Insufficient Sleep: Implications for Metabolism and T2 Diabetes Management

By the end of this session, diabetes educators will....

- Demonstrate familiarity of the basic neurobiology of sleep and appreciate the impact that sleep biology has on overall metabolism
- Understand the basic human need for sleep and how it changes across the lifespan
- Appreciate how insufficient sleep (<7 hours per night) can impact overall health
- Gain appreciation of the role SLEEP plays in glucose metabolism and insulin resistance
- Recognize some basic interventions that can be shared with patients with T2 diabetes to enhance sleep hygiene and sleep quality

Disclosure to Participants

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Please refer to learning goals and objectives.
Learners must attend the full activity and complete the evaluation in order to claim continuing education credit/hours.

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Sleep, metabolism and blood glucose levels are intimately related....

Insufficient Sleep (≤ 6 hours)
- Decreased Grehlin = Enhanced Hunger
- Decreased Leptin = Still hungry even after a full meal
- Increased Cortisol = Increased insulin
- Decreased melatonin = Decreased sleep

Just Enough Sleep (≥ 7 hours)
- Increased Grehlin = Normal Appetite
- Increased Leptin = Satisfied after a meal, normal satiety
- Decreased Cortisol = Decreased insulin
- Increased melatonin = Increased sleep

Insufficient Sleep:
- Implications for Metabolism and T2 Diabetes Management

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So what is sleep?

- Sleep is a reversible, physiologic and recurring state of relative unconsciousness, suspended sensory activity and decreased ability to react to stimuli.
  - Voluntary muscle activity is diminished or even fully suppressed.
  - Sleep is considered a state of heightened anabolism accompanied by growth and rejuvenation of immunologic, hematologic and neurologic systems.
  - Contrary to previous beliefs, sleep is an active state which saves only a trivial amount of energy (~50 Kcal over 8 hours).

So what is sleep?

- Rather than a passive process dictated by the ABSENCE of wakefulness, sleep is now regarded as an actively regulated process:
  - Vigorous brain activity and vivid hallucinatory dreaming occurs ~90 minutes (20-25% of sleep) during Rapid Eye Movement (REM) sleep.
  - Almost as many neurons increase their firing rate as decrease their firing during sleep.
  - Roles for memory storage and long term potentiation of learned material have been theorized.

And why does sleep matter to you and your patients?

- Suboptimal sleep duration was positively associated with diabetes in blacks and whites, although diabetes prevalence was higher at any level of sleep in blacks.


And why does sleep matter to you and your patients?

The interaction of circadian and homeostatic effects feedback to orexin production to determine when we sleep.

Neurobiology of sleep lite

Neurotransmitters important to wakefulness:
- Acetylcholine
- Epinephrine
- Dopamine
- Norepinephrine (LC)
- Glutamate
- Serotonin (Raphe)
- Histamine (TMN)
- Orexin (LHA)

Neurotransmitters important to sleep:
- GABA (VLPO)
- Glycine

Orexin probably acts as the “sleep switch”

Flip-Flop Switch Model
- A balancing act between wakefulness and sleep
- The pressure to sleep increases the longer we are awake (mediated in part by adenosine accumulation).

Sleep occurs in cycles

How much sleep do we need?

SLEEP DURATION RECOMMENDATIONS
And the sleep need changes over the human lifespan

And too little (or too much) sleep is associated with poor health outcomes

Less than < 7 hours of sleep per night affects activities of daily living

Insufficient sleep is associated with impaired glucose tolerance

Insufficient sleep is associated with central obesity

Sleep duration is associated with metabolic syndrome and high lipids
Insufficient sleep is associated with changes in food desirability

Insufficient sleep is associated with increased food intake

Insufficient sleep is associated with decreased insulin sensitivity

Insufficient sleep and the connection to DM, obesity and CVD
Cognitive behavioral therapy (CBT) can improve sleep efficiency in patients with chronic disease.

Hypnotic use is associated with increased mortality. Hypnotic use is associated with increased mortality. Hypnotic use is associated with increased mortality. Hypnotic use is associated with increased mortality.

And as few as 18 doses of hypnotics per year can increase the risk of death....

Components of CBT?

- Sleep hygiene education
  - Specific behaviors will directly interfere with the ability to sleep
  - The behaviors can be changed with education
  - No sufficient as a ‘stand alone’ treatment
- Sleep restriction therapy
  - Increased propensity to sleep by increasing homeostatic sleep drive with partial sleep deprivation
  - Systematic reduction of time in bed to the amount of total sleep time from sleep log data
  - Increases time in bed by 15 minutes only when sleep efficiency exceeds 90% for 5 nights
Components of CBT?

- Stimulus control therapy
  - Assumes that there is a learned association between wakefulness and the bedroom
  - To break the cycle, the patient must not spend time wide awake in the bedroom
  - Go to bed only when sleepy
  - Do not use the bedroom for sleep-incompatible activities
  - Leave the bedroom if awake for more than 20 minutes
  - Return to bed only when sleepy
  - Do not napping during the day
  - Arise at the same time every morning

Components of CBT?

- Relaxation training
  - Progressive muscle relaxation
  - Guided Imagery
  - Biofeedback
  - Self-hypnosis

Components of CBT?

- Five domains of cognitive activity hypothesized to contribute to insomnia
  - Worry and rumination
  - Attentional bias and monitoring for sleep-related threat
  - Unhelpful beliefs about sleep
  - Misperception of sleep and daytime deficits
  - The use of safety behaviors that maintain unhelpful beliefs

Online options for CBT

- CBTforInsomnia.com
- CBT-i Coach
- SHUTi
- Sleepio
- SleepTutor
- Cobalt Therapeutics’ RESTORE
- http://www.sleepreviewmag.com/2014/12/online-options-insomnia-therapy/

Take home points

- Sleep matters.....to you as an educator and to your patients with T2 DM
- Too little (< 7 hours) or too much (> 9 hours) is associated with a host of negative health outcomes, especially in patients with chronic medical conditions such as DM
- Insufficient sleep has a profound effect on obesity, energy expenditure and caloric intake (especially carbohydrate intake)
- Behavioral interventions to address insufficient sleep can positively impact sleep duration and long term health outcomes

Questions?