The Power of Sleep

Your A to Zzz Guide to Good Health

PARTICIPANT WORKBOOK

Presented by the Pinellas County Employee Wellness Program
Spring 2019
National Sleep Statistics

Let’s take a look at some statistics first.
Depending on where we live in the country, one-third to one-half of Americans report they sleep 6 hours or less.
Almost 40% of Floridians report 6 hours or less sleep per night.

Adults Getting More Than 6 Hours of Sleep per Night

Data Source: National Health Interview Survey (NHIS); Centers for Disease Control and Prevention, National Center for Health Statistics (CDC/NCHS)
Rally Health Survey Overview

The 2018 employee health survey shows that we are fairly close to the state and national averages.

1,039 employees answered the sleep question in the survey.

- 65% of those employees (in the yellow and green areas of the donut) responded that they get 7 or 8 hours of sleep
- 35% of this group gets 6 hours or less

Here’s what this means in terms of claims cost to employees and the County (bar graph):

- The left bar on the graph shows that employees who get 7 or more hours of sleep a night cost the County roughly $4,500 a year in medical reimbursement. This number represents the amount UnitedHealthcare pays after discounts, but does not include the member responsibility (the amount you pay).
- These averages exclude catastrophic cost (specific high risk conditions such as cancer, unforeseen traumas such as car accidents and other severe injuries).
- The middle bar shows that employees who get about 6 hours of sleep per night cost about $4,650 per year.
- Employees who get less than 6 hours cost $5,000, or about $500 dollars more.

As you can imagine, high claims cost paid also means a higher member responsibility (the part that you pay).

Lack of sleep not only affects our health, it also affects our personal finances.
What is Sleep and Why Do We Do It?

The definition of sleep from Merriam-Webster:

“The natural periodic suspension of consciousness during which the powers of the body are restored.”

Why humans sleep has eluded doctors and scientists for millennia. It’s one of the biggest biological mysteries.

Sleep is one of the four basic drives in life, along with:

- To eat
- To drink
- To reproduce
- To sleep

BUT sleep is:

- More than just a basic life drive
- More than just a lack of consciousness
- Complex
- Biologically active

If we look at it from an evolutionary standpoint, sleep actually seems like a waste of time. When we’re asleep, we cannot gather food or drink, we cannot be social or find a mate. Sleep leaves us vulnerable to predators. Asking why we sleep, however, is too simple of a question, because it implies there’s only one function. We tend to think of sleep merely as a state of unconsciousness, when in fact it is complex and an extremely biologically active endeavor, providing vital restoration and health for both brain and body.

Sleep Facts

All living beings sleep – even flies!
Why Sleep Matters

There are four pillars of health that work together to create wellbeing: physical, social, emotional and financial. Optimal health requires that we achieve balance between all four pillars. None, however, can be achieved without proper sleep.

Every major organ (including the brain) and tissue suffers if you are sleep deprived.

Countless large scale studies across industrialized countries that have included people of all gender, race, ethnicity and age have irrefutably come to the same conclusion: the shorter the sleep, the shorter the lifespan.

Sleep Facts

We lose about 1 liter of water through our breathing each night.

When you wake up each day, drink 12-16 oz. of water first thing in the a.m. (room temperature). This helps to replace water loss.
Emotional & Mental Health Benefits

Areas of the Brain

Different parts of the brain take part in regulating our mental health. If you took last year’s Stress-Proof Brain Wellness Series, you may remember the parts of the brain that affect stress:

- Amygdala - fight or flight response, exaggerated emotion
- Prefrontal cortex (hypothalamus) - the brain’s CEO, reasoning and logical thinking
- Hippocampus - the brain’s biographer, memory

Together, these brain area connections work to regulate emotions as well. We’ll explore these more in a later class.

Nature’s Best Medicine

The power of a good night’s rest is astounding. It is nature’s best medicine, a free, daily prescription that helps us feel better.

- Recalibrates brain circuits
- Improves navigation of social and stressful situations
- Controls rational thinking
- Re-sets the brain to create new memories and imprint older ones
- Manage depression, anxiety and other mental health disorders

Sleep Facts

Wait 90 minutes for your first cup of caffeine. It’s a diuretic and will cause additional water loss. Have a second cup of water and then reach for coffee.
Sleep Deprivation & Social Connection

If you are sleep deprived, you may have trouble with:

- Interpreting your environment
- Processing emotions
- Working well in a team
- Decision-making, problem solving
- Personal relationships
- Emotional control
- Reasoning
- Empathy

Sleep also impacts not only our desire for social connections, but our ability to navigate them effectively diminishes when we’re tired.

A sleep-deprived brain has trouble reading facial expressions and is more likely to interpret faces as threatening. As such, they are less likely to engage in conversations with others and may be very irritable.

Sleeplessness also affects the ability to process emotions - meaning sleep-deprived individuals often gauge the feelings of other people inaccurately, which reduces their ability to empathize.

Both personal and work relationships suffer.

Lack of these crucial abilities negatively affects communication, teamwork, trust, and cooperation. Teams with sleep-deprived members could potentially experience a lack of trust, teamwork and effective problem solving.

Brain Re-boot

You need sleep so your brain can re-boot and so you can:

- Effectively manage stress
- Improve memory
- Have more energy
- Increase attention span and ability to concentrate
- Strengthen relationships
Body Health Benefits

Sleep:
- Reduces blood pressure and keeps the heart healthy
- Regulates hunger hormones
- Controls blood sugar
- Helps fight off infection and improves healing

These processes:
- Prevent and help manage health conditions such as
  - Heart disease
  - Diabetes
  - Cancer
  - Obesity
- Assist with weight control
- Boost immunity

How Much Do I Really Need?

It is mind-boggling how sleep affects so many processes in our bodies. You’ve probably heard that doctors and scientists say we need about 8 hours of sleep. In this case, scientists define “need” by whether the amount of sleep obtained is adequate to complete all of the processes it’s designed for. When we say, “I only need 6 hours of sleep,” we tend to use a different definition of need: The number of hours I get/or need to get through the day. However, with chronic sleep deprivation, our bodies will acclimate and learn to function on less sleep, giving us a false sense that we are giving our bodies enough time to re-set.

Exact sleep requirements can vary from person to person. You may need slightly less or slightly more than 8 hours, but the fact remains that if you’re getting less than 7, you’re not getting enough to reap the benefits, and in fact, are doing your health a huge disservice.

The amount of sleep needed depends on a variety of factors such as age, physical exertion, health (are you fighting the flu?), pregnancy, etc.
How Much?
Sleep Opportunity

The recommendation includes time for sleep opportunity, not just the hours actually asleep.

Sleep opportunity is the time we physically get into and out of bed. When we get into bed at 10 p.m. and wake up at 6 a.m., we give ourselves 8 hours of sleep opportunity, giving ourselves time to fall asleep, reach deep sleep and wake up naturally. The time spent asleep is usually about an hour less. Although sleep time is less than 8 hours, this additional time we allow ourselves to move through stages of the sleep cycle is just as important.

Thus, if you get into bed at midnight and wake up at 6 a.m., the sleep opportunity is 6 hours, but actual sleep time is roughly only 5 hours, falling far short of the recommendation for good health.

Are you sleeping?

Universal indicators of sleep:

- Usually horizontal position
- Lowered muscle tone and relaxation of postural muscles
- No signs of communication or responsivity
- Easily reversible (unlike coma, anesthesia, or death)

Was I asleep?

When we wake up, we automatically know we’ve been sleeping, and we can also gauge whether we slept well or not.

We experience:

- Loss of awareness of the outside world
- Time distortion – don’t know how long or what time it is when we wake up
Sleep By YOUR Numbers

Assessing our own sleep habits can be extremely helpful in bringing awareness to ways in which we can improve it. We are going to do so in two ways.

- A quick sleep assessment
- Track our sleep and keep a sleep diary for the next 4 weeks

Sleep Assessment

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<th></th>
<th>Rarely/ Never (0)</th>
<th>Sometimes (1)</th>
<th>Usually/ Always (2)</th>
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<tbody>
<tr>
<td>Satisfaction</td>
<td>Are you satisfied with your sleep?</td>
<td></td>
<td></td>
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<tr>
<td>Alertness</td>
<td>Do you stay awake all day without dozing?</td>
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<tr>
<td>Timing</td>
<td>Are you asleep (or trying to sleep) between 2:00 a.m. and 4:00 a.m.?</td>
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<td>Efficiency</td>
<td>Do you spend less than 30 minutes awake at night? (This includes the time it takes to fall asleep and awakenings from sleep.)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Duration</td>
<td>Do you sleep between 6 and 8 hours per day?</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Total for all for items ranges from 0-10

0=Poor Sleep Health  Good Sleep Health=10

Total your score and take a look at the point ranges. The lower the score, the lower the sleep health.

Now ask yourself - Do you feel tired during the day? Or do you drink so much caffeine to numb your tiredness that you can’t fall asleep when you finally have the chance? In order to decide how much sleep you need, it's important to note how your body functions and feels throughout the day.
It should take 20-30 minutes after you get into bed to fall asleep. Any sooner than that, and you’re probably too tired. Any longer than that, you may be getting too much sleep. In the morning, you should wake up ready to take on your day. You may or may not wake up a little bit before your alarm, but if you do, you’re more than likely getting enough rest.

To determine how much sleep you need, let’s start by noting how much you’re getting now, how you feel, and your lifestyle behaviors. There are many variables that could make finding sleep hard.

You’ll find a sleep diary for each week of this class at the end of each section. It may seem like a lot of effort, but if you’re serious about feeling better and becoming healthier, it’s worth it.

In the morning, assess your sleep the night before. In the evening, take note of how you felt during the day, and the things you drank, ate and did.
Notice the first morning box asks what time you went to bed and woke up, and the time you slept. This measures your sleep opportunity as well as actual sleep duration.

Work through the boxes and take additional notes if you need to.

In the evening, assess your caffeine and alcoholic beverage intake, energy and activity levels. Were you excessively hungry/craved carbs? Had trouble concentrating? Felt irritable? Too tired to exercise? These can all affect your sleep quality and duration.

At the end of the day, compare your morning notes with your evening notes. Do you see any connection?

**Sleep Trackers**

A note about trackers…If you’re using a Fitbit or other wearable device, you can pull the information from the app; however, use the diary as well to observe additional information that will help identify your daily habits. Don’t worry if you don’t have a sleep tracker; it is not needed to use the diary.

If you’re interested in trying a sleep tracker app, there are free and subscription-based apps both for Android and iPhone.

Keep in mind that the only accurate way to measure sleep is a sleep study done at a sleep clinic. Both wearable devices and sleep tracker apps have limitations as to their accuracy. They’ll provide a general idea of sleep quality and duration but should not be used to self-diagnose any type of sleep condition.
Adjusting Sleep

Once you’ve spent a week getting an idea of your sleep and lifestyle patterns and making necessary adjustments, continue to keep a sleep diary and follow these steps:

- Adjust bedtime by 15 minutes
- Assess how you feel with 7 hours of sleep

Still tired?
- Move your bedtime 15 minutes earlier
- Continue this process until you feel rested

Use a bedtime calculator

Go to sleep 15 minutes earlier every 2-3 nights, until you’re getting at least 7 hours of sleep every single night.

Use a sleep calculator tool to figure out what time you need to go to bed to achieve the hours of sleep you’d like (don’t forget to factor in sleep opportunity). See the Bedtime Calculator on the National Sleep Foundation’s website - [www.sleepfoundation.org/articles/bedtime-calculator](http://www.sleepfoundation.org/articles/bedtime-calculator).

If you’re still tired during the day or you’re not ready to wake up when your alarm goes off, move your bedtime 15 minutes earlier.

Continue this process until you are getting enough sleep every night. You’ll probably end up somewhere between 7 and 9 hours, but listen to your body and follow its needs.

Keep in mind that this only determines how much sleep you need right now. If something changes in your life, your sleep needs could change, too. Or, as you become more and more rested, you may find that you need less sleep.
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<th>Number of hours slept last night:</th>
<th>Number of awakenings and total time awake last night:</th>
<th>How long it took to fall asleep:</th>
<th>Medications taken last night:</th>
<th>How awake did I feel when I got up this morning?</th>
<th>Naptimes and lengths today:</th>
<th>Exercise times and lengths:</th>
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**Source:** National Heart, Lung, and Blood Institute; National Institutes of Health; U.S. Department of Health and Human Services.
Session 2: Engineering Sleep

Review

Sleep is universal to all living things.

Sleep is the foundation for all the pillars of wellness:

- Physical
- Social
- Emotional
- Financial

Sleep is very complex and biologically active.

Engineering Sleep

Watch the video at www.youtube.com/watch?v=ZKNQ6gsW45M
The Sensory Gatekeeper: The Thalamus

When we’re awake, we’re aware of all of our senses. We can smell, see, hear, taste and touch. These signals all converge in one central area of the brain. As we fall into slumber, they continue to come together in the zone; however, the thalamus, which acts as the sensory gatekeeper, blocks these signals from reaching the cortex of the brain. The cortex allows us to consciously perceive the senses.

While the organs continue to receive the signals when we are asleep, the thalamus induces a state where we lose consciousness with the outside world.

Brainwaves

When we are awake, our electrical brain signals (brainwaves) are very frenetic and incoherent because we’re constantly processing and responding to the real world environment. When we move into the sleep stages, brainwaves become longer and slower the deeper we sleep. A good analogy for brain cell activity in wakefulness is to think of them as people seated in different parts of a large stadium. If you placed a microphone in the middle of the stadium, you’d hear a cacophony of noises from all areas, as the people are all having their own conversations. In Non-rapid Eye Movement (NREM) sleep, these conversations all become synchronized, increasing at the same time with an accompanying silent pause that directly follows it.

Interestingly, occasionally a sleep spindle, a burst of brainwave activity, appears at the end of a slow wave. Sleep spindles have multiple purposes, but one of them is to shield sleep by blocking out external noises.

Sleep Facts

Marine animals have almost no REM sleep because the muscles are turned off and they must retain muscle movement to stay aware of their environment.
Sleep Rhythms

What time is it?

Our bodies know when to wake up and go to bed based on signals from our Circadian Rhythms. Along with sleep pressure and melatonin, they drive the various stages of the sleep/wakefulness cycle.

Circadian Rhythms

Circadian Rhythm:
24 hour - sleep / dream cycle

![Diagram showing sleep stages]

Note: This chart is based on a normal 8 hour night of sleep with a 90 minute Ultradian Rhythm.

Circadian rhythms are biochemical, physiological, and behavioral cycles in all living things. In humans, they rise and fall in 24-hour cycles.

Numerous clocks throughout the human body drive circadian rhythms. Think of them as pacemakers.

Circadian rhythms are important because they:

- Prepare the body for expected environment changes (like exercise, sleep and meal times)
  - Set the sleep and wakefulness cycles
  - Promote sleepiness at usual bedtime
  - Initiate sleep
  - Promote wakefulness before usual wake-up time

Sleep Facts

Dolphins use both sides of the brain to stay vigilant. NREM alternates between the two sides which allows for one side of the brain to be alert at all times.
- Set the timing for other circadian rhythms that regulate physiology and behaviors
  - Hormones
  - Body temperature rhythm (higher in late afternoon and lower when we sleep)
  - Eating and digesting food

The pacemaker has an internally driven 24-hour rhythm that urges the body to wake up at the beginning of the day and go to sleep at night.

The day/night rhythms remain unchanged, preferring sleep at nighttime and wakefulness in the daytime.

External cues also impact the cycle.

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**Light and the Brain**

Light and dark are the strongest cues for circadian rhythms. Exercise and melatonin also appear to influence the timing of the pacemaker, but not as much as light. Normally, light enters the eye (even through closed eyelids during sleep) and signals the pacemaker to wake up, perform certain activities, and go to sleep.
Individual Rhythms

- Rhythms vary from person to person
- Early birds and night owls
- Partially genetically determined
- Impact work productivity

Not all humans have precisely the same circadian rhythm. You probably already know whether you’re an early bird or a night owl. This is determined partially by genetics.

Our own rhythms can work with or against our work schedules. If you’re a night owl and naturally prefer to go to bed late, it can be difficult to work an 8 a.m. - 5 p.m. schedule. The later sleep cycle and earlier wake time can make it challenging to concentrate, have positive work relationships and complete work duties.

Sleep Pressure

Another part of the sleep cycle is something called sleep pressure, caused by a steady increase of the chemical adenosine in the brain, which builds up in the body during waking hours and causes an increasing urge to sleep.

For most, this usually happens after 12 to 16 hours of wakefulness. The pressure gets stronger the longer we stay awake and decreases during sleep, reaching a low after a full night of good quality sleep. The cycle repeats when we wake up.

The dashes in the graph show that sleep pressure continues to increase if we do not sleep, and resets when we go to sleep.

Our body produces a higher need for sleep under some circumstances, where sleep could be longer and/or deeper. Sleep pressure increases:

- During illness/infection
- Learning/brain stimulation
- Intense physical demand
- Pregnancy
**Melatonin**

The brain communicates day and night signals to the body by the way of a messenger called **melatonin**. It is released into the bloodstream at dusk to send a message that it’s dark. Melatonin concentrations slowly decrease throughout the night.

Example: When it gets dark earlier and nights are longer, have you ever felt like it was time to go to bed earlier?

Although it is an extremely popular sleep aid, melatonin does not have anything to do with the generation of sleep. Think of it as the timing official at a race. It signals the start of the race but does not participate in it.

It can be helpful for jet lagged individuals whose nights and days have been altered but it’s not a very effective sleep aid for those on a regular night/day cycle. However, there is a significant sleep placebo effect which should not be underestimated.

**Caffeine**

As adenosine builds up through the day, working with circadian rhythm and melatonin, its signal to go to bed gets louder and louder.

Caffeine, which is the most widely used **psychoactive stimulant** in the world, fights the sleep pressure chemical for the receptor sites on the brain that welcome adenosine. Once caffeine occupies the landing sites, it masks the sleep signal, tricking the brain into thinking it’s wide awake.
It takes about 30 minutes for the effects of caffeine to peak. It also has a half-life of 5 to 7 hours. Half-life means the time it takes the body to remove 50% of the concentration. If you drink a cup of coffee with dinner at 7 p.m., your body would rid 50% of it at 1 a.m., so about half the caffeine continues to circulate throughout the body. For this reason, limiting caffeine intake to earlier in the day can be very helpful in improving sleep.

**Synchronized Rhythms**

The red line represents when we’re awake and the blue line represents sleep pressure. Our feeling of being awake rises until it begins to diminish in the evening. At the same time, the moment we wake from sleep, sleep pressure starts to build up again. Once we fall asleep, the pressure clears out by morning.

If you have a normal day/night wake/sleep schedule, sleep pressure and circadian rhythms are synchronized. It would seem logical to think that the circadian cycle would communicate with adenosine, but in fact they do not. Although they are coordinated to work toward a common goal, they do not talk to one another.

**De-synchronized Rhythms**

Circadian rhythms, melatonin and sleep pressure all march along on the 24-hour cycle that induces sleep at night and being awake during the day. If we do the opposite and stay awake at night, all of these processes continue to release signals and chemicals signaling the body to sleep at night. This desynchronization causes extreme fatigue and body disruptions.
Sleep Debt

When we don’t get enough sleep, we go into “sleep debt,” which builds over time. We must catch up on sleep to “pay down” this debt. For example, a person needing 8 hours of sleep but getting only 6 hours would accumulate a sleep debt of 2 hours that day. If they continue for 5 days, they’ll have 10 hours of sleep debt at the end of the week.

To keep sleep debt down, get the length of sleep you need in order to feel rested when you wake up. Allow extra time to sleep if you were not able to get enough sleep the previous night. A person does not necessarily need to pay back hour for hour of lost sleep since the body sometimes sleeps more soundly to pay down the debt.

However, it is a bad idea to build up sleep debt regularly and try to pay it off later by catching up on sleep. Although your level of sleepiness may return to normal after a day or two of recovery sleep, your brain and body functions continue to be somewhat compromised when compared to your well-rested norm. It is extremely important to get enough sleep on a regular basis rather than sporadically on a continuous basis.

Sleep Cycles

Sleep Facts

Bird flocks line up in a row to sleep. The two end birds act as sentinels, keeping the outside eye open and that part of the brain watchful for predators. Halfway through the sleep cycle, they both turn 180 degrees, open the other eye and activate the other side of the brain.
Humans don’t just sleep, they cycle through two completely different types of sleep in 5 cycles that repeat, but are not symmetrical.

There is more deep NREM sleep earlier in the night, whereas REM sleep predominates in the second half of the cycle.

**Sleep Cycles**

**Sleep Facts**

People who are sleep deprived do not have the ability to gauge how tired they are.
Sleep Cycle Video
Watch the video on https://www.youtube.com/watch?v=fNlp0UMqUJM

Non-Rapid Eye Movement (NREM)
Physical and electrical characteristics:
- Inactive muscles
- No eye movement
- Slower brainwaves

Hippocampus
Throughout the day, our brains absorb an incredible amount of information, which is stored in the hippocampus. If you took the Stress-Proof Brain Wellness Series, you’ll recall that the hippocampus is the biographer of the brain – it writes down the stories of the day. However, it is only temporary storage as it has limited space. NREM sleep identifies which of these stories are important enough to store permanently and with every slow brainwave, transfers them into permanent storage in the cortex.

If we do not get enough sleep, NREM does not effectively “clean house” in the hippocampus. As a result, we have
trouble absorbing and temporarily storing information the next day. When sleep deprivation is chronic, it poses continued memory problems.

Also, when we absorb information the day prior, it can sometimes be difficult to recall just before sleep. NREM refreshes the brain and allows for recall the next morning. After a night of adequate NREM, we've all experienced a moment where we say, “Oh! I remember now…”

**NREM for Skill Memory**

When we learn new skills that require movement, like riding a bike, typing on a keyboard or playing the piano, we cannot learn them by simply reading a book. They require repetitive and coordinated muscle movement. We often refer to this type of learning as muscle memory, when in fact, muscles do not have memory. The memories exist in the brain, and with repetition, practice and time, the brain creates increasingly strong neural pathways (information superhighways) to the muscle, giving it instruction to perform the skill.

Research has found that increasing speed and accuracy resides in stage 2 NREM sleep, especially the last two hours of an 8 hour night. Skill memory is linked to a high number of sleep spindles occurring at that time.

**Rapid Eye Movement (REM)**

During rapid eye movement sleep, brainwaves are fast and remarkably similar to those of wakefulness. If hooked up to a sleep tracking machine, the only distinguishing factor would be that of a lack of muscle activity during REM. There is no muscle tone at all.

REM sleep has other unique characteristics. In deep Non-Rapid Eye Movement (NREM) sleep, the floodgates from the thalamus to the cortex close, effectively blocking external “noise.” During REM sleep, the gates open, but not in the same way as wakefulness. Memories, emotions, motivations and many other signals reach the cortex and are played out in different areas of the cortex that control hearing, vision and movement.

REM sleep also produces dreams.

**Key functions**

Unlike NREM, which stores factual memories, REM processes these signals and refines our understanding of the real world, including insight, problem solving and communication. It also induces a therapeutic effect in ridding our brains of trauma and negative emotional experiences, helping to maintain emotional health.

As highly evolved animals, REM plays a role in cognitive intelligence and our understanding of the complexity of society and culture.
Sleep Across the Lifespan

As we age, both circadian rhythms and NREM sleep change. They interconnect with the brain in ways that both support early brain development, or, are affected by brain degeneration later in life.

In Vitro and Infants

The brain develops at an intense and extremely directed way during this time. REM sleep acts as a fertilizer for growing brain cells, which increases electrical activity, creating and increasing millions of neural pathways and synapses between different areas of the brain.

REM sleep is vital in building the brain mainframe. The objective is quantity because the brain creates as many connections as possible to provide for multiple ways of absorbing information and learning. However, this creates redundancy, which is addressed later in childhood. Also, baby’s circadian rhythms don’t develop until after the first few months of life where they finally start to show signs of sleep rhythms. This explains the erratic sleep of a newborn.

In the womb, a fetus spends the majority in REM sleep and babies split their time 50/50 between REM and NREM. Sleep disruption during this time is extremely serious as vital brain development halts if REM sleep is interrupted. Over time, it never fully catches up.
A good analogy for early developmental brain growth is that of an internet service provider laying fiber-optic cables in a new neighborhood. They lay the same type of cable to all homes, providing the same bandwidth.

**Childhood**

In mid to late childhood, the brain builds and learns from millions of experiences and shifts focus to create efficiency and effectiveness. Here, the original brain architecture begins to refine all of those connections, recognizing and choosing networks that are quicker, more useful and efficient. NREM/REM ratio shifts dramatically to a 70/30 dominance of deep NREM sleep, which prunes the brain’s connections. It is also critical in retaining new facts and cementing memories.

Continuing the internet analogy, we can liken this to the internet provider researching which households need more data and which don’t use much, and programming the cables to deliver stronger signals to the areas that need it most, and dial down signals in lower-use households.

As children mature into adolescence, a markedly higher percentage of deep NREM sleep develops cognitive reasoning and critical thinking.

**Adolescence**

Adolescents and young adults continue to broaden their cognitive capacity, building the brain that will eventually develop into an adult brain capable of making complex decisions, rational thinking, peer-group relationships and communication.

They face two challenges during this stage: a later circadian rhythm and early school start times.

As any parent of a teenager knows, it can be frustrating to find their child awake late into the night and unable to wake up in the morning. It turns out this is developmentally normal in sleep cycles and brain development. Having to wake up early for an early morning school start time poses a challenge for brain development and academic performance.

If you have or will have a teenager in your home, it’s important to support their sleep rather than label it as laziness. Go easy on your teenager; their brains are hard at work and need the sleep!

**Early Development & Mental Health**

Both sleep types (NREM and REM) are critical for brain development. Insufficient NREM in teenagers is linked to psychiatric disorders. Common disorders that appear in childhood and adolescence:
Altered or insufficient sleep during these critical stages early in life can have profoundly negative effects on healthy cognitive function. NREM sleep in teenagers provides some understanding of sleep’s connection to mental health.

**Adulthood and Aging**

It is a myth that adults and older adults need less sleep. In fact, they need just as much sleep as younger counterparts, and studies show they try to get enough, but aspects of aging can make it difficult to fall or stay asleep.

As we age, we experience reduced quantity and quality of sleep, reduced sleep efficiency and disrupted timing. REM sleep remains fairly constant throughout the lifespan, but NREM sleep begins to degenerate in both quantity and quality in the late twenties to early thirties. By our forties, our time spent in NREM sleep diminishes. These restorative brainwaves decline in both number and power. By the late forties, we experience 60-70% less NREM than teenagers, and 80-90% by the time we’re seventy.

This decline in NREM is directly related to degeneration of certain parts of the brain associated with aging. The middle-frontal region generates NREM sleep, and unfortunately is the first to decline. The more severe the deterioration of this region, the more dramatic the loss of NREM.

Let’s recall how important NREM is in childhood and adolescence in cementing memories and learning. Understanding that NREM suffers as we age, it’s not difficult to draw a strong connection between sleep, forgetfulness and reduced cognitive function.

**NREM Decline and Health**

The decline in all aspects of sleep has a strong causal link to health, energy, memory and mental health. Older adults often seek help for medical conditions but do not seek guidance for sleep improvement from a sleep medicine professional. Not all health conditions can be attributed to poor sleep quality and quantity; however, much research points to a significant decline in quality of life as NREM sleep declines.

The further along in the lifespan, the more fragmented our sleep becomes. Medications, a weak bladder and changing circadian rhythms disrupt sleep efficiency. Even if sleep opportunity is 8 hours, frequent wake-ups during the night result in less time asleep. This puts adults at a higher risk of disease, depression, memory loss and falling.

Scientists are researching how to address NREM decline in older adulthood in hopes of improving quality of life.
# Sleep Diary

**Name:**

**Beginning date:**

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<td>Time I went to bed last night:</td>
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<td>Time I woke up this morning:</td>
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<td>Number of awakenings and total time awake last night:</td>
<td>5 times 2 hours</td>
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<td>Medications taken last night:</td>
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<td>How awake did I feel when I got up this morning?</td>
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<td>1 – wide awake</td>
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<td>2 – awake but a little tired</td>
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<td>3 - sleepy</td>
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<td>Number of caffeinated drinks (coffee, tea, soda) and time when I had them:</td>
<td>1 drink 8 p.m.</td>
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<td>Number of alcoholic drinks (beer, wine, liquor) and time when I had them:</td>
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<td>How sleepy did I feel during the day?</td>
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<td>1 – So sleepy had to struggle to stay awake during much of the day</td>
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<td>2 – Somewhat tired</td>
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Session 3: The Good, the Bad and the Deadly

Review

The body generates sleep:
- Circadian rhythms
- Sleep pressure
- Melatonin

Two types of sleep:
- NREM
- REM

Sleep changes as we age.

Sleep impacts mental, physical and emotional health.

Sleep Tips

- Avoid exercise 2-3 hours before bed.
- Avoid nicotine. It's a stimulant and causes light sleep.
- Avoid large meals and beverages at night.
- Naps are great earlier in the day.
- When possible, delay medications that keep you awake.
  Check with your doctor.
- Wind down and relax before bed.
- Take a hot bath; it'll drop your body temperature and make you sleepy.
- Check the environment. In addition to light and temperature, humidity affects sleep.
Effects of Sleep Deprivation

There are so many benefits from a good night’s rest. What happens when we don’t get enough? Watch the video - [www.youtube.com/watch?v=0HxvEcYfbho](http://www.youtube.com/watch?v=0HxvEcYfbho)

- Acclimation to a state of deprivation
- Lack of concentration can be deadly
- Poor sleep and mortality exponential
- Fatigue and forgetfulness

Deprivation Acclimation

- Our bodies get used to how we feel when sleep deprived
- Function at a lower mental capacity
- Feel tired and more irritable or depressed
- Reduced physical performance
- Unaware that this happened

Over months and years of low level deprivation, we acclimate to reduced energy levels and lower level functioning. We’re unaware of the mental and physical performance degeneration, as well as the disastrous health effects that accumulate over time.

Some people maintain that they do just fine on 5 to 6 hours of sleep. If assessed in a sleep lab; however, the evidence would show to the contrary. Only an infinitesimally small percentage of people successfully function on so few hours of sleep. If you believe you’re one of them, it is extremely unlikely. To quote Dr. Thomas Roth (Henry Ford Hospital), “The number of people who can survive on five hours of sleep or less without impairment, expressed as a percent of the population, and rounded to a whole number, is zero.”

Lack of Concentration

- Declines even with minimal sleep loss
- Slowed response time
- Shortened focus duration
- Microsleep - loss of consciousness
  - Eyes partially open or closed
  - No visual or motor perception
- Extremely dangerous while driving
- 2 seconds can be fatal

Sleep Facts

Drowsy driving causes more accidents than alcohol and drugs combined.

Sleep Facts

More than 250,000 people fall asleep at the wheel every day.
Of all the dire consequences sleep deprivation inflicts, none suffers more quickly than concentration. Even the smallest loss of sleep reduces the ability to focus. When behind the wheel of a car, drowsy driving is as dangerous as driving under the influence of drugs or alcohol.

Drivers very rarely fall completely asleep at the wheel; instead, they suffer from a momentary lapse of consciousness called a microsleep. During microsleep, eyes can be partially or completely closed. The brain loses sense not only of the outside world, but its own perceptions, including visual and motor actions. Behind the wheel of a car, two seconds is enough to kill.

In a study on the effect of sleep on concentration, one scientist took a group of individuals into his laboratory for 14 days straight. They had 8 hours of sleep, measured by the lab, every night, and were put through a concentration test. The experiment consisted of the participant pushing a button when a light appeared on a screen. Both the responses and time to respond were recorded. After 14 days, researchers divided the subjects into 4 groups that were given different “doses” of sleep deprivation for another 2 weeks. The first group was kept awake for 72 hours straight, the second was allowed 4 hours per night, the third 6 hours per night, and the last group remained the control, continuing to get a full 8 hours rest.

Scientists observed striking results. It’s pretty obvious that those who lacked sufficient sleep had slower reaction times and shortened concentration, but in addition, at times, participants would stop responding altogether. The slower response speed was not the most disturbing, but rather, a lack of response altogether. These microsleeps were a complete loss of consciousness. Translated into a real world scenario, this is all of the time it takes to strike a child who runs out into the street to get a ball.

It’s not surprising that the control group maintained a steady and consistent response rate during the second 2 weeks, nor that the group that stayed up for 72 hours increased the rate of missed responses by 400%. What was surprising, however, were the results from the groups who received 4 and 6 hours of sleep. After six consecutive days of 4 hours of sleep, that group’s response rate decrease by 400% as well. By day 11, it was even worse.

After ten days, the 6 hour sleep group’s results were akin to staying awake for a full 24 hours. This is extremely eye opening, given how common 6 hours of sleep is for many adults.

Sleep Facts
A car accident caused by sleepiness occurs every 30 seconds in the U.S.
MYTH: If driving while sleepy, rolling the window down, playing the radio loudly or talking on the phone do not help drivers stay awake.
Drowsy vs. Drunk Driving

Later studies compared drowsy and drunk driving impairment. After 19 hours of being awake (ex: 6 a.m. - 1 a.m.), participants were just as impaired as someone who was legally drunk (0.08 blood alcohol). Now consider what the response times would be if an individual were both tired and intoxicated. It would stand to reason that the impact doubles, but in fact, it multiplies.

| 19 hours of wakefulness | Legally drunk (.08 blood alcohol) |

In a study using a driving simulator, four groups of various sleep deprivation doses and inebriation doses were tested. Scientists predicted that those under the influence of both, based on the results of the other groups, would deviate from the simulated road 12 times more often than a well-rested individual. What they found was they deviated **30 times more**.

If you’re still not convinced drowsy driving is an epidemic in the developing world, make sure to read the Sleep Facts scattered throughout this section.

Brain Anatomy and Feelings

Two different areas of the brain light up in different ways where emotion is concerned. The **amygdala** is the first responder to external stimulus. It triggers an alarm when it thinks danger, stress or conflict are present. Its job is to protect us by triggering a “fight or flight” response, which releases a whole cascade of hormones such as cortisol and adrenaline. These and other hormones increase heart rate and breathing and engage muscles to leave the scene.

While serving an important purpose, if the “fight or flight” becomes chronic, the body remains in a high sense of alert, stress and emotional stimulation (not the good kind!). The amygdala is not capable of classifying the external stimulus as good or bad. It is therefore important that its connection to the prefrontal cortex is a superhighway, and not a small path.

The **prefrontal cortex** is the brain’s CEO. It processes information on a higher level, assessing in a critical, logical and organized way, allowing the brain to identify what type of response or emotion is appropriate to the situation. Quality sleep helps to strengthen and speed up the

**Sleep Facts**

Drowsy driving is responsible for 1,550 fatalities and 40,000 nonfatal injuries annually in the United States.
neural connections between the amygdala and the prefrontal cortex, allowing us to regulate emotions.

Studies also show that in sleep deprivation, not only is the connection weakened, amygdala activity increases, which means we’re much more prone to moodiness, anger, and a diminished ability to read others’ emotions.

It bears noting that stress management also reigns in an overactive amygdala and promotes its communication with the prefrontal cortex. And since sleep impacts our stress levels, all roads lead back to the importance of a good night’s rest!

**Emotional Consequences**

- Irrational anger
- Irritability
- Mood swings (including positive)
- Aggression
- Bullying
- Violence
- Cravings and addictions

Emotional brain consequences are many fold.

Think about the implications this has both in our personal lives and in the workplace. We can all think of a time when we were tired that we flew off the handle and overreacted.

We’re much better equipped to handle peer and family relationships and communication, and are much more likely to seek out social connections, when we’re able to successfully control stress and emotion.

**Psychiatric Disorders**

All major conditions exhibit abnormal sleep:

- Depression
- Anxiety
- PTSD

There is not one psychiatric disorder that exhibits normal sleep. Mental health clinicians have always assumed that sleep disturbance is the result of the disorder, suggesting a one way relationship between the two.
**New Research**

- Brain regions impacted by mood disorders are the same as sleep regulation and loss
- Abnormal genes in some psychiatric disorders are the same as circadian rhythm control

Certain disorders possess the very same brain region abnormalities as those associated with sleep regulation and sleep loss. What’s more, genetic research has found that genetic abnormalities evident in some disorders are the very same that are responsible for circadian rhythm control. This is not to suggest that sleep loss causes or can cure mental health disorders, only that there is more of a two-way relationship than once believed.

**Alzheimer’s Disease**

A public health challenge.

- Over 40 million people suffer from Alzheimer’s (Walker, 2017)
- 1 in 10 over the age of 65 have it (Walker, 2017)
- Longer lifespan and decreased sleep time will increase this number in the future
- Sleep is key lifestyle factor
- No treatment or cure
- Exaggerated sleep disturbance
  - Early warning sign?
  - Contributes to disease?
  - Sleep and disease in negative spiral
- NREM
- Beta-amyloid and glymphatic system

Alzheimer’s is a brain disease that continues to be misunderstood, with no prevention or treatment available. In years of research, scientists have discovered that there’s a build-up of a toxic protein called beta-amyloid. It collects in sticky clumps in the brain and kills off brain cells in some (but not all) areas of the brain.

Sleep and the disease are intertwined in a negative spiral which worsens the condition.

Looking at an Alzheimer’s sufferer’s sleep, we would see that it is much more disrupted than the normal NREM decline associated with aging. Exaggerated sleep disturbances begin occurring several years prior to the onset of Alzheimer’s, meaning it could be either contributing to it or an early warning sign. The degree of sleep disruption mirrors that of the severity of the disease - the more jarring the sleep, the worse the disease.

Scientists discovered brain “power cleaners” called glial cells. They form the glymphatic system, which acts much like the lymphatic system in the body, a sewage system that cleans out unwanted waste. Among this metabolic waste is the sticky amyloid and other proteins.
that may be linked to Alzheimer’s. Clean-up occurs during NREM. This finding adds yet one more compelling reason to give ourselves the opportunity for both types of sleep throughout life.

**Sleep and the Body**

In addition to brain benefits, sleep keeps our bodies healthy:

- Heart health
- Immunity
- Cancer
- Weight gain/obesity
- Diabetes

**Heart Health**

Sleep is blood pressure medication.

Quality sleep provides a healthy dose of (free) blood pressure medication. With as little as 1-2 hours of sleep deprivation, our bodies begin to decline. Our heart rate accelerates and our blood pressure goes up. In essence, we’re triggering a “fight or flight” response. With a release of stress hormones cortisol and adrenaline, we’re primed and pumped.

As we discussed earlier, living in a chronic state of stress damages the body. Blood vessels deteriorate and no longer function properly; they’re prone to plaque buildup and hardening of the coronary arteries. What’s worse, the healing benefits of growth hormone is altered during stress/sleep deprivation, so we lose our ability to repair the damage.

During NREM sleep, the brain sends calming signals to the sympathetic nervous system to provide much needed relaxation and repair.

The chronically sleep deprived are at an extremely high risk for cardiovascular disease, heart attack and stroke.
Immunity

Sleep and immunity go together:
- Disease-fighting superpowers diminish
- When we’re ill, we need more sleep

Good sleep:
- Fosters stronger immunity
- Produces protective antibodies

The connection between illness and sleep is two way. When we lack sleep, disease-fighting superpowers diminish. When we’re ill, our need for sleep increases in order to combat the illness. Together with a healthy diet and regular exercise, sleep is the foundation for a strong immune system. We are born with an army of disease-fighting defenders, natural killer cells that mobilize and attack foreign bacteria, viruses and cells. With even a small sleep deficiency, killer cells are less effective.

One researcher at the University of California San Francisco performed an interesting study on 150 participants willing to subject themselves to a flu virus. First, he measured their sleep using a wearable device for one week. Second, he quarantined them in a lab and injected them with a flu virus. Samples of blood, saliva and mucus were collected to track the immune response. Based on antibody levels in the blood and saliva, he determined who caught the flu. The scientist then separated them into 4 groups based on the number of hours of sleep obtained the week prior. The infection rate for those that slept an average 5 hours was 50%, whereas the rate was only 18% for those that slept 7 or more hours. (Walker, 2017)

Sleep also affects our ability to build antibodies. When scientists administered the flu vaccine to 2 groups of adults with different sleep amounts, they found something surprising. Those that slept 4 hours for 6 nights produced only half the flu-fighting antibodies that their counterparts who got a full night’s rest did. Studies on Hepatitis A and B vaccines produced similar results.

Cancer

The science showing the link between lack of sleep and cancer is so strong, that the World Health Organization has classified nighttime shiftwork as a “probable carcinogen.”

We now know that people who work nights are at an astronomically higher risk of developing disease, including cancer. Chronic inadequate and low quality sleep compromises the immune system and every organ and tissue in the body. Our army of natural killer cells, when robust and fortified by sleep, are capable of destroying malignant tumor cells. A disrupted circadian rhythm renders killer cells less effective. There’s evidence that getting half the
recommended hours of sleep (4 hours), reduces killer cell circulation in the immune system by 70%. (Walker, 2017)

Individuals with less than 6 hours of sleep have a 40% higher risk of developing cancer than those who get between 7 and 8 hours. In addition to being higher risk, if cancer is present, it spreads much more quickly.

- Inadequate sleep compromises immune system
- Disrupted circadian rhythm = weaker natural killer cells
- Immune system \(\downarrow\) 70% with less than 4 hours
- Cancer risk 40% \(\uparrow\) less than 6 hours
- Disease spreads more quickly

**Metabolism: Weight Gain & Obesity**
- Hunger hormones disrupted
- “I’m full” signal turned off (leptin)
- “I’m hungry” signal amped up (ghrelin)
- Consume additional 300 calories per day
- 10-15 pounds weight gain per year
- Pre-frontal cortex turns off when food is present

The short clip we watched ([www.youtube.com/watch?v=0HxvEcyfbo](http://www.youtube.com/watch?v=0HxvEcyfbo)) referred to the skewed interplay of hunger hormones leptin and ghrelin when we’re tired. Not only is our “I’m full” signal turned off, but our “I’m hungry, feed me please,” dials up. We crave quick energy sources - carbs and sugar. The more tired we are, the more we eat, and the more weight we gain. Couple fatigue and the lack of desire for physical activity, and we have a recipe for obesity.

Studies show we eat up to an additional 300 calories per day when we’re sleepy. Add that up across a year, and the scale creeps up 10-15 pounds!
Researchers also studied brain activity patterns of sleep deprived individuals about to partake in a meal. Remember the pre-frontal cortex, the brain’s CEO in charge of self-control, reasoning and logical thinking? We remember from earlier that communication and signals decrease when we’re tired. When shown images of food, participants’ prefrontal cortex remained quiet, while the areas of the brain associated with pleasure and desire lit up.

**Diabetes**

A serious health condition where the body is unable to control blood sugar levels.

Individuals with diabetes are at a high risk for:

- Blindness
- High blood pressure and heart disease
- Kidney failure
- Nerve problems and limb amputations

Both fatigue and a poor diet lead us on a path to diabetes. In healthy individuals, the release of insulin successfully maintains glucose levels. Over the years, unmanaged diabetes damages the body and shortens life span. Their life expectancy is 10 years shorter than that of a healthy individual.

- Sleep loss - major contributor to type 2 diabetes
- Link between sleep and blood sugar
- Cells become less responsive to insulin
- Financial impact
  - About $85,000 treatment costs annually

Research has shown a connection between sleep loss and abnormal blood sugar levels. In one early study on diabetes, a group of otherwise healthy adults were allowed only 4 hours of sleep in a lab for 6 nights. In only 6 days, researchers found that their ability to absorb glucose by releasing insulin had reduced by 40%! We now know that the cells themselves become far less responsive to insulin, resisting insulin’s message for cells to open their receptors and absorb it.

The disease also impacts financial health. The average treatment cost for a diabetic is $85,000 per year. Evidence has shown that chronic sleep deprivation is a major contributor to type 2 diabetes, and is a completely preventable contribution. (Walker, 2017)
Mindfulness Based on Science

Mindfulness and sleep share similar benefits, PLUS mindfulness helps you fall asleep.

- Affects at least 8 parts of brain
- Self-regulation
- Memory
- Focus
- Motivation
- Compassion
- Resilience

Mindfulness

- A state of attention and focus on the present
- Active skill, not zoning out

Types:

- Breathing exercises
- Mindfulness of the senses (touch, sound, taste, smell)
- Meditation
- Yoga

Breathing Exercises

- Calms the amygdala and sympathetic nervous system (like REM)
- Blood pressure and heart rate return to normal levels

Breathing exercises are the most common form of mindfulness. When you get stressed, your breathing becomes faster and shallower as your sympathetic nervous system prepares you for fight or flight. When the stressful situation is over, your parasympathetic nervous system kicks in and slows down your breathing. With mindfulness, you purposely slow your breathing down and this slows down your heart rate. The parts of your brain responsible for sensing movement and breathing send signals to your amygdala that the threat is over and the whole system begins to calm down.

We’re going to try a short breathing exercise now. Remember as you go through this that there is no wrong or right way to do this. Do not change anything, simply notice where you are and do not judge or worry if you’re doing it right. Most importantly, be open to the experience!

Watch the video - https://www.youtube.com/watch?v=5Ef5TJZ6Nk
We’ve designed a digital calendar with two months’ worth of links for all kinds of ways to practice mindfulness: breathe, think, thank, move. See the Appendix to access the digital version.

Thanks to The Monday Campaigns for sharing their materials which are valuable every day of the week!

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MONTH 1

MONTH 2

Want to train your brain to be less stressed?

It’s easy to be more mindful with these quick enjoyable activities, all 10 minutes or less. Establish a new habit by practicing it on a Monday. When we start the week off right it sets a positive tone, and we are much more likely to repeat the habit throughout the rest of the week.

Here’s how to find your happy place every day:

- Select a preferred time to take a work break.
- Identify a place where you feel comfortable.
- Set a reminder on your cell phone or in Outlook.
- When you are ready to begin, click a link on the calendar and follow the instructions.

- If you find you’d rather do a different activity, feel free to choose another link.
- Invite co-workers to join in and make the experience twice the fun.
- For added benefit, take stress breaks on the weekend too.
# Sleep Diary

**Name:**

**Beginning date:**

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| Number of hours slept last night: | 8 |
| Number of awakenings and total time awake last night: | 5 times 2 hours |
| How long it took to fall asleep: | 30 minutes |

| Medications taken last night: | None |
| How awake did I feel when I got up this morning? | 2 |
| 1 – wide awake | |
| 2 – awake but a little tired | |
| 3 – sleepy | |

| Number of caffeinated drinks (coffee, tea, soda) and time when I had them: | 1 drink 8 p.m. |
| Number of alcoholic drinks (beer, wine, liquor) and time when I had them: | 2 drinks 9 p.m. |
| Naptimes and lengths today: | 3:30 p.m., 45 minutes |
| Exercise times and lengths: | None |
| How sleepy did I feel during the day? | 1 |
| 1 – So sleepy had to struggle to stay awake during much of the day | |
| 2 – Somewhat tired | |
| 3 – Fairly alert | |
| 4 – Wide awake | |

Session 4: Awake at Night – the Downside of the Modern Age

Sleep Disorders

There are over 100 classified sleep disorders. We’re going to cover only the most common; however, there are more resources in the Appendix. If you feel you may have a sleep disorder, start with your primary care physician, who will make an initial assessment and provide next steps as necessary.

Insomnia

- Most common sleep disorder
- NOT sleep deprivation (able to sleep but inadequate sleep opportunity)
- Insomniacs have adequate sleep opportunity but are unable to sleep

Two types
- Sleep onset
- Sleep maintenance
- Can have one or the other or both

Diagnostic Criteria

- Unsatisfied with length or quality of sleep
  - Falling asleep
  - Staying asleep
  - Waking early
- Significant impairment during the day
- At least 3x/week for more than 3 months
- No existing mental or medical conditions that can masquerade as insomnia

Insomnia Triggers

- Emotional concerns and worry
- Emotional distress and anxiety
- Psychological (mental health disorders)
- Medical
- Physical
  - Aging, caffeine and alcohol consumption, physical activity

Sleep Facts

10 million Americans take a sleeping aid every month.
Prevalence / Risk Factors

- Extremely prevalent
- 40 million people (1 in 9 Americans)
- If guidelines were 1x/week, 2/3 of population would be insomniac
- Twice as common in women
- African and Hispanic American - increased risk

A note about African Americans and Hispanic Americans. Both of these groups have a higher prevalence of cardiovascular disease, diabetes and obesity, so it's not surprising that we also see a higher likelihood of insomnia.

Medications and Substances Associated with Insomnia

- Alcohol (use and withdrawal)
- Caffeine
- Nicotine
- Antidepressants (SSRI, SNRI, atypical)
- Corticosteroids
- Decongestants
  - Phenylpropanolamine
  - Pseudoephedrine
- β agonists, theophylline derivatives
- β antagonists
- Statins
- Stimulants
- Dopamine agonists

Any drug that crosses the blood brain barrier and affects a neurotransmitter system may be associated with insomnia.
**Physical Effects**

As with other conditions, an insomniac has the inability to wind down and shut active areas of the brain down. Their sympathetic nervous system remains activated, remaining in the “fight or flight” state resulting in elevated heart rate and blood pressure, metabolic rate and release of stress hormones.

Those suffering from insomnia also have a higher core temperature (remember, our body temperature drops for sufficient sleep). When sufferers remain in the “fight or flight” mode, they are in “alertness” mode and release cortisol, adrenaline and noradrenaline into the blood stream. When we look at the brainwaves of someone who has chronic trouble finding sleep, the activity pattern is different than that of normal sleep. The emotion-centered amygdala, and the memory-linked brain keeps the brain in a constant memory of reliving past experiences and worrying about the future. Insomniac brains, once asleep, achieve more shallow NREM and fragmented REM.

**Old School vs. New School: Sleep in the Modern Age**

**Sleep Facts**

The use of an iPad reduces melatonin release by 50% at night.

Our ancestors followed the most innate circadian rhythms. With no electricity or temperature control, they rose with the sun and went to bed when it got dark. Even after the discovery of fire and later gas lamps, nighttime activities such as storytelling and singing or playing an instrument were subdued, and bedtime continued to be much earlier.

Electricity and the invention of the lightbulb changed everything. Humans could extend the daylight hours and maintain warmer temperatures inside. Televisions and eventually computers came to every household.

In 1997, Japanese engineers invented the LED (light emitting diode). Unlike other forms of light, LED emits blue light. The human eye is particularly sensitive to blue in the color spectrum which suppresses the nighttime release of melatonin by 50% when compared to a warm light incandescent bulb.

**Sleep Facts**

90% of Americans use some form of LED electronic device less than 60 minutes before bed.
Sleep Apnea

A condition where the upper area of the breathing airways closes up and cuts off/interrupt breathing until you wake up again.

- Affects 18 million Americans
- Frequent awakenings prevent sufficient restorative deep sleep

Higher risk for:

- Behavior and mood problems
- Tripled risk of car accidents
- Increased headaches
- Trouble concentrating, thinking clearly, learning, remembering

Because people who have sleep apnea frequently go from deeper sleep to lighter sleep during the night, they rarely spend enough time in deep, restorative stages of sleep. They are therefore often excessively sleepy during the day. Such sleepiness is thought to lead to mood and behavior problems, including depression, and it more than triples the risk of being in a traffic or work-related accident.

The many brief drops in blood-oxygen levels that occur during the night can result in morning headaches and trouble concentrating, thinking clearly, learning, and remembering. Additionally, the intermittent oxygen drops and reduced sleep quality together trigger the release of stress hormones. These hormones raise your blood pressure and heart rate and boost the risk of heart attack, stroke, irregular heartbeats, and congestive heart failure.
Signs of Apnea

Common signs of apnea:

- Loud, consistent snoring
  - Wake up gasping for air
  - Stop breathing momentarily
  - Making choking sounds
- Waking up tired
- Sleeping with mouth open
- Waking up due to breathing difficulty

If you know or have been told by your partner that you snore, stop breathing or gasp for air, the best place to start is with your primary care physician (PCP). Your PCP can exclude other issues, determine if a sleep study might be warranted, and refer you to a sleep specialist.

What is a Sleep Study?

Watch the video - [www.youtube.com/watch?v=GMV6Cd0jVzc](http://www.youtube.com/watch?v=GMV6Cd0jVzc)

UnitedHealthcare (UHC) Cost Estimator

Find sleep specialists on [www.myuhc.com](http://www.myuhc.com). You’ll also want to use the cost calculator to get an estimate of the cost of a sleep study. Providers negotiate different contracts with insurance companies, so some are much more affordable to you than others (usually depending on the location of the study).

Log into [www.myUHC.com](http://www.myUHC.com):

- Find Care and Costs
- Cost Estimates
- Office Visit
- Specialist Visit

Keep in mind that at-home sleep studies are much less expensive. There is specific medical criteria and physician documentation that is required in order for insurance to cover part of the cost.
Somnoambulism

- Sleep walking
- Sleep eating
- Sleep talking
- Sleep texting
- Sleep homicide (very rare)

Scientists aren’t sure why this moving during sleep happens, but one guess is that there is a spike in the nervous system which jolts the brain from NREM to consciousness but gets stuck in the middle. It is somewhat common, especially in children, and unless it poses a safety or health risk, is not dangerous.

- Not REM dream sleep (remember muscles are completely turned off!)
- In NREM sleep

Take a Chill Pill (or Not)

Natural sleep is far different than the “sleep” that comes out of a prescription bottle, which actually increases health risks. Sleeping pills are sedative hypnotics, so rather than helping us to sleep, they sedate us. When compared, sedative brainwaves lack the largest and deepest brainwaves natural sleep entails. Additionally, side effects include inability to cement memories, grogginess and slowed reaction times. This may induce a vicious cycle where we consume more caffeine to stay awake, only to have trouble falling asleep the following night, thereby perpetuating the insomnia.

Sleeping pills also induce an insomnia rebound effect. We build up a tolerance to the drug and when the drug is stopped, our brains go through a withdrawal process. This usually entails far worse sleep than prior to taking the pills.

When a committee of researchers reviewed published studies on newer sleep sedatives, they found that although individuals reported that they fell asleep faster, slept more soundly and woke up less often. When subjected to a sleep test that looked at brainwaves, that was not in fact the case. The amount of time it took individuals to fall asleep on the placebo versus the medication was roughly the same, so there was no benefit to the medication beyond what the placebo effect accomplished.*

Pill Pitfalls

- May weaken brain connections associated with learning and memory
- Higher likelihood of developing cancer
- Higher risk of fatality
  - Could be due to lowered immunity
  - Higher risk of fatal drowsy driving
  - Incurred health risk due to poor sleep prior to meds

In animal studies, the use of Ambien to induce sleep showed that the drug actually weakened the neural connections that form during learning and cementing memories. Doctors are now prescribing sleeping sedatives to younger and younger populations, which is concerning since the brain is in full development and increasing and refining these connections.*

Another concerning effect of sleep aids such as Ambien is that individuals who use the drug are much more likely to develop cancer than those who did not.^ In 2012, over 10,000 individuals taking Ambien or Restoril were followed across two-and-a half years. They were compared against a group of 20,000 that were not. After controlling for many factors, including BMI, smoking, exercise history and drinking, those that took sleeping pills were 4.6 times more likely to die over this two year period. The more frequent use, the higher the likelihood of death compared to those not using sleep aids. Fifteen other studies to date have shown similar findings.

The reason for higher mortality rates is hard to answer from available data. One frequent cause of death is the risk of infection. Remember that natural sleep provides strong immunity. Sleeping pills that sedate users do not offer these health benefits. Another potential cause of death is a higher rate of fatal car accidents. Upon waking after a night of sedation, users are more groggy and drowsy, putting them at a higher risk.

To be clear, these findings do not prove that sleep sedatives cause cancer. Other factors could play a role, especially that of the individual’s poor sleep prior to taking the medication (which would put them at a higher risk of disease and deadly drowsy driving as well). More research needs to be done.

If you currently use Ambien or another sedative, we are NOT prescribing that you cease taking them, but it’s important to be aware of risks in order to make a well-informed decision about using the medication.


Other Sleep Therapy Options

Other methods in early stages of research:

- Electrical
- Magnetic
- Auditory (sounds)

Alternative methods of sleep therapy that include electrical, magnetic and auditory stimulation are under research; however, these are in the early stages.

The most effective method to improve insomnia is cognitive behavioral therapy for insomnia (CBT-I). This treatment involves working with a therapist for several weeks who instructs the patient on techniques to improve bad sleep habits and decrease anxiety. Some include the tips for better sleep reviewed earlier in the class; however, some are actually counterintuitive, such as initially reducing time in bed to six hours or less. Over time, the patient’s confidence to generate good sleep increases.

Sleep in the Workplace

Societal change in industrialized countries:

- Must start work at a certain time
- Culture shift that values less sleep
  - Example: CEO’s/supervisors send emails late into night

There is an organizational disconnect between sleep and productivity. There are existing policies on:

- Employee health
- Safety
- Conduct
- Smoking
- Ethical behavior
- Substance abuse

But no sleep policy.

The High Cost of Sleep Deprivation

- Estimated $2,000 cost per employee in lost productivity per year
- $411 BILLION lost productivity in the U.S.*
  - Unproductive employees (“presenteeism”)  
  - Less accurate solutions  
  - Less motivated, less creative  
  - Ethics negatively affected

Leaders and Supervisors

- Reduced ability to lead effectively
- Poor self-control
- Employees less engaged

Sleep deprivation in leaders and supervisors results in a reduction of effective leadership, self-control and employee engagement.

Leadership Support

When leadership supports work-life programs:

- 74% employees exceed performance expectations
- 75% more satisfied with job
- 48% increase in morale
- 53% improved health
- 44% manage stress better
- Only half of employees felt they had supervisor support in work/life program use

A 2018 Federal Government study of government employees* found that those who engaged in work/live and health and wellness programs were 74% more likely to exceed expectations on performance reviews, were 75% more satisfied with their job, and were 66% more likely to want to remain with their employer. There is a 48% increase in morale, 53% improved health, and 44% were able to better manage stress.

Eighty two percent of employees perceive supervisor support of employee needs (time off, personal and family responsibility, etc.), but only about half feel that supervisors support the use of work/life programs. This is an important consideration for supervisors, who have an opportunity to improve their department culture, employee happiness and ultimately production.


In Conclusion …

There are a vast range of sleep deprivation consequences from poor brain development and crankiness to fatality.

To foster change:

- Individual internal motivation to improve sleep
- Societal/workplace support of wellness, work/life balance, and adequate rest
| Section 1: Complete in the MORNING |  |  |  |  |  |  |  |  |
| Time I went to bed last night: | 11 p.m. |  |  |  |  |  |  |  |
| Time I woke up this morning: | 7 a.m. |  |  |  |  |  |  |  |
| Number of hours slept last night: | 8 |  |  |  |  |  |  |  |
| Number of awakenings and total time awake last night: | 5 times 2 hours |  |  |  |  |  |  |  |
| How long it took to fall asleep: | 30 minutes |  |  |  |  |  |  |  |
| Medications taken last night: | None |  |  |  |  |  |  |  |
| How awake did I feel when I got up this morning? | 2 |  |  |  |  |  |  |  |
| 1 – wide awake |  |  |  |  |  |  |  |  |
| 2 – awake but a little tired |  |  |  |  |  |  |  |  |
| 3 - sleepy |  |  |  |  |  |  |  |  |

| Section 2: Complete in the EVENING |  |  |  |  |  |  |  |  |
| Number of caffeinated drinks (coffee, tea, soda) and time when I had them: | 1 drink 8 p.m. |  |  |  |  |  |  |  |
| Number of alcoholic drinks (beer, wine, liquor) and time when I had them: | 2 drinks 9 p.m. |  |  |  |  |  |  |  |
| Naptimes and lengths today: | 3:30 p.m., 45 minutes |  |  |  |  |  |  |  |
| Exercise times and lengths: | None |  |  |  |  |  |  |  |
| How sleepy did I feel during the day? | 1 |  |  |  |  |  |  |  |
| 1 – So sleepy had to struggle to stay awake during much of the day |  |  |  |  |  |  |  |  |
| 2 – Somewhat tired |  |  |  |  |  |  |  |  |
| 3 – Fairly alert |  |  |  |  |  |  |  |  |
| 4 – Wide awake |  |  |  |  |  |  |  |  |

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APPENDIX

This class was inspired by the work of Dr. Matthew Walker, Ph.D.  
*Why We Sleep: Unlocking the Power of Sleep and Dreams*, Matthew Walker, Ph.D., 2017

CLASS VIDEOS

Session 2:  
Sleep Cycles www.youtube.com/watch?v=GMV6Cd0jVzc
Five Tips for Falling Asleep Quicker www.youtube.com/watch?v=ZKNQ6gsW45M

Session 3:  
Effects of Sleep Deprivation www.youtube.com/watch?v=0HxvEcvfbho
Breathing Exercise www.youtube.com/watch?v=SEfs5TJZ6Nk

Session 4:  
Sleep Study www.youtube.com/watch?v=GMV6Cd0jVzc

ASSESSMENTS

SATED Sleep Assessment - Sleep Apnea  

RESOURCES / INFORMATION

Bedtime Calculator www.sleepfoundation.org/articles/bedtime-calculatortm

Calendar, Stress Less  
www.pinellascounty.org/hr/health_wellness/pdf/stress-less-perpetual-calendar.pdf

Diary, Sleep www.pinellascounty.org/hr/health_wellness/pdf/sleep-diary.pdf

Dreams - How Lucid Dreaming Works www.youtube.com/watch?v=qH-MGqokk_Y

Drowsy Driving www.sleepfoundation.org/professionals/drowsy-driving

The Effects of Alcohol on Quality of Sleep www.ncbi.nlm.nih.gov/pmc/articles/PMC4666864/

Guide to Healthy Sleep (National Institute of Health: National Heart, Lung, and Blood Institute)  

Healthy People 2020 Objectives (Office of Disease Prevention and Health Promotion)  
www.healthypeople.gov/2020/topics-objectives/topic/sleep-health
National Center for Sleep Disorder Research  
www.nhlbi.nih.gov/about/divisions/division-lung-diseases/national-center-sleep-disorders-research

National Sleep Foundation www.sleep.org/

Pain www.sleepfoundation.org/articles/pain-and-sleep

Pillows www.sleepfoundation.org/articles/how-pick-right-pillow-you

Restless Leg Syndrome www.rls.org/

Stress Less Calendar  
www.pinellascounty.org/hr/health_wellness/pdf/stress-less-perpetual-calendar.pdf

Shiftwork  
Nightshift Worker Training (Centers for Disease Control and Prevention: National Institute for Occupational Safety and Health)  
https://www.cdc.gov/niosh/work-hour-training-for-nurses/mobile/211.html  
www.sleepfoundation.org/articles/shift-work-and-sleep

Statistics  
www.sleepassociation.org/about-sleep/sleep-statistics/  

Teens and Sleep www.sleepfoundation.org/sleep-topics/teens-and-sleep

UnitedHealthcare Resources  
13 min video on Sleep Health  
www.brainshark.com/uhcna/vu?pi=zl4z2dQjvzORnTz0&nodesktopflash=1

Find a sleep doctor or sleep clinic www.myuhc.com
Health & Wellness Program
(727) 464-4049
wellness@pinellascounty.org

Visit the Wellness website at www.pinellascounty.org/hr/wellness