Sleep and Chronic Disease in Older Adults: cause/effect and opportunities to intervene

Tim Juergens MD
UW School of Medicine and Public Health/Department of Veterans Affairs
Timothy.juergens@va.gov

Objectives

• 1. Changes in sleep with aging
• 2. Sleep and Chronic medical conditions
• 3. Common sleep conditions that are adversely impacting disease
• 4. The bi-directional relationship with sleep and chronic health conditions
• 5. Interventions

Scope of problem

• The importance of chronic disease and sleep is exacerbated by our rapidly aging population with increasing rates of chronic conditions.
• 70% of middle-aged adults and 90% of older adults have at least one chronic health condition.
The TRIUMVIRATE of HEALTH

Health

- SLEEP
- DIET/NUTRITION
- EXERCISE/ACTIVITY

CHANGES IN SLEEP WITH AGING

- Sleep is something that happens, when the right environment internally and externally has the right conditions. It is less successful to ‘force’ sleep. (similar to happiness analogy)
- Sleep is driven mainly by:
  • Homeostatic Drive
  • Circadian Rhythm
  • And some disorders may be related to high vigilance/arousal.

Normal Adult Sleep

<table>
<thead>
<tr>
<th>Sleep stage</th>
<th>Hours of sleep</th>
</tr>
</thead>
<tbody>
<tr>
<td>Awake</td>
<td>1 2 3 4 5 6 7 8</td>
</tr>
<tr>
<td>REM</td>
<td></td>
</tr>
<tr>
<td>Stage 1</td>
<td></td>
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<td>Stage 2</td>
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<td>Stage 3</td>
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<td>Stage 4</td>
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</tbody>
</table>
Changes in Sleep with Aging

- Total sleep time: Decrease
- Sleep efficiency: Decrease
- Awakenings/arousals: Increase *
- Sleep latency: Increase
- Slow wave sleep: Decrease *
- REM latency: Decrease
- Day napping: Increase
- Day sleepiness: Increase
Aging and Sleep

- As we age, many common sleep disorders become more common (circadian rhythm disorders, sleep disordered breathing, limb movement disorders).
- As we age, ‘secondary’ sleep disorders become more common, by the nature of greater odds of having more of those potentially contributing conditions (pain, urinary symptoms, heart/lung disease...).

Consequences of Disturbed Sleep as People Age

- Daytime sleepiness, low energy, fatigue
- Depressed mood
- Decreased quality of life
- Difficulty with attention, response time, memory problems
- Inappropriate use of OTC meds or prescription sleep aids
- Alcohol use at night
- Risk of nighttime falls
What about bad sleep causes the distress/problem to your physiology, beyond sleepiness?

- Insufficient time of sleep
- Insufficient quality of sleep
- Arousals
- Increased CO2 in blood
- Decreased Oxygen (continuous, and desaturation/resaturation)

So, any condition that may impact these may have adverse effects.

INSOMNIA/SLEEP DISRUPTION AND CHRONIC MEDICAL CONDITIONS

- Diabetes
- Depression
- Cardiovascular Disease
- Obesity
- Memory
- COPD (Chronic Obstructive Pulmonary Disorder)
- Congestive Heart Failure
- Irritable Bowel Syndrome
- Parkinson's Disease

DIABETES

- Insufficient sleep is linked to an increased risk for the development of Type 2 diabetes.
- Specifically, sleep duration and quality have emerged as predictors of levels of Hemoglobin A1c, an important marker of blood sugar control, representing average blood sugars over time.
- Recent research suggests that optimizing sleep duration and quality may be an important means of improving blood sugar control in persons with Type 2 diabetes.
DEPRESSION

• While sleep disturbance has long been held to be an important symptom of depression, recent research has indicated that depressive symptoms may decrease once sleep apnea has been effectively treated and sufficient sleep restored.
• The interrelatedness of sleep and depression suggests it is important that the sleep of people with depression be assessed and that symptoms of depression be monitored among persons with a sleep disorder.
• SLEEP findings (non specific): decreased slow wave sleep, decreased efficiency, some earlier REM sleep, AM awakenings

Adult Sleep

• Insomnia predicts depression (and other psychiatric disorders).
• Depression predicts insomnia.
• Sleep disturbance/fatigue are often symptoms that continue when other symptoms of depression improve.
Prevalence of comorbid psychiatric disorders in people with insomnia

Significantly more respondents with insomnia had one or more psychiatric disorders vs. those with no sleep complaints.

* p<.05 vs. no sleep complaint; + p<.001 vs. no sleep complaint

Most Common Symptom in Treated MDD is Sleep Disturbance

MDD indicates major depressive disorder.

CARDIOVASCULAR DISEASE

• Hypertension, stroke, coronary heart disease and irregular heartbeats (cardiac arrhythmias) have been found to be more common among those with disordered sleep than their peers without sleep abnormalities.

• People with atrial fibrillation are more likely to have OSA (sleep apnea). People without OSA treatment are likely to have it again after cardioversion, but CPAP (continuous positive airway pressure) helps.

• Sleep apnea and hardening of the arteries (atherosclerosis) appear to share some common physiological characteristics, further suggesting that sleep apnea may be an important predictor of cardiovascular disease.

Figure. Superimposed recordings of the electrooculogram (EOG), electroencephalogram (EEG), electromyogram (EMG), ECG (EKG), sympathetic nerve activity (SNA), respiration (RESP), and blood pressure (BP) during REM sleep in a patient with OSA. (From Somers et al. 1995).

Figure. Recordings of sympathetic nerve activity (SNA) during wakefulness in patients with OSA and matched control subjects showing high levels of SNA in patients with OSA. (From Somers et al. 1995).
OBESITY

• Laboratory research has found that short sleep duration results in metabolic changes that may be linked to obesity.
• Epidemiologic studies conducted in the community show an association between short sleep duration and excess body weight. This association has been reported in all age groups—but has been particularly pronounced in children. It is thought that sleep in childhood and adolescence is quite important for brain development and that insufficient sleep in youngsters may adversely affect the function of the hypothalamus, which regulates appetite and the expenditure of energy.
Memory consolidation is facilitated by sleep. (dendritic pruning)
- Specific types of sleep deprivation can impact memory and learning.
- Conditions that 'create' sleep deprivation can have similar impacts
- Conditions that create physiological and psychological stressors may as well.

COPD
CHF - Congestive Heart Failure
PAIN AND INSOMNIA

• One study showed that pain in 2 or more sites was independently associated with a 16-41% greater likelihood of having sleep difficulties.
• Persons with more severe pain had a more than 2 times likelihood of having trouble getting to sleep on 1 or more days per week than those with the lowest pain severity score.
• There was strong and consistent association between more severe and disseminated chronic pain and heterogeneous sleep complaints.
• Dysfunction of the hypothalamic pituitary adrenal axis has been found to be associated with increased risk of developing chronic widespread pain.
• Irritable bowel syndrome patients have high rates of insomnia.
• Severity and distribution of pain was strongly associated with sleep disturbances.
• Sleep deprivation makes the same painful stimulus feel more painful.
• Medications used for pain can often disrupt and fragment sleep and sleep breathing.

IRRITABLE BOWEL/PAIN

PARKINSONISM

• Sleep: nocturnal hallucinations, nightmares, agitated confusion
• Insomnia, and sometimes hypersomnia (medication related)
• REM sleep behavior disorder
• Some caused by drugs for treatment
• Some caused by neurodegenerative process
COMMON SLEEP CONDITIONS THAT ADVERSELY IMPACT OTHER CONDITIONS

Common Causes of Sleep Problems

- Primary sleep condition
- Medical condition
- Psychiatric condition/psychosocial stressors
- Medication/substance(s)
- Sleep hygiene/behaviors
Primary Sleep Condition

Sleep and Aging-Primary Sleep Conditions

- Insomnia
- Sleep Breathing Disorders
- Movement disorders (PLMS-periodic limb movements of sleep, RLS-restless leg syndrome), and RBD-REM sleep behavior disorder
- Circadian Rhythm Disorders

Insomnia

- Difficulty falling or staying asleep, or nonrestorative sleep, with daytime consequences

- This is a condition of hyperarousal.
SLEEP APNEA

- Sleep apnea and diabetes are well-tied, with sleep apnea impairing insulin sensitivity. Additionally often both have obesity as a part.
- Sleep apnea is an independent risk factor for stroke.
- Sleep apnea is tied with some hypertension.
- Sleep apnea and depression are linked, with improvement in mood for some with treatment of comorbid sleep apnea.
- CPAP treatment can improve glucose control in diabetes, particularly poorly-controlled diabetics, just as it can improve blood pressure control in some people with hypertension.

POLYSOMNOGRAPHY OF OSA- Obstructive Sleep Apnea
OSA - Insomnia
PERIODIC LIMB MOVEMENTS and RESTLESS LEG SYNDROME

• More common with age
• More common if neuropathic injury (such as from diabetes or chronic alcohol use).
• Many medications can worsen (most antidepressants).
• Medical conditions (renal problems-increased creatinine, low iron, low thyroid can all worsen)
CIRCADIAN RHYTHMS

Demonstration of a circadian rhythm by Jean Jacques d'Ortous de Mairan in 1729
Retinally mediated melatonin suppression in blind humans
Circadian Rhythms Following SCN lesion (suprachiasmatic nucleus)
Normal Sleep Pattern

Bidirectional Relationship

• People with chronic medical conditions often struggle to try to get sound sleep.
• Sleep problems can exacerbate or contribute to chronic conditions.

Bidirectional Relationship

• Alcohol use leads to sleep disruption.
• Sleep disruption is a reason some use alcohol.

• Pain can disrupt and fragment sleep. Chronic pain is commonly tied with sleep disruption.
• Sleep deprivation and fragmented sleep make the same stimulus feel more painful.

• Sleep deprivation impacts cravings for certain foods, and adversely impacts insulin resistance. Blood glucose changes and disrupt sleep.
• Increased urinary urgency and frequency can fragment sleep.
• Sleep apnea (specifically) or other fragmentation can increase times to urinate at night.
• Short sleep may contribute to obesity.
• Obesity increases risk of sleep disruptive disorders such as obstructive sleep apnea.
• Insomnia is predictive of people currently having and of not depressed people developing depression. Treatment of some conditions that disrupt sleep improve mood.
• Depression is predictive of people having insomnia and can contribute to sleep problems in many ways— from the depression, to the decreased social interactions that help circadian rhythm, to the decreased activities that increase sleep debt and depth of sleep, and decreased light exposure.

COPD- desaturations and coughing disrupt sleep. Disrupted sleep contributes to less stable breathing at night.
• PTSD symptoms of hypervigilance/hyperarousal can worsen sleep. Other conditions of hyperarousal (like sleep apnea with increased sympathetic tone) can worsen PTSD, with both benefiting from treatment.
  • Treatment focused on PTSD may decrease arousals, which can help with fewer sleep/wake transitions and stabilize breathing.
  • Treatment focused on sleep disordered breathing can decrease sympathetic tone from that disease that likely does not interact well with PTSD.
  • Treatment focused on insomnia may again be a stabilizing factor in this otherwise downward spiral of combinations.

Other Interventions
• Work to really strengthen to degree possible the circadian component of sleep at sleep time. This MAY involve changing expectation if physiologically the body is not able to produce the ‘desired’ sleep all night, up all day pattern.
  • Light exposure timing
  • Scheduled timing of social activities/interactions
  • Scheduled timing of meals in relation to sleep time
  • Temperature manipulation/melatonin
Other Interventions

- To degree possible, increase homeostatic drive to sleep at night (sleep deprivation component we each have each day).
- Timing and duration of daytime naps
- Physical activity
- Mental activity/stimulation/learning
  - Naps—pros/cons recommendations
    - Earlier/shorter
    - Can decrease evening behavioral outbursts
    - Takes off some of sleep debt drive to sleep at night

- Treatment rationale overall

  - Address sleep specifically or address underlying known contributor, or both? There is rationale to do both, as in many circumstances these feed on each other in a downward spiraling direction. Anything to slow or change the course of that may have benefit.

- Intervention on Sleep Conclusions in Chronic Disease

  1. ADDRESS BOTH THE CONDITION AND THE SLEEP.
  2. Address the common things that occur for people related to aging that may disrupt sleep. 10-15% here and there add up (pain, urinary, cough, gastroesophageal reflux...)
  3. Pay particular attention to circadian rhythm disturbances.
  4. Consistent behaviors/activities and environments help as far as cues to the brain and body. Our body evolved for more boring routine each day.
  5. Think of sleep as 24 hour a day issue, not only about what happens when the sun goes down.
QUESTIONS?