Chapter 15
The Sleep–Wake System and Alzheimer’s Disease

Denise Sharon
Advanced Sleep Center, Tulane University, USA

ABSTRACT
The goal of this chapter is to raise awareness about the sleep-wake changes experienced by persons with Alzheimer’s disease (AD) through a comprehensive review of the literature. The sleep-wake cycle is vital to our existence. Normal sleep is essential for restoration of the body and the brain. Sleep and wake states follow a circadian rhythm that regulates the body’s internal processes. Sleep plays an important role in learning and memory consolidation, affecting wake-time cognitive functioning. The sleep-wake system is subject to aging and affected by a variety of disorders, including AD. The effect of AD on the sleep-wake cycle is magnified by comorbidities and situational factors. Disturbances of the sleep-wake cycle in AD are associated with increased caregiver burden and institutionalization and can significantly impact the affected individual’s quality of life and subjective experience. Behavioral interventions designed to stabilize the sleep-wake cycle can be easily implemented.

INTRODUCTION
Sleep is a reversible behavioral state of perceptual disengagement from and unresponsiveness to the environment. Wakefulness, in turn, is a reversible behavioral state of perceptual engagement and responsiveness to the environment. Approximately a third of our life is occupied by sleep. Sleep and wake are affected by genetics, age, volition, the environment, and a variety of disorders (Carskadon, & Dement, 2011). Among persons with Alzheimer’s disease (AD) sleep and wake disturbances are a leading cause for disability and one of the most common contributors to institutionalization and caregiver burnout and (Gallagher-Thompson, Brooks, Bliwise, Leader, & Yesavage, 1992). Still, the research on the relationship of AD and the sleep-wake cycle is in its infancy.

This chapter will provide a broad review of sleep with a special focus on how sleep patterns and quality change in AD. Understanding these changes is particularly important as the sleep disturbances that occur in AD can significantly impact the experience of living with dementia for both the affected
individual and the caregiver. Of particular interest is the impact on the affected individual, for whom sleep disturbances may, as will be reviewed here, result in cognitive decline, daytime napping and sleepiness, apathy, challenging behavioral symptoms (e.g., wandering and agitation), and dream-like hallucinations.

To increase understanding of sleep-wake changes in AD and how they may affect the person’s subjective experience, this chapter will review (a) normal sleep, (b) the impact of aging on the sleep/wake system, (c) abnormal sleep patterns in AD, (d) the commonality between brain sites involved in sleep and AD, (e) how AD pathology impacts the brain’s ability to control the sleep-wake cycle and the resulting effects on sleep, dreaming, and false memories, (f) triggering behaviors and factors in sleep disturbances as well as early signs and symptoms, (g) the effect of sleep disturbances on the patient’s wake-time awareness and behavior, and (h) how patient sleep-wake perceptions may change during the course of the disease. The possibility that in-between states such as drifting and daydreaming may explain frequent "napping” will also be explored.

Finally, sleep disorders frequently associated with the dementias that potentially worsen the clinical picture will be briefly described, along with selected treatment options and medications. A short discussion about the effects of sleep disturbances in home and facility settings will precede the conclusions.

METHODS

This chapter is based on a review of pertinent literature identified through a search of the PubMed and Scopus databases. Search terms included sleep and AD, sleep and dementia, AD or dementia and sleep apnea, AD or dementia and insomnia, AD or dementia and Willis Ekbom disease/restless legs syndrome, AD or dementia and sleep-related movement disorders, AD or dementia and REM behavior disorder, and AD or dementia and irregular sleep-wake rhythm disorder. Reports about sleep-wake changes from patients seen by the author at the Advanced Sleep Center in Metairie, Louisiana, and other settings were assessed for common experiences.

BACKGROUND

Normal Sleep and Its Functions

Normal human sleep can be simply defined as a reversible behavioral state of perceptual disengagement from and unresponsiveness to the environment. Sleep is a dynamic, active process during which characteristic physiologic and behavioral changes take place. Sleep onset is associated with a gradual decrease of muscle tone, slow and asynchronous eye movements, and low-voltage, mixed-frequency EEG (Agnew, & Web, 1972). Behavioral changes in wake-to-sleep transitions include automatic behavior patterns. For example, automatism occurs when an individual taking a tapping test continues tapping for several seconds after sleep-related physiologic changes occur (Carskadon, & Dement, 1979). Similarly, a drowsy driver automatically continues driving momentarily after the transition from wake to sleep begins. While sleep onset is generally associated with disengagement from the environment, specific stimuli may penetrate the sensory barrier. Such meaningful stimuli may include one’s name, one’s baby crying (Oswald, Taylor, & Treisman, 1960), or incorrect response contingent punishment (Williams, Morlock, & Morlock, 1966). When the latter researchers threatened participants during waking with punishment
Related Content

Cognitive Decline and the Changing Self in Relationship
Darby Morhardt and Marcia Spira (2015). *Psychosocial Studies of the Individual’s Changing Perspectives in Alzheimer’s Disease* (pp. 61-75).
www.igi-global.com/chapter/cognitive-decline-and-the-changing-self-in-relationship/136954?camid=4v1a

The Sleep-Wake System and Alzheimer’s Disease
www.igi-global.com/chapter/the-sleep-wake-system-and-alzheimers-disease/136969?camid=4v1a

Stable Self-Concepts and Flexible Coping Strategies of People with Dementia Attending Dementia Self-Help Groups in Germany: Results from the Qualitative Longitudinal SEIN Study

Steve’s Story: Living with Mild Cognitive Impairment
www.igi-global.com/chapter/steves-story/136953?camid=4v1a