

Sleep Problems and School Performance:  
Identification and Intervention

Chris Bedford, PhD, LP, ABSNP

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Introductions

- ▶ Chris Bedford, PhD, LP, ABSNP
- ▶ PhD in Psychology from University of Minnesota
- ▶ Post-Doctoral MS in Clinical Psychopharmacology from Fairleigh Dickinson
- ▶ Licensed psychologist with a private practice in St. Paul, Minnesota
- ▶ Associate Director at the School Neuropsychology Institute
- ▶ Executive Director of the American Board of School Neuropsychology
- ▶ Owner of a Sleep Number bed

▶ Disclaimer: I am not a sleep medicine doctor, but I've done a lot of research.

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Agenda

- ▶ Prevalence of Sleep Problems in Students—A Call to Action
- ▶ Neurobiology of Sleep
- ▶ Causes of Poor Sleep
- ▶ Consequences of Chronic Poor Sleep
- ▶ How to Assess Sleep Problems
- ▶ Interventions and Recommendations

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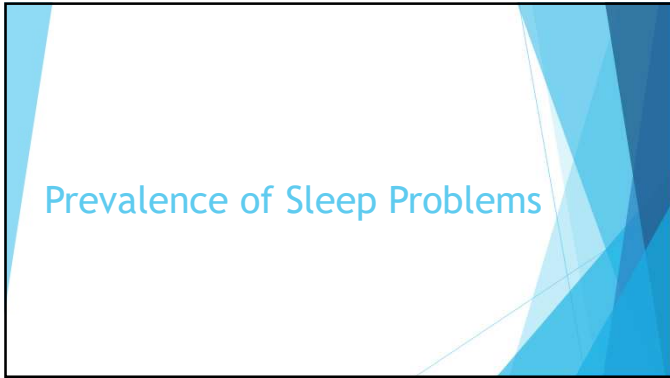
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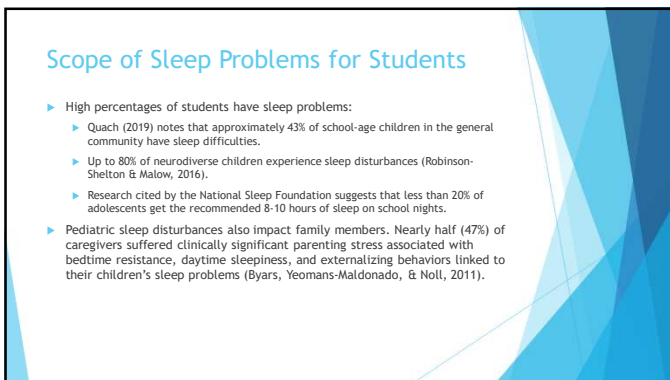
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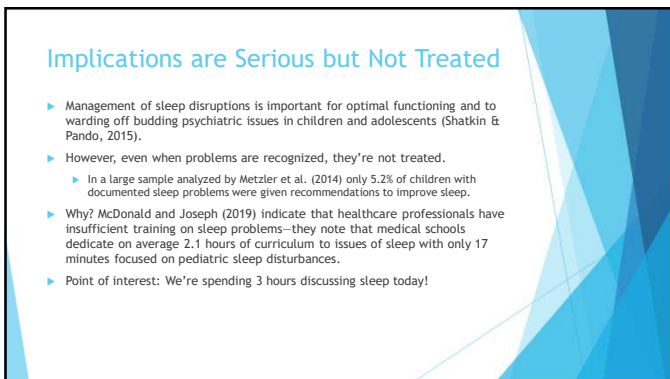
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**School Psychology isn't much better**

- ▶ Drapeau (2021) investigated behavioral sleep medicine training in School Psychology graduate programs:
  - ▶ A group of self-selected School Psychologists (n=59) completed an online survey about their training in behavioral sleep medicine.
  - ▶ 8.5% of respondents attended training programs that included formal training related to sleep disturbances.
  - ▶ 80% of surveyed school psychologists never receiving any classroom instruction in behavioral sleep medicine.
  - ▶ 77% of school psychologists reported never screening for sleep disorders.
  - ▶ 79% reported not assessing for sleep disorders during special education evaluations.
  - ▶ 88% reported not treating sleep disorders in the school setting.
  - ▶ The majority of school psychologists reported virtually no knowledge about how to assess or address/treat sleep disorders.

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**Neurobiology of Sleep**

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**Sleep 101**

- ▶ Essentially there are two forms of sleep:
  - ▶ Rapid Eye Movement—REM sleep
  - ▶ Non-Rapid Eye Movement—NREM sleep
- ▶ Each form of sleep plays a vital role in cognitive health and functioning.
- ▶ The ratio of REM to NREM sleep changes as the brain develops.

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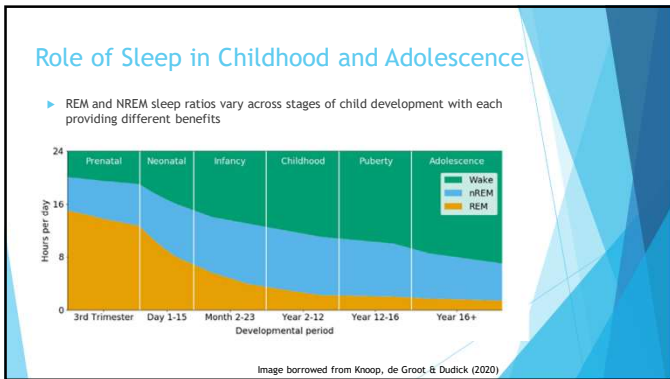
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### REM Sleep

- **Brain Activity:** REM sleep is associated with high levels of brain activity similar to being awake. During REM sleep, the brain is often as active as it is when a person is awake.
- **Dreaming:** REM sleep is the stage most commonly associated with vivid dreaming.
- **Muscle Atonia:** During REM sleep major skeletal muscles are essentially paralyzed. This prevents people from physically acting out their dreams.
- **Eye Movement:** REM sleep is characterized by rapid and random movement of the eyes beneath the closed eyelids.
- **Heart Rate and Breathing:** Heart rate and respiration increase and become more irregular during REM sleep compared to NREM sleep.
- **Duration:** REM sleep typically occurs in cycles throughout the night, with each REM period becoming longer as the night progresses. The first REM cycle usually lasts only a few minutes, while the final one can last up to an hour.

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### Benefits of REM Sleep

- **Cognitive Development:** REM sleep is involved in formation and maintenance of synapses. It provides stimulation for development of new neural networks.
- **Motor Learning:** REM sleep is involved in motor skill consolidation. It helps improve the performance of motor tasks learned during the day by building the neural pathways and muscle memory involved in these activities.
- **Creativity:** REM sleep has been linked to enhanced creativity. Some studies suggest that the brain's ability to make novel connections and find creative solutions to problems may be heightened during REM sleep.
- **Dreaming and Emotional Processing:** Dreaming may serve several functions, including emotional processing, problem-solving, and the integration of experiences and emotions. It may reduce the intensity of negative emotions.

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### NREM Sleep

- ▶ **Brain Activity:** NREM sleep is characterized by less active/intense brain activity. It represents deeper and more restorative phases of sleep.
- ▶ **Dreaming:** While dreaming can occur during NREM sleep, it is typically less vivid and memorable than dreams experienced during REM sleep.
- ▶ **Muscle Tone:** NREM sleep is associated with normal muscle tone. There is no paralysis of the skeletal muscles during NREM sleep.
- ▶ **Eye Movement:** Eye movements are minimal or absent during NREM sleep.
- ▶ **Heart Rate and Breathing:** Heart rate and respiration remain relatively stable and regular during NREM sleep.
- ▶ **Duration:** NREM sleep is divided into three stages: N1, N2, and N3. N1 is the lightest stage, N2 is deeper, and N3 is the deepest sleep. The duration and distribution of these stages vary throughout the night, with N3 being more prevalent during the first half of the night.

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### Benefits of NREM Sleep

- ▶ **Cognitive Efficiency:** NREM sleep is involved in downsizing the synaptic networks; it optimizes functioning by pruning unnecessary or redundant neural connections.
- ▶ **Memory Consolidation:** Slow-wave sleep (N3), is crucial for memory consolidation. During this stage, the brain transfers information from temporary storage in the hippocampus to long-term storage in the cortex.
- ▶ **Physical Restoration:** NREM sleep is "restorative sleep" because it is essential for physical recovery and repair. Growth hormone is also released during NREM sleep, promoting physical growth and development.
- ▶ **Immune System Support:** Adequate NREM sleep strengthens the immune system. It promotes the production and release of cytokines, proteins that play a role in immune response.
- ▶ **Emotional Regulation:** NREM sleep contributes to emotional well-being. It helps regulate emotions and manage stress by reducing cortisol levels.

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### Sleep Architecture

▶ Periods of REM and NREM sleep alternate throughout the night.

Figure borrowed from *Why We Sleep* by Matthew Walker (2017)

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### Circadian Rhythms

- ▶ Natural internal processes that roughly follow a 24-hour cycle driven by an internal biological clock that coordinates bodily functions with the external environment, particularly the light-dark cycle.
- ▶ The biological clock is centralized in the suprachiasmatic nucleus of the hypothalamus. It receives input from light-sensitive cells in the eyes to synchronize the internal clock with the external day-night cycle.
- ▶ People naturally feel drowsy at night and alert during the day due to the influence of the circadian clock.
- ▶ Circadian rhythms influence the release of hormones, including melatonin, cortisol, and growth hormone.

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### Chronotypes influence Circadian Rhythms

- ▶ **Morning Larks (Morning Chronotypes):**
  - ▶ Naturally wake up early in the morning and feel most alert and productive during the early hours of the day; often experience midday dip in energy.
  - ▶ They typically have an easier time falling asleep in the evening and may not enjoy staying up late at night.
  - ▶ Estimates are that about 40% of the population are "morning people."
- ▶ **Night Owls (Evening Chronotypes):**
  - ▶ Naturally stay up late at night and have difficulty waking up early in the morning. They feel most alert and active in late afternoon and evening hours.
  - ▶ They may find it challenging to wake up early for school or work and often prefer activities that occur later in the day.
  - ▶ Approximately 30% of the population tend towards this chronotype.
  - ▶ The remaining 30% of people fall someplace between these two extremes.

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### But Chronotypes often vary by age

- ▶ Variations are influenced by changes in circadian rhythms, sleep patterns, and lifestyle factors over the course of a person's life.
- ▶ **Children (Elementary School Age):**
  - ▶ Tend to have a circadian rhythm that aligns with a morning chronotype.
  - ▶ Typically wake up early and are most alert and focused during the daytime hours.
  - ▶ Bedtimes are typically earlier during this stage, reflecting a natural inclination to sleep in the early evening.
- ▶ **Adolescents (Teenagers):**
  - ▶ There are significant shifts in their circadian rhythms during puberty, resulting in a delayed sleep-wake pattern.
  - ▶ Many teenagers develop a night owl chronotype, preferring to stay up later at night and sleep in later in the morning.
  - ▶ This shift is influenced by hormonal changes and alterations in the biological clock.
  - ▶ Adolescents often struggle to align their natural chronotype with early school start times, leading to sleep deprivation.

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### Melatonin

- ▶ Melatonin is a hormone released by the pineal gland deep in the back of the brain to signal the onset of the evening.
- ▶ Increased melatonin is a signal to the brain that it'll soon be time to sleep.
- ▶ Production picks up at dusk and quickly drops off at dawn.
- ▶ BUT contrary to popular belief, melatonin isn't involved in the generation of sleep, but it can be a useful in preparing or tricking the brain into thinking it's time to go to sleep.
- ▶ Exposure to light at nighttime can block or reduce melatonin production.

Figure borrowed from *Why We Sleep* by Matthew Walker (2017)

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### Adenosine and Sleep Pressure

- ▶ Adenosine is a neurotransmitter produced in the basal forebrain.
- ▶ Levels of adenosine increase with every waking minute creating increased "sleep pressure" that causes drowsiness.
- ▶ During sleep the brain clears the brain of adenosine, reducing sleep pressure
- ▶ Caffeine blocks adenosine receptors but doesn't stop the build up adenosine in the brain, so when caffeine is cleared by the liver, adenosine rushes into the receptors causing a rebound effect.

Figure borrowed from *Why We Sleep* by Matthew Walker (2017)

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### Sleep Duration Recommendations

Age Group	Recommended (Hours)	Not Recommended (Hours)
Newborn (0-3 months)	14-17	18-19
Infant (4-11 months)	12-15	16-18
Toddler (1-2 years)	11-14	15-16
Preschool (3-5 years)	10-13	14
School Age (6-12 years)	9-11	12
Teen (13-17 years)	8-10	11
Young Adult (18-25 years)	7-9	10-11
Adult (26-64 years)	7-9	10
Older Adult (65+ years)	7-8	9

Image borrowed from the National Sleep Foundation

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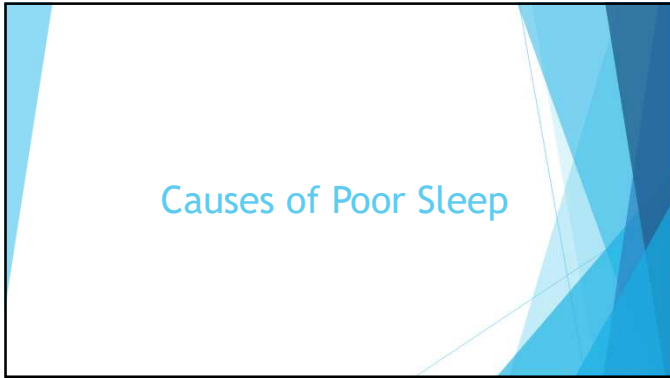
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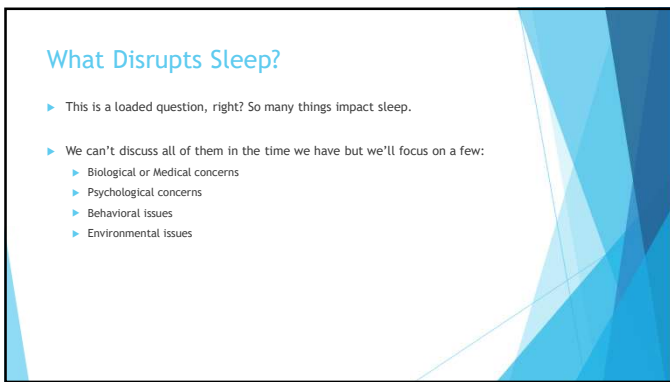
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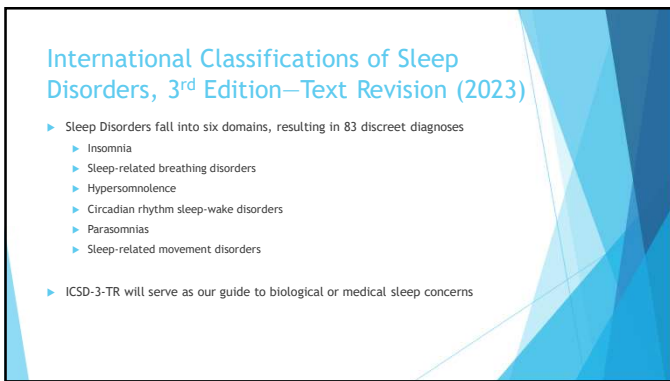
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### Insomnia

- ▶ Difficulty initiating or maintaining sleep.
- ▶ Impacts approximately 11% of adolescents (de Zambotti et al., 2018).
- ▶ Often co-occurs with neurodevelopmental disorders, chronic medical conditions, psychiatric disorders.
- ▶ Before puberty, insomnia is equally common in boys and girls, or more common in boys. Puberty is associated with a 3.4-fold increase in insomnia symptom prevalence in girls, and a 2.1-fold increase in boys (Marver & McGlinchey, 2020).
- ▶ It may be important to distinguish between onset insomnia and maintenance insomnia—interventions could be different.

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### Pediatric Sleep-related Breathing Disorders

- ▶ Sleep apnea is characterized as repeated interruptions in breathing during sleep, which lead to brief awakenings throughout the night, preventing individuals from enjoying sufficient deep, restorative sleep.
- ▶ Approximately 1-6% of children and adolescents struggle with sleep apnea (Baker-Smith et al., 2021).
- ▶ Snoring is a risk factor: 10-20% of children who habitually snore have OSA.
- ▶ Obesity, high blood pressure, and diabetes are also risk factors.
- ▶ Older adolescents and adults typically experience excessive daytime sleepiness, while children are more likely to be hyperactive and demonstrate poor concentration during the day (Reynolds et al., 2023).
- ▶ Anxiety disorders are significantly more common among those with OSA compared the general population ( $p = 0.001$ ; Rezaeitalab et al., 2014).

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### Hypersomnolence

- ▶ Hypersomnolence is characterized by excessive daytime sleepiness and an increased propensity to fall asleep during the day, even in situations where it is inappropriate or unintended.
- ▶ People with hypersomnolence often struggle to stay awake and alert during waking hours despite having had sufficient nighttime sleep.
- ▶ The most common hypersomnolence diagnosis is narcolepsy. Pediatric narcolepsy is very rare, afflicting 20-50 out of 100,000 children and adolescents. (Chung et al., 2022).
- ▶ Youth with narcolepsy often exhibit increased duration of nighttime sleep, coupled with daytime naps, sleep attacks, hyperactivity, and irritability (Morse, 2019).
- ▶ Because narcolepsy is so rare and many symptoms are subtle or easily attributed to other causes (e.g., insomnia, sleep resistance), correct diagnoses are often not made for more than a decade after the initial symptom onset (Rocca et al., 2015).

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### Circadian rhythm sleep-wake disorders

- ▶ These disorders are associated with disruptions in the body's natural 24-hour sleep-wake cycle—the circadian rhythm we discussed earlier.
- ▶ As noted previously, the natural circadian rhythm advances in teens, pushing them to stay up later and want to sleep in longer.
- ▶ Debilitating or extreme versions of this circadian shift are diagnosed as Delayed Sleep-Wake Phase Disorder (DSWPD). Prevalence rates among adolescents range from 1-4% (Siversten et al., 2013).
- ▶ DSWPD is associated with substance dependence (both alcohol and caffeine), increased levels of anxiety and depression, poor school attendance, and irritability (Reynolds et al., 2023).

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### Parasomnias

- ▶ Parasomnias are group of sleep disorders characterized by abnormal or unusual behaviors, movements, emotions, perceptions, or physiological activities that occur while falling asleep, within sleep, or during periods of arousal from sleep.
- ▶ NREM parasomnias are more common among youth and occur in the first third of the night, typically within 1-3 hours of falling asleep.
- ▶ Approximately 17% of children between 3 and 13 will experience episodes of confused arousal (Shelton, 2023) and roughly 5% of children will sleepwalk with the behavior peaking between 8 and 12 years of age (Stallman & Kohler, 2016).
- ▶ Parasomnias can be primed by OSA, movement disorders, noise, stress, anxiety, sleep deprivation, and use of sedatives.
- ▶ Confusional awakenings can disrupt sleep and lead to excessive daytime sleepiness. Sleepwalking can be a safety concern (stairs, sharp objects, etc.).

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### Sleep-related movement disorders

- ▶ Restless Sleep Disorder (a newly described diagnosis) and Restless Legs Syndrome are common in many ways, and both impact daytime functioning due to poor sleep quality.
- ▶ Restless Sleep Disorder is characterized by excessive movement throughout the night, repositioning, and fragmented sleep. Prevalence appears to be around 7.7% in clinical settings (DelRosso & Ferri, 2019).
- ▶ Restless Leg Syndrome is described as discomfort and a nearly uncontrollable urge to move the legs, which impacts sleep onset (think onset insomnia) but also contributes to restless sleep throughout the night. Prevalence is estimated to be around 2% in youth but is more common among adolescents (Shelton, 2023).

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### Psychological Concerns

- ▶ A variety of psychological disorders common in pediatric populations cause sleep disturbances:
  - ▶ Anxiety Disorders
  - ▶ Depression
  - ▶ Trauma and PTSD
  - ▶ Attention-Deficit/Hyperactive Disorder
  - ▶ Autism Spectrum Disorder
  - ▶ Eating Disorders
- ▶ At first glance, sleep symptoms may cause practitioners to assume the issues are biological or medical in nature instead of psychological (or vice versa depending on your perspectives/biases).

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### Anxiety Disorders

- ▶ Hard to discriminate between anxiety disorders and sleep disorders
- ▶ It's a chicken and egg conundrum: is the poor sleep causing the child to be anxious, or is the anxiety disrupting sleep?
- ▶ While causality may be difficult to pinpoint, the correlations are concerning. According to Alfano and colleagues (2010), 85% of youth aged 7-14 with diagnosed anxiety disorders experience clinically significant disrupted sleep.
- ▶ Increased anxiety is related to bedtime resistance, often an unwillingness to sleep alone, difficulty falling asleep and staying asleep (Gregory et al., 2006), and greater frequency of nightmares (Willis & Gregory, 2015).

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### Depression

- ▶ Nearly 75% of youth with major depression reported some kind of sleep disturbance; insomnia was the most common complaint (Asarnow & Mirchandaney, 2021).
- ▶ Sleep problems can both increase the risk of developing depression and worsen the symptoms of existing depression.
- ▶ Research from Gregory and colleagues (2009) suggests that sleep problems (insomnia at age 8) can predict future mood concerns (depression at age 10).
- ▶ In another study, late bedtimes during middle school (perhaps sleep resistance) predicted depressive episodes in young adulthood (Asarnow, McGlinchey & Harvey, 2014).
- ▶ Treating sleep problems can improve (and arguably avoid) depressive symptoms as children and adolescents get older.

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### Trauma and PTSD

- ▶ Difficulties with sleep are very common in people with trauma and PTSD. Up to 90% of people with PTSD experience sleep problems (Cox & Olatunji, 2020).
- ▶ Sleep problems associated with PTSD make it difficult to concentrate, remember things, and regulate emotions and leads to fatigue, excessive daytime sleepiness, and increased irritability.
- ▶ Common sleep difficulties among people with trauma and PTSD include:
  - ▶ **Hypervigilance:** People with trauma and PTSD may be hypervigilant when they are trying to sleep. This can make it difficult to fall asleep and stay asleep (onset and maintenance insomnia).
  - ▶ **Nightmares and Flashbacks:** Nightmares about the trauma are common in people with PTSD. Likewise, flashbacks can occur during sleep. These difficulties can wake people up during the night and make it difficult to fall back asleep.
  - ▶ **Avoidance:** People with PTSD may avoid certain people, places, or activities that remind them of the trauma. This can make it difficult to fall asleep and stay asleep if worried about being triggered by something in their environment while sleeping.

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### Attention-Deficit/Hyperactivity Disorder

- ▶ Like other mental health concerns, ADHD and sleep disturbances seem to have a bidirectional relationship.
- ▶ There's a high correlation between ADHD and sleep disorders; 25-70% of youth with ADHD experience sleep disturbances (Polanczyk et al., 2014).
- ▶ They have trouble with insomnia, restless sleep, and as they get older are more likely to experience delayed sleep-wake phase disorder.
- ▶ Some evidence suggests common neurobiological factors contribute to issues with sleep and ADHD:
  - ▶ Regions of the brainstem and cortex associated with the regulation of sleep are also implicated in studies of ADHD (Becker & Langberg, 2017).
  - ▶ Both dopamine and norepinephrine are involved in maintaining prefrontal activation while awake and are impacted by deficit sleep (Gruber et al., 2000).

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### Autism Spectrum Disorder

- ▶ Estimates are that 50-80% of children with ASD have sleep problems, which when treated can improve daytime behaviors in the child but also parent functioning (Reynolds et al., 2023).
- ▶ ASD appears to impact circadian regulation patterns; some research suggests that mutations to genes relevant to circadian rhythms are more common in those on the autism spectrum (Yang et al., 2016)
- ▶ Other research suggests that those with ASD have higher heart rates during sleep (Harder et al., 2016); this can impact the ability to fall asleep (insomnia) but can also make it difficult to engage in deep restorative sleep.
- ▶ Finally, emerging research suggests that parenting stress can carry over to impact sleep onset in children with ASD (Reynolds et al., 2023).

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### Eating Disorders

- ▶ Interaction between eating disorders and sleep mean that difficulties with one tends to exacerbate difficulties with the other.
- ▶ Approximately 57% of adolescents with eating disorder diagnoses have problems with sleep, including onset and maintenance insomnia, early awakenings, parasomnia, and hypersomnolence (Cooper et al., 2020).
- ▶ Relative to anorexia, the neuropeptide Orexin-A is believed to activate the body to seek food and sustenance; it fuels wakefulness in the context of hunger and may contribute to insomnia (Sauchelli et al., 2016).
- ▶ Regarding bulimia, research suggests that evening binge eating episodes contributes to on average a one hour delayed bedtime (Cooper et al., 2020), which results in less restorative NREM sleep and increased daytime sleepiness.

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### Behavioral Sleep Issues

- ▶ A variety of behaviors, habits, or practices can impact sleep quantity and quality in children, adolescent, and adult populations.
  - ▶ Sleep Resistance (maybe not so much in adults)
  - ▶ Inconsistent sleep schedules
  - ▶ Screen time
  - ▶ Caffeine consumption
  - ▶ Napping

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### Sleep Resistance

- ▶ Delaying or avoiding sleep, despite feeling tired.
- ▶ Causes/explanations vary.
  - ▶ **Biological:** usually onset insomnia.
  - ▶ **Psychological:** predominantly anxiety and PTSD.
  - ▶ **Behavioral:** our emphasis in this section.
    - ▶ Conditioning—needing specific conditions to fall asleep.
    - ▶ Fear of Missing Out (FOMO).
    - ▶ Revenge Bedtime Procrastination—delaying sleep make up for a lack (or perceived lack) of free time earlier in the day due to work, school, or other obligations.
    - ▶ Time Management/Planning Difficulties—often seen in cases of ADHD, staying up late to complete work.

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### The All-Nighter

- ▶ Pulling the all-nighter—whether to write that paper or cram for the exam—is the ultimate form of sleep resistance.
- ▶ However, studies with healthcare providers working long hours equates lack of sleep with blood alcohol concentration (Arnedt et al., 2005):
  - ▶ Being awake for 17 hours is similar to a blood alcohol concentration (BAC) of 0.05%.
  - ▶ Being awake for 24 hours is similar to a BAC of 0.10%.
  - ▶ Note that in most states a BAC of .08 is considered drunk driving.
- ▶ Dissuading adolescents from the belief that the all-nighter is some kind of rite of passage would be a great service to them.

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### Inconsistent Sleep Schedules

- ▶ Bedtime irregularity (sometimes called social jetlag) is associated with decreased sleep duration as well as decreased sleep quality (Kang & Cheng, 2009). It also contributed to conduct issues in youth (Lin & Yi, 2015).
- ▶ Biologically, inconsistent sleep schedules have been shown to undermine insulin sensitivity, which impacted regulation of metabolism and causes weight gain (Depner et al., 2019). This can be the start of a slippery slope with increased weight further eroding sleep quality.
- ▶ Depner and colleagues (2019) also found that extra sleep on the weekends does not compensate for irregularity in weekday sleep schedules. “Catch up” sleep isn’t effective.
- ▶ Inconsistent sleep schedules can also lead to napping.

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### Napping

- ▶ Naps can be helpful in addressing issues with sleep debt, especially among teenagers, who circadian rhythms have them going to sleep later but still needing to get up in time for school.
- ▶ Some research suggests that in adult populations a short nap can improve mood (Lastella et al., 2022).
- ▶ However, naps should be used judiciously. The general consensus is that naps should be short—around 30 minutes—and done at least four hours before bed.
- ▶ Napping can delay nighttime sleep onset (i.e., fuel insomnia) and over-reliance on naps can lead to fragmented nighttime sleep (Schwab, 2022).
- ▶ Despite the potential benefits of napping, some research suggests that among adolescents, napping can push adolescent bedtimes back even further, which might counter the benefits of napping (Santos et al., 2021).

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### Screen Time

- ▶ A meta-analysis of several studies found that as Internet use increased, so did the severity of sleep disruptions, resulting in later bedtimes and longer sleep onset durations (Kokka et al., 2021).
- ▶ Nursalam and colleagues (2019) found that 5+ hours of daily Internet use generated symptoms of insomnia in adolescents and lead to increased levels of daytime sleepiness.
- ▶ Part of the problem is that exposure to bright lights in the evening can suppress melatonin production, pushing back the signal that it's time to prepare to sleep (Duffy & Czeisler, 2013).
- ▶ Playing VGs for long periods (60+minutes) in the evening results in difficulty falling asleep and produces low quality sleep. Moreover, research suggests that prolonged gaming results in poor sustained attention and verbal memory impairments the next day (Peracchia & Curcio, 2018).

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### Caffeine Consumption

- ▶ Adolescent caffeine use results in more self- and parent-reported difficulties falling and staying asleep, particularly when caffeine is consumed in the afternoon and evening hours (Cusick et al., 2020). The researchers noted that use of caffeine later in the day was significantly more common (2.47x) among those with ADHD.
- ▶ Lunsford-Avery and colleagues (2022) found that afternoon and evening caffeine use by adolescents resulted in increased sleep-onset latency, and reduced total sleep time, sleep efficiency, and rapid eye movement sleep.
- ▶ Caffeine levels peak about 30 minutes after consumption, but caffeine has a half-life of about 5-7 hours. If a teenager drinks a can of Mountain Dew at 7:30 p.m., half of that caffeine is still active and circulating through their brain at 1:30 a.m. (Walker, 2017).

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### Environmental Sleep Issues

- ▶ Finally, several factors within the bedroom environment can make quality sleep difficult to obtain.
  - ▶ Excessive Noise
  - ▶ Excessive Light
  - ▶ Uncomfortable mattress, pillow, or bedding
  - ▶ Temperature or ventilation problems
  - ▶ Sibling or pet disturbances

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### Excessive Noise

- ▶ It almost goes without saying, but it's difficult for most people to sleep in a noisy environment.
- ▶ Noises obviously can wake someone up, causing fragmented sleep, but even sounds that don't wake someone up can disrupt sleep.
- ▶ Environmental sounds increase N1 sleep, while decreasing restorative N3 and generative REM sleep (Basner et al., 2011).
- ▶ Nighttime noises can also increase the release of cortisol and increase adrenaline levels, both of which undermine deep, slow wave sleep (Basner et al., 2017).
- ▶ Incidental sounds are likely worse than continuous sounds.

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### Excessive Light

- ▶ Sleeping with a light on interferes with sleep cycles and results in fragmented sleep; these issues tend to be most notable a few hours before waking up, as the amount of melatonin and adenosine are decreasing in the brain.
- ▶ Light wavelength also matters—blue light, emitted from many handheld devices, has been shown to interfere with melatonin production.
- ▶ Closing your eyes isn't enough, even light sensed through eyelids will impact melatonin production (Figueiro & Rea, 2012), which could have implications for children that share rooms with older siblings who have later bedtimes.

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### Uncomfortable mattress, pillow, or bedding

- ▶ A high-quality pillow can reduce nighttime awakenings, preserving more time in restorative sleep and REM sleep (Yang et al., 2021).
- ▶ Some pillows used in research studies based on biomechanics have been able to reduce and eliminate snoring (Ahn et al., 2022), which should improve sleep quality.
- ▶ A meta-analysis of studies examining sleep quality and mattresses suggests that a medium-firm mattress supports sleep quality and efficiency (Gaggiari et al., 2021).

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### Temperature or ventilation problems

- ▶ Body temperature naturally drops while sleeping; cooler core temperatures help people feel sleepy, while warmer core temps helps people feel more alert (Harding et al., 2019).
- ▶ Sleeping in warmer temperatures has been correlated with decreased amounts of slow-wave restorative sleep (Kräuchi et al., 2018).
- ▶ The Sleep Foundation recommends sleeping in temperatures between 60-68 degrees for optimal sleep.

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### Sibling or pet disturbances

- ▶ Bed sharing can have positive effects in terms of psychological comfort, which can alleviate some of the mental health contributors to poor sleep (Drews et al., 2017).
- ▶ However, a study with children ages 4-10 who share a bed with a parent or sibling were found to have shorter sleep duration and more behavioral and emotional problems (Cortesi et al., 2008).
- ▶ Sleeping with pets is associated with decreased sleep efficiency, increased nocturnal awakenings, and more disrupted sleep due to pet movement (Hoffman et al., 2018).
- ▶ Dogs in particular generally have three sleep/wake phases throughout the night compared to the typical single sleep/wake phase of their human companions (Smith & Litchfield, 2009). Canine movement during their waking phases can disturb their co-sleepers.

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### Consequences of Sleep Problems

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### Excessive Daytime Sleepiness

- ▶ Excessive daytime sleepiness is generally considered a symptom of sleep disorders or disturbed sleep rather than a disorder itself.
- ▶ Excessive daytime sleepiness can impact academic performance, cognitive function, mood, and increase the risk of harmful accidents.
- ▶ Approximately 20% of prepubescent children and nearly 50% of postpubescent youth experience EDS. Symptoms are associated with short weekday sleep duration, long and short weekend sleep duration, night owl chronotype, and insomnia symptoms (Liu et al., 2019).
- ▶ Children and young adolescents experience less EDS because of a propensity to still have a morning lark chronotype (Liu et al., 2019).

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### Cognition and Academic Performance

- ▶ Sleep problems negatively impact mathematics abilities, spelling, oral comprehension (such as listening to instruction/lectures), and to a lesser degree reading comprehension. Word decoding and handwriting abilities appeared to remain intact despite sleepiness (Macchitella et al., 2020).
- ▶ However, at least one study (Mayes et al., 2008) found that sleep problems had minimal (not statistically significant) impacts on academic performance. That said, the study focused more on recall of previously learned academic facts and didn't account for classroom learning and problem solving that is reflective of more naturalistic learning environments.

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### Executive Functioning and Attention

- ▶ Macchitella and colleagues (2020) that poor sleep compromised attention more than any other cognitive function or academic ability that they examined.
- ▶ Parent ratings on the BRIEF-2, as well as direct measures of planning ability and switching ability are significantly impacted by sleep problems (Anderson et al., 2009).
- ▶ A studying that had elementary students to stay awake just one hour longer for just three nights, lead to significantly worse performance sustained attention and working memory compared to students who got their regular night's sleep or went to bed one hour earlier (Sadeh et al., 2003).

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### Learning and Memory Performance

- ▶ First, recognize that attention plays a vital role in learning and recall. Without adequate attention, it's very difficult to encode new information. Additionally, working memory aids in the encoding and retrieval of information from memory.
- ▶ Assuming information gets into memory, it's temporarily stored in the hippocampus until the next period of deep sleep when it's consolidated into long-term storage in the cortex. Consolidation occurs during NREM sleep, and insufficient NREM sleep will compromise long-term memory; and inadequate REM sleep might result in memory stored in isolation rather than connected or linked in meaningful ways (Walker, 2017).
- ▶ Note: none of our available memory batteries examine consolidated memory.

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### Emotional Regulation

- ▶ Adolescents with greater sleep problems are more likely to qualify for a mood or anxiety disorder and report poorer emotion regulation strategy use.
- ▶ Specifically, they reported less problem solving, and greater avoidance, suppression, and rumination. Sleep problems were indirectly associated with anxiety disorders through greater suppression and rumination, and indirectly associated with mood disorders through greater rumination and weaker problem solving (Palmer et al., 2018).
- ▶ It's easy to imagine the overlap with executive functioning and those with poor sleep having more difficulty inhibiting initial emotional reactions to better regulate their responses.
- ▶ Personal experience: it's really, really easy to get an out of proportion reaction from a sleepy 14-year-old boy at 6:45 in the morning.

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### Social Functioning

- ▶ Social interactions are fraught with attention and executive functioning demands, an ability to regulate emotional responses, and possible the recall of information from previous interactions. All of these skills are impinged upon by sleep problems.
- ▶ One study using the Social Responsiveness Scale found that children with sleep disorders experiences more social withdrawal, lacked social awareness, and struggled more with social cognition than same-aged controls with normal sleep patterns (Quaedackers et al., 2019).
- ▶ The pathway to anxiety, including social anxiety, as well as depression, which were noted earlier is potentially paved with social functioning difficulties rooted in sleep problems.

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### Accidents and Injuries

- ▶ Motor vehicle crashes are the second leading cause of death among adolescents in the United States (Yellman et al., 2020).
- ▶ Drowsy driving is reported by more than half of teenage drivers and is a significant factor in adolescent driving accidents (Owens et al., 2018).
- ▶ In August 2017, secondary school start times in the Cherry Creek School District (c. 55,000 students) in Arapahoe County, Colorado were delayed 70 minutes from 7:10 a.m. to 8:20 a.m.
- ▶ With later start times, there was a 32.8% decrease in the number of students who reported frequent drowsy driving. Teen motor vehicle crash rates went down in Arapahoe County ( $p = .04$ ), while no increases or decreases in MVC rates were seen in neighboring counties that maintained early start times (Meltzer et al., 2022).

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### Evaluating Sleep Problems

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### Home-Based Sleep Tracking Devices

- ▶ Seems like everyone has a phone, a watch, a bracelet, a ring, or a bed that will track your sleep and provide data about how well you slept.
- ▶ Are these devices reliable?
- ▶ While they do provide some relevant information, studies don't suggest they're nearly as effective as professional sleep evaluations.
- ▶ Conley and colleagues (2019) found these devices were accurate about 78% of the time when discriminating between sleep and wake states, and only had about 38% accuracy in determining how long it took someone to fall asleep.
- ▶ However, there may still be use for these devices to observe intrapersonal trends in sleep and sleep quality.

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### Free Parent Rating Forms

- ▶ 100s of free and paid sleep ratings scales are available—this is a brief sample
- ▶ Sleep Disturbances Scale for Child (1996)
  - ▶ University of Rome
  - ▶ Validated on children ages 6-16
- ▶ Pediatric Sleep Questionnaire (2000)
  - ▶ University of Michigan
  - ▶ Ages 2-18; validated scales for sleep disordered breathing
- ▶ Children's Sleep Habits Questionnaire (2000)
  - ▶ Harvard Medical School/Boston's Children's Hospital
  - ▶ Ages 4-10

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### Free Self-Rating Forms

- ▶ Pediatric Daytime Sleepiness Scale (2007)
  - ▶ Iowa Sleep Disorders Center
  - ▶ For middle school students—grades 6-8
- ▶ Sleep Self-Report (2002)
  - ▶ Boston Children's Hospital Sleep Center
  - ▶ Ages no specified
- ▶ Cleveland Adolescent Sleepiness Scale (2007)
  - ▶ Case Medical School
  - ▶ Ages 11-17

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### Sleep Disorder Inventory for Students—Revised (SDIS-R; 2019)

- ▶ Parent completed rating scale
  - ▶ Children's Form: 2-10 years old
  - ▶ Adolescent's Form: 11-18 years old
- ▶ Includes five scales but 24 additional medical questions to provide context
- ▶ Good psychometric properties with a large sample
- ▶ Can be completed online
- ▶ Fee-based administration

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### Problem with Sleep Questionnaires

- ▶ None *seem* to have any questions about Internet use, screens, or devices, though I couldn't review all of them.
- ▶ *STOP, THAT, and 100 other Sleep Scales* (2012) published by Springer is 439 pages long and a thorough search of a .pdf of the book suggests that none of the scales include questions about Internet use.
- ▶ Searches for scales published after 2012 weren't fruitful either.
- ▶ Except for the Screen Media Use and Sleep Symptoms Questionnaire
  - ▶ But don't spend too much time looking for it...

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### Clinical Interview: BEARS

- ▶ BEARS is an acronym for the key areas to be covered in a clinical interview drawn from Owens (2005)
  - ▶ Bedtime (and time to fall asleep)
  - ▶ Excessive Daytime Sleepiness
  - ▶ Awakenings
  - ▶ Regularity and duration of sleep
  - ▶ Snoring

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### B is for Bedtime (and time to fall asleep)

- ▶ What time do you go to bed?
- ▶ How long does it take to fall asleep?
- ▶ What is the bedtime routine?
- ▶ For children with two homes: Is bedtime similar at both houses?

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**E is for Excessive Daytime Sleepiness**

- ▶ Do you feel sleepy during the day?
- ▶ Does it last all day? How does your sleepiness ebb and flow through the day?
- ▶ Are you so tired that you need to take a nap?
- ▶ Do you ever fall asleep in classes?

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**A is for Awakenings (before morning)**

- ▶ Once you fall asleep, do you stay asleep all night?
- ▶ If you wake up in the middle of the night, is it hard to fall back asleep?
- ▶ Do you get out of bed during the night? If so, where do you go?

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**R is for Regularity and Duration**

- ▶ Do you go to sleep and wake up at the same time every day?
- ▶ Do you need an alarm to wake up?
- ▶ Do you feel refreshed?
- ▶ How much sleep do you think you need?
- ▶ How much do you usually get?

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### S is for Snoring

- ▶ Do you snore, or has anyone every told you that you snore?
- ▶ Do you have difficulty breathing at night or when lying on your back?
- ▶ Have you have had any problems with your tonsils or adenoids?

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### Clinical Sleep Evaluations

- ▶ **Polysomnography:** measures a variety of functions throughout the night, including eye movements, brain and muscle activity, respiratory effort and airflow, blood oxygen levels, body positioning and movements, snoring, and heart rate. Assessment is conducted by a sleep technician.
- ▶ **Multiple Sleep Latency Test:** measures how quickly someone falls asleep and how quickly they enter REM sleep during daytime naps. This test is primarily used to assess excessive daytime sleepiness that may be due to narcolepsy or an unknown cause (idiopathic hypersomnia).
- ▶ **Home Sleep Apnea Testing:** collects data about a patient's breathing, heart rate, and blood oxygen levels overnight. However, home testing provides less information than polysomnography, and the process is not overseen by a sleep technician.

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### Interventions

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### Medical Interventions

- ▶ Within the medical field there are several interventions available
  - ▶ Medications
  - ▶ Supplements
  - ▶ CPAP
  - ▶ Oral Devices
  - ▶ Procedures

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### Prescription Medications

- ▶ **Non-benzodiazepine hypnotics**, such as eszopiclone (Lunesta), zolpidem (Ambien) are used to treat short-term insomnia.
- ▶ **Melatonin receptor stimulator**, ramelteon (Rozerem), was approved in 2005 and is used to treat insomnia.
- ▶ **Antidepressants or anti-anxiety medications** can be used for sleep because drowsiness is one of their main side effects. These include medications such as mirtazepine (Remeron), trazodone, and quetiapine (Seroquel).
- ▶ **Benzodiazepines**, which include alprazolam (Xanax), clonazepam (Klonopin) may be used to treat parasomnias.
- ▶ **Dopamine Agonists**, such as gabapentin (Horizant), pramipexole (Mirapex) may be used to treat restless legs syndrome.
- ▶ **Antinarcotics**, such as methylphenidate (Ritalin) and modafinil (Provigil), can be used to improve daytime wakefulness.

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### Supplements

- ▶ **Melatonin** used in supplement form facilitates falling asleep, helps normalize sleep patterns, and improves sleep quality overall. Because it promotes better sleep, melatonin has also been linked to improvements in mood.
- ▶ **L-Theanine** is similar in structure to several neurotransmitters. It's been shown to have relaxing, anti-anxiety, and stress-relieving effects.
- ▶ **ZMA** is a mineral supplement of zinc, magnesium aspartate, and vitamin B6. Zinc helps regulate sleep, and magnesium improves sleep quality. There's also evidence that a deficiency of vitamin B6 might impair sleep quality
- ▶ **5-HTP** stimulates the production of serotonin and is thought to affect sleep and relieve depression and pain sensations.
- ▶ **Iron** supplements have been found to help with restless sleep and restless leg syndrome in children, adolescents, and adults.

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### CPAP

- ▶ Continuous Positive Airway Pressure (CPAP) is a device that uses mild air pressure to keep airways open while sleeping. It's used to treat OSA.
- ▶ CPAP machine includes a mask that fits over the nose or nose and mouth with straps that position the mask. It also includes a tube that connects the mask to the machine's motor and a motor that blows air into the tube.
- ▶ It will take some time and patience to get used to your CPAP machine.

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### Oral Devices

- ▶ Oral devices are devices worn in the mouth while sleeping. They hold the jaw or tongue in a position that keeps airways open. Devices are used to treat mild sleep apnea.
- ▶ There are two types of oral devices that work differently:
  - ▶ Mandibular advancement devices cover the upper and lower teeth and hold the jaw in a position that prevents it from blocking the upper airway.
  - ▶ Tongue retaining devices hold the tongue in a forward position to prevent it from blocking the upper airway.
- ▶ A new oral device was recently approved by the FDA for use while awake. It delivers electrical muscle stimulation through a mouthpiece that sits around the tongue. The mouthpiece is worn once a day for 20 minutes for 6 weeks. It stimulates the tongue muscle while awake to help prevent the tongue from collapsing backward and obstructing the airway during sleep.

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### Medical Procedures

- ▶ Medical procedures are all used to treat OSA.
- ▶ Adenotonsillectomy surgery removes the tonsils and adenoids.
- ▶ Surgery to remove some soft tissue from the mouth and throat can make the upper airway bigger.
- ▶ A maxillary or jaw advancement surgery moves the upper jaw (maxilla) and lower jaw (mandible) forward to make the upper airway bigger.
- ▶ Surgical implants can monitor breathing patterns and control certain muscles that open airways during sleep.
- ▶ Nerve stimulator implants can control tongue muscles while sleeping to prevent the tongue from blocking airways.

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**Psychological Interventions**

- ▶ Psychotherapy Approaches
- ▶ Light Therapy
- ▶ Medication

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**Psychotherapy Approaches**

- ▶ **Cognitive Behavioral Therapy for Insomnia (CBT-I)** is a 6- to 8-week treatment plan to help people fall asleep faster and stay asleep longer. This is usually recommended as the first treatment option for long-term insomnia. CBT-I typically involves the following parts:
  - ▶ Cognitive therapy helps you feel less nervous about not being able to sleep.
  - ▶ Relaxation or meditation therapy teaches you how to relax and fall asleep faster.
  - ▶ Sleep education helps you learn good sleep habits.
- ▶ **Sleep Restriction Therapy** gives people a specific amount of time to spend in bed, even if they are not able to sleep during this time. With time, this helps them sleep better when they go to bed. Sleep time can be increased when they start to sleep better.
- ▶ **Stimulus Control Therapy** helps create a regular sleep-wake cycle so people link being in bed with being asleep. This involves going to bed only if sleepy, getting out of bed if they cannot sleep, and using their bed only for sleep.

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**Light Therapy**

- ▶ Light therapy involves sitting in front of a light box, which produces bright light similar to sunlight. Light visors and light glasses may also be effective.
- ▶ Light therapy helps adjust the amount of melatonin the body makes to help reset the sleep-wake cycle.
- ▶ To move sleep and wake times earlier, use the light box in the morning. This may also help reduce daytime sleepiness. This method may be used to help treat delayed sleep-wake phase disorder.
- ▶ To move sleep and wake times later, use the light box late in the afternoon or early in the evening. This method may be used to help treat advanced sleep-wake phase disorder.
- ▶ Richardson and colleagues (2018) found light therapy very effective with a sample of adolescents but also noted that long-term relapse was common, suggesting that ongoing or periodic treatment might be useful.

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### Psychotropic Medications

- ▶ Medications for psychological difficulties are obviously most useful with the root cause of sleeping difficulties is determined to be psychological
- ▶ Antianxiety and antidepressant medications (SSRIs), such as Zoloft and Prozac can be helpful, especially since drowsiness is a common side effect of this class of medication.
- ▶ Nonstimulant ADHD medications (alpha-2 agonists), such as clonidine or guanfacine (Intuniv) can be helpful for people who can tolerate stimulant medications to treat ADHD. The meds can be dosed at night and help quiet overactive minds, and a common side effect of the medications is fatigue.

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### Behavioral/Environmental Interventions

- ▶ Sleep hygiene
- ▶ Mindfulness Practices

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### Sleep Hygiene Strategies

- ▶ Sleep hygiene practices are broadly defined but most recommendations cover four core areas:
  - ▶ Keeping regular bedtimes and rise times
  - ▶ Maintaining a comfortable sleep environment
  - ▶ Curbing substance use (e.g., alcohol, nicotine, caffeine)
  - ▶ Exercising

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### Regular Bedtimes and Rise Times

- ▶ Maintaining regular bed and waking limits the accumulation of sleep debt, provided the times provide enough sleep to feel refreshed.
- ▶ Recommended bedtimes will vary based on age, school starting times, etc. but should generally ensure people fall within recommended sleep duration guidelines.
  - ▶ School-age children: 9-11 hours
  - ▶ Teens: 8-10 hours
- ▶ Staying up too late on weekend nights and sleeping in too long on Sunday morning will make getting to sleep more difficult on Sunday night.

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### Comfortable Sleep Environment

- ▶ Generally, people sleep best in dark environment that allows melatonin to do its job throughout the entire evening.
- ▶ Likewise, avoiding bright light/blue light prior to bedtime is helpful.
- ▶ The Sleep Foundation suggests that an optimal sleeping temperature is between 60-68 degrees
- ▶ White noise may improve sleep quality by drowning out environmental sounds that can disrupt sleep even if it doesn't wake someone up (Capezuti et al., 2022). The research impact was minimal, but some people experience phenomenal improvements in sleep with background noise.
- ▶ Other research suggests that a well-ventilated room improves sleep quality (Fan et al., 2022).

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### Curbing Substance Use

- ▶ Caffeine blocks adenosine and pushes off sleepiness. Avoiding caffeine after lunch is ideal.
  - ▶ Note that some pain medications include caffeine (e.g., Excedrin: Extra Strength, Migraine, and Tension Headache).
  - ▶ And decaffeinated coffee is not uncaffeinated coffee (decaf usually has 15-30% of the caffeine as a regular cup of coffee).
- ▶ Some youth with ADHD will take stimulant medications that interfere with sleep onset
  - ▶ Ensure they're taking the medication early enough in the day to get to sleep at night. Some will be prescribed afternoon boosters that will be strong enough to disrupt sleep.
  - ▶ Discussions about how they sleep both on and off medication is important.
- ▶ Alcohol can promote drowsiness but leads to fragmented, lower quality sleep. Some adolescents will abuse alcohol to blunt anxiety that is causing insomnia.

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### Exercise

- ▶ Exercise increases total sleep time in adolescents by reducing sleep onset latency, reducing nocturnal awakenings after initial onset of sleep, and increasing sleep efficiency (Suppiah & Chia, 2015).
- ▶ However, because of a slower accumulation of adenosine in youth, the exercise may need to be more vigorous to improve sleep than adult populations require (Dworak et al., 2007).
- ▶ Also note that exercise has been shown to improve a number of the mental health concerns that impact sleep: stress, anxiety, depression.
- ▶ Encouraging more physical exercise may yield improvements on multiple fronts simultaneously.

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### Mindfulness Interventions

- ▶ Mindfulness interventions are typically used to treat issues with Insomnia.
- ▶ The approach proposes to treat insomnia in three ways:
  - ▶ Increasing awareness of the mental and physical states that arise when experiencing insomnia symptoms.
  - ▶ Shifting mental processes to reduce sleep-related arousal.
  - ▶ Promoting a mindful stance to respond when symptoms of insomnia arise.
- ▶ A mindfulness-based group sleep intervention was shown to improve behavior problems in at-risk adolescent by improving sleep quality on school nights (Blake et al., 2017).
- ▶ However, the approach may be appropriate for younger children, who might struggle to engage in a mindfulness practice.

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### Referrals when you suspect sleep issues

- ▶ There are also a variety of professionals you can refer families to when you're concerned that a sleep issue may be the root cause of a student's difficulties
  - ▶ School Nurses may be able to provide advice on sleep hygiene and discuss the importance of obtaining good sleep.
  - ▶ School counselors and psychotherapists may be helpful when the root cause of sleep issues is believed to be anxiety, depression, or other mental health concerns.
  - ▶ Pediatricians could be helpful when the issues are thought to be medically based. They may prescribe medications to help manage symptoms or provide a referral for a sleep study.
  - ▶ Some dentists specialize in sleep dentistry and fit oral appliances to reduce or eliminate snoring to improve sleep quality.

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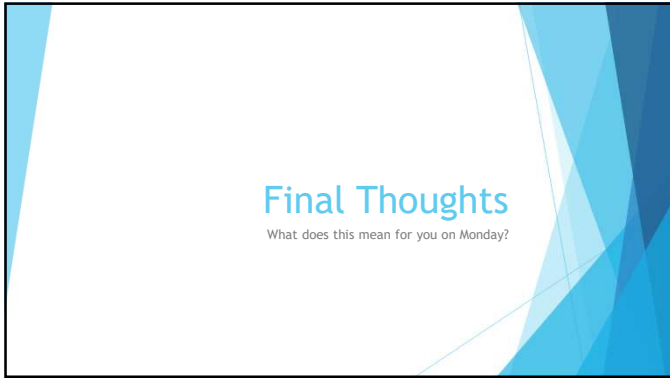
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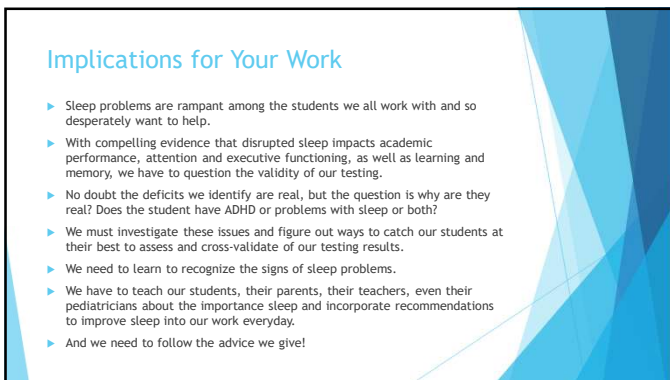
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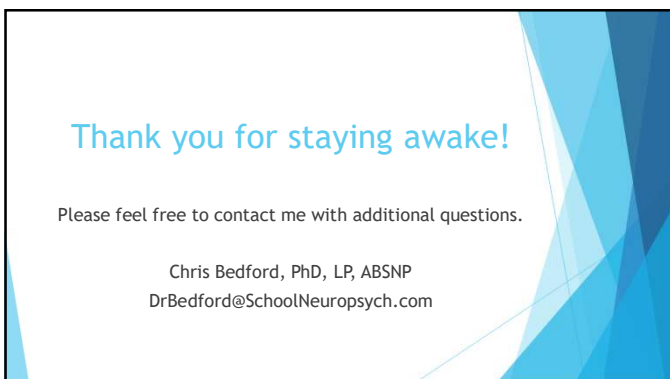
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