



The Guidelines

Breathing and Sleep

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Introduction

Our brains require oxygen, detoxification, and memory consolidation to survive and stay healthy. We take about 20,000 breaths every day, one roughly every 4 seconds, and should sleep about a third of our lives to provide these elements. Even seemingly small issues with either function compound into increasingly larger problems over time, notably cognitive decline and dementia. This guideline focuses

on the importance of breathing and sleep, how problems affect the brain and practical steps to ensure and create optimal function.

The Importance of Breathing and Sleeping

Before detailing the problems, it is important to emphasize that health comes from quality breathing and sleep. Improvements in breathing, air quality or sleep quality will likely result in improvements in health, and the unfortunate reality is that most people have some room for improvement in these areas.

While everyone knows death or brain damage will result from a lack of oxygen, very few—even professionals—know that less acute but chronic oxygen deprivation can have devastating effects. Even just breathing polluted or low quality air can harm the brain over time, and disrupted sleep from poor breathing or other causes damages sleep architecture inhibiting the detoxification and memory consolidation processes. Dementia can be one of those devastating effects. New research has identified dementia as a common symptom of oxygen deprivation and sleep disturbances, especially with Obstructive Sleep Apnea (OSA).

A Lifetime of Breathing and Sleep

Although dementia occurs primarily in the elderly, the factors that cause it can begin as early as childhood when they harm not only the brain but the rest of the body. For example, mouth breathing can cause abnormal facial and dental development, poor sleeping habits that interfere with growth and academic performance, and produce a misdiagnosis of ADHD.¹ The damage may show up during childhood as neurobehavioral and neurocognitive disorders, but consequences in adulthood extend to double, triple, or quadruple the risk of cancer, diabetes, stroke, heart disease, cardiac-mortality, and dementia. In adulthood, mouth breathing can cause poor oxygen concentration in the bloodstream, which can cause high blood pressure, heart problems, and sleep apnea, all risk factors for dementia. This example shows how important paying attention to seemingly small issues with breathing and sleep as the harm can add up over a lifetime.

Reduced Oxygen Level Damage

Repeated curtailment of air intake desaturates the blood reducing the amount of oxygen the blood carries creating hypoxia, a deficiency in the amount of oxygen in the tissues. Hypoxia diminishes and distorts cellular activity and effectiveness throughout the body, curtailing normal brain development in children and brain cell replacement and brain function in adults.²

Poor Sleep Quality Damage

For as long as the healthy sequence of sleep states is disturbed, the body cannot execute the important processes that occur during each of those stages, particularly detoxification and memory consolidation. According to Nedergaard, a leader in sleep research from the University of Rochester

¹ GASP: Airway Health, The Hidden Path to Wellness. Published 2016 by Dr. Michael Gelb and Dr. Howard Hindin

² *Dementia In Institutionalized Elderly: Relation To Sleep Apnea*, Sonia Ancoli-Israel PhD^{†,*}, Melville R. Klauber PhD[§], Nelson Butters PhD^{†,‡}, Linda Parker MS^{†,‡} and Daniel F. Kripke MD^{†,‡}, [Sleep](#). 1991 Dec;14(6):486-95.

NY, glial cells shrink during the night allowing cerebrospinal fluid to essentially wash the brain and carry away waste. But this housekeeping function of the brain, called the glymphatic system, can take place efficiently only during deep NREM sleep, and it requires at least 20% of total sleep time per night. The process removes beta-amyloid and tau proteins, which play significant roles in Alzheimer's pathology, so robbing the brain of deep sleep may contribute to the buildup of these in the Alzheimer's affected brain.³ Poor sleep also disrupts memory consolidation, another vital sleep process of storing new memories and pruning unused information, which thus diminishes memory recall over time.⁴

Secondary Sleep Effects

Why are these primary sleep and breathing disruptions so often unrecognized, undiagnosed as problematic, and consequently untreated? Because very few people (even professionals) are aware that hypoxia and fragmented sleep architecture produce the following secondary effects that can cause or contribute to dementia symptoms:

1. *Weakened blood-brain barrier*: A weakness in the blood-brain barrier allows an increase in the brain's toxic load, further contributing to the buildup of poisons in the brain caused by incomplete detoxing activities.
2. *Hardening of arteries*: Oxygen deprivation causes the tissues in the lining of the blood vessels to stiffen, which prevents the vessels from expanding enough to carry adequate nutrition throughout the body. Noted physician, author, and radio host Ronald Hoffman M.D. of The Hoffman Center has stated that vascular dementia may start earlier and be far more common even than Alzheimer's.⁵
3. *Increased oxidative stress*: Hypoxia and sleep disturbances increase oxidative stress—generating more free radicals than the body can neutralize and thus leading to DNA damage.
4. *Systemic inflammation*: Hypoxia and disturbed sleep architecture create inflammation throughout the body, which leads to premature aging and mental and physical deterioration.⁶
5. *Disrupted Diet control*: A lack of sleep disrupts the hunger and satiety hormones, ghrelin and leptin, and without the natural signals for when to eat and stop eating, it is common to overeat. Decreased willpower also results from decreased sleep and contributes to this effect.
6. *Diminished Cognitive ability*: lack of sleep results in diminished cognitive ability after only one night as anyone who has ever had a bad night of sleep can attest.

³ *Greater Risk Of Alzheimer's Disease In Older Adults With Insomnia* Osorio et Al, [J Am Geriatr Soc. 2011 Mar; 59\(3\): 559–562.](#) doi: [10.1111/j.1532-5415.2010.03288.x](#)

⁴ Walker, M. P. (2017). *Why we sleep: Unlocking the power of sleep and dreams*.

⁵ Dr Ronald Hoffman personal communication to Dr. Michael Gelb, DDS, MS, a member of the Sharp Again Naturally Medical and Dental Advisory Board.

⁶ Int J Mol Sci. 2019 Feb; 20(3): 459. *Obstructive Sleep Apnea and Inflammation: Proof of Concept Based on Two Illustrative Cytokines*, L. Gozal and D. Gozal

A Deeper Look Into What Causes Damage

Breathing Problems

Neither the public nor the professional community, even dentists, neurologists, pulmonologists, and ENT specialists, are equipped with the training and education they need in order to understand how severe the damage caused by dysfunctional breathing patterns, especially during sleep, can be. Fortunately, the situation is improving. The consequences of airway problems can be alleviated with proper treatment and even dramatically reverse in some cases.⁷ Moreover, the option to treat remains available long after the breathing problem begins, in many cases well into the last third of life. CPAP and oral appliance therapy can reverse many of the deficits; one study from The Center for Cognitive Neuroscience in Italy was especially encouraging. Researchers found patients with OSA had decreased grey matter volume in specific cerebral regions (the frontal and hippocampal regions) and deficits in executive functioning and short-term memory. These structural deficits were reversed after CPAP therapy, as were the functional and memory problems.⁸

There are many causes of an obstructed airway. The issue can be environmental as with Asthma, or physical, either from birth or from damage (e.g. a broken nose). Airway function can be mapped on a spectrum of obstruction⁹:

1. *Zero blockage*: Breathing through the nose is easy, free, and full. Cells of the body are fully oxygenated.
2. *Mouth breathing*: Breathing through the nose is mildly difficult to impossible, so the person breathes through the mouth, part or all of the night. This makes the air intake dry and interferes with sleep.
3. *Snoring*: Snoring occurs when both nose and mouth breathing are compromised, and the membranes and structures of the airways vibrate with the pressure of air being forced through narrowed channels.
4. *Upper Airway Resistance Syndrome (UARS) and Hypoapnea*: Characterized by the increased effort required for inhaling without instances of full blockage (apneas). Symptoms include sleepiness and harms/ severity of effects can range from snoring to OSA.
5. *Obstructive Sleep Apnea (OSA)*: OSA occurs when the airway is completely obstructed for 10 seconds or more at a time, causing intermittent nocturnal oxygen deprivation. A gasp reflex follows, pulling the brain up out of deep REM and NREM sleep and thus disrupting sleep architecture, sometimes hundreds of times a night.¹⁰

⁷ *Finding Connor Deegan* Published on Mar 13, 2015. By the Foundation for Airway Health, a 501(c)(3) non-profit organization. <https://www.youtube.com/watch?v=ZX5s4WNXK3M>.

⁸ *Obstructive Sleep Apnea: Brain Structural Changes And Neurocognitive Function Before And After Treatment* Nicola Canessa, Vincenza Castronovo, Stefano F. Cappa, Mark S. Aloia, Sara Marelli, Andrea Falini, Federica Alemanno and Luigi Ferrini-Strambi. *American Journal of Respiratory and Critical Care Medicine*, Vol. 183, No. 10 (2011), pp. 1419-1426. doi: [10.1164/rccm.201005-0693OC](https://doi.org/10.1164/rccm.201005-0693OC)

⁹ GASP: Airway Health, The Hidden Path to Wellness. Published 2016 by Dr. Michael Gelb and Dr. Howard Hindin

¹⁰ *Cognitive Effects Of Treating Obstructive Sleep Apnea In Alzheimer's Disease: A Randomized Controlled Study*, Sonia Ancoli-Israel et al. *J Am Geriatr Soc.* 2008 Nov 1; 56(11): 2076–2081. Published online 2008 Sep 15. doi: [10.1111/j.1532-5415.2008.01934.x](https://doi.org/10.1111/j.1532-5415.2008.01934.x)

A Quick Review of the Basics of Sleep

Sleep is complex. The body relies on normal patterns to get asleep, stay asleep and perform recovery and maintenance processes while asleep. This section gives a high level overview of some major sleep concepts to lay the foundation for discussing sleep problems and how they harm the brain. The first two, the Sleep/ Wake Cycle and Sleep Architecture, are the patterns of sleep, and the second two, memory consolidation and detoxification, the most important sleep processes for brain health.

Daily Sleep/ Wake Cycle: The daily cycle of sleeping and being awake is controlled by two complementary forces that should be synchronized: circadian rhythm and sleep pressure. The circadian rhythm, a roughly 24 hour cycle, powers wakefulness and peaks in early afternoon. The body sets this internal clock using routine external cues like daylight or eating. Sleep pressure creates sleepiness and results from the buildup of adenosine throughout the day and the clearance of it during the night. Maximum wakefulness occurs when the circadian rhythm is peaking and sleep pressure is low.

Sleep Architecture: The two major stage categories are REM (Rapid Eye Movement) and NREM (Non-Rapid Eye Movement). The stages occur in cycles with NREM weighted toward the beginning of the night and REM weighted more to the end. Consequently, going to bed later than usual diminishes NREM and waking up earlier reduces REM. Each stage serves many purposes, but at a high-level REM sleep strengthens connections in the brain and NREM prunes away unused connections. Deep NREM sleep is particularly important, because it's when the glymphatic system activates.

Memory Consolidation: The nightly process of strengthening new memories and pruning away unused information. Both processes occur during different sleep stages as discussed above, and they are both required for a healthy brain.

Detoxification through the Glymphatic System: As previously discussed, the brain detoxification system activates during NREM deep sleep and functionally washes the brain, cleaning away the marquee Alzheimer's proteins.

Sleep Problems

There are several problems that can impact sleep quality and duration, and therefore, brain health. Several of the following issues occur increasing as people age and may provide the basis for sleep quality and duration generally decreasing throughout life.

Deep Sleep Decline: Deep NREM sleep declines during aging and begins in the late twenties and early thirties. By the mid-to-late forties, 60 to 70 percent of deep sleep is gone and 80 to 90 percent is gone by age 70¹¹.

Sleep Fragmentation: Octogenarians have less than 70 to 80 percent sleep efficiency, meaning during 8 hours in bed they spend over 2 hours awake. In well-controlled studies, lower sleep efficiency translates to less energy, more likely to suffer from depression, higher mortality risk, lower cognitive functions, and worse physical health¹².

¹¹ Walker, M. P. (2017). *Why we sleep: Unlocking the power of sleep and dreams*.

¹² Walker, M. P. (2017). *Why we sleep: Unlocking the power of sleep and dreams*.

Creeping Circadian Rhythm: The circadian rhythm of older people can creep forward as they age, resulting in misaligned sleep/wake cycles and sleep disruption. Napping and a shift in when melatonin gets released contributes to this phenomena.

Brain Atrophy: Brains atrophy as people get older, and research has shown that one of the first parts of the brain to weaken helps generate sleep. The more severe the deterioration in that area, the more deep sleep loss a person experiences.¹³

Insomnia: People with insomnia have trouble falling asleep and/or staying asleep, which causes significant daytime impairment and dissatisfaction with their amount of sleep. For an insomnia diagnosis, sleep issues need to occur at least 3 times per week and cannot be attributable to other mental health issues. Insomnia is not the same as sleep deprivation in that it is characterized by the inability to sleep even when there is ample opportunity.

Sleep Deprivation: People with sleep deprivation are considered to have the ability to sleep, but not take or have the opportunity to sleep. Long term sleep deprivation has similar effects as insomnia.

It is also important to note that the quality of sleep and therefore its effectiveness can be greatly diminished without being a diagnosable clinical issue. Sleep is similar to other facets of health in that you are not simply getting good or bad sleep, but there is a spectrum of sleep quality. In pursuit of health, optimizing sleep, especially as one ages, can be one of the simplest and most important things to improve.

How to Improve Sleep and Breathing over a Lifetime

Starting in Childhood

Earliest intervention is highly recommended to open and strengthen the airway, because adequate oxygen and detoxing capabilities can have such an enormous impact on the development of the brain and the body. Many approaches have proven highly effective in a variety of cases including: breastfeeding¹⁴, adenotonsillectomy (removal of tonsils and adenoids), rapid palate expansion to increase airway space and decrease nasal resistance¹⁵, allergy treatments, myofunctional therapy to promote proper tongue position for improved breathing and occupational therapy.

Adulthood

Fortunately, we are coming to understand that Airway Sleep Disorder is not only a significant problem, it is also usually correctable. This is a cause for real hope for patients suffering from many associated conditions long considered intractable, including dementia.

Identify Airway and Hypoxia Problems

The first step to improving cognition is to assess if there is a problem with breathing during sleep. Review the indicators below to see if you experience any of them.

¹³ Walker, M. P. (2017). *Why we sleep: Unlocking the power of sleep and dreams*.

¹⁴ For a complete list of the benefits of breastfeeding, see "101 Reasons to Breastfeed" at <http://www.notmilk.com/11.html>

¹⁵ Pediatric obstructive sleep apnea and the critical role of oral-facial growth

Indicators of neurocognitive deficits that could relate to Airway Sleep Disorder		
Foggy brain	Memory loss	Weight gain
Daytime sleepiness	Morning headache	Chronic pain
Difficulty concentrating and focusing	Carbohydrate cravings	Cannot breathe well through nose
Allergies	Allergic shiners	Asthma
Nocturia (multiple urinations per night)	Chronic Periodontal Disease	Occlusion
Snoring/disturbed sleep	Tongue enlarged	Taking medications for:
<ul style="list-style-type: none"> • Frequent arousals 	<ul style="list-style-type: none"> • Cannot see the back of throat when mouth is open 	<ul style="list-style-type: none"> • Sleep or pain
<ul style="list-style-type: none"> • Gasping 	<ul style="list-style-type: none"> • Cannot touch back of front teeth w/ mouth open wide 	<ul style="list-style-type: none"> • Blood pressure or lipidemia
<ul style="list-style-type: none"> • Restless legs 	<ul style="list-style-type: none"> • Scalloped edges 	<ul style="list-style-type: none"> • Thyroid or Diabetes

If these indicators are present in significant numbers or intensity, you might want to take some of the following steps to determine if your sleep and breathing are impaired:

1. Take the [STOP-BANG](#) sleep test online:
2. Fill out an [Epworth Sleepiness questionnaire](#).
3. Ask your bed partner or caregiver if you snore or ever stop breathing.
4. Ask yourself:
 - a. Do I have a poor memory or difficulty concentrating?
 - b. Do I clench or grind your teeth at night?
5. Schedule a sleep study: If the answers to all these questions suggest sleep and airway disorders are a problem, make an appointment for a sleep study with a sleep physician, ear-nose-throat (ENT) specialist, or dentist trained in diagnosing and treating airway, sleep, and breathing problems.

Taking Action

There are many ways to improve the quality of breath and sleeping. This section covers sleep testing basics as well as practical tips for better breathing and sleep hygiene.

Sleep Testing

A sleep test is the only fully reliable way to understand sleep and possible issues. Every sleep test, whether done at home or in a lab, measures how often and to what degree sleep is disturbed. The report may describe the pattern of disturbance as “intermittent hypoxia” and/or “disturbed sleep architecture,” which means the patient failed to get adequate amounts of REM or stage 3 NREM, the deepest levels of restorative sleep. The results of a sleep study can be very surprising. For example,

adults with snoring, resistive breathing, and apnea may wake up hundreds of times in a single night without even knowing it. The only evidence may be feeling groggy and fuzzy in the morning. For this reason, if you have the indicators in the above section, consider getting a sleep study done, even if you think your sleep quality and breathing is fine.

Breathing

While awaiting the results of your sleep test, you can get a jump on improving your airway and breathing health by:

1. Shedding excess weight by reducing or eliminating dairy, sugar, and gluten, for starters, and also other potential allergens
2. Sleeping in a more upright position
3. Buying an over-the-counter sleeping appliance to open airways. Importantly, 50-85% of bite plates/ night guards for preventing grinding of teeth have been shown by research to make the problem worse by narrowing or closing the airway, so make sure to purchase one designed for opening the airway, not just grinding.

Sleep Hygiene

This section includes a list of tips, techniques and tools that may help increase the quality and quantity of your sleep. These options are not prescriptive and each one will not be right for everyone. Additionally, you should not try them all at once; implement new things one at a time to see what works for you. Smart people may disagree with some of these suggestions for different reasons and they may be right, so it is important to monitor whether something may improve or diminish your sleep quality. Our goal is to provide a wide range of options that are effective for some people and for you to take it from there.

Waking Up:

1. **Wake up and go to sleep at the same time every day**, your body craves routine to normalize the sleep pressure and circadian rhythm cycles.
2. **Consider using a sleep tracker.** Getting data on your sleep can help cut through the illusion that you're sleeping well and provide a tool for experimenting with sleep-promoting habits. Even your phone can be a sleep tracker, but many fitness trackers or smartwatches have sleeping tracking capabilities. High quality sleep trackers include the Whoop biosensor, Oura Ring and Fitbit. Merely knowing the amount of time you are asleep is incredibly useful in the process of trying to get better sleep. You may be surprised by how much of the night you are awake without realizing it. *Note:* Having a phone or smartwatch in bed with you may detract from some peoples sleep. In this case, you may consider using this type of tracker for a week to understand your sleep and then remove the phone from the bedroom.

During the Day

1. **Exercise!** Sleep helps improve exercise, and exercise helps improve sleep. It even creates adenosine, which controls sleep pressure.
2. **Monitor caffeine** intake later in the day. Consider stopping caffeine intake up to 14 hours before bedtime. Caffeine has a half-life of 6 hours, so 25% of the caffeine you consume is still in your system 12 hours later. *Note: Caffeine metabolism varies widely in individuals.*
3. **Be aware of long naps** (usually). Adenosine, your body's signal to fall asleep builds up throughout the day and gets depleted during sleep. If you nap, some of the critical built-up

adenosine will be removed, and your natural bedtime will be delayed. Instead, stay awake throughout the day and allow yourself an earlier bedtime.

4. **Get sunlight during the day.** Your body's circadian rhythm depends on sunlight exposure to function optimally, so you should be sure to get sunlight during the daylight hours in addition to limiting light before bed. Sunlight or even brighter lights at home early in the day will help you feel more awake.

Preparing for Sleep

1. **Avoid food 3 hours before bedtime.** Eating and digestion can raise your core body temperature, which impairs sleep and laying down while full can increase the incidence of acid reflux at night.
2. **Less light 90 minutes before bedtime** to start sending your body sleep signals.
 - a. **No screens**
 - b. **Blue light** seems to disrupt melatonin, so consider using "blue blocker" glasses and night mode on devices to limit exposure to it¹⁶.
 - c. **Dim the lights** or turn off half the lights. Some people even use red light bulbs or smart light bulbs in their houses to limit blue light before bedtime.
3. **Create relaxation before bed.**
 - a. Remove all anxiety and excitement inducing things (phones, video games, angrily reading the news)
 - b. Journaling
 - c. Meditating
 - d. Body Relaxation
4. **Alcohol** is a significant inhibitor of sleep. There's not a concrete rule, but the more alcohol consumed closer to bed, the less restful sleep will be. Consider setting an alcohol limit and cutoff time (e.g. 1 drink, 4 hours before bedtime)
 - a. "Sedation is not sleep"¹⁷. Alcohol and THC might help someone fall asleep, but it significantly diminishes the quality of sleep.
 - b. Keep track of your consumption (even mentally) and sleep quality to determine the best consumption pattern.
5. **Prescription Sleep Aids:** again, "sedation is not sleep". More on this topic is covered in the Prescription Medicine sections, but sleep aids should be a last resort for improving sleep.
6. **Melatonin** - Studies show two main areas that taking melatonin helps: older people and jet-lagged people. Older people do not produce as much melatonin and release it earlier in the night, so taking a melatonin supplement can help improve their sleep. *Note:* It's not shown to be effective otherwise, but if you're getting a benefit from melatonin supplementation (from a

¹⁶ Attia, Peter (Host). Walker, Mathew (Guest). (2019, June 17) #58 – AMA with sleep expert, Matthew Walker, Ph.D.: Strategies for sleeping more, sleeping better, and avoiding things that are disrupting sleep [Audio Podcast]. Retrieved from <https://peterattiamd.com/matthewwalkerama/>

¹⁷ Attia, Peter (Host). Walker, Mathew (Guest). (2019, June 17) #58 – AMA with sleep expert, Matthew Walker, Ph.D.: Strategies for sleeping more, sleeping better, and avoiding things that are disrupting sleep [Audio Podcast]. Retrieved from <https://peterattiamd.com/matthewwalkerama/>

reputable manufacturer), you should not necessarily stop taking it.⁴¹⁸ Your body may be different, and the placebo effect can be substantial and real.

While Sleeping

1. **Strive for a whole night of sleep** without wake-ups by using the restroom before bed, not drinking an amount of water before bed that will result in you waking up and limiting any other reasons for waking up.
2. **Lower your bedroom temperature** to 65-68 degrees Fahrenheit. Your core body temperature needs to drop by 2-3 degrees to initiate sleep. If your feet, hands or skin are cold, warm them up with socks, gloves, a warm water bottle in your bed or a hot shower. Warmer extremities and skin provide more blood flow, which makes it easier for your body to drop the core temperature by radiating heat away.
3. **Consider removing clocks** from the bedroom. Staring at a clock, watching time pass increases anxiety for some and reduces the chance of falling asleep.
4. **Create an associative environment for sleep** in your bed and bedroom
 - a. Don't lie in bed, awake for too long; your body will start to associate the bed with wakefulness and anxiety.
 - b. Don't do too many other activities in the bed/bedroom that are not sleeping, because your brain will associate the area with those activities instead of sleep — for example, working from the bed/bedroom, watching hours of TV in bed or working out.
5. **Consider sleeping separately from your partner.** Disruptions from a partner can be one of the major causes of low-quality sleep, so sleeping apart might be a benefit to both of you: better sleep results in a better mood, better interpersonal relationships, and better sex hormones and desire.
6. **Do not sleep with the radio or TV on.** Your brain continues to process the audio while sleeping.

Conclusion

Breathing and sleeping are core activities for life and maintaining and optimizing both over a lifetime will lead to better brain health. Problems in these areas can have negative consequences as soon as the next day and can compound over a lifetime. We have provided some scientific background on the importance of sleep and breathing, how to identify problems and ways to start making improvements. Our final notes are to not try to change everything all at once and to engage experts for their help. Some of these problems may seem normal to the person who has them, but when fixed, they will feel the difference.

¹⁸ Attia, Peter (Host). Walker, Mathew (Guest). (2019, June 17) #58 – AMA with sleep expert, Matthew Walker, Ph.D.: Strategies for sleeping more, sleeping better, and avoiding things that are disrupting sleep [Audio Podcast]. Retrieved from <https://peterattiamd.com/matthewwalkerama/>