2005). Daytime sleep and the threat to well-being of persons with dementia. *Dementia (Sage Publications, Ltd.), 4*, 233-247.

Lee, K. A. (1997). An overview of sleep and common sleep problems. *American Nephrology Nurses' Association (ANNA) Journal, 24*, 614-623, 677; quiz 624-615.

Lee, K. A., Landis, C., Chasens, E. R., Dowling, G., Merritt, S., Parker, K. P., et al. (2004). Sleep and chronobiology: recommendations for nursing education. *Nursing Outlook, 52*, 126-133.

Lee, M. G., Hassani, O. K., Alonso, A., & Jones, B. E. (2005). Cholinergic basal forebrain neurons burst with theta during waking and paradoxical sleep. *Journal of Neuroscience, 25*, 4365-4369.

McGinty, D. J., & Beahm, E. K. (1984). Neurobiology of Sleep. In N. A. Saunders & C. E. Sullivan (Eds.), *Sleep and Breathing* (Vol. 21, pp. 1-58). New York, NY: Marcel Dekker.

Paavilainen, P., Korhonen, I., Lotjonen, J., Cluitmans, L., Jylha, M., Sarela, A., et al. (2005). Circadian activity rhythm in demented and non-demented nursing-home residents measured by telemetric actigraphy. *Journal of Sleep Research, 14*, 61-68.

Paniagua, M. A., & Paniagua, E. W. (2008). The demented elder with insomnia. *Clinics in Geriatric Medicine, 24*, 69-81, vii.

Pollak, C. P., & Perlick, D. (1991). Sleep problems and institutionalization of the elderly. *Journal of Geriatric Psychiatry and Neurology, 4*, 204-210.

Ralph, M. R., Foster, R. G., Davis, F. C., & Menaker, M. (1990). Transplanted suprachiasmatic nucleus determines circadian period. *Science, 247*, 975-978.

Salin-Pascual, R., Gerashchenko, D., Greco, M., Blanco-Centurion, C., & Shiromani, P. J. (2001). Hypothalamic regulation of sleep. *Neuropsychopharmacology, 25*, S21-27.

Saper, C. B., Chou, T. C., & Scammell, T. E. (2001). The sleep switch: hypothalamic control of sleep and wakefulness. *Trends in Neurosciences, 24*, 726-731.

Saper, C. B., Scammell, T. E., & Lu, J. (2005). Hypothalamic regulation of sleep and circadian rhythms. *Nature, 437*, 1257-1263.

Selbach, O., & Haas, H. L. (2006). Hypocretins: the timing of sleep and waking. *Chronobiology International, 23*, 63-70.

Stopa, E. G., Volicer, L., Kuo-Leblanc, V., Harper, D., Lathi, D., Tate, B., et al. (1999). Pathologic evaluation of the human suprachiasmatic nucleus in severe dementia. *Journal of Neuropathology and Experimental Neurology, 58*, 29-39.

Swaab, D. F., Fliers, E., & Partiman, T. S. (1985). The suprachiasmatic nucleus of the human brain in relation to sex, age and senile dementia. *Brain Research, 342*, 37-44.

Turek, F. W. (1998). Circadian rhythms. *Hormone Research, 49*, 109-113.

Van Someren, E. J. (2000). Circadian rhythms and sleep in human aging. *Chronobiology International, 17*, 233-243.

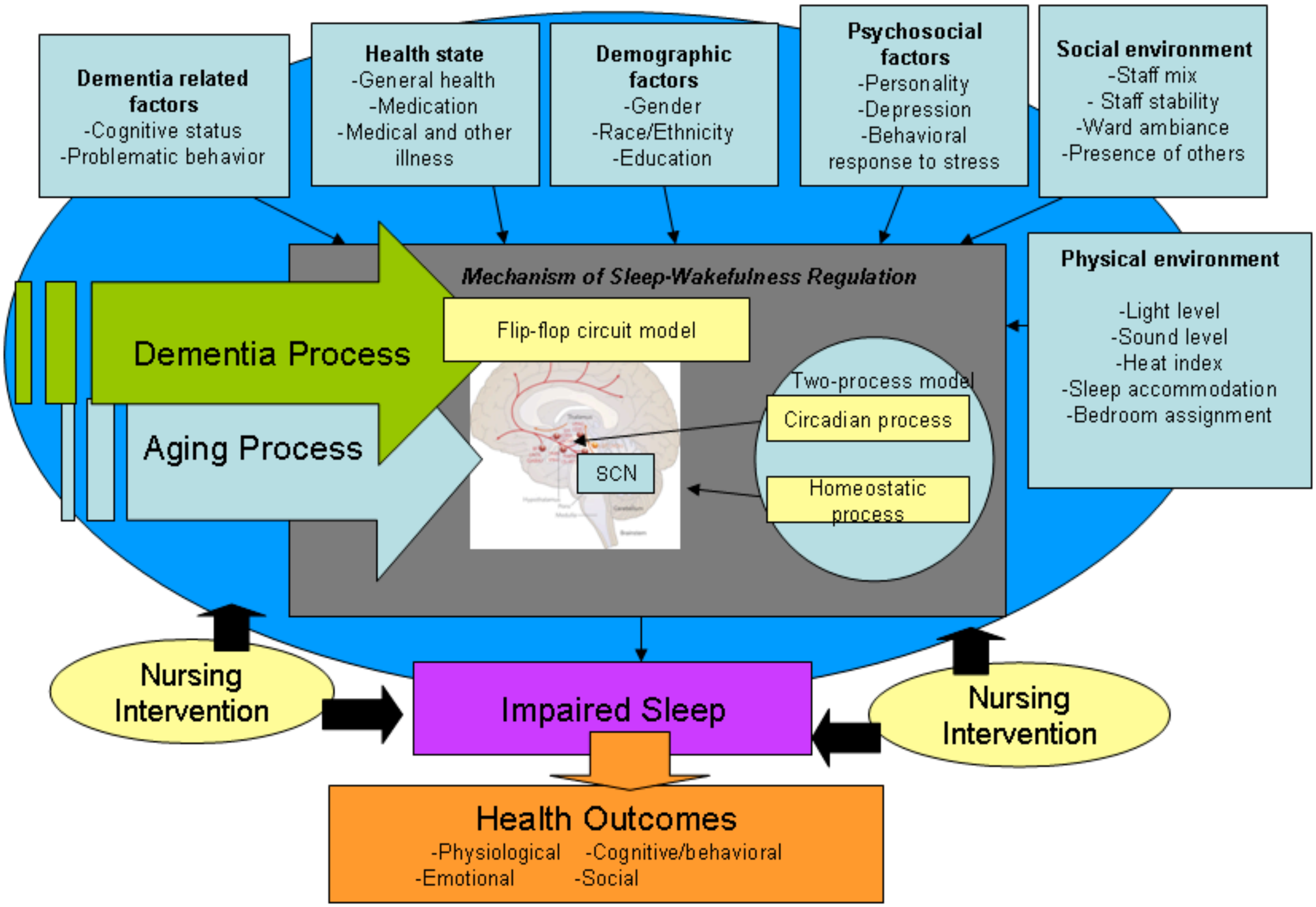
von Economo, C. (1930). Sleep as a problem of localization. *Journal of Nervous and Mental Disease, 71*, 249.

Wallin, A., Carlsson, A., Ekman, R., Gottfries, C. G., Karlsson, I., Svennerholm, L., et al. (1991). Hypothalamic monoamines and neuropeptides in dementia. *European Neuropsychopharmacology, 1*, 165-168.

Zeitzer, J. M., Buckmaster, C. L., Parker, K. J., Hauck, C. M., Lyons, D. M., & Mignot, E. (2003). Circadian and homeostatic regulation of hypocretin in a primate model: implications for the consolidation of wakefulness. *Journal of Neuroscience, 23*, 3555-3560.

Zisapel, N. (2007). Sleep and sleep disturbances: biological basis and clinical implications. *Cellular and Molecular Life Sciences, 64*, 1174-1186.

Figure. Conceptual Framework of Impaired Sleep in Older Adults with Dementia



Chapter 2.

Sleep in Older Adults with Dementia

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Abstract

Sleep in older adults with dementia is very fragmented and sleep-wake rhythms are disturbed. Their poor quality of sleep is challenging for their caregivers and often results in institutionalization. Many variables, including gender, medications, depression, and environmental factors, influence sleep in persons with dementia. Interventions such as light and melatonin therapy, sleep hygiene, and physical activity are commonly implemented in order to treat or prevent sleep problems. Neuroscience nurses can be critical in assessment of sleep characteristics and related factors. In addition, nurses can play an important role in educating caregivers and staff, providing family members with emotional support, and conducting research.

KEY WORDS**:** Dementia, sleep, circadian rhythm, older

Introduction

Sleep problems are experienced by over half of adults aged 65 years and older (Ancoli-Israel & Alessi, 2005). Many of these adults complain of waking up more often during the night, experiencing less total sleep time, taking longer to fall asleep, and taking more naps than do younger people (Feinsilver, 2003; Foley et al., 1995; Klerman, Davis, Duffy, Dijk, & Kronauer, 2004; Kryger, Monjan, Bliwise, & Ancoli-Israel, 2004). Sleep is even more fragmented and disturbed in older adults with dementia than those without dementia. Moreover, severely demented patients have more disturbed sleep-wake rhythms compared to moderately, mildly, or non-demented patients (Ancoli-Israel et al., 1997a).

Sleep problems are associated with decreased survival (Gehrman et al., 2004), cognitive and functional decline, as well as behavioral and psychological symptoms (Moe, Vitiello, Larsen, & Prinz, 1995; Moran et al., 2005). Sleep problems are a source of physical and psychological burden for caregivers of persons with dementia (Donaldson, Tarrier, & Burns, 1998) and, as a result, are a major cause of institutionalization (Ancoli-Israel, Klauber, Gillin, Campbell, & Hofstetter, 1994). Nurses have an important role in identifying sleep characteristics, assessing specific needs, and providing care for persons with dementia who suffer with sleep problems.

This article presents an overview of sleep problems in older adults with dementia. First, the prevalence of sleep problems and normal sleep characteristics are addressed. Then common sleep characteristics in older adults with dementia are differentiated from normal age-related changes. Lastly, the risk factors of sleep problems and interventions for older adults with dementia and implications for neuroscience nursing practice are discussed.

Prevalence of Sleep Problems

The high prevalence of sleep problems is well documented in older adults. In an American study of 9,000 adults over age 65, 43% had difficulty initiating or maintaining sleep, 30% had nocturnal awakening, 29% had insomnia, 25% had daytime napping, 19% had trouble falling asleep, 19% woke too early, 13% woke without feeling rested, and only 12% had no sleep complaints (Foley et al., 1995). In 2003, American Sleep Poll reported 67% of 1,506 older adults between 55 to 84 years of age with one or more symptoms (i.e., difficulty falling asleep, waking up too early, frequent waking) of a sleep problem at least a few nights a week (National Sleep Foundation, 2003).

People with memory problems, including Alzheimer's disease (AD) or other related dementias, are more likely to have difficulty initiating and maintaining sleep compared to those not having memory problems (Foley, Ancoli-Israel, Britz, & Walsh, 2004). Cross-sectional studies of community or clinic samples revealed up to a 40% prevalence of some type of sleep problem in persons with AD, including difficulty falling asleep, multiple awakenings during sleep, disrupted sleep-wake rhythm, and early morning awakenings (Carpenter, Strauss, & Patterson, 1995; McCurry et al., 1999; Moran et al., 2005).

Normal Sleep Characteristics

Sleep Stages

Sleep is composed of two states: non-rapid eye movement (NREM) and rapid eye movement (REM) sleep. NREM sleep is subdivided into stages based on depth of sleep.

In healthy young adults, sleep usually begins with the lightest stage, NREM stage 1, which is easiest to awaken. After reaching the deepest sleep, stage 4, the sleeper progresses back to lighter sleep and then into REM sleep. Sleep stage is identified by recording from the surface of the scalp and face to obtain electrical activity from the cerebral cortex with an electroencephalogram, eye movements with an electrooculogram, and muscle activity with an electromyogram (Chesson et al., 1997). The combination of these three recordings is referred to as polysomnography (Smith, Nowakowski, Soeffing, Orff, & Perlis, 2003).

In polysomnography, alpha waves (8 to 13 cycles per second [cps]) appear when the person is relaxed with his/her eyes closed (Carskadon & Rechtschaffen, 2005). Stage 1 sleep is generally in the theta wave (3 to 7 cps) range. Stage 2 sleep is distinguished from stage 1 by showing sleep spindles and K complexes. The sleep spindle is defined by the standard sleep scoring system as a "term only to describe activity between 12 and 14 cps" (De Gennaro & Ferrara, 2003, p. 424). The K-complex is a paroxysmal waveform which consists of a negative sharp wave followed by a positive component (Carskadon & Rechtschaffen, 2005). Each subsequent stage becomes progressively deeper with stages 3-4, also referred to as slow wave sleep, delta sleep, or deep sleep. In this stage, sleep is defined by high voltage (greater than 75µv) and slow delta waves with 2 cps or less (Carskadon & Rechtschaffen, 2005). REM sleep is characterized by recurrent periods of low-voltage, muscle atonia, and rapid eye movements that occur in bursts (Darchia, Campbell, & Feinberg, 2003). REM sleep is also the stage most associated with dreaming.

Sleep quality can be defined as nighttime sleep characteristics that can be measured by self-report or polysomnography. It usually includes sleep onset latency, waking frequency, durations of awakening after sleep onset, the amount of nighttime sleep, and sleep efficiency (i.e., the ratio of time asleep to time in bed; Floyd, 2002).

Circadian Rhythms

Circadian rhythms indicate the pattern of wake and sleep that should repeat in a 24-hour cycle. Human circadian rhythms are biological cycles of about 24 hours that include peaks and troughs for cycles of sleep-wake and body temperature as well as melatonin and cortisol secretion, to name just a few (Ancoli-Israel, Martin, Kripke, Marler, & Klauber, 2002). They are usually presented in 24-hour adjusted values of acrophase (peak of the rhythms), amplitude (peak-to-nadir difference), and mesor (mean of the rhythms). A phase delay indicates that the peak levels are reached later and a phase advance indicates that the peak levels are reached earlier than the majority of the population. The timing and duration of sleep are controlled by suprachiasmatic nucleus, a small group of neurons in the anterior hypothalamus thought to harmonize a number of physiological rhythms to induce a single circadian oscillation in mammals (Mirmiran et al., 1992). The suprachiasmatic nucleus deteriorates in both normal aging and in dementia, contributing to alterations in circadian rhythms and disrupted sleep-wake cycles (Mirmiran et al., 1992; Swaab, Fliers, & Partiman, 1985).

Aging and Sleep

The quantity and quality of sleep changes as a person ages. REM/NREM cycles last about 50 to 60 minutes in newborns and approximately 90 minutes in adults (Carskadon & Dement, 2005). REM sleep comprises as much as 50% of an infant's sleep, but diminishes to between 20% and 25% in young adults (K. A. Lee, 1997). Percentage of stage 3-4 is the highest in young children and decreases significantly with age

(Carskadon & Dement, 2005). Older adults spend more of the night in lighter, stage 2 sleep than do younger adults, with a consequent increase in sleep complaints (Kryger et al., 2004; Neubauer, 1999). Sleep efficiency is also significantly diminished in older adults (Haimov & Lavie, 1997; Redline et al., 2004). Despite spending more time in bed, older adults complain of waking up more often during the night, experiencing less total sleep time, taking longer to fall asleep, and taking more naps (Kryger et al., 2004). They also have advanced sleep phase in which they sleep the same amount of time, but their major sleep period is advanced in relation to clock time (Ancoli-Israel, Poceta, Stepnowsky, Martin, & Gehrman, 1997b).

Sleep Characteristics in Older Adults with Dementia

Impaired Sleep

Most studies examining sleep in dementia have been in people with AD since they represent the largest proportion of patients with dementia. Sleep efficiency has been shown to be significantly worse, with longer sleep latencies in persons with AD compared to healthy older persons (Buysse et al., 1992; Gagnon et al., 2006) and more frequent awakenings during the night compared to non-demented older adults (Bonanni et al., 2005). The increased awakenings result in decreased REM sleep (Bonanni et al., 2005) as well as reduced stage 3-4 compared to healthy older adults (Gagnon et al., 2006). Increased daytime sleep is also typical in older adults with dementia, especially those who reside in institutions (Ancoli-Israel et al., 1997a; Fetveit & Bjorvatn, 2006; Kuhn, Edelman, & Fulton, 2005) and this increases with increasing severity of dementia (Ancoli-Israel et al., 1997a; J. H. Lee et al., 2007; Pat-Horenczyk, Klauber, Shochat, & Ancoli-Israel, 1998).

Disturbed Circadian Rhythms

Research indicates that sleep-wake activity rhythms are disturbed in institutionalized older adults with dementia. Cross-sectional studies have found impaired circadian rhythms including decreased amplitude, shorter than 24-hour cycle, or free-running rhythm types (Motohashi, Maeda, Wakamatsu, Higuchi, & Yuasa, 2000; Pollak & Stokes, 1997). Severely demented patients had a lower mesor, a later acrophase (i.e., phase delay), and a more blunted amplitude than moderately, mildly, or non-demented older patients (Ancoli-Israel et al., 1997a). Studies of circadian rhythms using melatonin level also found reduced amplitude (Dori et al., 1994; Magri et al., 2004; Mishima et al., 1999a) and decreased melatonin production in older adults with dementia (Luboshitzky et al., 2001; Mishima et al., 1999a). Circadian rhythm characteristics of body temperature are not consistent. Some studies have shown severely demented AD patients to be relatively phase-delayed, with temperature peaks and nadirs occurring significantly later compared to healthy older adults (Harper et al., 2005; Satlin, Volicer, Stopa, & Harper, 1995).

Disrupted Behaviors Related to Circadian Rhythms

Behavioral disorders such as delirium, agitation, or wandering in older adults with severe dementia might be related to disrupted biological rhythms (Okawa et al., 1991). Older individuals with dementia who exhibited behavioral problems showed various types of sleep-wake disorders such as reversed day/night rhythms or irregular sleep-wake rhythms corresponding to decreased amplitude of the sleep-wake cycle (Okawa et al., 1991). Sundowning, a constellation of increasing behavioral disturbance in patients with dementia in the late afternoon or early evening (Vitiello & Borson, 2001), is associated with a phase-delay and lower amplitude of body temperature (Volicer, Harper, Manning, Goldstein, & Satlin, 2001). The temporal pattern of sundowning has been thought to reflect a deterioration in the maintenance of normal diurnal rhythms, although the disrupted behaviors in dementia cannot be directly attributed to sleep disturbance (Bliwise, Carroll, Lee, Nekich, & Dement, 1993; Vitiello & Borson, 2001).

Sleep Differences by Type of Dementia

Sleep characteristics by type of dementia have been reported. Persons with dementia with Lewy bodies have a greater tendency to fall asleep at inappropriate times during the day, have more night time sleep disturbance, and experience more movement disorders compared to persons with AD (Grace, Walker, & McKeith, 2000). Particularly, REM behavior disorder, characterized by prominent motor activity with loss of normal muscle atonia during REM sleep, is common in persons with dementia with Lewy bodies (Boeve et al., 1998; Turner, 2002). The evidence of differences in circadian rhythms by type of dementia is limited. The circadian rhythm of both sleep-wake activity and body temperature is phase-delayed in AD patients, whereas patients with frontotemporal dementia appeared phase-advanced in activity rhythms with relatively unchanged in body temperature rhythms (Harper et al., 2001).

Factors Influencing Sleep in Older Adults with Dementia

Sleep changes in older adults with dementia may not only be a result of the aging or the dementing processes per se, but are likely influenced by many other factors as well. Gender, medications, depression, and environmental factors may contribute to poor sleep quality.

Gender is an important factor used to characterize sleep. Older men are more likely to have lighter sleep with a lower percentage of deep sleep compared to older women (Fukuda et al., 1999; Hume, Van, & Watson, 1998; Kobayashi et al., 1998; Redline et al., 2004). However, older women are more likely to have subjective sleep-related symptoms including feeling tired (Reyner, Horne, & Reyner, 1995), depressed (Foley, Monjan, Izmirlian, Hays, & Blazer, 1999), and using more sedatives and hypnotics (Blazer, Hybels, Simonsick, & Hanlon, 2000). In older adults with dementia, male gender was significantly associated with higher sleep disturbance at night (McCurry et al., 1999) and more daytime sleep (Viegas et al., 2006).

A variety of medications can also contribute to sleep problems. Older adults metabolize drugs slower than do younger adults, and therefore medications such as hypnotics commonly prescribed to older adults are particularly cumulative and dangerous (Ancoli-Israel & Kripke, 1991). Many older adults with dementia, particularly those who reside in nursing homes, are prescribed medications such as antipsychotics, antidepressants, benzodiazepines, and nonbenzodiazepine sedative-hypnotics (Simpson, Richards, Enderlin, O'Sullivan, & Koehn, 2006; Svarstad & Mount, 2002). However, these medications have possible negative side effects such as sleep disturbances. For example, selective serotonin reuptake inhibitors resulted in a lower percentage of nighttime sleep and increased daytime napping, whereas trazodone improved nighttime sleep in one study (Simpson et al., 2006).

Depression is an important factor associated with sleep problems in persons with dementia (Lopez et al., 2003; McCurry, Vitiello, Gibbons, Logsdon, & Teri, 2006). A recent study showed greater percent nighttime sleep was related to lower depression in older persons with dementia (McCurry et al., 2006). Researchers have pointed out that the combination of dementia and depression may result in even more serious sleep disturbances than dementia alone (Ancoli-Israel et al., 1997b). In one study, older adults with concurrent symptoms of depression and dementia showed less deep sleep than either depressed or demented patients (Buysse et al., 1992). However, the relationship between sleep problems and depression is complex because depression is known to lead to sleep problems, and sleep problems can lead to depression (Ancoli-Israel & Cooke, 2005). The evidence is limited in persons with dementia.

Physical environment has shown to be strongly related to sleep in persons with dementia. Light level has a significant effect on sleep. Bright light appears to be a powerful synchronizer of circadian rhythms and directly influences sleep-wake rhythm and melatonin and other hormone secretion. Light intensity is commonly reported in units of lux (Sack et al., 2007). Lux is the International System of unit for illumination (International Bureau of Weights and Measures, 2006). One lux is equal to the light intensity of a standard candle one meter away from the eye (Sack et al., 2007). Direct sunlight on a clear day varies from 30,000 lux up to over 100,000 lux. Several studies have shown that institutionalized persons with dementia are exposed to only a few minutes of light brighter than 1,000 lux, and none or very few were exposed to light above 2,000 lux (Ancoli-Israel et al., 1991; Ancoli-Israel et al., 1997a; Shochat, Martin, Marler, & Ancoli-Israel, 2000). Noise from staff or resident vocalization, equipment (i.e., cleaning, linen carts), or television may also result in sleep disturbances in nursing home residents (Schnelle et al., 1998).

Interventions

Light Therapy

Light therapy is the most common intervention currently used in management of sleep disturbances in older adults with dementia. The rationale for the use of light therapy progresses from the observation that circadian rhythms in humans can be phase-shifted by scheduled exposure to light (Chesson et al., 1999). Light exposure prior to endogenous core body temperature minimum, usually in the evening, delays rhythms, while phase advance occurs when light exposure is scheduled just after the minimum of the endogenous core body temperature, usually in the early morning (Chesson et al., 1999). Morning and/or evening light therapy have been applied to older adults with dementia, using various intensities (from 1,500 lux up to 8,000 lux) and duration of exposure (one or two hours a day for one week up to several weeks) and beneficial effect on sleep are reported. Benefits included increased nocturnal sleep time, reduced waking time, increased sleep efficiency, decreased daytime napping (Fetveit & Bjorvatn, 2005; Fetveit, Skjerve, & Bjorvatn, 2003; Mishima et al., 1994), stability of circadian rhythms (Ancoli-Israel et al., 2003; Dowling, Mastick, Hubbard, Luxenberg, & Burr, 2005), and decreased behavioral disturbances such as sundowning (Satlin, Volicer, Ross, Herz, & Campbell, 1992). Indirect bright light exposure (ceiling-mounted) also increased stability of rest-activity rhythms in patients with dementia (Van Someren, Kessler, Mirmiran, & Swaab, 1997). Light has virtually no side effects (Chesson et al., 1999; Sloane et al., 2007) if administered at the proper time, but could result in manic activity or hyperarousal if administered at the wrong time of day

Nurses can play an integral role in implementing light therapy and maintaining compliance in institutionalized older adults with dementia. Nurses can assess individuals' sleep characteristics (e.g., sleep-wake rhythm) and determine appropriate times for light administration. For example, light exposure in the morning for phase-delayed persons and in the evening for phase-advanced persons would be beneficial. Since artificial light therapy usually requires a light box, it is often difficult to engage the participants' full attention on the light box. To ensure their compliance, nursing staff need to help participants engage in the therapy such as scheduling a daily routine (i.e., tea or meal time) in front of light. For effectiveness of light therapy in community-dwelling people with dementia, is less clear (Colenda, Cohen, McCall, & Rosenquist, 1997) and it may be less practical since the protocols are demanding for caregivers. Furthermore, there is no standard protocol for the duration, timing, frequency, and intensity of light therapy. Nurse scientists can be instrumental in testing the effectiveness of light therapy in collaboration with other care providers in both institutions and community settings.

Melatonin Therapy

Melatonin, the 'sleep hormone', is secreted by the pineal gland and plays a major role in the circadian component that regulates the timing of sleep (Cardinali, Furio, & Reyes, 2005). Decreased melatonin level in older adults with dementia is related to disrupted circadian rhythms (Mishima et al., 1999b; Wu & Swaab, 2005). Melatonin delays circadian rhythms when administered on the declining phase of the endogenous rhythm, usually in the morning, and advances the rhythm when administered from about 6 hours before to about 4 hours after the initial onset of endogenous secretion, usually in the afternoon or early evening (Arendt & Skene, 2005; Lewy, Ahmed, Jackson, & Sack, 1992). In studies using various dosages (3 mg, 6 mg, and 9 mg) of exogenous melatonin administration in patients with dementia, melatonin has been suggested to improve sleep, decrease daytime sleepiness and reduce sundowning (Cardinali, Brusco, Liberczuk, & Furio, 2002; Cohen-Mansfield, Garfinkel, & Lipson, 2000). Combined therapy (5mg melatonin administration with light exposure) has also been shown to increase daytime wake time and strengthen circadian rhythms (Dowling et al., 2007). In contrast, other studies in patients with AD reported no significant effect on sleep with doses of 10 mg and 2.5 mg (Singer et al., 2003), or 6 mg melatonin (Serfaty, Kennell-Webb, Warner, Blizard, & Raven, 2002). No adverse effects (i.e., nausea, headache, dizziness, and drowsiness) have been reported in the short term for patients with dementia (Cohen-Mansfield et al., 2000; Serfaty et al., 2002). Nevertheless, the safety of melatonin in long-term use has not been evaluated (Arendt & Skene, 2005). Appropriate dose and formulation of melatonin for the adjustment of circadian rhythms have not been established. Since melatonin is available as a dietary supplement without a prescription in the U.S., nurses should carefully monitor whether persons with dementia take an appropriate dose of melatonin at the proper time for their circadian rhythm. Nurses can obtain adequate data (i.e., dosage, timing) about melatonin based on current available research findings and collaborative work with other researchers, pharmacists or doctors. Potential benefits and adverse effects should also be carefully monitored. Nurses can continuously evaluate the effectiveness of melatonin administration and modify the intervention plan.

Sleep Hygiene and Physical Activity

Sleep hygiene refers to daily behaviors, environmental conditions and other sleep-related factors that can be adjusted and are believed to promote sleep quality (American Sleep Disorders Association, 1997; Stepanski & Wyatt, 2003). It could include setting desirable bed and rising times, improving sleep environment and routine, and eliminating possible triggers for nighttime awakenings (McCurry, Gibbons, Logsdon, Vitiello, & Teri, 2003; McCurry, Gibbons, Logsdon, Vitiello, & Teri, 2005). Applying a sleep hygiene program for community dwelling older adults with dementia has resulted in improved sleep. Individualized sleep hygiene programs conducted by trained caregivers resulted in a significant improvement in nighttime sleep, a decrease in daytime sleepiness and depression, and an increase in weekly exercise days (McCurry et al., 2005). Physical activity (Alessi et al., 1995) and combinations of other interventions such as improving the physical environment and increasing daylight exposure (Alessi et al., 2005; Alessi, Yoon, Schnelle, Al-Samarrai, & Cruise, 1999) also resulted in decreased daytime sleep and agitated behaviors in institutionalized older adults with dementia.

In community settings, nursing interventions should include caregivers' participation in order to improve sleep in patients with dementia over the long term. A sleep hygiene program may not be feasible for persons with dementia since it requires adherence to a structured routine. Caregivers may feel burdened when trying to change patients' sleep habits. Thus, nurses responsible for planning the program should examine the feasibility of program components and evaluate adherence to a planned sleep schedule.

Implications for Nursing

Sleep problems in older adults with dementia may influence their health and their caregivers' sleep and stress. Nurses are in an important position to be able to assess sleep in patients with dementia (see Table 1). Nurses should be knowledgeable about possible causes and symptoms related to sleep problems. For example, monitoring a patient's nighttime (sleep time, sleep efficiency, sleep onset latency, awakenings, and nocturnal wandering or agitation) and daytime sleep (excessive daytime sleepiness) is needed to evaluate for sleep problems. Broad assessment of their living environment and other causal factors is necessary to promote good sleep and to decrease daytime sleepiness. Family caregivers and institutional facility staff may also be integral in obtaining other useful information. In institutional environments, routines of care, staffing patterns and duties, staff-resident interactions, the behaviors of other residents, and the location of residents' rooms in relation to sources of light and noise should be explored (Vitiello & Borson, 2001). In home settings, daytime routines, mood and behavioral problems, and past and present relationship with caregivers must be assessed (Vitiello & Borson, 2001).

An important role for nurses who care for older adults with dementia having sleep problems is that of educator. Nurses can discuss the problems with caregivers and provide them with resources. To help caregivers to identify sleep problems in persons with dementia, it could be useful to teach them how to use sleep diaries. Nurses can plan sleep hygiene programs (see Table 2) and teach caregivers about strategies to promote sleep for individuals with dementia. Educating other staff members about sleep problems and appropriate interventions is also vital.

Emotional support for caregivers or family members is also necessary. Since sleep problems in persons with dementia often cause caregiver stress, burden or consequent sleep deprivation, these may have an impact on caregiver's willingness to conduct recommended changes for their relative with dementia. Nurses must spend time talking with caregivers about their own concerns and address their problems as they are identified (Teri, Logsdon, & McCurry, 2002), and make referrals to support group.

Nurse scientists are able to conduct and evaluate many interventions and to modify or develop new ones. Further research on the effectiveness of interventions is needed. It should include testing duration, intensity, and frequency of light therapy, dose and timing of melatonin, and effectiveness of combined interventions (e.g., light therapy with sleep hygiene) for short and long term.

Summary

Sleep problems are common in older adults and include frequent awakenings during nighttime sleep, difficulty falling asleep, early morning awakening, and daytime sleepiness. Sleep in older adults with dementia is even more disturbed with decreased sleep efficiency, decreased deep sleep and REM sleep, and disrupted circadian rhythms compared with healthy older adults. Recognizing sleep characteristics and factors that contribute to sleep problems in this population will improve our ability to appropriately and successfully treat these problems. Nurses can play a prominent role in helping these patients to sleep better at night and maintain their function during the day, thus also improving the sleep of the caregiver and other family members.

References

Alessi, C. A., Martin, J. L., Webber, A. P., Cynthia Kim, E., Harker, J. O., & Josephson, K. R. (2005). Randomized, controlled trial of a nonpharmacological intervention to improve abnormal sleep/wake patterns in nursing home residents. *Journal of the American Geriatrics Society, 53*, 803-810.

Alessi, C. A., Schnelle, J. F., MacRae, P. G., Ouslander, J. G., al-Samarrai, N., Simmons, S. F., et al. (1995). Does physical activity improve sleep in impaired nursing home residents? *Journal of the American Geriatrics Society, 43*, 1098-1102.

Alessi, C. A., Yoon, E. J., Schnelle, J. F., Al-Samarrai, N. R., & Cruise, P. A. (1999). A randomized trial of a combined physical activity and environmental intervention in nursing home residents: do sleep and agitation improve? *Journal of the American Geriatrics Society, 47*, 784-791.

American Sleep Disorders Association. (1997). *The international classification of sleep disorders: Diagnositc and Coding Manual Revised*. Rochester, MN: Am. Sleep Disord Assoc.

Ancoli-Israel, S., & Alessi, C. (2005). Sleep and aging. *American Journal of Geriatric Psychiatry, 13*, 341-343.

Ancoli-Israel, S., & Cooke, J. R. (2005). Prevalence and comorbidity of insomnia and effect on functioning in elderly populations. *Journal of the American Geriatrics Society, 53*, S264-271.

Ancoli-Israel, S., Gehrman, P., Martin, J. L., Shochat, T., Marler, M., Corey-Bloom, J., et al. (2003). Increased light exposure consolidates sleep and strengthens circadian rhythms in severe Alzheimer's disease patients. *Behavioral Sleep Medicine, 1*, 22-36.

Ancoli-Israel, S., Jones, D. W., Hanger, M. A., Parker, L., Klauber, M. R., & Kripke, D. F. (1991). Sleep in the nursing home. In S. T. Kuna, P. M. Suratt & J. E. Remmers (Eds.), *Sleep and Respiration in Aging Adults* (pp. 77-84). New York: NY:Elsevier Press.

Ancoli-Israel, S., Klauber, M. R., Gillin, J. C., Campbell, S. S., & Hofstetter, C. R. (1994). Sleep in non-institutionalized Alzheimer's disease patients. *Aging, 6*, 451-458.

Ancoli-Israel, S., Klauber, M. R., Jones, D. W., Kripke, D. F., Martin, J., Mason, W., et al. (1997a). Variations in circadian rhythms of activity, sleep, and light exposure related to dementia in nursing-home patients. *Sleep, 20*, 18-23.

Ancoli-Israel, S., & Kripke, D. F. (1991). Prevalent sleep problems in the aged. *Biofeedback and Self Regulation, 16*, 349-359.

Ancoli-Israel, S., Martin, J. L., Kripke, D. F., Marler, M., & Klauber, M. R. (2002). Effect of light treatment on sleep and circadian rhythms in demented nursing home patients. *J Am Geriatr Soc, 50*, 282-289.

Ancoli-Israel, S., Poceta, J. S., Stepnowsky, C., Martin, J., & Gehrman, P. (1997b). Identification and treatment of sleep problems in the elderly. *Sleep Med Rev, 1*, 3-17.

Arendt, J., & Skene, D. J. (2005). Melatonin as a chronobiotic. *Sleep Med Rev, 9*, 25-39.

Blazer, D., Hybels, C., Simonsick, E., & Hanlon, J. T. (2000). Sedative, hypnotic, and antianxiety medication use in an aging cohort over ten years: a racial comparison. *Journal of the American Geriatrics Society, 48*, 1073-1079.

Bliwise, D. L., Carroll, J. S., Lee, K. A., Nekich, J. C., & Dement, W. C. (1993). Sleep and "sundowning" in nursing home patients with dementia. *Psychiatry Research, 48*, 277-292.

Boeve, B. F., Silber, M. H., Ferman, T. J., Kokmen, E., Smith, G. E., Ivnik, R. J., et al. (1998). REM sleep behavior disorder and degenerative dementia: an association likely reflecting Lewy body disease. *Neurology, 51*, 363-370.

Bonanni, E., Maestri, M., Tognoni, G., Fabbrini, M., Nucciarone, B., Manca, M. L., et al. (2005). Daytime sleepiness in mild and moderate Alzheimer's disease and its relationship with cognitive impairment. *Journal of Sleep Research, 14*, 311-317.

Buysse, D. J., Reynolds, C. F., 3rd, Hoch, C. C., Houck, P. R., Berman, S. R., Matzzie, J., et al. (1992). Rapid eye movement sleep deprivation in elderly patients with concurrent symptoms of depression and dementia. *Journal of Neuropsychiatry and Clinical Neurosciences, 4*, 249-256.

Cardinali, D. P., Brusco, L. I., Liberczuk, C., & Furio, A. M. (2002). The use of melatonin in Alzheimer's disease. *Neuro Endocrinol Lett, 23 Suppl 1*, 20-23.

Cardinali, D. P., Furio, A. M., & Reyes, M. P. (2005). Clinical perspectives for the use of melatonin as a chronobiotic and cytoprotective agent. *Annals of the New York Academy of Sciences, 1057*, 327-336.

Carpenter, B. D., Strauss, M. E., & Patterson, M. B. (1995). Sleep disturbances in community-dwelling patients with Alzheimer's disease. *Clinical Gerontologist, 16*, 35-49.

Carskadon, M. A., & Dement, W. C. (2005). Normal Human Sleep: An Overview. In M. H. Kryger, T. Roth & W. C. Dement (Eds.), *Principles and Practice of Sleep Medicine* (4th ed., pp. 13-23). Philadelphia: Elsevier Saunders.

Carskadon, M. A., & Rechtschaffen, A. (2005). Monitoring and staging human sleep. In M. H. Kryger, T. Roth & W. C. Dement (Eds.), *Principles and Practice of Sleep Medicine* (4th ed., pp. 1359-1377). Philadelphia: W.B. Saunders Company.

Chesson, A. L., Jr., Ferber, R. A., Fry, J. M., Grigg-Damberger, M., Hartse, K. M., Hurwitz, T. D., et al. (1997). The indications for polysomnography and related procedures. *Sleep, 20*, 423-487.

Chesson, A. L., Jr., Littner, M., Davila, D., Anderson, W. M., Grigg-Damberger, M., Hartse, K., et al. (1999). Practice parameters for the use of light therapy in treatment of sleep disorders. *Sleep: Journal of Sleep Research & Sleep Medicine, 22*, 641-660.

Cohen-Mansfield, J., Garfinkel, D., & Lipson, S. (2000). Melatonin for treatment of sundowning in elderly persons with dementia - a preliminary study. *Archives of Gerontology and Geriatrics, 31*, 65-76.

Colenda, C. C., Cohen, W., McCall, W. V., & Rosenquist, P. B. (1997). Phototherapy for patients with Alzheimer disease with disturbed sleep patterns: results of a community-based pilot study. *Alzheimer Disease and Associated Disorders, 11*, 175-178.

Darchia, N., Campbell, I. G., & Feinberg, I. (2003). Rapid eye movement density is reduced in the normal elderly. *Sleep, 26*, 973-977.

De Gennaro, L., & Ferrara, M. (2003). Sleep spindles: an overview. *Sleep Med Rev, 7*, 423-440.

Donaldson, C., Tarrier, N., & Burns, A. (1998). Determinants of carer stress in Alzheimer's disease. *International Journal of Geriatric Psychiatry, 13*, 248-256.

Dori, D., Casale, G., Solerte, S. B., Fioravanti, M., Migliorati, G., Cuzzoni, G., et al. (1994). Chrono-neuroendocrinological aspects of physiological aging and senile dementia. *Chronobiologia, 21*, 121-126.

Dowling, G. A., Burr, R. L., Van Someren, E. J., Hubbard, E. M., Luxenberg, J. S., Mastick, J., et al. (2007). Melatonin and Bright-Light Treatment for Rest-Activity Disruption in Institutionalized Patients with Alzheimer's Disease. *Journal of the American Geriatrics Society*.

Dowling, G. A., Mastick, J., Hubbard, E. M., Luxenberg, J. S., & Burr, R. L. (2005). Effect of timed bright light treatment for rest-activity disruption in institutionalized patients with Alzheimer's disease. *International Journal of Geriatric Psychiatry, 20*, 738-743.

Feinsilver, S. H. (2003). Sleep in the elderly. What is normal? *Clinics in Geriatric Medicine, 19*, 177-188, viii.

Fetveit, A., & Bjorvatn, B. (2005). Bright-light treatment reduces actigraphic-measured daytime sleep in nursing home patients with dementia: a pilot study. *American Journal of Geriatric Psychiatry, 13*, 420-423.

Fetveit, A., & Bjorvatn, B. (2006). Sleep duration during the 24-hour day is associated with the severity of dementia in nursing home patients. *International Journal of Geriatric Psychiatry, 21*, 945-950.

Fetveit, A., Skjerve, A., & Bjorvatn, B. (2003). Bright light treatment improves sleep in institutionalised elderly--an open trial. *International Journal of Geriatric Psychiatry, 18*, 520-526.

Floyd, J. A. (2002). Sleep and aging. *Nursing Clinics of North America, 37*, 719-731.

Foley, D. J., Ancoli-Israel, S., Britz, P., & Walsh, J. (2004). Sleep disturbances and chronic disease in older adults: results of the 2003 National Sleep Foundation Sleep in America Survey. *Journal of Psychosomatic Research, 56*, 497-502.

Foley, D. J., Monjan, A. A., Brown, S. L., Simonsick, E. M., Wallace, R. B., & Blazer, D. G. (1995). Sleep complaints among elderly persons: an epidemiologic study of three communities. *Sleep, 18*, 425-432.

Foley, D. J., Monjan, A. A., Izmirlian, G., Hays, J. C., & Blazer, D. G. (1999). Incidence and remission of insomnia among elderly adults in a biracial cohort. *Sleep, 22 Suppl 2*, S373-378.

Fukuda, N., Honma, H., Kohsaka, M., Kobayashi, R., Sakakibara, S., Kohsaka, S., et al. (1999). Gender difference of slow wave sleep in middle aged and elderly subjects. *Psychiatry and Clinical Neurosciences, 53*, 151-153.

Gagnon, J. F., Petit, D., Fantini, M. L., Rompre, S., Gauthier, S., Panisset, M., et al. (2006). REM sleep behavior disorder and REM sleep without atonia in probable Alzheimer disease. *Sleep, 29*, 1321-1325.

Gehrman, P., Marler, M., Martin, J. L., Shochat, T., Corey-Bloom, J., & Ancoli-Israel, S. (2004). The timing of activity rhythms in patients with dementia is related to survival. *Journals of Gerontology. Series A, Biological Sciences and Medical Sciences, 59*, 1050-1055.

Grace, J. B., Walker, M. P., & McKeith, I. G. (2000). A comparison of sleep profiles in patients with dementia with Lewy bodies and Alzheimer's disease. *International Journal of Geriatric Psychiatry, 15*, 1028-1033.

Haimov, I., & Lavie, P. (1997). Circadian characteristics of sleep propensity function in healthy elderly: a comparison with young adults. *Sleep, 20*, 294-300.

Harper, D. G., Stopa, E. G., McKee, A. C., Satlin, A., Harlan, P. C., Goldstein, R., et al. (2001). Differential circadian rhythm disturbances in men with Alzheimer disease and frontotemporal degeneration. *Archives of General Psychiatry, 58*, 353-360.

Harper, D. G., Volicer, L., Stopa, E. G., McKee, A. C., Nitta, M., & Satlin, A. (2005). Disturbance of endogenous circadian rhythm in aging and Alzheimer disease. *American Journal of Geriatric Psychiatry, 13*, 359-368.

Hume, K. I., Van, F., & Watson, A. (1998). A field study of age and gender differences in habitual adult sleep. *Journal of Sleep Research, 7*, 85-94.

International Bureau of Weights and Measures. (2006). *The International System of Units (SI)* (8th ed.).

Klerman, E. B., Davis, J. B., Duffy, J. F., Dijk, D. J., & Kronauer, R. E. (2004). Older people awaken more frequently but fall back asleep at the same rate as younger people. *Sleep, 27*, 793-798.

Kobayashi, R., Kohsaka, M., Fukuda, N., Honma, H., Sakakibara, S., & Koyama, T. (1998). Gender differences in the sleep of middle-aged individuals. *Psychiatry and Clinical Neurosciences, 52*, 186-187.

Kryger, M., Monjan, A., Bliwise, D., & Ancoli-Israel, S. (2004). Sleep, health, and aging. Bridging the gap between science and clinical practice. *Geriatrics, 59*, 24-26, 29-30.

Kuhn, D., Edelman, P., & Fulton, B. (2005). Daytime sleep and the threat to well-being of persons with dementia. *Dementia (Sage Publications, Ltd.), 4*, 233-247.

Lee, J. H., Bliwise, D. L., Ansari, F. P., Goldstein, F. C., Cellar, J. S., Lah, J. J., et al. (2007). Daytime sleepiness and functional impairment in Alzheimer disease. *American Journal of Geriatric Psychiatry, 15*, 620-626.

Lee, K. A. (1997). An overview of sleep and common sleep problems. *ANNA Journal, 24*, 614-623, 677; quiz 624-615.

Lewy, A. J., Ahmed, S., Jackson, J. M., & Sack, R. L. (1992). Melatonin shifts human circadian rhythms according to a phase-response curve. *Chronobiology International, 9*, 380-392.

Lopez, O. L., Becker, J. T., Sweet, R. A., Klunk, W., Kaufer, D. I., Saxton, J., et al. (2003). Psychiatric symptoms vary with the severity of dementia in probable Alzheimer's disease. *Journal of Neuropsychiatry and Clinical Neurosciences, 15*, 346-353.

Luboshitzky, R., Shen-Orr, Z., Tzischichinsky, O., Maldonado, M., Herer, P., & Lavie, P. (2001). Actigraphic sleep-wake patterns and urinary 6-sulfatoxymelatonin excretion in patients with Alzheimer's disease. *Chronobiology International, 18*, 513-524.

Magri, F., Sarra, S., Cinchetti, W., Guazzoni, V., Fioravanti, M., Cravello, L., et al. (2004). Qualitative and quantitative changes of melatonin levels in physiological and pathological aging and in centenarians. *Journal of Pineal Research, 36*, 256-261.

McCurry, S. M., Gibbons, L. E., Logsdon, R. G., Vitiello, M., & Teri, L. (2003). Training caregivers to change the sleep hygiene practices of patients with dementia: the NITE-AD project. *Journal of the American Geriatrics Society, 51*, 1455-1460.

McCurry, S. M., Gibbons, L. E., Logsdon, R. G., Vitiello, M. V., & Teri, L. (2005). Nighttime insomnia treatment and education for Alzheimer's disease: a randomized, controlled trial. *Journal of the American Geriatrics Society, 53*, 793-802.

McCurry, S. M., Logsdon, R. G., Teri, L., Gibbons, L. E., Kukull, W. A., Bowen, J. D., et al. (1999). Characteristics of sleep disturbance in community-dwelling Alzheimer's disease patients. *Journal of Geriatric Psychiatry and Neurology, 12*, 53-59.

McCurry, S. M., Vitiello, M. V., Gibbons, L. E., Logsdon, R. G., & Teri, L. (2006). Factors associated with caregiver reports of sleep disturbances in persons with dementia. *American Journal of Geriatric Psychiatry, 14*, 112-120.

Mirmiran, M., Swaab, D. F., Kok, J. H., Hofman, M. A., Witting, W., & Van Gool, W. A. (1992). Circadian rhythms and the suprachiasmatic nucleus in perinatal development, aging and Alzheimer's disease. *Progress in Brain Research, 93*, 151-162; discussion 162-153.

Mishima, K., Okawa, M., Hishikawa, Y., Hozumi, S., Hori, H., & Takahashi, K. (1994). Morning bright light therapy for sleep and behavior disorders in elderly patients with dementia. *Acta Psychiatrica Scandinavica, 89*, 1-7.

Mishima, K., Tozawa, T., Satoh, K., Matsumoto, Y., Hishikawa, Y., & Okawa, M. (1999a). Melatonin secretion rhythm disorders in patients with senile dementia of Alzheimer's type with disturbed sleep-waking. *Biological Psychiatry, 45*, 417-421.

Mishima, K., Tozawa, T., Satoh, K., Matsumoto, Y., Hishikawa, Y., & Okawa, M. (1999b). Melatonin secretion rhythm disorders in patients with senile dementia of Alzheimer's type with disturbed sleep-waking. *Biological Psychiatry, 45*, 417-421.

Moe, K. E., Vitiello, M. V., Larsen, L. H., & Prinz, P. N. (1995). Symposium: Cognitive processes and sleep disturbances: Sleep/wake patterns in Alzheimer's disease: relationships with cognition and function. *Journal of Sleep Research, 4*, 15-20.

Moran, M., Lynch, C. A., Walsh, C., Coen, R., Coakley, D., & Lawlor, B. A. (2005). Sleep disturbance in mild to moderate Alzheimer's disease. *Sleep Med, 6*, 347-352.

Motohashi, Y., Maeda, A., Wakamatsu, H., Higuchi, S., & Yuasa, T. (2000). Circadian rhythm abnormalities of wrist activity of institutionalized dependent elderly persons with dementia. *Journals of Gerontology. Series A, Biological Sciences and Medical Sciences, 55*, M740-743.

National Sleep Foundation. (2003). *2003 Sleep in America Poll*: National Sleep Foundation.

Neubauer, D. N. (1999). Sleep problems in the elderly. *American Family Physician, 59*, 2551-2558, 2559-2560.

Okawa, M., Mishima, K., Hishikawa, Y., Hozumi, S., Hori, H., & Takahashi, K. (1991). Circadian rhythm disorders in sleep-waking and body temperature in elderly patients with dementia and their treatment. *Sleep, 14*, 478-485.

Paavilainen, P., Korhonen, I., Lotjonen, J., Cluitmans, L., Jylha, M., Sarela, A., et al. (2005). Circadian activity rhythm in demented and non-demented nursing-home residents measured by telemetric actigraphy. *Journal of Sleep Research, 14*, 61-68.

Pat-Horenczyk, R., Klauber, M. R., Shochat, T., & Ancoli-Israel, S. (1998). Hourly profiles of sleep and wakefulness in severely versus mild-moderately demented nursing home patients. *Aging, 10*, 308-315.

Pollak, C. P., & Stokes, P. E. (1997). Circadian rest-activity rhythms in demented and nondemented older community residents and their caregivers. *Journal of the American Geriatrics Society, 45*, 446-452.

Redline, S., Kirchner, H. L., Quan, S. F., Gottlieb, D. J., Kapur, V., & Newman, A. (2004). The effects of age, sex, ethnicity, and sleep-disordered breathing on sleep architecture. *Archives of Internal Medicine, 164*, 406-418.

Reyner, L. A., Horne, J. A., & Reyner, A. (1995). Gender- and age-related differences in sleep determined by home-recorded sleep logs and actimetry from 400 adults. *Sleep, 18*, 127-134.

Sack, R. L., Auckley, D., Auger, R. R., Carskadon, M. A., Wright, K. P., Jr., Vitiello, M. V., et al. (2007). Circadian rhythm sleep disorders: part I, basic principles, shift work and jet lag disorders. An American Academy of Sleep Medicine review. *Sleep, 30*, 1460-1483.

Satlin, A., Volicer, L., Ross, V., Herz, L., & Campbell, S. (1992). Bright light treatment of behavioral and sleep disturbances in patients with Alzheimer's disease. *American Journal of Psychiatry, 149*, 1028-1032.

Satlin, A., Volicer, L., Stopa, E. G., & Harper, D. (1995). Circadian locomotor activity and core-body temperature rhythms in Alzheimer's disease. *Neurobiol Aging, 16*, 765-771.

Schnelle, J. F., Cruise, P. A., Alessi, C. A., Ludlow, K., al-Samarrai, N. R., & Ouslander, J. G. (1998). Sleep hygiene in physically dependent nursing home residents: behavioral and environmental intervention implications. *Sleep, 21*, 515-523.

Serfaty, M., Kennell-Webb, S., Warner, J., Blizard, R., & Raven, P. (2002). Double blind randomised placebo controlled trial of low dose melatonin for sleep disorders in dementia. *International Journal of Geriatric Psychiatry, 17*, 1120-1127.

Shochat, T., Martin, J., Marler, M., & Ancoli-Israel, S. (2000). Illumination levels in nursing home patients: effects on sleep and activity rhythms. *Journal of Sleep Research, 9*, 373-379.

Simpson, K., Richards, K., Enderlin, C., O'Sullivan, P., & Koehn, M. (2006). Medications and sleep in nursing home residents with dementia. *Journal of the American Psychiatric Nurses Association, 12*, 279-285.

Singer, C., Tractenberg, R. E., Kaye, J., Schafer, K., Gamst, A., Grundman, M., et al. (2003). A multicenter, placebo-controlled trial of melatonin for sleep disturbance in Alzheimer's disease. *Sleep, 26*, 893-901.

Sloane, P. D., Williams, C. S., Mitchell, C. M., Preisser, J. S., Wood, W., Barrick, A. L., et al. (2007). High-internsity environmental light in dementia: effect on sleep and activity. *Journal of the American Geriatrics Society, 55*, 1524-1533.

Smith, L. J., Nowakowski, S., Soeffing, J. P., Orff, H. J., & Perlis, M. L. (2003). The measurement of sleep. In M. L. Perlis & K. L. Lichstein (Eds.), *Treating sleep disorders: Principles and practice of behavioral sleep medicine* (pp. 29-73). New York, NY: Wiley.

Stepanski, E. J., & Wyatt, J. K. (2003). Use of sleep hygiene in the treatment of insomnia. *Sleep Medicine Reviews, 7*, 215-225.

Svarstad, B. L., & Mount, J. K. (2002). Effects of residents' depression, sleep, and demand for medication on benzodiazepine use in nursing homes. *Psychiatric Services, 53*, 1159-1165.

Swaab, D. F., Fliers, E., & Partiman, T. S. (1985). The suprachiasmatic nucleus of the human brain in relation to sex, age and senile dementia. *Brain Research, 342*, 37-44.

Teri, L., Logsdon, R. G., & McCurry, S. M. (2002). Nonpharmacologic treatment of behavioral disturbance in dementia. *Medical Clinics of North America, 86*, 641-656, viii.

Turner, R. S. (2002). Idiopathic rapid eye movement sleep behavior disorder is a harbinger of dementia with Lewy bodies. *Journal of Geriatric Psychiatry and Neurology, 15*, 195-199.

Van Someren, E. J., Kessler, A., Mirmiran, M., & Swaab, D. F. (1997). Indirect bright light improves circadian rest-activity rhythm disturbances in demented patients. *Biological Psychiatry, 41*, 955-963.

Viegas, S., Richards, K., Beck, C., Lambert, C., O'Sullivan, P., Cole, C., et al. (2006). Predictors of daytime sleep of nursing home residents with dementia. *Journal of the American Psychiatric Nurses Association, 12*, 286-293.

Vitiello, M. V., & Borson, S. (2001). Sleep disturbances in patients with Alzheimer's disease: epidemiology, pathophysiology and treatment. *CNS Drugs, 15*, 777-796.

Volicer, L., Harper, D. G., Manning, B. C., Goldstein, R., & Satlin, A. (2001). Sundowning and circadian rhythms in Alzheimer's disease. *American Journal of Psychiatry, 158*, 704-711.

Wu, Y. H., & Swaab, D. F. (2005). The human pineal gland and melatonin in aging and Alzheimer's disease. *Journal of Pineal Research, 38*, 145-152.

Table 1. Neuroscience Nurses' Role for Caring Persons with Dementia Having Sleep Problems

Role	Detail
Assessment	• Monitor sleep characteristics at day and nighttime - How long does he/she sleep during nighttime? - How long does it take to fall asleep? - How often does he/she awaken during nighttime? - How long does he/she take naps during daytime? • Assess related factors - Gender - Medications - Depressive symptoms - Environment: light exposure, noise (e.g., staff or resident vocalization, television), sleep accommodation (e.g., bed, sofa, chair), room assignment (e.g., single, shared), relationship with staff or caregivers, daily routine or activities, staffing patterns
Education	• Educate staff about sleep problems and interventions • Provide caregivers with sleep hygiene recommendations
Emotional Support	• Address and solve problems (e.g., burden, stress, sleep deprivation) in Caregivers • Make referrals to support group
Research	• Test effectiveness of interventions (e.g., light therapy, melatonin administration, sleep hygiene, physical activity and combined therapy)

Table 2. Example of Sleep Hygiene Program for Older Adults with Dementia

Sleep-Wake Rhythm

- Set a regular schedule and bedtime routine
- Set desired bedtime and rising time
- Limit daytime napping to a short duration, usually in the early afternoons; avoid napping in the evenings

Environment

- Keep the bedroom environment quiet and consistent.
- Keep the bedroom as dark as possible
- Provide adequate lighting; reduce light levels in bedroom, expose the individual to sunlight or artificial bright light in the morning or the evening depending on their rhythm patterns
- Remove the sources of nighttime sleep interruptions (e.g., TV, noise from bedroom partner, inadequate bedroom temperature)

Eating and Activities

- Provide light snack or milk before bed if hungry.
- Reduce caffeine intake (e.g., coffee, soda, tea, chocolate) during the daytime and eliminate completely in the evening.
- Avoid alcohol and smoking
- Set fixed meal times
- Avoid excessive fluid intake in the evening
- Set routine activities (e.g., walking, games, watching TV, bathing) during the daytime
- Avoid excessive activities around bedtime

Chapter 3.

Assessing Environmental Risk Factors Related to Sleep Problems in Institutionalized Older Adults with Dementia: A Case Study Approach

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Abstract

Sleep disturbances are common in institutionalized older adults with dementia. Prolonged sleep onset, nocturnal awakenings, excessive napping, and disrupted circadian rhythms are characteristic of this problem. To provide older persons with dementia with more effective interventions, health care providers must assess their risk factors, particularly those that can be modified. The assessment and identification of environmental factors as causal agents are often overlooked. In this case study, we used actigraphy to measure rest-activity patterns in four women for seven, consecutive, 24-hour periods. The results address disturbed sleep in four cases. They also suggest environmental factors that affect disrupted rest-activity patterns to be considered for future treatment and care.

KEYWORDS: Sleep, circadian rhythm, older adults, dementia, institutionalized

Introduction

Sleep disturbances are common in older adults with dementia (Carpenter, Strauss, & Patterson, 1995; Fetveit & Bjorvatn, 2002; McCurry et al., 1999), particularly in those who reside in institutions (Ancoli-Israel et al., 1997a; Fetveit & Bjorvatn, 2002). Studies have confirmed that sleep in institutionalized older persons with dementia is extremely fragmented with low sleep efficiency, frequent awakenings, excessive daytime sleep, and impaired sleep-wake rhythms (Ancoli-Israel et al., 1997a; Fetveit & Bjorvatn, 2002, 2006; Kuhn, Edelman, & Fulton, 2005; Motohashi, Maeda, Wakamatsu, Higuchi, & Yuasa, 2000; Viegas et al., 2006). Moreover, these older adults sleep more during the day and sleep quality worsens as their dementia progresses (Pat-Horenczyk, Klauber, Shochat, & Ancoli-Israel, 1998; Shochat, Martin, Marler, & Ancoli-Israel, 2000).

The sleep disturbances in these people are believed to be caused by damage to neuronal pathways that regulate arousal and sleep-wake cycle, including the cholinergic basal fore brain nuclei, serotoninergic dorsal and median raphe nuclei, and noradrenergic locus coeruleus stemming from their dementia (Saper, Chou, & Scammell, 2001; Vitiello & Borson, 2001).

Personal characteristics, such as gender, age, type of health condition, and medication use, are known to affect sleep (Simpson, Richards, Enderlin, O'Sullivan, & Koehn, 2006). Environmental factors, such as irregular meal times or bedtimes, limited light exposure (Shochat et al., 2000) and noise (Schnelle et al., 1998) can also contribute to poor sleep quality. The assessment and identification of environmental risk factors in institutionalized persons are essential if a sleep problem occurs. Interventions for a person's sleep problem without also evaluating his or her environmental risk factors may not improve sleep quality and may result in unsuccessful or adverse outcomes.

Using a single case design with four cases from two institutions, we describe the sleep characteristics of each case and suggest possible risk factors in the institutional environment that might influence sleep quality and the rest-activity circadian rhythm. Each case involves a female resident with dementia aged 80 to 90 years with a score less than 20 out of 30 on the Mini-Mental State Examination-Korean version (MMSE-K), which indicates moderate to severe dementia.

Methods

Sleep Measure

The Actiwatch®, an activity monitor (AW-64, Mini Mitter Co., Inc., Bend, OR, USA), was used to measure sleep-wake characteristics and rest-activity rhythms. Each participant wore an Actiwatch® for seven, consecutive, 24-hour periods in May 2007. By definition, nighttime sleep and related wakening episodes occurred between the hours of 8:00 p.m. and 6:00 a.m.; daytime sleep and related time spent asleep occurred between the hours of 6:00 a.m. and 8:00 p.m. Parametric and nonparametric analyses were used to estimate rest-activity rhythms. The results of parametric rest-activity rhythms included amplitude (peak-to-nadir difference), acrophase (time of peak activity), mesor (mean of activity), and model fit to 24-hour cosine curve (R^2). Nonparametric analytic techniques can be more sensitive in characterizing the rest-activity rhythm because of its highly nonsinusoidal waveform (Van Someren et al., 1999). Calculated variables include interdaily stability (IS), intradaily variability (IV), start of sequence for five least active hours in 24-hour average activity profile (L5), start of sequence for 10 most active hours

(M10), amplitude (the difference between M10 and L5 in an average 24-hour pattern), and relative amplitude (RA: the normalized difference between the M10 and the L5 in an average 24-hour pattern).

Light Level Measure

The light level was measured in the afternoon between 2:30 p.m. and 3:30 p.m. during sleep measure periods using a calibrated, precision light meter (cal-LIGHT 400™, Cooke Corporation, Romulus, MI, USA). Daylight length was calculated from local sunrise to sunset. During the study period, the early summer weather was sunny and calm.

Cognitive Status and Problematic Behavior Measures

The MMSE-K was used to assess cognitive status. This instrument was translated by Kwon and Park (1989) by basis on the original MMSE (Folstein, Folstein, & McHugh, 1975) and is an officially approved Korean version of the original version. It consists of 12 questions that examine six cognitive components including orientation (10 points), memory (3 points), reminiscence (3 points), concentration and numerical calculation (5 points), language (7 points), and understanding and judgment (2 points). Scores range from 0 to 30, with scores below 24 indicating cognitive impairment. The MMSE-K was administered through the interview on the first day of the study.

Behavioral problems were measured using the Problematic Behavior Scale developed by K. A. Kim (2003). The Problematic Behavior Scale is a three-point rating scale, measuring the frequency of problematic behaviors in institutionalized older adults with dementia. It consists of 25 items that include aggressive psychomotor behaviors, non-aggressive psychomotor behaviors, and irritated behaviors. Scores range from 0 to 75 and high scores are associated with more problematic behaviors. High correlation

(correlation coefficient $r = 0.83$) with Korean version of Neuropsychiatric Inventory and high reliability (Spearman's $rho = 0.84$) have been reported in the studies of Korean older adults with dementia (Jeong, 2004; Kim, 2003). This instrument was administered by nursing staff or assistants on the last day of data collection.

Settings

The study's two settings (Institutions A and B) were located in South Korea. Institution A is a private facility that does not provide its residents with a consistent set of daily activities, except for fixed meal times: breakfast at 8:00 a.m., lunch at noon, and dinner at 6:00 p.m. Residents are encouraged to spend their time privately. Evening bedtime and morning wake times are flexible. Institution B is a nursing home that provides residents with a structured daytime routine that includes planned activities. These residents also have fixed meal times: breakfast at 7:30 a.m., lunch at noon, and dinner at 6:00 p.m. Evening bedtime is set at 8:00 p.m., and morning wake time is set at 6:00 a.m.

This study was approved by the Committee on Human Research of the University of California, San Francisco and the institutions in Korea. Informed consent was obtained from each participant's authorized surrogate because the participants were unable to consent, based on MMSE-K scores lower than 24 points.

Results

Case 1A

Mrs. S. is an 87-year-old Korean woman with dementia (type unknown) who has resided at an elder care institution (Institution A) for more than 4 years. At night she slept an average of 7 hours, with 51 minutes of total wake time. She also had an average of 14 wake episodes and was awake an average of 3 minutes per wake episode. Her daytime sleep was excessive (average 6 hours). She showed impaired rest-activity rhythm with low R^2 (0.17), low daily stability (IS = 0.18), and high variability (IV = 1.34).

According to her medical record, Mrs. S. did not have any comorbidity but took supplements that included calcium and multivitamins. Her MMSE-K score, 11 out of 30, indicated low cognitive ability. She rarely exhibited problematic behaviors (score 6 out of 75) but displayed anger or verbal abuse toward care providers or others about once a week and showed no interest in surrounding activities. She had a private single room and slept on a thin futon. Mrs. S. led a sedentary lifestyle, sitting in a chair or lying down in her room for most of the day.

Case 2A

Mrs. L. is an 86-year-old Korean woman diagnosed with Alzheimer's disease. She was admitted to Institution A in 1997. At night she slept for an average 7.6 hours, with 83 minutes of total wake time and 12 wake episodes. She napped for a total of 3 hours during the daytime. Her rest-activity rhythm showed low R^2 (0.28), low stability (IS = 0.37), and high variability (IV = 1.33), indicating disrupted rhythms.

Mrs. L. was taking diltiazem 180 mg for high blood pressure and glipizide 5 mg for diabetes. Her MMSE-K score was 14 out of 30 and her problematic behavior score was 2 out of 75. During the week she was monitored, Mrs. L. shouted in a loud voice and was disinterested in her surroundings, but these behaviors were rare, happening less than once a week. She slept on a thin futon in her own room and spent most of her daytime sitting in a chair.

Case 3B

Mrs. E. is an 83-year-old Korean woman who was transferred from her home to Institution B in 2005 because a family member could no longer care for her. She was diagnosed with Alzheimer's disease in 2005. At night, her average total sleep time was 7.6 hours. She had multiple, short, wake episodes during the night (94 minutes of total wake time and 27 wake episodes averaging 4 minutes per episode). She also napped for a total of 60 minutes during the day. Her IS was 0.66 and RA was 0.94, indicating strong circadian rhythms. The sequence of five least active hours began at 12:16 a.m., indicating a relatively phase-delayed rhythm, particularly considering the set institutional bedtime of 8:00 p.m.

Mrs. E.'s medical record indicated that she had no comorbidities and was taking multivitamins. Her MMSE-K score was 14. Mrs. E. was sharing a room with three other residents and slept on a thin futon. Her problematic behavior score was low, 9 out of 75, but she always made strange noises during her meal times, often complained about inconsequential things, and collected and hid objects of no apparent importance.

Case 4B

Mrs. P., an 87-year-old Korean woman diagnosed with Alzheimer's disease in 2003, was admitted to Institution B in May 2003. At night she slept 8 hours and was awake for 54 minutes. Her wake episodes numbered 19 with average 3 minutes per episode. She napped for a total of 2 hours during the daytime. Mrs. P. had stable and strong circadian rhythms, with an IS of 0.66 and an RA of 0.95, however, she also had a high IV, 1.34.

Mrs. P.'s medical record indicated that she had high blood pressure and was taking Norvasc® (amlodipine besylate, Pfizer, USA) and L-Carnitine. Her MMSE-K score was 5 out of 30. Mrs. P. was sharing her room with three other residents and slept on a thin futon. Her problematic behavior score was also very low (3 out of 75), but she often intruded into inappropriate areas, such as other residents' rooms about two or three times a week.

Discussion

Multiple and short awakening episodes at night were identified in all four cases, although average total sleep time remained fairly stable. All four women spent more than an hour per day napping; excessive napping, however, was most noticeable in case 1A. Studies have confirmed that nursing home residents spend extended time in bed and sleep frequently during the day (Fetveit & Bjorvatn, 2006; Jacobs, Ancoli-Israel, Parker, & Kripke, 1989; Kuhn et al., 2005). For example, a sample of 23 nursing home patients with dementia slept an average of 12 hours and 39 minutes during a 24-hour day, distributed as more than 3 hours of daytime sleep and more than 9 hours of nighttime sleep (Fetveit & Bjorvatn, 2006). In another study, only 37 % of 166 residents with dementia never slept during the daytime, 48 % were observed sleeping up to an hour, and 15 % were observed sleeping more than an hour (Kuhn et al., 2005). Moreover, persons with profound dementia were observed sleeping significantly more of the time than less seriously impaired patients.

Disturbed rest-activity rhythms were found in cases 1A and 2A. These cases revealed decreased amplitude, low mesor and low IS, whereas cases 3B and 4B showed relatively high amplitude and mesor with high IS (Figure). Peak activity occurred between meal times in all cases. Disturbed rest-activity rhythm in institutionalized older adults with dementia has been reported in other studies. Ancoli-Israel and colleagues

(1997b) reported that severely demented patients in nursing homes had lower mesor, later acrophase (phase delay), and more blunted amplitudes than did moderately, mildly, or nondemented patients. Motohashi et al. (2000) found that more than half of institutionalized older adults with dementia had activity rhythm abnormalities, as measured by wrist actigraphy, and were classified into four categories: severely impaired rhythm with no boundary between day and night, free-running rhythm, decreased circadian amplitude, and accentuation of ultradian rhythm. Impaired circadian rhythms can also present as problematic behaviors, such as wandering, agitation, or sundowning. Sundowning is a constellation of increasing behavioral disturbance in persons with dementia that typically begins in the late afternoon or early evening (Vitiello & Borson, 2001). Agitation, which gets worse at night or near sunset, may involve the circadian timing system (Bliwise, Carroll, Lee, Nekich, & Dement, 1993; Klaffke & Staedt, 2006), although conflicting findings have been reported (Cohen-Mansfield, 2007; Martin, Marler, Shochat, & Ancoli-Israel, 2000). No noticeably altered behaviors were found in the case studies in this paper.

Assessing Factors Contributing to Sleep Problems in Institutions

Assessing risk factors for sleep problems should begin with a review of a patient's medical record, including his or her demographic data. Age, gender, type of dementia, duration of institutionalization, comorbidities, and medications can influence sleep, as shown in Figure.

The quantity and quality of sleep changes as a person ages. Frequent nocturnal awakenings, early morning awakenings, and daytime napping in older adults are notable when compared with younger adults (Ancoli-Israel et al., 1997b; Ayalon, Liu, & Ancoli-

Israel, 2004; Floyd, 2002; Foley, Monjan, Izmirlian, Hays, & Blazer, 1999; Mathew & Wright, 2005). The four cases in this paper were women aged 80- 90 years. Gender and age should be considered because research has shown that healthy older men exhibit lighter sleep (Fukuda et al., 1999; Hume, Van, & Watson, 1998; Kobayashi et al., 1998; Redline et al., 2004) and that older men with dementia have a greater number of sleep disturbances (McCurry et al., 1999) than women and younger adults.

Three women in this case study had Alzheimer’s disease, and one had an unknown type of dementia, but all had MMSE-K scores less than 20 out of 30. Type of dementia should be assessed because each type can present with different types of sleep problems. Nocturnal agitation (Volicer, Harper, Manning, Goldstein, & Satlin, 2001) and obstructive sleep apnea (Bliwise, 2002) are prevalent in persons with Alzheimer’s disease, and movement disorders and falling asleep at inappropriate times of the day are common in persons with dementia with Lewy bodies (Grace, Walker, & McKeith, 2000).

Assessing medication use is also essential. Many medications, especially benzodiazepines, can exacerbate cognitive deficits and obstructive sleep apnea syndrome and can lead to daytime sleepiness (Petit, Montplaisir, & Boeve, 2005). Comorbid medical conditions can also contribute to disrupted sleep. Osteoarthritic pain, gastroesophageal reflux, chronic obstructive pulmonary disease, and nocturnal dyspnea from cardiovascular disease all contribute to sleep problems (Alessi & Schnelle, 2000). Nocturia, the need to get up several times a night to urinate, may be caused by medicine for cardiovascular disease and may also cause sleep problems. For example, cases 1A and 3B only took supplements, while cases 2A and 4B took medications for high blood pressure and diabetes, which could be related to sleep disruption.

Some factors, particularly those related to the environment, may be more modifiable than medications or health conditions. Thus, when planning an intervention for sleep problems, assessing factors that affect a person's sleep in his or her unique environment during the day and night is critically important. Alessi and Schnelle (2000) have suggested three areas that should be assessed for nursing home residents who have sleep disturbances: (a) medical conditions and medications known to affect sleep, (b) behavioral lifestyle (e.g., a low level of physical activity and a sedentary lifestyle), and (c) environmental factors (e.g., daytime light exposure and noise in a resident's room). Of these areas, behavioral lifestyle and environmental factors were suggested to be more modifiable than any other factors.

Light exposure. Light levels should be accounted for because bright light appears to be a powerful synchronizer of circadian rhythms and, thus, directly influences sleep-wake activity, melatonin secretion, and other circadian rhythms (Ancoli-Israel, Martin, Kripke, Marler, & Klauber, 2002). Nursing home residents are rarely exposed to light above 2,000 lux (Ancoli-Israel, Klauber, Butters, Parker, & Kripke, 1991; Ancoli-Israel et al., 1997a; Shochat et al., 2000). Moreover, higher light levels are associated with fewer nighttime awakenings (Shochat et al., 2000). Table 1 presents the light level readings for each of the four cases while in the common living area and in the resident's room during the afternoon and the amount of daylight hours at that time of year (May) in Korea. High levels of light were identified in the common living area for Institution A, although bedrooms at both institutions had low levels of light.

Bed surface and bedroom environment. Cases 3B and 4B slept on thin futons and shared their room with other residents; Cases 1A and 2A slept on a thin futon but had private rooms. Despite a lack of evidence on the effect of environment on sleep in persons with dementia, assessing their sleep surface (i.e., bed, couch, or futon) and room assignment (i.e., a single room or a shared room) is important, particularly when they reside in an institution. Because institutionalized older adults may share their bedroom with other residents, the noises from roommates could contribute to poor sleep quality.

Lifestyle. Institutions often provide little daily stimulation, which may cause low activity and sedentary behavior. Lack of a structured lifestyle can contribute to sleep fragmentation in nursing home patients (Ancoli-Israel et al., 1997a). As described earlier, Institution A provided residents with less structured activities compared with Institution B. Although meals were served at the same time each day in both institutions, environmental stimulation, socialization, and light exposure may have an effect on keeping circadian rhythms synchronized. Cases 1A and 2A both had low rest-activity levels and poor rhythms, whereas cases 3B and 4B had relatively strong rest-activity rhythms despite lower levels of light exposure in the common living area.

Staffing. Although this study did not collect information on staffing, it may be related to sleep outcomes in institutions. The quality and maintenance of a resident's health is often proportional to the staff care he or she receives in an institution. Inadequate staffing (i.e., staff-to-resident ratio, staff work assignment, and work shift) may contribute to a resident's sleep disturbance by limiting access to activities and failing to encourage socially engaging interactions, thus resulting in excessive daytime sleep. For example, a cross-sectional study of 882 residents in 34 California nursing homes (Bates-Jensen, Schnelle, Alessi, Al-Samarrai, & Levy-Storms, 2004) reported that residents in lower-staffed homes spent more time in bed during the day than those in high-staffed homes. Moreover, higher daytime sleep was observed in those participants who spent more time in bed.

Conclusion

Caring for older adults with dementia who develop sleep problems is often challenging in institutional settings. The four women in this study had common sleep problems despite their institutional setting, but their rest-activity patterns were different. Assessing risk factors that contribute to sleep problems is absolutely necessary before any intervention is undertaken. Individual and environmental factors should be accounted for in a broad assessment. Environmental factors may be more modifiable than individual factors and considering the institutional setting as part of the intervention plan may contribute to improving sleep quality in institutionalized persons with dementia.

References

Alessi, C. A., & Schnelle, J. F. (2000). Approach to sleep disorders in the nursing home setting. REVIEW ARTICLE. *Sleep Medicine Review, 4*, 45-56.

Ancoli-Israel, S., Klauber, M. R., Butters, N., Parker, L., & Kripke, D. F. (1991). Dementia in institutionalized elderly: relation to sleep apnea. *Journal of the American Geriatrics Society, 39*, 258-263.

Ancoli-Israel, S., Klauber, M. R., Jones, D. W., Kripke, D. F., Martin, J., Mason, W., et al. (1997a). Variations in circadian rhythms of activity, sleep, and light exposure related to dementia in nursing-home patients. *Sleep, 20*, 18-23.

Ancoli-Israel, S., Martin, J. L., Kripke, D. F., Marler, M., & Klauber, M. R. (2002). Effect of light treatment on sleep and circadian rhythms in demented nursing home patients. *Journal of the American Geriatrics Society, 50*, 282-289.

Ancoli-Israel, S., Poceta, J. S., Stepnowsky, C., Martin, J., & Gehrman, P. (1997b). Identification and treatment of sleep problems in the elderly. *Sleep Medicine Reviews, 1*, 3-17.

Ayalon, L., Liu, L., & Ancoli-Israel, S. (2004). Diagnosing and treating sleep disorders in the older adult. *Medical Clinics of North America, 88*, 737-750, ix-x.

Bates-Jensen, B. M., Schnelle, J. F., Alessi, C. A., Al-Samarrai, N. R., & Levy-Storms, L. (2004). The effects of staffing on in-bed times of nursing home residents. *Journal of the American Geriatrics Society, 52*, 931-938.

Bliwise, D. L. (2002). Sleep apnea, APOE4 and Alzheimer's disease 20 years and counting? *Journal of Psychosomatic Research, 53*, 539-546.

Bliwise, D. L., Carroll, J. S., Lee, K. A., Nekich, J. C., & Dement, W. C. (1993). Sleep and "sundowning" in nursing home patients with dementia. *Psychiatry Research, 48*, 277-292.

Carpenter, B. D., Strauss, M. E., & Patterson, M. B. (1995). Sleep disturbances in community-dwelling patients with Alzheimer's disease. *Clinical Gerontologist, 16*, 35-49.

Cohen-Mansfield, J. (2007). Temporal patterns of agitation in dementia. *American Journal of Geriatric Psychiatry, 15*, 395-405.

Fetveit, A., & Bjorvatn, B. (2002). Sleep disturbances among nursing home residents. *International Journal of Geriatric Psychiatry, 17*, 604-609.

Fetveit, A., & Bjorvatn, B. (2006). Sleep duration during the 24-hour day is associated with the severity of dementia in nursing home patients. *International Journal of Geriatric Psychiatry, 21*, 945-950.

Floyd, J. A. (2002). Sleep and aging. *Nursing Clinics of North America, 37*, 719-731.

Foley, D. J., Monjan, A. A., Izmirlian, G., Hays, J. C., & Blazer, D. G. (1999). Incidence and remission of insomnia among elderly adults in a biracial cohort. *Sleep, 22 Suppl 2*, S373-378.

Folstein, M. F., Folstein, S. E., & McHugh, P. R. (1975). "Mini-mental state". A practical method for grading the cognitive state of patients for the clinician. *Journal of Psychiatric Research, 12*, 189-198.

Fukuda, N., Honma, H., Kohsaka, M., Kobayashi, R., Sakakibara, S., Kohsaka, S., et al. (1999). Gender difference of slow wave sleep in middle aged and elderly subjects. *Psychiatry and Clinical Neurosciences, 53*, 151-153.

Grace, J. B., Walker, M. P., & McKeith, I. G. (2000). A comparison of sleep profiles in patients with dementia with Lewy bodies and Alzheimer's disease. *International Journal of Geriatric Psychiatry, 15*, 1028-1033.

Hume, K. I., Van, F., & Watson, A. (1998). A field study of age and gender differences in habitual adult sleep. *Journal of Sleep Research, 7*, 85-94.

Jacobs, D., Ancoli-Israel, S., Parker, L., & Kripke, D. F. (1989). Twenty-four-hour sleep-wake patterns in a nursing home population. *Psychology and Aging, 4*, 352-356.

Jeong, J. S. (2004). *The Effects of a Folk Play Program on Cognition, ADL, and Problematic Behavior for the Elderly with Dementia.* Pusan National University, Pusan, Korea.

Kim, K. A. (2003). *Deveopment of an assessment tool of problematic behaviors for institutionalized old people with dementia.* Seoul National University, Seoul, Korea.

Klaffke, S., & Staedt, J. (2006). Sundowning and circadian rhythm disorders in dementia. *Acta Neurologica Belgica, 106*, 168-175.

Kobayashi, R., Kohsaka, M., Fukuda, N., Honma, H., Sakakibara, S., & Koyama, T. (1998). Gender differences in the sleep of middle-aged individuals. *Psychiatry and Clinical Neurosciences, 52*, 186-187.

Kuhn, D., Edelman, P., & Fulton, B. (2005). Daytime sleep and the threat to well-being of persons with dementia. *Dementia (Sage Publications, Ltd.), 4*, 233-247.

Kwon, Y. C., & Park, J. H. (1989). Korean version of mini-mental state examination: Part 1 Development of the test for the elderly. *Journal of Korean Neuropsychiatric Association, 28*, 125-135.

Martin, J., Marler, M., Shochat, T., & Ancoli-Israel, S. (2000). Circadian rhythms of agitation in institutionalized patients with Alzheimer's disease. *Chronobiology International, 17*, 405-418.

Mathew, M. K., & Wright, J. (2005). Sleep disorders in the elderly. *Journal - Oklahoma State Medical Association, 98*, 152-155; quiz 156-158.

McCurry, S. M., Logsdon, R. G., Teri, L., Gibbons, L. E., Kukull, W. A., Bowen, J. D., et al. (1999). Characteristics of sleep disturbance in community-dwelling Alzheimer's disease patients. *Journal of Geriatric Psychiatry and Neurology, 12*, 53-59.

Motohashi, Y., Maeda, A., Wakamatsu, H., Higuchi, S., & Yuasa, T. (2000). Circadian rhythm abnormalities of wrist activity of institutionalized dependent elderly persons with dementia. *Journals of Gerontology. Series A, Biological Sciences and Medical Sciences, 55*, M740-743.

Pat-Horenczyk, R., Klauber, M. R., Shochat, T., & Ancoli-Israel, S. (1998). Hourly profiles of sleep and wakefulness in severely versus mild-moderately demented nursing home patients. *Aging, 10*, 308-315.

Petit, D., Montplaisir, J., & Boeve, B. F. (2005). Alzheimer's Disease and Other Dementias. In M. H. Kryger, T. Roth & W. C. Dement (Eds.), *Principles and Practice of Sleep Medicine* (4th ed., pp. 853-862). Philadelphia: Elsevier Saunders.

Redline, S., Kirchner, H. L., Quan, S. F., Gottlieb, D. J., Kapur, V., & Newman, A. (2004). The effects of age, sex, ethnicity, and sleep-disordered breathing on sleep architecture. *Archives of Internal Medicine, 164*, 406-418.

Saper, C. B., Chou, T. C., & Scammell, T. E. (2001). The sleep switch: hypothalamic control of sleep and wakefulness. *Trends in Neurosciences, 24*, 726-731.

Schnelle, J. F., Cruise, P. A., Alessi, C. A., Ludlow, K., al-Samarrai, N. R., & Ouslander, J. G. (1998). Sleep hygiene in physically dependent nursing home residents: behavioral and environmental intervention implications. *Sleep, 21*, 515-523.

Shochat, T., Martin, J., Marler, M., & Ancoli-Israel, S. (2000). Illumination levels in nursing home patients: effects on sleep and activity rhythms. *Journal of Sleep Research, 9*, 373-379.

Simpson, K., Richards, K., Enderlin, C., O'Sullivan, P., & Koehn, M. (2006). Medications and sleep in nursing home residents with dementia. *Journal of the American Psychiatric Nurses Association, 12*, 279-285.

Van Someren, E. J., Swaab, D. F., Colenda, C. C., Cohen, W., McCall, W. V., & Rosenquist, P. B. (1999). Bright light therapy: improved sensitivity to its effects on rest-activity rhythms in Alzheimer patients by application of nonparametric methods. *Chronobiology International, 16*, 505-518.

Viegas, S., Richards, K., Beck, C., Lambert, C., O'Sullivan, P., Cole, C., et al. (2006). Predictors of daytime sleep of nursing home residents with dementia. *Journal of the American Psychiatric Nurses Association, 12*, 286-293.

Vitiello, M. V., & Borson, S. (2001). Sleep disturbances in patients with Alzheimer's disease: Epidemiology, pathophysiology and treatment. *CNS Drugs, 15*, 777-796.

Volicer, L., Harper, D. G., Manning, B. C., Goldstein, R., & Satlin, A. (2001). Sundowning and circadian rhythms in Alzheimer's disease. *American Journal of Psychiatry, 158*, 704-711

Table 1. Characteristics of sleep-wake and light exposure

Case (Site)	Nighttime (8:00 p.m. to 6:00 a.m.)				Daytime (6:00 a.m. to 8:00 p.m.)	Light level (lux)	Daylight length
	TST (h)	WT (min)	Wake episode duration (min)	No. of wake episodes	TST (h)		
1(A)	7.2	50.7	3.2	14	6.0	2398 ± 1179 (l) 863 ± 364 (b)	14 h 5 min
2(A)	7.6	82.6	7.0	12	3.2	2398 ±1179 (l) 323 ± 255 (b)	14 h 6 min
3(B)	7.6	94.3	3.9	27	1.1	1791 ± 199 (l) 335 ± 28 (b)	14 h 20 min
4(B)	7.9	54.0	2.8	19	2.3	1887 ± 259 (l) 116 ± 2 (b)	14 h 28 min

TST = total sleep time, WT = wake time, h = hour, min = minutes, 1 = living room, b = bedroom.
Light level was measured in the afternoon between 2:30 p.m. and 3:30 p.m.

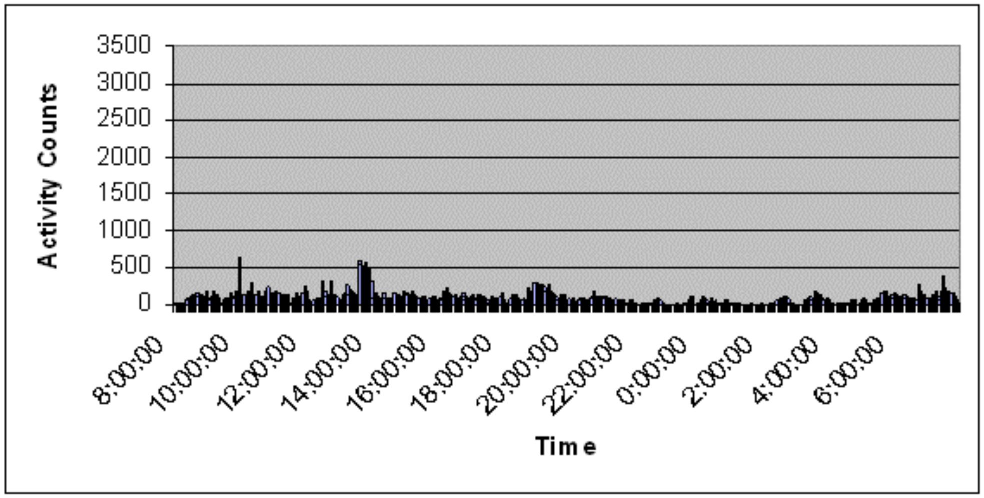
Table 2. Characteristics of parametric circadian rhythms

Case (Site)	Parametric circadian rhythms			
	Amplitude	Mesor	Acrophase (clock time)	Fit of the data to the 24-hour cosine curve (R^2)
1(A)	1.30	2.34	13:27:16	0.17
2(A)	1.95	2.99	13:09:11	0.28
3(B)	2.73	3.52	12:52:04	0.47
4(B)	2.51	3.18	13:23:36	0.41

Table 3. Characteristics of nonparametric circadian rhythms

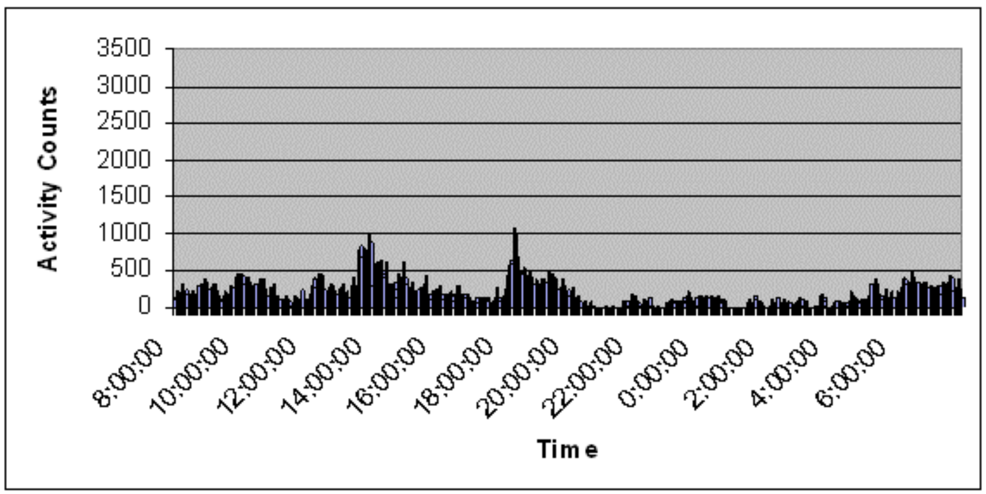
Case (Site)	Nonparametric circadian rhythms							
	IS	IV	L5	L5 onset	M10	M10 onset	Amplitude	RA
1(A)	0.18	1.34	19	21:26	113.8	9:44	95.1	0.72
2(A)	0.37	1.33	43	20:30	256.94	9:49	213.9	0.71
3(B)	0.66	0.98	19	24:16	578.37	9:33	559.35	0.94
4(B)	0.66	1.34	12	20:09	468.69	10:01	456.78	0.95

IS = interdaily stability, IV= intradaily variability, L5 = start of sequence of the five least active hours in 24-hour average activity profile, M10 = start of sequence of the 10 most active hours, RA = relative amplitude.



Case 1(A)

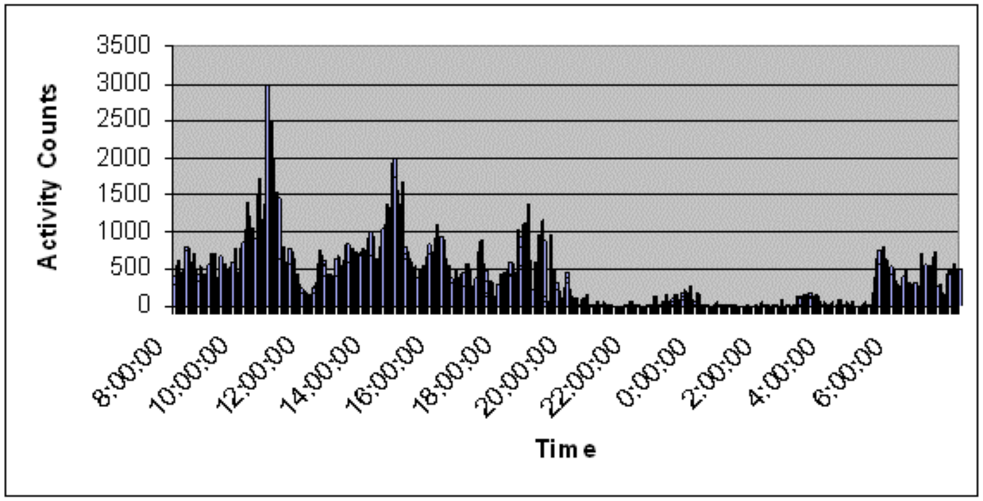
- Age: 87
- Gender: female
- Type of dementia: Unknown
- Duration of institutionalization: 49 months
- Comorbidities: None
- Medications: Calcium, multivitamins



Case 2(A)

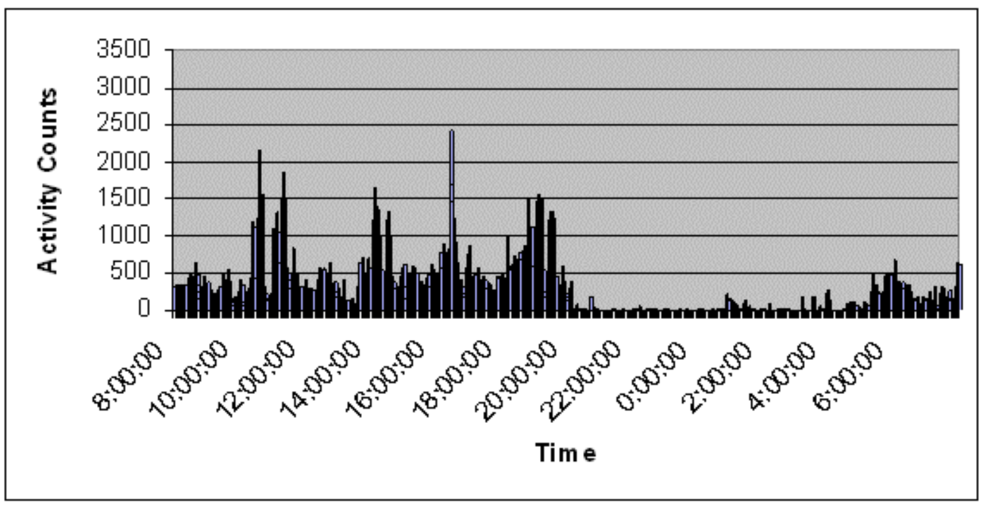
- Age: 86
- Gender: female
- Type of dementia: Alzheimer's disease
- Duration of institutionalization: 122 months
- Comorbidities: hypertension, diabetes
- Medications: Glipizide 5mg, diltiazem 180mg

Figure. Rest-activity patterns in each case



Case 3(B)

- Age: 83
- Gender: female
- Type of dementia: Alzheimer's disease
- Duration of institutionalization: 22 months
- Comorbidities: None
- Medications: multivitamins



Case 4(B)

- Age: 87
- Gender: female
- Type of dementia: Alzheimer's disease
- Duration of institutionalization: 47 months
- Comorbidites: hypertension
- Medications: Norvasc®, L-Carnitine

Figure Rest-activity patterns in each case (continued)

Chapter 4.

Rest-Activity Patterns in Institutionalized Older Korean Adults with Dementia: A Pilot Study

Song, Y., Dowling, G.A., Wallhagen, M.I., Lee, K.A., Strawbridge, W.J., & Hubbard, E.M.

Abstract

This pilot study examined rest-activity patterns and related factors in institutionalized older adults with dementia in Korea. Twelve individuals, residing in a nursing home and an assisted living facility, participated in the study. Actigraphic measurements were collected for seven, consecutive, 24-hour periods to assess rest-activity patterns. The participants' demographic characteristics, cognitive function, problematic behaviors, and light exposure were also assessed. The results indicate that the participants experienced sleep disturbances, including multiple awakenings at night and excessive daytime napping. Those in the nursing home had significantly more interdaily stability and less intradaily variability, with higher relative amplitude in their rest-activity rhythms, indicating more stable and stronger rest-activity rhythms, than those at the assisted living facility. These findings emphasize the importance of the institutional environment in care planning to improve sleep and rest-activity rhythm for older persons with dementia.

KEY WORDS: Dementia, sleep, circadian rhythms, aged, institutionalized

Background

Sleep problems become more common as people age and occur in over half of adults aged 65 and older (Kryger, Monjan, Bliwise, & Ancoli-Israel, 2004). Sleep is severely fragmented in institutionalized older adults, particularly those with dementia. Studies in several countries, including the United States, have confirmed that nursing home residents have poor sleep quality at night, spend an extended time in bed during the day, and nap frequently (Fetveit & Bjorvatn, 2002, 2006; Shochat, Martin, Marler, & Ancoli-Israel, 2000). In a study of sleep-wake activity in nursing home residents using actigraphy, researchers found that sleep was extremely fragmented in older adults with dementia (Ancoli-Israel et al., 1997b). Moreover, the severely demented group had a lower activity mesor (mean), a more blunted amplitude (height of the peak), and was more phase-delayed in their rhythm than moderate, mild, or nondemented patients. The disruption in circadian rhythm is associated with shorter lifespan (Gehrman et al., 2004), and severe nighttime sleep disturbances result in excessive daytime sleepiness in institutionalized older adults with dementia (Pat-Horenczyk, Klauber, Shochat, & Ancoli-Israel, 1998).

Many factors affect sleep. Some are part of the physical and social environment in which we live, others are part of one's personal characteristics and medical conditions. For example, environmental level of light exposure must be accounted for because bright light is a powerful circadian synchronizer and directly influences circadian rhythms such as sleep-wake activity and secretion of melatonin (Czeisler & Gooley, 2007). Institutionalized people with dementia are rarely exposed to bright light over 2,000 lux (Ancoli-Israel et al., 1997b; Shochat et al., 2000). Within the institutional environment, social factors, such as patterns of care, activities, and personal relationships between residents and staff, can also affect older people (Alessi & Schnelle, 2000). Finally, sleep can be dramatically affected by a person's age (Ancoli-Israel & Cooke, 2005), gender (Redline et al., 2004), race (Carpenter, Strauss, & Patterson, 1995), medications (Alessi & Schnelle, 2000), comorbidities (Ayalon, Liu, & Ancoli-Israel, 2004; Vitiello & Borson, 2001), genetics (Craig, Hart, & Passmore, 2006), depression, and mental health (Lopez et al., 2003).

Korea has one of the most rapidly growing populations of older adults in the world (Hayutin, 2007). Institutions for older adults are proliferating becoming increasingly important providers of senior care in modern Korean society. For example, the number of assisted living and nursing home facilities increased from 278 in 2002 to 1,584 in 2007 (Ministry for Health Welfare and Family Affairs, 2008). However, most studies of sleep in institutionalized older persons with dementia have been conducted in Western countries, and their generalizability to Eastern countries is unknown.

Given the data on the vulnerability of older persons with dementia to poor sleep, nurses must assess sleep-related parameters to identify potential problems. Recognizing rest-activity patterns can determine the causes of sleep disturbance, while investigating other contributing factors will provide for effective interventions, appropriate care plans, and treatments to improve sleep quality.

Purpose

The purpose of this study was to describe rest-activity patterns in older adults with dementia and to investigate the personal and behavioral characteristics and environmental factors associated with poor sleep in two Korean care settings: a nursing home and an assisted living facility. The research questions were (a) What are the nocturnal sleep and daytime sleep characteristics in a sample of older adults with dementia residing in a nursing home and an assisted living facility in Korea?, (b) What are the rest-activity rhythm characteristics in this sample?, and (c) Are there significant relationships between nocturnal sleep, daytime sleep, rest-activity rhythms, and other factors (e.g., age, comorbidities, cognitive function, light level, medications, type of dementia, type of institution, and problematic behaviors)?

Methods

Participants and Settings

To be included in this study, older adults had to be Korean; aged 65 years or older; medically diagnosed with dementia as defined by the *Diagnostic and Statistical Manual of Mental Disorders, Fourth Edition* (American Psychiatric Association, 1994); institutionalized for at least 3 months; and capable of independent ambulation.

Residents were excluded from participating in this study if their score on the Mini-Mental State Exam-Korean version (MMSE-K) was 24 or higher or if they had moderate-to-severe pyramidal or extrapyramidal motor symptoms, such as a severely abnormal gait, intention tremor, hemiparesis, or myoclonus. These conditions would have affected the validity of rest-activity measures that use motion detectors.

The study was conducted in two institutions in South Korea. Institution A is a for-profit assisted living facility that does not provide residents with structured activities except for meals, which are served at fixed times: breakfast at 8 a.m., lunch at noon, and dinner at 6 p.m. Each resident has a private room with a private bathroom. Institution B is a not-for-profit nursing home that provides residents with a structured daytime routine that includes fixed meal times: breakfast at 7:30 a.m., lunch at noon, and dinner at 6 p.m. The residents share rooms and bathrooms (three to four residents per one room). A total of 12 female residents participated in this study: four from Institution A, whose resident population is mostly women, and eight from Institution B, whose resident population is all women.

Sleep Measures

The Actiwatch®, an activity monitor (AW-64, Mini Mitter Co., Inc., Bend, OR, USA), was used to collect rest-activity data. The Actiwatch®, which looks like a small wristwatch, is a compact, battery-operated, activity monitor that stores activity counts in a memory chip (Dowling, Mastick, Hubbard, Luxenberg, & Burr, 2005b). Actigraphy is based on the principle that people move less during sleep and more when they are awake (Littner et al., 2003). It is useful when polysomnography is impractical, such as for patients with dementia. Wrist activity has been used extensively in studies involving older adults with dementia, particularly in nursing homes (Ancoli-Israel et al., 2003; Dowling et al., 2007; Dowling et al., 2005a; Gehrman et al., 2003). Criterion validity is well-established, with correlations between actigraphy and polysomnography reported for total sleep time (r = 0.81 to 0.91) and for percent sleep (r = 0.61 to 0.78) in patients with dementia in a nursing home (Ancoli-Israel, Clopton, Klauber, Fell, & Mason, 1997a). The AW-64 activity monitor has also revealed moderate-to-high correlations to polysomnography when measuring sleep characteristics (the number of awakenings, wake time after sleep onset, total sleep time, and sleep efficiency) for people with insomnia, including older adults (Lichstein et al., 2006).

Daytime (8 a.m. to 6 p.m.) and nighttime (6 p.m. to 8 a.m.) were defined by each institution's usual routine for bedtime and rise time. Information on actual time in bed and rise time was impossible to attain for each participant because of staff work load and the inability of participants to self-report. This method of defining daytime and nighttime has been used in other studies of sleep in persons with dementia (Ancoli-Israel, Martin, Kripke, Marler, & Klauber, 2002; Dowling et al., 2005b).

Actigraphic data were used to calculate nighttime variables (i.e., total sleep time, wake time, the mean duration of wake episodes during the night, and the number of wake episodes). Daytime variables, such as sleep time and the number of sleep events, were also calculated between 8 a.m. and 6 p.m. Rest-activity pattern parameters were also calculated from actigraphic data and included: interdaily stability (consistency between the days, indicating the strength of the rhythm, range 0 - 1, higher values indicate a more stable rhythm), intradaily variability (frequency and extent of transitions between rest and activity, range 0 - 2, higher values indicate a more fragmented rhythm), L5 (the sequence of the five least active hours in a 24-hour period, average activity profile, indicating trough or nadir of the rhythm), M10 (the sequence of the 10 most active hours, indicating peak of the rhythm), amplitude (the difference between M10 and L5 in an average 24-hour period), and relative amplitude (the normalized difference between M10 and L5 in an average 24-hour pattern, range 0 - 1, higher values indicate a stronger rhythm; Dowling et al., 2007; Van Someren et al., 1999).

Other Measures

Medical records were reviewed to assess each participant's demographic characteristics, health state, and type and duration of dementia. The MMSE-K, the version translated by Kwon and Park (1989), was used to estimate cognitive status based on the original version (Folstein, Folstein, & McHugh, 1975). It consists of 12 questions that test six areas of cognitive function: orientation, registration, attention, recall, language, and understanding and judgement. Scores range from 0 to 30; scores below 24 indicate cognitive impairment. The coefficient alpha was 0.82 in a study of Koreans with dementia (H. K. Kim & Lee, 2000). The Problematic Behavior Scale, developed by Kim (2003), was used to assess the frequency of behavior problems. It consists of 25 items that assess aggressive psychomotor behaviors, nonaggressive psychomotor behaviors, and irritated behaviors. The total score ranges from 0 to 75, higher scores indicating more problematic behaviors. High reliability (Spearman's rho = 0.84) and validity (correlation coefficient *r* = 0.83 with the Korean version of the Neuropsychiatric Inventory [K-NPI]) have been reported (Jeong, 2004; K. A. Kim, 2003). The light level in each setting was measured at the resident's eye level using a calibrated precision light meter (cal-LIGHT 400™, Cooke Corporation, Romulus, MI, USA).

Study Procedure

The study was approved by the institutional review boards of the University of California, San Francisco and the two Korean institutions. The study settings were conveniently selected. The nursing director at each setting first determined prospective participants (*N* = 12) who met the eligibility criteria and whose authorized surrogates were considered to be potentially interested in having their relatives involved in the study. The directors explained the study when the surrogates visited their relatives. The surrogates were informed of possible benefits and side effects or risks and the right of each participant to withdraw from the study at anytime. The surrogates were then given time to think about their relatives' participation in the study. Written informed consent was obtained from twelve surrogates on the same or the following visit.

Data were collected in April and May, 2007. Each participant wore an Actiwatch on the dominant wrist for seven, consecutive, 24-hour periods; a nylon locking cable was affixed through the watchband to deter the participant's ability to remove the monitor (Dowling et al., 2005b). Medical records were reviewed on the first day of data collection to assess each participant's demographics and health state. These factors included age, comorbidities, gender, type and duration of dementia, medication use, and length-of-stay at the institution. The MMSE-K data were obtained by resident interview on the first day of the study. The Problematic Behavior Scale, a simple to use questionnaire which includes easy-to-follow guidelines, was completed by nurses or assistants on the last day of data collection. Light level measures were taken in the morning (at 9:30 a.m.) and afternoon (at 3:30 p.m.) every day from baseline through the end of the study.

Data Analysis

Data were analyzed using the Statistical Package for the Social Sciences (SPSS) 15.0. Descriptive statistics were calculated for all variables. Mann-Whitney *U* tests were performed to compare group (i.e., two settings) differences on sleep-wake and rest-activity rhythm variables. Spearman's *rho* was used to test the relationships between sleep-wake variables and rest-activity rhythm parameters and other personal, behavioral, and environmental factors (i.e., age, cognitive function, problematic behaviors, and light exposure). Statistical analysis was performed using $\alpha = .05$ significance level.

Results

Adherence to Actigraphy

Two participants were withdrawn from the study. The first removed the activity monitor before any recordable data had been collected. The second developed a mild skin rash on the third day, but the partial data obtained from the first two days were sufficient to include in the sleep and wake variable analyses (*N* = 11) but not the rest-activity rhythm analyses (*N* = 10). Participants had an average of 137 hours of valid data (SD = 30, range 96-168).

Participant Characteristics

The mean age of the 11 participants included in the data analysis was 85.6 ± 7.2 years (range 70 to 95). Four participants were diagnosed with Alzheimer's disease, one had vascular dementia, and six had no specific type of dementia diagnosis. The duration of institutionalization varied from 5 months to 10 years. Most of the participants had comorbid conditions, including high blood pressure, diabetes, and arthritis. Six participants were taking medications for their comorbidities, and three were taking supplements that included vitamins and calcium. The average MMSE-K score was 13.1 ± 4.0 (range 5 to 21). The scores for the Problematic Behaviors Scale were low, averaging 6.9 ± 6.3 (range 1 to 21). The average light level during the afternoon was moderate at 2,038 ± 288 lux in the common areas (2,378 ± 41 lux at Institution A, 1,832 ± 51 lux at Institution B) and low at 591 ± 498 lux in the bedrooms (1,048 ± 601 lux at Institution A, 330 ± 121 lux at Institution B).

Sleep Time and Wake Time

At night, the average, total, sleep time was 7.6 ± 0.7 hours, and the ratio of total sleep time to time in bed was 0.76 ± 0.07, illustrating low sleep continuity. The average total wake time was 72.2 ± 28.9 minutes, ranging widely from 12.0 to 106.4 minutes. The average duration of wake episodes was 3.4 ± 1.4 minutes, and the number of wake episodes averaged 22 ± 9. During the daytime, napping behavior was considerable, with a mean of 4.3 ± 2.4 hours of sleep during the day between 8 a.m. and 6 p.m.

The oldest person, aged 95, had the longest sleep (9.1 hours), the least wake time (12 minutes) during the night, and the longest sleep (9.7 hours) during the day. No significant differences in sleep parameters between the environmental setting, cognitive function, or other variables were detected.

Rest-Activity Rhythm

Mean interdaily stability was moderate at 0.47 ± 0.14, and mean intradaily variability was slightly high at 1.36 ± 0.27. Mean onset of 5 least-active hours in the 24-hour average activity profile occurred at 10:09 p.m., indicating phase delay. A significant difference in rest-activity rhythms was found between the two institutions (see Table 1). Residents at Institution A had lower interdaily stability (0.35 ± 0.12) than the residents at Institution B (0.56 ± 0.08). Mean activity during L5 was significantly higher in residents at Institution A (25.09 ± 11.99; median: 19.38) compared to those at Institution B (13.63 ± 5.01; median 15.38). Relative amplitude was significantly lower in Institution A (0.77 ± 0.07), indicating stronger rhythms in residents in Institution B (0.89 ± 0.07). The figure illustrates median rest-activity patterns for residents in both institutions.

Discussion

This pilot study supports the hypothesis that institutionalized older Korean adults with dementia have sleep disturbances that include multiple awakenings at night and significant napping during the day. These findings are consistent with studies of other ethnic and racial groups (Bonanni et al., 2005; Fetveit & Bjorvatn, 2006) and suggest that the sleep characteristics of institutionalized Korean adults with dementia do not differ from non-Korean resident with similar characteristics in the United States or other Western countries.

Rest-activity rhythm in the participants was fragmented and phase-delayed. These characteristics of disrupted rhythms are also consistent with other studies of older adults with dementia (Fetveit & Bjorvatn, 2006; Harper et al., 2005; Motohashi, Maeda, Wakamatsu, Higuchi, & Yuasa, 2000).

Our study also examined the relationships between rest-activity characteristics and other variables, including age, comorbidities, medication use, cognitive function, problematic behaviors, and light level. Significant relationships were only found by type of institution. The residents at Institution B, the not-for-profit nursing home, had stronger and more stable rest-activity rhythms than those at Institution A, the for-profit assisted living facility. These findings imply that rest-activity rhythms may be influenced by the environmental setting. Scheduled activity programs and fixed meal times were provided at Institution B, whereas residents at Institution A did not have any structured routines, except for meal times, and were encouraged to spend their time privately. Although this study did not investigate institutional environment factors in depth, the significant difference in rest-activity rhythms by type of institution may be related to the staff-resident ratio, the types of activities offered, or the imposition of structure around activities of daily living.

This is the first study to use actigraphy to objectively measure sleep in older Korean adults with dementia. A few studies have measured sleep in older adults with dementia in Korea using subjective measurements. For example, using self-reported sleep questionnaires, Kim and colleagues (1998) found that older adults reported their nocturnal sleep time to be significantly less and sleep onset tended to be phase-delayed after they were admitted to the hospital than before admission. Although other studies (K. Kim, 2000a, 2000b) have investigated sleep characteristics and influencing factors in nursing homes and the community, these studies did not compare sleep in different settings.

Many studies have examined patients in nursing homes, but only a few sleep studies have compared different types of institutions. Kuhn and colleagues (2005) investigated daytime sleep among 166 persons with dementia in three different settings: three nursing homes, two assisted living facilities, and three adult day centers. Sleep characteristics were assessed by sleep observations made between 9 a.m. to 3 p.m. on a weekday. Daytime sleep was observed more frequently in residential care settings than in adult day care centers. Moreover, residents who participated in staff-led activities (e.g., exercises, games, dancing) had less daytime sleep than those who did not participate in the activities (Kuhn et al., 2005).

The clinical significance of how rest-activity rhythm differs by type of institution has not been systematically studied. However, environmental setting may affect residents' quality of life, daily functioning, or other health outcomes related to rest-activity rhythms. This pilot study elucidates the association between the institutional environment and the rest-activity rhythm in residents of different types of facilities. A facility that provides structured programs could benefit its residents' health and their circadian rhythms. Femia and colleagues (2007) reported that programs offered at adult day care centers can decrease the nighttime sleep problems experienced by patients with dementia (Femia, Zarit, Stephens, & Greene, 2007). More studies are needed to determine if differences in rest-activity rhythms between care settings are due to lifestyle, staffing pattern, or other factors. Investigating the effects of sleep and circadian rhythms on other health outcomes (i.e., depression) by type of environmental setting is also necessary.

Limitations

This study has several limitations. All participants were women. The generalizability of the findings is limited by the small sample size and the lack of a comparison group of healthy older adults living independently. Further research with a larger sample size should be conducted at various facilities, such as nursing homes, assisted living facilities, and hospitals, and include a control group of older adults living in community settings. Since these facilities do not require a detailed medical record of the patients, data on dementia-specific diagnoses were not available. More frequent light level measurements over the 24-hour period would have been useful to determine relationships between light exposure and sleep. Other important variables, such as depression and sleep accommodations (e.g., bed or futon), should also be investigated.

This study defined daytime and nighttime as the rise and bed times enforced by the institutions. This was done because staff were not always present to note the actual time for each study participant, and institutions usually schedule bed time at a fixed hour. However, using a fixed rise and bed time may have underestimated sleep efficiency (amount of total sleep time/ time in bed) because of a prolonged time in bed (Dowling et al., 2005b).

Implications for Nursing

The importance of sleep and related rhythms in maintaining and improving health in older adults is often undersestimated, particularly in people with dementia and those who reside in institutions. Despite this study's limitations, the results suggest ways to enhance the care of older persons with dementia who have sleep-wake rhythm problems. First, improving nighttime sleep, time awake during the day, and rest-activity rhythm should be part of nursing care plans. Second, nurses in various types of institutions should be knowledgeable about and able to assess sleep-wake rhythms in older adults with dementia. In an ideal world, using sleep diaries or actigraphy for at least one week could help the nurses to evaluate the residents' sleep patterns, including wake-up time and sleep onset and its rhythmicity.

This study also suggests that geriatric nurses who care for older adults with dementia in institutional settings should consider how environmental factors influence their sleep and circadian rhythms. These factors may include activity, social interaction, daytime routines, or lifestyle. Because this study's findings are based on a small sample, geriatric nurse researchers could replicate studies that examine sleep and rest-activity rhythms in various settings. Collaborative research could recruit larger samples and increase the applicability of findings to nursing practice and health care.

Conclusion

This study's results suggest possible effects of environmental factors on rest-activity rhythm in institutionalized older people with dementia. Where institutions provide structured routines, residents had more stable and stronger rest-activity rhythms than those at less structured institutions. More research with larger samples is needed to determine which factors contribute to sleep and rhythm problems in older adults with dementia, particularly in institutional settings, such as nursing homes and assisted living facilities. The findings of subsequent research in this area will facilitate interventions for sleep problems in institutionalized older adults with dementia.

References

Alessi, C. A., & Schnelle, J. F. (2000). Approach to sleep disorders in the nursing home setting. REVIEW ARTICLE. *Sleep Medicine Review, 4*(1), 45-56.

American Psychiatric Association. (1994). *Diagnostic and Statistical Manual of Mental Disorders - IV* (4th ed.). Washington D.C.: The American Psychiatric Association.

Ancoli-Israel, S., Clopton, P., Klauber, M. R., Fell, R., & Mason, W. (1997a). Use of wrist activity for monitoring sleep/wake in demented nursing-home patients. *Sleep, 20*(1), 24-27.

Ancoli-Israel, S., Cole, R., Alessi, C., Chambers, M., Moorcroft, W., & Pollak, C. P. (2003). The role of actigraphy in the study of sleep and circadian rhythms. *Sleep, 26*(3), 342-392.

Ancoli-Israel, S., & Cooke, J. R. (2005). Prevalence and comorbidity of insomnia and effect on functioning in elderly populations. *Journal of the American Geriatrics Society, 53*(7 Suppl), S264-271.

Ancoli-Israel, S., Klauber, M. R., Jones, D. W., Kripke, D. F., Martin, J., Mason, W., et al. (1997b). Variations in circadian rhythms of activity, sleep, and light exposure related to dementia in nursing-home patients. *Sleep, 20*(1), 18-23.

Ancoli-Israel, S., Martin, J. L., Kripke, D. F., Marler, M., & Klauber, M. R. (2002). Effect of light treatment on sleep and circadian rhythms in demented nursing home patients. *Journal of the American Geriatrics Society, 50*(2), 282-289.

Ayalon, L., Liu, L., & Ancoli-Israel, S. (2004). Diagnosing and treating sleep disorders in the older adult. *Medical Clinics of North America, 88*(3), 737-750, ix-x.

Bonanni, E., Maestri, M., Tognoni, G., Fabbrini, M., Nucciarone, B., Manca, M. L., et al. (2005). Daytime sleepiness in mild and moderate Alzheimer's disease and its relationship with cognitive impairment. *Journal of Sleep Research, 14*(3), 311-317.

Carpenter, B. D., Strauss, M. E., & Patterson, M. B. (1995). Sleep disturbances in community-dwelling patients with Alzheimer's disease. *Clinical Gerontologist, 16*(2), 35-49.

Craig, D., Hart, D. J., & Passmore, A. P. (2006). Genetically increased risk of sleep disruption in Alzheimer's disease. *Sleep, 29*(8), 1003-1007.

Czeisler, C. A., & Gooley, J. J. (2007). Sleep and circadian rhythms in humans. *Cold Spring Harbor Symposia on Quantitative Biology*, 72, 579-597.

Dowling, G. A., Burr, R. L., Van Someren, E. J., Hubbard, E. M., Luxenberg, J. S., Mastick, J., et al. (2007). Melatonin and Bright-Light Treatment for Rest-Activity Disruption in Institutionalized Patients with Alzheimer's Disease. *Journal of the American Geriatrics Society*.

Dowling, G. A., Hubbard, E. M., Mastick, J., Luxenberg, J. S., Burr, R. L., & Van Someren, E. J. (2005a). Effect of morning bright light treatment for rest-activity disruption in institutionalized patients with severe Alzheimer's disease. *International Psychogeriatrics, 17*(2), 221-236.

Dowling, G. A., Mastick, J., Hubbard, E. M., Luxenberg, J. S., & Burr, R. L. (2005b). Effect of timed bright light treatment for rest-activity disruption in institutionalized patients with Alzheimer's disease. *International Journal of Geriatric Psychiatry, 20*(8), 738-743.

Femia, E. E., Zarit, S. H., Stephens, M. A., & Greene, R. (2007). Impact of adult day services on behavioral and psychological symptoms of dementia. *Gerontologist, 47*(6), 775-788.

Fetveit, A., & Bjorvatn, B. (2002). Sleep disturbances among nursing home residents. *International Journal of Geriatric Psychiatry, 17*(7), 604-609.

Fetveit, A., & Bjorvatn, B. (2006). Sleep duration during the 24-hour day is associated with the severity of dementia in nursing home patients. *International Journal of Geriatric Psychiatry, 21*(10), 945-950.

Folstein, M. F., Folstein, S. E., & McHugh, P. R. (1975). "Mini-mental state". A practical method for grading the cognitive state of patients for the clinician. *Journal of Psychiatric Research, 12*(3), 189-198.

Fontana Gasio, P., Krauchi, K., Cajochen, C., Someren, E., Amrhein, I., Pache, M., et al. (2003). Dawn-dusk simulation light therapy of disturbed circadian rest-activity cycles in demented elderly. *Experimental Gerontology, 38*(1-2), 207-216.

Gehrman, P., Marler, M., Martin, J. L., Shochat, T., Corey-Bloom, J., & Ancoli-Israel, S. (2004). The timing of activity rhythms in patients with dementia is related to survival. *Journals of Gerontology. Series A, Biological Sciences and Medical Sciences, 59*(10), 1050-1055.

Gehrman, P., Martin, J. L., Shochat, T., Nolan, S., Corey-Bloom, J., & Ancoli-Israel, S. (2003). Sleep-disordered breathing and agitation in institutionalized adults with Alzheimer disease. *American Journal of Geriatric Psychiatry, 11*(4), 426-433.

Harper, D. G., Volicer, L., Stopa, E. G., McKee, A. C., Nitta, M., & Satlin, A. (2005). Disturbance of endogenous circadian rhythm in aging and Alzheimer disease. *American Journal of Geriatric Psychiatry, 13*(5), 359-368.

Hayutin, A. M. (2007). *How population aging differs across countries: A Briefing on Global Demographics*: Standford Center on Longevity.

Jacobs, D., Ancoli-Israel, S., Parker, L., & Kripke, D. F. (1989). Twenty-four-hour sleep-wake patterns in a nursing home population. *Psychology and Aging, 4*(3), 352-356.

Jeong, J. S. (2004). *The Effects of a Folk Play Program on Cognition, ADL, and Problematic Behavior for the Elderly with Dementia.* Pusan National University, Pusan, Korea.

Kim, H. K., & Lee, O. R. (2000). A study on the effects of cognition, behavior and affection of the music therapy for dementia senile people. *Journal of Korean Academy of Adult Nursing, 12*(3), 463-476.

Kim, K. (2000a). A study on quality of sleep and sleep disturbing factors among community dwelling elderly. *Korean Elderly Welfare Research, 7*(1), 173-192.

Kim, K. (2000b). A study on sleep patterns, sleep disturbing factors and quality of sleep in the institutionalized elderly. *Korean Elderly Welfare Research, 10*(1), 247-270.

Kim, K. A. (2003). *Deveopment of an assessment tool of problematic behaviors for institutionalized old people with dementia.* Seoul National University, Seoul, Korea.

Kim, M., Cho, S., Lee, S., Jeong, S., & Park, K. (1998). Sleep pattern and related factors of before and after hospitalized elderly. *Nursing Science, Ehwa Women's Univ., Korea, 10*(1), 1-17.

Kryger, M., Monjan, A., Bliwise, D., & Ancoli-Israel, S. (2004). Sleep, health, and aging. Bridging the gap between science and clinical practice. *Geriatrics, 59*(1), 24-26, 29-30.

Kuhn, D., Edelman, P., & Fulton, B. (2005). Daytime sleep and the threat to well-being of persons with dementia. *Dementia (Sage Publications, Ltd.), 4*(2), 233-247.

Kwon, Y. C., & Park, J. H. (1989). Korean version of mini-mental state examination: Part 1 Development of the test for the elderly. *Journal of Korean Neuropsychiatric Association, 28*(1), 125-135.

Lichstein, K. L., Stone, K. C., Donaldson, J., Nau, S. D., Soeffing, J. P., Murray, D., et al. (2006). Actigraphy validation with insomnia. *Sleep, 29*(2), 232-239.

Littner, M., Kushida, C. A., Anderson, W. M., Bailey, D., Berry, R. B., Davila, D. G., et al. (2003). Practice parameters for the role of actigraphy in the study of sleep and circadian rhythms: an update for 2002. *Sleep, 26*(3), 337-341.

Lopez, O. L., Becker, J. T., Sweet, R. A., Klunk, W., Kaufer, D. I., Saxton, J., et al. (2003). Psychiatric symptoms vary with the severity of dementia in probable Alzheimer's disease. *Journal of Neuropsychiatry and Clinical Neurosciences, 15*(3), 346-353.

Ministry for Health Welfare and Family Affairs. (2008). *State of Korean Elderly Welfare Facilities*.

Motohashi, Y., Maeda, A., Wakamatsu, H., Higuchi, S., & Yuasa, T. (2000). Circadian rhythm abnormalities of wrist activity of institutionalized dependent elderly persons with dementia. *Journals of Gerontology. Series A, Biological Sciences and Medical Sciences, 55*(12), M740-743.

Pat-Horenczyk, R., Klauber, M. R., Shochat, T., & Ancoli-Israel, S. (1998). Hourly profiles of sleep and wakefulness in severely versus mild-moderately demented nursing home patients. *Aging, 10*(4), 308-315.

Redline, S., Kirchner, H. L., Quan, S. F., Gottlieb, D. J., Kapur, V., & Newman, A. (2004). The effects of age, sex, ethnicity, and sleep-disordered breathing on sleep architecture. *Archives of Internal Medicine, 164*(4), 406-418.

Shochat, T., Martin, J., Marler, M., & Ancoli-Israel, S. (2000). Illumination levels in nursing home patients: effects on sleep and activity rhythms. *Journal of Sleep Research, 9*(4), 373-379.

Van Someren, E. J., Swaab, D. F., Colenda, C. C., Cohen, W., McCall, W. V., & Rosenquist, P. B. (1999). Bright light therapy: improved sensitivity to its effects on rest-activity rhythms in Alzheimer patients by application of nonparametric methods. *Chronobiology International, 16*(4), 505-518.

Vitiello, M. V., & Borson, S. (2001). Sleep disturbances in patients with Alzheimer's disease: Epidemiology, pathophysiology and treatment. *CNS Drugs, 15*(10), 777-796.

Table 1. *Mean (Median) rest-activity rhythm by type of institution (N = 10)*

Variable	Total	Type of Setting	
		Institution A	Institution B
Interdaily stability	0.47 ± 0.14 (0.49)	0.35 ± 0.12 * (0.37)	0.56 ± 0.08 * (0.53)
Intradaily variability	1.36 ± 0.27 (1.34)	1.22 ± 0.12 (1.24)	1.46 ± 0.30 (1.46)
Activity during 5 least-active (L5) hours	18.21 ± 9.84 (17.09)	25.09 ± 11.99 * (19.38)	13.63 ± 5.01 * (15.38)
Onset of L5 (hh:mm:ss)	22:09:12 ± 1:45:56 (21:58:00)	22:23:15 ± 1:41:39 (22:30:30)	21:59:50 ± 1:57:12 (21:29:30)
Activity during 10 most-active (M10) hours	261.67 ± 147.40 (218.19)	200.04 ± 62.58 (214.70)	302.76 ± 178.04 (221.45)
Onset of M10 (hh:mm:ss)	9:29:30 ± 1:13:41 (9:51:00)	8:53:00 ± 1:51:23 (9:46:30)	9:53:50 ± 0:23:30 (10:02:00)
Amplitude	243.45 ± 147.99 (201.09)	174.95 ± 56.05 (195.30)	289.12 ± 176.86 (211.48)
Relative amplitude	0.84 ± 0.09 (0.85)	0.77 ± 0.07 * (0.77)	0.89 ± 0.07 * (0.90)

Data are given as mean ± SD (median)

* $p < 0.05$, Mann-Whitney U test was used.

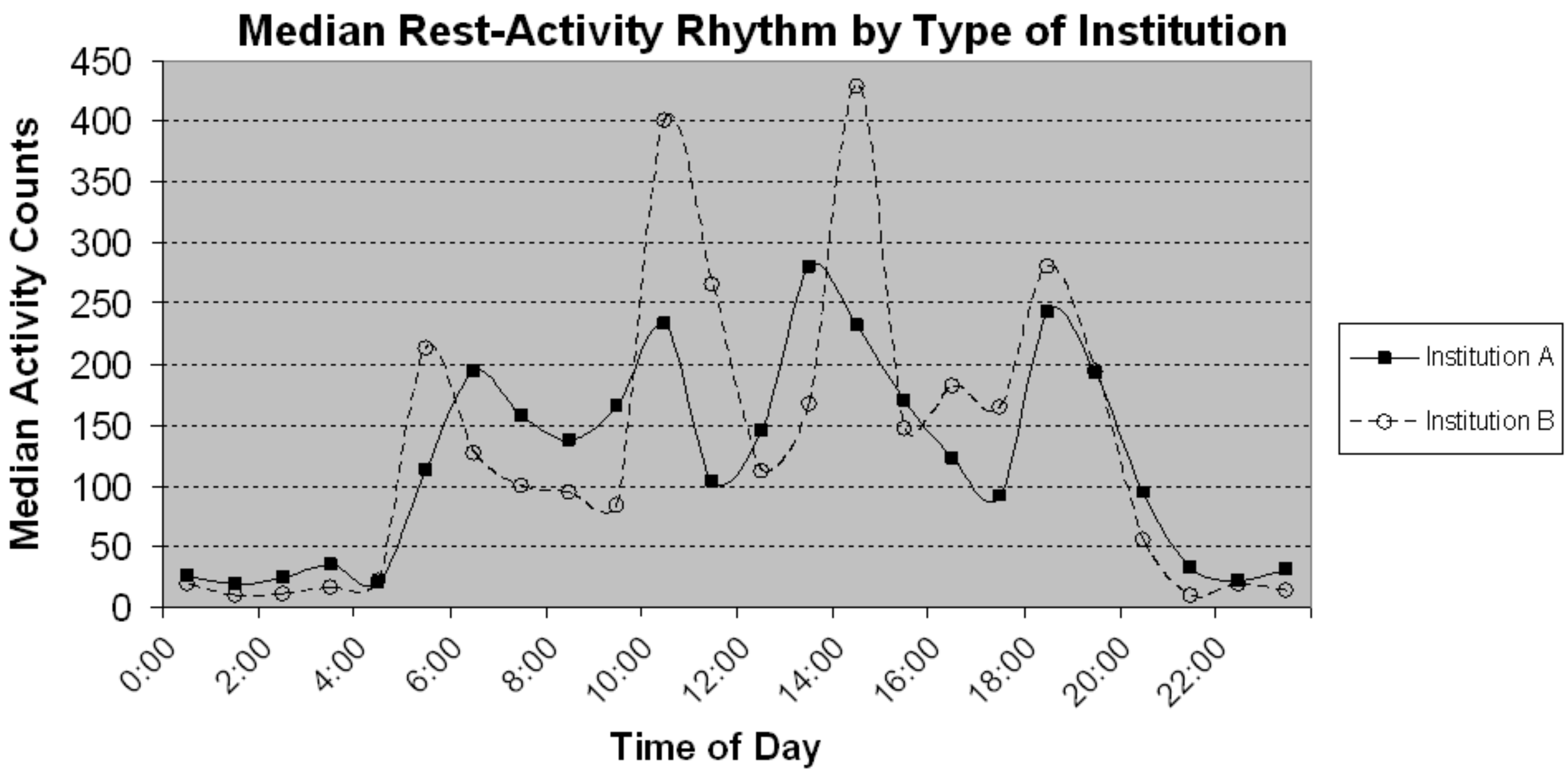


Figure. Median rest-activity rhythm by type of institution ($n = 4$ for Institution A, $n = 6$ for Institution B).

Chapter 5

Conclusion

Summary

Current research reveals a high prevalence of sleep problems in older adults with dementia and their negative effects on health and caregivers' lives. However, most of these findings are based on data from the United States and other Western countries. Moreover, although environmental factors are known to affect sleep, insufficient empirical data exist to explain the relationships between institutional environment and sleep in older persons with dementia. The impetus for this research study arose from the need to understand sleep problems and their correlates in older persons with dementia in Korea, which has one of the fastest growing older populations in the world.

Three publishable papers are presented in this dissertation: a review of literature and two data-based papers. The research involved 12 older Korean women with dementia in two Korean institutions (a nursing home and an assisted living facility). This chapter summarizes the key findings of the three papers and applies those findings to the conceptual framework of impaired sleep in older adults with dementia. Finally, recommendations for future research are suggested.

The first paper (Chapter 2) describes a systematic review of the literature on sleep in older adults with dementia. A high prevalence of sleep disturbance in persons with dementia, up to 40%, is noted. These individuals suffer from sleep disturbances including poor sleep quality, multiple awakenings, and disrupted sleep-wake rhythms. Although multiple factors involving personal characteristics and the living environment are known to affect sleep, nurses can play an important role in preventing and treating sleep problems in older adults with dementia. For example, nurses can assess sleep patterns and identify causal factors. Appropriate interventions such as light therapy, melatonin therapy, sleep hygiene, and physical activity can then be applied. Nurses can initiate such interventions by setting goals, designing the implementation process, monitoring safety, and evaluating effectiveness. Providing caregivers with emotional support and strategies (e.g., sleep hygiene) for a good night's sleep for individuals with dementia is also an important nursing role. Because dosing for light and melatonin therapies has not been identified, more research is necessary. Multidisciplinary work may also facilitate successful sleep management.

The second paper (Chapter 3) describes sleep problems and identifies their possible risk factors in four cases (two at each institution). All cases showed multiple awakenings at night and daytime sleepiness. Disturbed rest-activity rhythm patterns were found in two cases at the same institution. Assessment of age, gender, type of dementia, duration of institutionalization, comorbidities, and medication use were explained in each case. Environmental factors are considered modifiable and can easily be adjusted to treat sleep problems. Suggested environmental factors were light exposure, bed surface and bedroom environment, lifestyle, and staffing. This case study emphasizes the importance of assessing the environment of institutionalized persons with dementia before interventions are applied. It can serve as a practical guideline to assess sleep problems and their causal factors.

The third paper (Chapter 4) investigates sleep characteristics and explores factors related to sleep in institutionalized older Korean adults with dementia. The study confirms that older Korean adults with dementia experienced sleep disturbances. Although multiple awakenings during nighttime and considerable napping were observed in all participants with dementia, significant differences in rest-activity rhythms were noticed between the two institutions. Residents in the nursing home that offered a structured routine showed stronger and more stable rhythms over 7 days than those in the assisted living facility that did not provide structured activities. The findings suggest that an institution's environment may affect residents' sleep. For example, the staff-resident ratio, types of activities offered, or structured activities of daily living may play a key role and are amenable to nursing interventions. Because the relationship between specific environmental factors and sleep could not be established, further studies are needed to investigate this issue.

The relationship between institutional environment and sleep has been reported in only a few other studies (Bates-Jensen, Schnelle, Alessi, Al-Samarrai, & Levy-Storms, 2004; Kuhn, Edelman, & Fulton, 2005). A large sample (N = 882) of nursing home residents in a cross-sectional study examined the effect of staffing level on time-observed-in-bed in 34 Southern California nursing homes (Bates-Jensen et al., 2004). The strongest predictor of observations in bed was level of staffing. Residents in nursing homes with less staff were about 6 times more likely to have more than 50% observations in bed than residents residing in higher-staffed nursing homes. The level of staffing remained a predictor of observations-in-bed even after resident functional level was controlled. Moreover, less social engagement, lower food and fluid intake, and higher daytime sleep were observed in residents who spent more than 50% of their time in bed. Another study (Kuhn et al., 2005) also investigated daytime sleep in 166 persons with dementia in multiple settings. Participants in the residential care settings (nursing homes and assisted living facilities) slept more during the day than those in the adult day care center. Greater frequency of daytime sleep was related to less participation in staff-led activities. However, these studies focused only on daytime sleep, and sleep was measured subjectively for only a short period.

Application of Theory

The major finding of this research study, the potential effect of environmental factors on sleep in older adults with dementia, supports the conceptual model of impaired sleep in older adults with dementia. However, this model does not address the types of institution as a subconcept of social or physical environmental factors. Although our studies found a difference in rest-activity rhythm by type of institution (nursing home vs. assisted living facility), structured routines between the two institutions also differed. Thus, it is not clear if the sleep difference was simply due to the difference in type of institution or other factors that make sleep different. Studies of multiple settings, such as nursing homes, assisted living facilities, and daycare centers, are needed to support this model.

Other factors in this study's model were not significant correlates. The disturbed sleep characteristics of the participants were similar to the findings of other studies in the United States and other Western countries. For example, Fetveit and Bjorvatn (2006) conducted a cross-sectional study in Norway to investigate sleep characteristics in nursing home patients with dementia ($N = 23$). Sleep was assessed for 14 consecutive 24-hour periods using actigraphy. The residents experienced multiple awakenings at night (14 ± 6 times), low sleep efficiency (73 ± 14 %), and extended daytime sleepiness (3 hours 19 minutes ± 53 minutes). In a study of 166 older adults with dementia in eight institutions in the United States, Kuhn and colleagues (2005) reported that daytime sleep was never observed in only 37% of residents. Because this study did not compare Korean people with other racial groups, more studies are needed to test the relationship between race-ethnicity and sleep. Contrary to other studies, cognitive status, age, comorbidity, and problematic behaviors were not significant correlates of impaired sleep in this study. Our study had several limitations that made it difficult to test the relationship between problematic behaviors and sleep. The sample size was very small and the average problematic behavior score was very low, indicating a low occurrence of problematic behaviors. Moreover, wearing an actigraph is not feasible for persons prone to problematic behaviors. In this study, a female participant could not continue because her problematic behaviors (i.e., aggressiveness, agitation, wandering) interfered with wearing an actigraph. Larger sample sizes involving various levels of problematic behaviors are necessary to examine the relationship between behaviors and sleep in persons with dementia.

Directions for Future Research

Because this was a pilot study with a small sample size, the generalizability of its findings to older populations with dementia is limited. Continuous, cross-sectional studies at various points along the trajectory of dementia are necessary to determine which interventions work best at which stage of illness (Dowling, 1996). It is also necessary to include different types of dementia and control groups and healthy older people in multiple settings, including institutions and community settings. The variability of sleep and rest-activity rhythm between weekdays and weekends also merits further study, including the possible effects of staff-to-resident ratio on residents' sleep.

Complementary tools, such as sleep diaries and video recordings, should be used in future studies to overcome the limitation of using a fixed rising and bed time. Defining actual rising and bed time is difficult for sleep data analysis in persons with dementia because they cannot press the event marker (a feature of the actigraph that indicates rise and bed time). Contrary to the method of fixed time, other researchers have determined individual bed and rising time from sleep diaries (Fetveit & Bjorvatn, 2002, 2006). Dowling and colleagues (2005) suggested using a block of time (e.g., 12 a.m. to 4 a.m.) when all participants were likely to have been in bed and asleep.

More important, future studies with large sample sizes that measure more specific institutional environmental factors are needed to determine the relationships between causal factors and sleep disturbances in older persons with dementia. Including caregiver burden, stress, and health outcomes, such as sleep, is also important to develop interventions to promote their quality of life.

References

Bates-Jensen, B. M., Schnelle, J. F., Alessi, C. A., Al-Samarrai, N. R., & Levy-Storms, L. (2004). The effects of staffing on in-bed times of nursing home residents. *Journal of the American Geriatrics Society, 52*, 931-938.

Dowling, G. A. (1996). Behavioral intervention strategies for sleep-activity disruption. *International Psychogeriatrics, 8 Suppl 1*, 77-86.

Fetveit, A., & Bjorvatn, B. (2002). Sleep disturbances among nursing home residents. *International Journal of Geriatric Psychiatry, 17*, 604-609.

Fetveit, A., & Bjorvatn, B. (2006). Sleep duration during the 24-hour day is associated with the severity of dementia in nursing home patients. *International Journal of Geriatric Psychiatry, 21*, 945-950.

Kuhn, D., Edelman, P., & Fulton, B. (2005). Daytime sleep and the threat to well-being of persons with dementia. *Dementia (Sage Publications, Ltd.), 4*, 233-247.

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