Chapter 17
Sleep and Sleep Disorders in Old Age: Assessment and Non-Pharmacological Management

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ABSTRACT
Sleep complaints are prevalent among older adults. Sleep quality and quantity changes with advancing age. There are changes in sleep patterns that are normal with ageing but many changes are the sign of disordered sleep. Sleep can be divided into rapid eye movement (REM) sleep and non-rapid eye movement sleep (NREM). Each has unique characteristics that are differentiated by their waveforms on the electroencephalogram (EEG) and by other physiological signals; several physiological age-related changes are thought to produce alterations in circadian rhythms. While there are numerous psychological and social factors contributing to quality and quantity of sleep, specific sleep disorders more prevalent in old age are insomnia, sleep apnea, and rapid eye movement disorder. Non-pharmacological treatment is effective in management of sleep disorders. Cognitive behaviour therapy is most effective to tackle insomnia. Cognitive behavior therapy along with meditation is beneficial for other sleep disorders and a new technique is also emerging: mindfulness.

INTRODUCTION
Sleep is a process in which important physiological changes (i.e. shift in brain activity, slowing of basic bodily functions) are accompanied by major shifts in consciousness (Barron, 2001). The pattern of sleep progression is called sleep architecture. Markov and Goldman (2006) reported two types of sleep architecture, rapid eye movement (REM) sleep and non-rapid eye movement (NREM) sleep. NREM sleep is
characterized by a reduction in physiological activity. As sleep gets deeper, the brain waves measured by electroencephalogram (EEG) gets slower and have greater amplitude, breathing and heart rate slow down, and blood pressure drops. The NREM phase consists of four stages. When an individual is awake and alert, EEG contains many beta waves, relatively high frequency (14-30 cycles per second or Hz) low voltage activity. During the transitions between wakefulness and sleep, beta waves are replaced by low-voltage(amplitude) rhythmic alpha activity(8-13Hz). As the individual fall asleep and enter into stage 1 sleep, these alpha waves are replaced by low voltage mixed frequency (4-8Hz) theta waves. In stage 1, muscle activity is diminished from that of wakefulness, asynchronous eye movements are present for the first few minutes and the individual may be easily aroused as this is the most “shallow” of all aspects of sleep (Erwin et al, 1984). After spending about 10 minutes in stage 1, individual enters into stage 2 sleep, which is marked by sleep spindles and K complexes. Sleep spindles are short bursts of 12 to 14 Hz wave forms for the duration of 1.5 seconds occurring 2 to 5 times per minute. They reduce brain sensitivity to sensory input which helps to enter deeper stages of sleep. K complexes are sudden, sharp waveforms that occur once in a minute and it may help in remaining asleep. The arousal threshold is increased in stage 2 sleep, muscle tone declines and no eye movements are seen. After that sleep enter into slow wave stage 3 followed by stage 4 which is marked by EEG pattern consisting of synchronized high amplitude (>75µV) and slow (0.5-2 Hz) delta waves. EEG activity during stage 4 is characterized by a greater amount (>50%) of delta waves compared to stage 3 (20-50%). Slow wave sleep (SWS) is considered the deepest stage of sleep as it has a much higher arousal threshold, eye movements are not observed and muscle tone continues to decline.

After the ninety minutes of process in different stages of sleep, individual enters into REM sleep. During this phase electrical activity of brain changes rapidly, delta activity disappears and becomes nearly similar to the wakefulness state of brain activity which is characterized by low voltage high frequency alpha activity(8-14 Hz) waves. Along with the activated periods of REM sleep, rapid eye movements and muscle atonia are seen (Vaughn, 2008). Tonic (Persistent) REM sleep is continuous throughout this stage and is characterized by muscle atonia and desynchronized EEG. Intermittent phasic (Episodic) events of rapid eye movements and irregular respiration and heart rate are present during REM sleep (Hirshnowitz, 2004). REM sleep has also been termed paradoxical sleep. Pulse, respiration and blood pressure in humans are all high during REM sleep- much higher than during NREM sleep and often higher than during the awake state. There is near total paralysis of the skeletal (Postural) muscles so the body movement is absent during REM sleep. The most distinctive feature of REM sleep is dreaming.

(Graphical representation of EEG brains waves is shown in Figure 1. The periods of REM and NREM stages of sleep continues to alternate by one another throughout the night, the duration of which is vari-

<table>
<thead>
<tr>
<th>Table 1. Stages of sleep pattern in the EEG wave forms</th>
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<tr>
<td><strong>Wakefulness</strong></td>
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<td><strong>Stage 1</strong></td>
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<td><strong>REM sleep</strong></td>
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