

ADVANCED TREATMENT GUIDES

Sleep Apnea: The 21st Century Epidemic

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TABLE OF CONTENTS

1	CHAPTER 1: Five Essential Things That Your Insurance Company Would Rather You Don't Know About the Importance of Good Sleep on Your Health and Longevity
13	CHAPTER 2: Incidence of Obstructive Sleep Apnea
23	CHAPTER 3: Short Sleep Duration and Weight Gain
31	CHAPTER 4: Sleep Apnea and Cardiovascular Disease
35	CHAPTER 5: Sleep, Apnea, and the Brain
47	CHAPTER 6: The Gross Injustice of Under-Diagnosing and Under-Treating Sleep Apnea
57	CHAPTER 7: Sleep and Longevity
65	CHAPTER 8: Testing for Sleep Apnea
71	CHAPTER 9: NightLase® and NightLase® C3
79	References grouped by main topic, some are used in multiple chapters.

CHAPTER 1:

Five Essential Things That Your Insurance Company Would Rather You Don't Know About the Importance of Good Sleep On Your Health and Longevity

Sleep Disordered Breathing, the 21st Century Epidemic

Sleep is a passive activity that we often take for granted. If we don't get much sleep due to a busy schedule or difficulty making time for sleep, it may become a bragging point "I only need 5 hours of sleep".

But not so fast! We didn't evolve over the millennia to require about 7-8 hours per night of good sleep without a good reason. Science tells us that we need about 8 hours of sleep per night, plus or minus an hour. This book will talk specifically about sleep-disordered breathing, which includes disrupted sleep from snoring to sleep apnea. There are many other sleep disorders, such as insomnia, sleepwalking, night terrors, and other conditions that are important but will not be the subject of this book.

This book will review obstructive sleep-disordered breathing, a condition where the upper airway malfunctions while sleeping, leading to noisy breathing, snoring, and or sleep apnea.

Obstructive sleep apnea is when your airway collapses, and you either under breathe or stop breathing for a short period. It is

associated with a decrease in oxygen concentration in your blood.

There's a strong correlation between snoring and sleep apnea; however, either can occur without the other.

Generally, a sleeping partner knows if you stop breathing because they hear it, which isn't comforting. The medical definition of obstructive sleep apnea is five or

more episodes per hour of significantly decreased airway flow or cessation of breathing.

The AHI, or the apnea-hypopnea index, measures the degree of apnea.

You will learn about the critical importance of apnea in health and longevity. A big focus of this book will be on a modern non-surgical laser treatment that reduces or reverses both obstructive sleep apnea and snoring.

AHI= Apnea Hypopnea Index and is the scoring system for sleep apnea

Apnea is a Significant Risk Factor for Disease and a Shortened Lifespan

Untreated sleep apnea leads to weight gain and cardiovascular disease (such as heart attack and stroke). Apnea is also a risk factor for diabetes, certain cancers, daytime sleepiness, depression, accidents, and so on.

But let's review one of the most cited studies in the United States that first brought significant attention to the implications of untreated obstructive sleep apnea.

The Wisconsin Cohort Study began in 1988 to understand the incidence of sleep apnea in a healthy population and observe those same individuals' lifetime outcomes.

A random sample of about 3000 people aged 30 to 60 were selected for participation. They would measure their sleep in a laboratory to determine if they had sleep apnea. These were not individuals chosen because of suspicion of sleep problems; it was a random selection from the payroll records of Wisconsin State agencies. The majority of people with sleep apnea don't know they have it.

Approximately half of the people who were asked to participate agreed. About 1500 people went through the process of having their sleep measured in a sleep laboratory in the late 1980s.

The sleep lab defined the individuals as having no apnea or degree of mild, moderate, or severe apnea. We will review what these terms mean more specifically in a later chapter, but you get the picture.

The Wisconsin Cohort Study showed that untreated severe apnea at age 30-60 was associated with decreased survival, and three times the death rate of individuals without apnea over the next 20 years.

Mortality Risk

Mortality means death, and in this case, by any cause. In 2008, 20 years after the initial study, the researchers used the US Social Security death index and the Wisconsin State Bureau of health information and policy vital records section.

The study cohort was a group of people 30 to 60 years old and observed for up to 20 years.

They confirmed records for the cause of death in those individuals who died in the prior 20 years.

Using individuals with no apnea as a baseline, they compared the death rates of those with apnea. Individuals who had mild-moderate apnea were 1 1/2 times as likely to be dead than individuals with no apnea. People with severe apnea were three times as likely to die as those who had no apnea.

The researchers compared individuals with and without apnea with similar medical conditions such as pre-existing diabetes, hypertension, or cardiovascular disease. They found the same thing. Individuals with those pre-existing conditions were about three times more likely to die in the next 20 years compared to individuals who did not have apnea but had those medical conditions.

Keep in mind when the study started, the age range of the participants was 30 to 60 years old. The average age of death during the study was 61.1 years.

This study did not specifically look at treating sleep apnea; it was observational. But they did assess the risk of dying in individuals with severe sleep apnea who never had treatment for their apnea. They were 5.2 times as likely to be dead than individuals without apnea. This book will review this Wisconsin Cohort Study more because it affected how we think about apnea today.

In the United States, We Waste Billions of Dollars Annually by Under Diagnosing and Under Treating Sleep Apnea

A study commissioned by the American Academy of Sleep Medicine in 2016 sought to answer the question, "if we screened everybody for sleep apnea and treated those who had apnea, what would the impact be on the United States economy?"

Their study looked at costs related to diseases that appear to be directly caused by sleep apnea and other expenses, such as

motor vehicle accidents and workplace accidents resulting from daytime sleepiness.

They found that the economic impact of not identifying and treating sleep apnea in adults in the United States costs approximately \$150 billion annually. Because diagnosis and treatment of sleep apnea are relatively inexpensive, if we routinely screened people for sleep apnea and pursued treatments, the investment (costs associated with testing and treatment) is phenomenal at over 300% return on investment.

Why Do Most Americans Never Get a Sleep Study, and Why Do So Few People With Known Obstructive Sleep Apnea Not Comply With Treatment?

Testing:

The first part of the question is why so few people undergo sleep studies. Quite frankly, this is not at the top of the mind of most primary care physicians. When I went to medical school, we never talked about sleep; there was no effective treatment for sleep apnea if we did learn about it.

Health care is disease care. Primary care physicians have a lot to do and are trained in treating diseases such as diabetes, heart disease, hypertension, high cholesterol, and various other medical conditions. But prevention, even though everybody talks about it, isn't that top of mind to most physicians in the United States. You have insurance not to keep you healthy or to prevent disease but

to cover the costs associated when a disaster strikes or you develop an infection.

In the past 20 years, there's been some forward momentum, notably with the Affordable Health Care Act (AHA) of 2010.

The AHA required insurers to pay for specific screening tests such as mammograms

or colonoscopies and dozens of other preventative care efforts. Before that, there were few requirements for health insurance companies to pay for any screening.

Today, as I write this book, insurance companies will not pay for screening for sleep apnea for the general population. There are circumstances under which they will pay for a sleep study, and they are very rigid. Your doctor has to ensure that you meet all the criteria, but there's no requirement to pay for routine screening for sleep apnea. And this is despite the considerable risk associated with untreated sleep apnea and the substantial economic burden of ignoring sleep apnea.

Traditional testing is done in a hospital or outpatient facility lab. In sleep labs, wires and tubes are attached to you while you are observed sleeping. This was and is considered the gold standard for sleep testing. Still, there are obvious reasons why people are reluctant to get a sleep test in an unfamiliar setting.

Home wearable devices have been FDA approved to measure sleep and apnea and are comparable to hospital-based sleep labs. Yet, doctors were reluctant to prescribe these due to their community's abundance of sleep labs.

80% of Americans with sleep apnea have never been diagnosed.

In some cases, insurance pays for sleep laboratories. However, if you don't qualify, the cost is about \$3000.

Then COVID hit. All of a sudden, these at-home wearable devices seemed attractive in the face of a pandemic, particularly when they were shown to be just about as good for most people and costing a fraction of the price.



The WatchPAT One® is the device we use for patients and the one I wore for my test. There's a finger probe, a chest sensor, and a watch device. It connects to your smartphone, and the results are immediately available to your doctor the following day. It cost me around \$100.

If you meet the criteria, your insurance may cover a wearable home device for sleep apnea testing. However, even if you don't meet the strict insurance criteria, these things are inexpensive.

Treatment:

Most individuals' standard of care treatment for sleep apnea is a CPAP device. A CPAP is a system you wear over your nose or mouth at night that forces air into your lungs. It helps you breathe while sleeping. These work very effectively for sleep apnea, but only about 30% of people are compliant with the use of CPAP. They can be cumbersome, difficult for your sleeping partner to tolerate the machine's noise, hard to travel with, and uncomfortable.

There's a new device called Inspire®, where a pacemaker-like device is surgically inserted into your chest, and wires are attached to the hypoglossal nerve of your throat to stimulate breathing while sleeping for people with sleep apnea. Many patients are afraid to undergo this type of surgery for sleep apnea. This procedure is costly, and many insurers will not cover it.

NightLase®

Uvulopalatoplasty is the name for a surgery where tissues of the airway are removed to help to breathe at night. Still, there are significant limitations, and it is used sparingly.

Laser-assisted uvulopalatoplasty is the name of a surgery where a laser assists the surgeon in cutting away tissues for apnea. Again, this was limited and not found effective as the removal of tissue leads to scarring and other problems and fails to address the primary issue of throat relaxation while sleeping.

Laser rejuvenation allows the tissues to tighten and be less likely to collapse when relaxed and sleeping.

About ten years ago, a unique laser technology (called an Erbium YAG laser SMOOTH® mode) could be tuned to stimulate the rejuvenation of tissues without cutting, burning, or removing tissues. This innovation was called NightLase® and was shown to reduce snoring after 2-3 treatments.

NightLase® has been used and studied for over a decade, with the primary purpose being to reduce snoring. Dr. Harvey Shiffman is a dentist in Florida who has been treating snoring with various dental appliances worn in the mouth to reduce snoring. He showed that combining NightLase® erbium laser with a deep heating laser made the procedure more effective.

We've been performing the NightLase® procedure for about seven years to treat snoring. This procedure involved using an erbium laser to treat the tissues and regenerate or rejuvenate the airway so it's not as likely to collapse at night while breathing, resulting in less snoring. I had it done myself seven years ago, which resolved my snoring. .

A more advanced treatment has evolved using a dual-wavelength that is two laser types to treat the components of the airway, the base of the tongue, and the floor of the mouth. Clinical studies have shown a substantial improvement in airflow during sleeping after this procedure. The tissues shrink and tighten up and become more youthful.

The combination of lasers and more advanced protocols has evolved into the NightLase® C3 procedure. The laser is done

The NightLase® C3 has evolved into a non surgical, no downtime treatment that can reduce or reverse obstructive sleep apnea and snoring.

awake without sedation. There is no downtime, and it generally takes three sessions. These are done approximately two weeks apart for your breathing to improve substantially. Reductions of snoring and apnea are noted in most patients with as few as three treatments.

Published in Photobiomodulation, Photomedicine, and Laser Surgery in late 2021, was a case series using combined laser technologies to reduce sleep apnea. After a series of 3 treatments, done a couple of weeks apart, the average person saw a reduction in apnea severity of 66%, with all patients in the study, had some degree of improvement. This is the same improvement predicted after the surgically implanted breathing stimulation device (Inspire®), more than typically seen with conventional CPAP use.

Taking this a step further, NightLase® C3 is a process that utilizes two laser wavelengths (ND:YAG and ER:YAG) in a specific stepwise fashion, with a predetermined amount of total energy, depth of heat penetration, and anatomical sites to tighten the entire airway.

This laser process leads to consistent improvement in snoring, nighttime breathing, and reduction of obstructive sleep apnea. It needs to be made clear how long an individual will have an improvement in their sleep-disordered breathing after the laser procedure. If an individual's weight stays about the same, and they don't develop new health problems, it is likely to last for several years. However, suppose someone is concerned that as they're aging their apnea will naturally worsen. However, naturally the risk for obstructive sleep apnea increases as we age, so it may be appropriate to suggest patients concerned about reoccurrence receive annual touch-up treatments.



CHAPTER 2:

Incidence of Obstructive Sleep Apnea

As our population changes and we as a society grow heavier, the incidence of sleep apnea is rising, but other factors can make it challenging to pin down an exact number. There needs to be more agreement as to the incidence of obstructive sleep apnea. We will go through the various studies that can give us the best answer.

Sleep apnea is defined as having a period of not breathing or under breathing for at least 10 seconds with a decrease in the oxygenation of the blood. Before 2012 the standard criterion was a decrease in oxygen saturation of 4%. To put this into context, blood is typically saturated with oxygen at 95%. When being tested, the device calculates your average oxygen saturation and measures periods that are longer than 10 seconds where you are not breathing or under breathing (hypopnea). Your oxygen falls 4% below the average, typically below 91%.

In 2012 the American Academy of Sleep Medicine looked at the data and found that people with even less desaturation, a 3% reduction, also suffer the adverse health effects of sleep apnea. They concluded that laboratories needed to change the criteria of the AHI score (apnea-hypopnea index) from 4% desaturation to 3% desaturation.

They ran into a problem with the government, notably Medicare. Since Medicare was paying for most of the apnea treatments in America, adjusting their criteria from 4% down to 3% may save lives, as the American Academy of Sleep Medicine

determined. Still, it was going to cost more money. So Medicare refused to accept the experts' position and ignored the science demonstrating that even people with mild sleep apnea still suffered the consequences.

When a sleep study is done, and insurance is paying for it, they will report the AHI adds a 4% desaturation, thereby missing millions of people who have more mild sleep apnea or miscategorizing people who may have severe sleep apnea to moderate sleep apnea based on a 3% threshold.

Wisconsin Cohort Study

The Wisconsin study went from 1987 to 2008; however, they measured the incidence of sleep apnea it was in 1987 when Americans were not as heavy as they are today. Sleep apnea indeed occurs in people that are not obese, but overweight and obesity do contribute significantly to sleep apnea. In the Wisconsin study, they performed sleep studies on about 1500 people. They tracked them for 20 years to see the death rate in those with significant sleep apnea versus those without apnea. In the Wisconsin study, they used the older 4% AHI cut-off. They reported the incidence of sleep apnea in the population that participated. There is a fundamental flaw with voluntary participation in clinical studies. In the case of the Wisconsin cohort, they invited 3000 individuals to participate and only 1500 did. When they looked at the data, the individuals that did not participate in the sleep study tended to be heavier with more diseases. The incidence they determined could be a little bit higher if there were some mandatory participation for a group of people, but that's not realistic.

The generally accepted incidence of sleep apnea that the government, insurance payers, and statisticians use are based

on the Wisconsin Cohort Study done in the 80s. At that time, they found that 9% of women and 24% of men between the ages of 30 and 60 had sleep apnea.

European Study 2008-2012

A population-based study was done about 20 years later in the Pomeranian region of Germany over the four years of 2008 to 2012. The group's age was 20 to 79 years old. They randomly selected people and asked 10,000 people to participate in their trial. 1264 underwent sleep studies in the randomly selected group. It is common to have a low level of participation because they were doing a laboratory-based sleep study which requires an overnight stay, and it's a fairly unpleasant experience. But at that time, the modern wearable sleep studies that we use at home today did not exist.

This was also before the updated criteria for what defines sleep apnea. It was in 2012 that the American Academy of Sleep Medicine changed the requirements of sleep apnea from 4% to 3%. This was also a more extensive age range of individuals than the Wisconsin cohort study (30-60 yo). The sample size was about the same, and the testing was the same.

In this study, the average BMI was 28 kg/m².

That means the average person in the study was classified as overweight. That was the average BMI for Americans in 2000. Right now, it is a little over 29, so if anything, the group in this European study was slightly lighter than the average American.

The study found that 46% of people have some sleep apnea, and that apnea increases with age.

They found that 46% of the population had some degree of clinical apnea. 21% of the population had moderate to severe

apnea, which is the most detrimental to our health. Men have more apnea than women, and people older than 60 have more apnea than people younger than 60.

Men tended to have significant apnea at any age range, but once they hit 70 years old, it was 80%. Women had a lower incidence of apnea, and it started becoming significant around 30 years old at 2%. Still, by age 50, the apnea rate in women increased substantially.

HypnoLaus Study

This study was done at about the same time as the Pomeranian study. The setting was Switzerland from 2009 to 2013. A notable difference was that the individuals were allowed to do the sleep studies at home, which improved the chance of getting a truly random selection of the population. Again people that tend to be sicker tend to decline participation in studies if there's some challenge to it. In the Wisconsin study, we saw that the people that participated in the sleep evaluation tended to be healthier than the ones that declined participation.

In this study, they invited 3043 participants aged 33 to 70 years to participate, and 2121 people did, making it a more realistic statistical sample. They used the 4% AHI criteria to diagnose the degree of apnea.

They found 83.8% of men had mild to severe sleep apnea, and 60.8% of women had sleep apnea. Going one step further, they looked at moderate to severe apnea, which has a more significant impact on an individual's health. They found that 49.7% of men had moderate to severe sleep apnea, and 23.4% of women had moderate to severe sleep apnea.

The main risk factors associated with a sleep disorder were age, sex, BMI, and snoring. Men have more apnea than women, older

people have more apnea than younger people, heavier people have more apnea than thinner people, and people who snore have more apnea than those who do not snore.

This was the most extensive population-based sleep study to date. The US government and American health insurance companies use the Wisconsin data, produced in 1987 and isn't likely reliable anymore. Insurance companies have "medical necessity" policies that your doctor has to go through to order a sleep study. The various policies from Medicare regarding sleep policies tend to be over 30 pages long.

This last study found a higher incidence of sleep apnea than in prior studies. This was likely due to a promising study design. Because the study was done at home a higher percentage of the randomly selected people agreed to go through with it. Additionally, they use more modern testing than the prior studies to determine rates of sleep apnea.

One of the hurdles to routinely testing for sleep apnea is that the US government has recommended against it through the United States Preventive Health Task Force. Insurance companies, including Medicare, are not required to pay for sleep tests unless there's a clear medical indication.

In this study (HypnoLaus), they asked the standard questionnaires that doctors are required to ask their patients before they order a sleep test. In this case, the Epworth sleepiness scale. They found no correlation between the severity of sleep apnea and the Epworth sleepiness scale.

It is important to note that insurance companies, including Medicare, can prevent your doctor from ordering a sleep test and billing the insurance company if they don't have a high Epworth sleepiness scale. For example, I live in Michigan, and our primary commercial insurance carrier is Blue Cross and Blue Shield. One

of the requirements for a sleep test is an Epworth sleepiness score of greater than 10. This study showed that the score did not correlate to the degree of sleep apnea, but insurance still requires it (effective date 7/1/2022).

That doesn't mean you can't have a screening sleep study; it just means that your insurance doesn't have to pay for it. Wearable devices for measuring sleep apnea are no longer expensive or out of reach.

Knowing if you have sleep apnea is of critical importance if you want to live a healthy life. Because the incidence of sleep apnea is so high and questionnaires are not particularly effective at determining the degree of sleep apnea it would be logical to test yourself periodically. Particularly since there are wearable devices that are inexpensive and they're getting less expensive and easier to access every year. As discussed in other chapters, at least moderate to severe sleep apnea is associated with a shorter health span, a shorter lifespan, more dementia, cardiovascular disease, accidents, missed work, hospitalizations, and higher healthcare costs.

There are sections of this book that review the incidence of diseases that are affected by sleep apnea. There is not going to be a section on cancer because the link between sleep apnea and cancer has only recently become clear. Some cancers are more frequent in apnea patients, but it is not substantial. However, studies have shown that poor sleep or excessive snoring, both associated with sleep apnea, reduces the likelihood of surviving cancer, particularly breast cancer.

When we look at these extensive population studies and realize the high incidence of undiagnosed sleep apnea and the lack of the medical establishment's attention to it, we have a problem. Moreover, the government's stance of not routinely screening for

a modifiable risk factor of cardiovascular disease, obesity, and death is short-sighted. It will save them money in the short term, but it's costly in the long term.

CHAPTER 3:

Short Sleep Duration And Weight Gain

Sleep-disordered breathing, which includes apnea and snoring, is an epidemic in America. Poor sleep leads to poor health and weight gain. Poor sleep is associated with a significant increase in cardiovascular disease, dementia, Alzheimer's, hypertension, diabetes, and obesity. It is also tied to psychosocial problems and even an increase in accidents.

Weight gain and obesity are epidemics in America that lead to poor health, an increase in cardiovascular disease, diabetes, hypertension, certain cancers, Alzheimer's disease, and dementia.

The catch-22 is that obesity leads to sleep apnea, and sleep apnea leads to obesity. Both of these conditions lead to a shortened lifespan, a decrease in wellness, and increases in chronic disease.

A study by the Johns Hopkins Bloomberg School of Public Health investigated the link between the duration of sleep and subsequent weight maintenance or weight gain and reported their findings in 2006.

This was a deep dive into the massive study called the Nurses' Health Study. This study started in 1976 when 121,700 female married registered nurses ages 30 to 55 reported details of their medical history and lifestyle. The setting of this portion of the investigation started in 1986 and went on for 16 years to evaluate sleep patterns and subsequent weight changes.

Because this was a long study, 16 years, they selected relatively younger women to account for the fact that sleep quality generally declines with age. They ultimately wound up with 68,183 women reporting their typical sleep patterns.

To make the study more meaningful, they categorized people by identifying smoking status, alcohol consumption, caffeine consumption, spousal education, use of medications that may affect sleep, menopausal status, snoring history, and shift work history (i.e., nights or days). They also grouped them by age, activity level, and diet.

In reporting the study, it was important to identify what affected weight gain because they were trying to determine if sleep duration had anything to do with weight gain and obesity. For example, they would compare short versus longer duration sleep amongst smokers versus mixing them all.

Numerous studies have found strong links between sleep apnea and weight gain, as well as weight gain and sleep apnea. It is bidirectional.

They considered 7 to 8 hours a night of sleep to be the ideal standard duration for the maintenance of body weight. They found across all time points (years), shortened sleep duration was associated with significantly more weight gain than normal sleep duration. The shorter the sleep, the more weight the women gained over time.

On average, women who slept 5 hours a night were 50% more likely to gain 50 pounds over the next 16 years than women who slept a normal duration of 7 to 8 hours.

It can be concluded from this very large, well-designed trial that when accounting for other lifestyle factors, short sleep duration is strongly associated with weight gain and obesity.

Sleep Apnea and Weight, the Chicken or the Egg?

Obesity is a vital independent risk factor for sleep apnea.

Numerous studies have shown that the incidence of clinically significant apnea increases with increasing body weight.

A long-term 10-year study was undertaken to determine if weight loss would improve obstructive sleep apnea. This was called the AHEAD study. These participants were type 2 diabetics who are overweight and obese and were randomized to intensive lifestyle intervention programs designed to help them lose weight versus typical diabetic support education programs. There was no control group.

Over the 10-year study, there was a linear relationship between weight loss and improvements in obstructive sleep apnea.

The AHI score (severity of apnea) decreased as their weight decreased. The more significant the weight loss, the more significant the improvement of sleep apnea. Those on the intensive lifestyle intervention program lost more weight and had better reductions in sleep apnea than those receiving standard diabetic education.

The goal of this study was multiple, but for this purpose, it was to validate the concept that more aggressive lifestyle intervention results in more weight loss which results in less severity of disease, in this case, obstructive sleep apnea.

Studies such as this AHEAD trial may seem obvious. Of course, more aggressive lifestyle interventions will lead to more weight loss. Yet they are done to prove what seems obvious, to exclude the naysayers, and to help form public policy in health care decisions.

It is generally accepted that obesity leads to sleep apnea because of the clear epidemiologic correlation. And it has been

shown time and time again that weight loss leads to improvement of sleep apnea symptoms and overall health.

Does Sleep Apnea Cause Weight Gain and Obesity?

In the Nurses' Health Study where it was identified that poor or short sleep is associated with the development of obesity. That study was performed before we had a good understanding of sleep apnea and easy ways to measure it, so the cause of the poor sleep was not assessed in that particular study.

Numerous other studies have shown that obesity, particularly visceral obesity, is associated with sleep apnea. Visceral obesity refers to fat that wraps around the abdominal organs. We can think of it as the so-called "beer belly." This fat is associated with far more metabolic derangements. It is more strongly related to diabetes and cardiovascular disease, as well as neurocognitive decline versus subcutaneous fat, which is the pinchable fat that might be in your arms or legs.

This relationship between obesity and particularly central or visceral obesity with obstructive sleep apnea has been demonstrated in numerous studies with numerous populations in multiple countries.

Published in the Mayo Clinic Proceedings in 2019, from the Physical Activity and Weight Management Research Center, Department of Health and Physical Activity, University of Pittsburgh, was a study looking at the bidirectional effect of obesity and sleep apnea.

In this study, the participants receive behavioral weight loss intervention over 12 months. They recruited individuals over 18 years old with a BMI of 27 to 44 kg/m (2). BMI stands for Body Mass Index. It is an imperfect way to classify people as normal,

underweight, overweight, or obese. A BMI of 27 is overweight, and a BMI of 44 is extremely obese.

The subjects were coached to reduce their calories to 1200 kilocalories per day for women and 1500 kilocalories per day for men. They were also coached to increase their physical activity to achieve 150 minutes per week of light to moderate exercise. Additionally, they measured their sleep. The participants underwent sleep studies and were given a calculation of their AHI (apnea-hypopnea index or severity of sleep apnea score). Of the participants, 52% had obstructive sleep apnea. Those with sleep apnea who lost significant (>5%) weight saw their sleep apnea scores improve. However, the individuals who had obstructive sleep apnea at baseline were less likely to have significant weight loss than those who were not diagnosed with obstructive sleep apnea. This was also controlling for other risk factors such as starting weight or other factors.

In this study, they showed that individuals with obstructive sleep apnea were less compliant with their lifestyle changes, did not adhere to the diets, and were not as physically active as the identical or matched individuals who did not have obstructive sleep apnea.

Why Does Sleep Apnea Drive Behaviors that Lead to Weight Gain?

This has been extensively studied, and the answer could be clearer. It is neuro-hormonally driven. The two best understood hormones that cause hunger or fullness are ghrelin and leptin. Ghrelin creates hunger and leptin decreases your appetite. Ghrelin is made in your stomach and signals your brain when you're hungry, and leptin is made in your fat cells and decreases your appetite.

The complex relationship between these two hormones and their link to normal weight and obesity are under continued decades-long investigation. There are so many interconnections and other variables that we need help understanding which leads to confusion when comparing scientific literature. But these two hormones are the most understood to control hunger and satiety (fullness).

Individuals with obstructive sleep apnea have abnormally high leptin and ghrelin levels in their circulation. That means that individuals with obstructive sleep apnea have increased hunger hormones and increased fullness hormones at the same time. It is also noted that individuals with obstructive sleep apnea have an increased energy expenditure, which is to say they have an increased metabolism.

It has been observed that individuals with obstructive sleep apnea have a decreased level of physical activity than people without obstructive sleep apnea. They have increased hunger and fullness hormones, and they have an increased energy expenditure. The current thinking is that the increase in energy expenditure associated with sleep apnea induces an overcompensation in the drive for hunger and the intake of calories. This is combined with the observation of decreased physical activity because of daytime sleepiness in individuals with sleep apnea.

Summary

Both poor sleep and sleep apnea are closely linked to the development of weight gain and obesity. Treating sleep apnea does not lead to an automatic reduction in weight. Still, it does make it easier for an individual to lose weight. When considering lifestyle choices that need to be made to get in shape or lose

weight, a critical component is to assess for sleep apnea and measure your sleep. If your sleeping cycle is short, less than 7 hours a night, it will be very hard for you to lose weight. If you snore a lot during the night or have periods of apnea, it is going to be very difficult for you to lose weight without treating the apnea. A home sleep apnea test is straightforward to perform and relatively inexpensive. There's also an app for a smartphone called Snorelab® that measures nighttime snoring. There's a very strong correlation between snoring and sleep apnea. Sleep apnea can occur in the absence of snoring, but it is less common. I recommend that individuals who want to be healthier or lose weight purchase a home sleep study kit such as the WatchPAT®.

CHAPTER 4:

Sleep Apnea and Cardiovascular Disease

The Wisconsin Sleep Cohort study that started in the 80s was the first time we strongly associated sleep apnea with cardiovascular mortality. Cardiovascular mortality refers to dying as a result of disease in our cardiovascular system. This includes strokes, heart attacks, congestive heart failure, pulmonary hypertension, sudden cardiac arrest, and any death directly attributable to our circulation that is not traumatic.

This study started in 1987 when they randomly selected people and asked them to measure their sleep, or they sleep study. Of those that participated, they were ranked as having mild-moderate or severe sleep apnea. They went back 20 years later, in 2008, and checked the death records.

In this study of 1522 people followed for 20 years, they found that individuals with severe sleep apnea who did not undergo treatment were 5.2 times as likely to die of cardiovascular events. They found that people with no sleep apnea were generally alive 20 years later about 94% of them. Of people that had severe sleep apnea and didn't get treatment, less than 60% survived. The largest cause of death and those with severe sleep apnea were cardiovascular diseases, but this is not surprising because that remains the number one cause of death in the population in general. It's just that people with severe sleep apnea are five times more likely to have died in the 20 years of the study.

Mayo Clinic Studies Economic Impact

The department of cardiovascular medicine at the Mayo Clinic underwent a study to determine the cost-effectiveness of treating sleep apnea and individuals with known cardiovascular disease. As discussed repeatedly in this book, the government and insurance companies, including Medicare, do not support routine screening for sleep apnea stating that it is not medically necessary for this prevalent cause of disease and death.

Because sleep apnea is not routinely tested for, and it is estimated that 80% of people with it don't know they have it and have never been diagnosed, the Mayo Clinic study looked at Medicare claims data. They first selected individuals who had a diagnosis of cardiovascular disease.

They then looked at two sets of data. How many people were diagnosed with obstructive sleep apnea, and how many people received treatment? Medicare data is available, and it's an enormous database, but it gives us valuable information.

Individuals with sleep apnea and cardiovascular disease have a higher complication rate if the apnea is not treated vs those who get help.

Sleep studies have diagnostic codes, so when it's billed to Medicare, that can be found. The treatment for sleep-disordered breathing or sleep apnea is with CPAP or occasionally with surgical techniques, which are billed To Medicare.

They were able to drill down and compare groups of people who were diagnosed with sleep apnea with a sleep study and those that were compliant or adherent to CPAP treatment.

We have two groups of people. They both have cardiovascular disease diagnoses, both groups have known sleep apnea, and

some people went through treatment, and some people did not through their own choice.

Individuals with cardiovascular disease and sleep apnea who underwent treatment with CPAP consumed \$4487 less Medicare expenditures over a year than individuals who were not compliant with CPAP. The group that underwent treatment for their apnea had fewer hospitalizations and, when hospitalized, could go home sooner. The group that was treated did have higher costs related to the use of the machines, but the other healthcare costs were so much lower that ultimately the government saved \$4487 per Medicare beneficiary that underwent treatment.

Sleep Apnea and Stroke

In 2016, published in the journal SLEEP, investigators reported their findings regarding sleep apnea and the incidence of stroke.

Approximately 800,000 individuals in the United States will suffer a stroke annually. This is a leading cause of disability and has a huge negative impact on healthcare costs.

Prior studies have shown a 300% to 400% increase in stroke in individuals with moderate to severe obstructive sleep apnea. This study aimed to determine the incidents of stroke and apnea, including apnea that might be mild.

This study was referred to as MROS Sleep or outcomes of sleep disorders in men. They enrolled men 65 years and older in six clinical centers throughout the United States. 2872 men participated in-home sleep studies.

This study used a more modern definition of sleep apnea which was 10 seconds or greater with an oxygen saturation drop of 3% or more associated with

There are numerous studies linking untreated sleep apnea to an increase of stroke risk.

decreased ventilation or breathing. They follow the men for an average of seven years with phone calls or mailed questionnaires. The men reported emergency room visits or hospital admissions related to the cardiovascular system.

Throughout the study, 5.4% of them had a stroke. Little over 1% died from the stroke. They found that decreased oxygen during sleep was strongly associated with stroke. The risk of stroke was almost double in men with significant apnea, and the risk of dying of a stroke was three times as likely in men with apnea. In this study, they found there was more of a correlation between the amount of time spent with a decreased oxygen saturation versus the actual AHI score. When a sleep study is performed it reports multiple things and one of them is the amount of time spent with oxygen saturation below 90%. In the individuals who spent 10% or more of their night with a low oxygen count, the risk of stroke was substantially increased, and the risk of fatal stroke was even higher.

Does Cpap Prevent Heart Attacks?

A study published in the New England Journal of medicine in 2016 was designed to determine if the use of CPAP reduced cardiovascular events. In this study, they recruited 2717 adults aged 45 to 75 with moderate to severe obstructive sleep apnea and cardiovascular disease.

They randomized them into usual medical care alone or usual medical care plus CPAP. They found no significant decrease rate of cardiovascular events between the two groups. A substantial limitation of this study is that the men assigned to CPAP were typically not compliant. In other words, many or most of them do not use the machines, or they use them very little. The average use was three hours per night.

But studies are done with the scientific method and only sometimes follow logic. They summarized that CPAP did not alter cardiovascular outcomes in individuals with moderate to severe sleep apnea. But they never separated the individuals who used CPAP regularly from those who did not. They just separated individuals who were prescribed CPAP from those who were not. There was a reduction in events among the individuals that used CPAP. Still, it wasn't enough to be statistically significant, and the study was not large enough to have separated the individuals who were not compliant with treatment.

The Wisconsin cohort study noted that individuals with severe sleep apnea were five times more likely to die of cardiovascular events in the next 20 years if they did not undergo treatment for sleep apnea. They also noted that individuals with severe sleep apnea, regardless of CPAP use, were three times as likely to die of cardiovascular events. But because of statistics and group size and the low compliance rate, the Wisconsin Cohort study was not powerful enough to determine to what degree CPAP reduces cardiovascular disease.

Summary

In 2021 the American Heart Association published a scientific statement advising physicians to assess patients with known cardiovascular disease for sleep apnea. They recommended that all patients with severe sleep apnea should be considered for apnea treatment to reduce the progression of cardiovascular disease and mortality.

We know that untreated sleep apnea is strongly associated with cardiovascular disease and death. Still, there is no good data to tell us how much of an impact CPAP makes on reducing that risk which is quite different than the studies on neurocognitive decline.

These studies demonstrate that not having sleep apnea is much safer than having sleep apnea from a cardiovascular standpoint. Also, having moderate-severe sleep apnea is much healthier for your cardiovascular system than having mild sleep apnea. This helps clarify that we should seek to eliminate sleep apnea versus prescribing CPAP treatments.

CHAPTER 5:

Sleep, Apnea, and the Brain

This is a big one. I've been thinking a lot about longevity and the technological breakthroughs that will occur or have already occurred in extending healthy life. But before we start thinking about technology or medications to expand lifespan, we want to keep our organs as healthy as possible when we get there, particularly our brain.

The Big Three

Some things cause us to die early or to have a lower quality of life. We can imagine that fatalities from drunk driving can be avoided by using ride-sharing or designated drivers. We could see lower rates of pneumonia and influenza with safe vaccinations, antibiotics, and antivirals. And suicide and homicide can be reduced with social programs.

This leads us to the most common causes of death and disability.

Cardiovascular Disease

cardiovascular disease can hit us when we're relatively young. Everyone knows somebody in their 50s who dropped dead of a heart attack with no advanced warning. However, suppose someone knew they would have a heart attack in five years. In that case, they could undergo aggressive lifestyle intervention and medication therapy and potentially avoid a heart attack altogether or at least for decades.

This exists today. There's something called a coronary calcium score, a CT scan of the heart that is very good at screening younger individuals for the presence or absence of cardiovascular disease. It isn't perfect, but it is much better than a cholesterol test or a risk factor questionnaire in determining who is going to die prematurely of a heart attack. And it's very inexpensive, around \$100. It is not covered by insurance because the US Preventative Services Task Force recommended that it is not worth the cost of the testing to prevent heart attacks and death.

There is another task called a CIMT, or carotid intima-media thickness ultrasound which is more sensitive than a cat scan at picking up premature cardiovascular disease decades or more before causing a problem. This is also not covered by insurance as a screening test, and it's a little bit more expensive at about \$300 but a better overall test.

Individuals screened positive for sleep apnea should be screened for cardiovascular disease despite the government's recommendation that your life is not worth the cost of the test. We know that untreated sleep apnea is associated with a marked increase incidence of cardiovascular disease, particularly among those with severe sleep apnea, so we should be attacking both causes of death and disability. You can pay for it yourself.

Cancer

Historically cancer screening was not covered by health insurance because it was considered not medically necessary if you did not have cancer symptoms. When cancer becomes symptomatic, it is already fairly advanced, and you will likely die from it. Early detection, however, can pick up small tumors, which can be removed generally with simple surgical excision. In 2010 with the Affordable Health Care Act, the government mandated that

insurance companies cover specific screening tests, including certain cancer screening tests. This includes colonoscopies over age 50, cat scans of the lungs of smokers, and mammograms in women.

Yet about three quarters of cancers do not have a screening test covered by insurance. Routine screening can only pick up about 25% of cancers. For the sake of this discussion, we are not talking about skin cancer.

FDA approved in the summer of 2021 a blood test called a liquid biopsy called Grail®. This is a blood test that screens for small DNA fragments of cancers that may be floating around in the blood given off by a tumor. It is imperfect. However, adding the liquid biopsy to routine screening increases the likelihood of detecting cancer in its early stages by closer to 50%.

A full-body MRI has emerged as an option for using an advanced imaging study to define small tumors about the size of a pencil eraser that may be otherwise undetectable with conventional screening or a liquid biopsy.

Neither the liquid biopsy nor full body MRI is covered by insurance. That does not mean that you cannot or should not do them.

It's just a matter of who's going to pay for them. The liquid biopsy currently costs between 650 and \$950. A whole body MRI generally costs under \$3000 at centers that specialize in this technology.

The reason to consider screening beyond what your insurance covers is to increase your chance of surviving should you develop cancer.

Neurocognitive Decline, Dementia, and Alzheimer's Disease

Cardiovascular disease tends to occur younger, this is followed by an increased risk of cancer, and as we get older and survive without cardiovascular disease or cancer or risk of Alzheimer's disease and brain dementia goes up remarkably.

There are currently ways to screen for dementia and Alzheimer's before there are symptoms. The treatment of neurocognitive decline has been solely focused on people with existing and relatively advanced diseases, and quite frankly, it just doesn't work very well.

However numerous interventions can be done for unhealthy people who do not have significant symptoms of neurocognitive decline or not at all, but their brain is going in the wrong direction and declining.

There are currently some mental tests that can be performed to pick up neurocognitive decline before it is evident, and volumetric measurement of the brain's structures with an MRI is probably the most accurate way to pick up future brain problems. This is not something that is covered by insurance unless the individual is already at the point of having obvious dementia.

Let's recap this. There's a way to detect Alzheimer's or dementia years in advance at a point where it can be treated and the disease avoided, but it is not covered by insurance. But once you have irreversible brain damage, your insurance company will pay for the imaging of your brain that confirms that is already damaged. This may seem absurd, but your health insurance is similar to your car insurance or your home insurance. It is mainly designed to pay for costs associated with a catastrophe versus preventing the catastrophe in the first place.

Sleep and Neurocognitive Decline

Dementia, Alzheimer's, and neurocognitive decline can be grouped together even though there are multiple factors for the various diseases that fall under these groups.

The principal way we image the brain is with an MRI. We can see the amount of brain material compared to the amount of Dead Space which was a liquid contained in spaces called ventricles. As the brain ages, the ventricles get larger, and the brain tissues shrink. Additionally, damage within the brain tissue can be easily seen with MRI. By measuring the amount of brain tissue, particularly certain structures of the brain such as the hippocampus, we can predict the future development of cognitive impairment or Alzheimer's disease.

Brain Damage Caused By Untreated Sleep Apnea

A study published in the journal SLEEP in 2014 evaluated the lesions or injuries to the brain that are seen in people with obstructive sleep apnea and the impact of treatment with CPAP on brain damage. In this study, they measured the white matter of fiber integrity and something called fractional anisotropy and mean diffusivity. This is medical jargon for "bad spots on the brain".

In this study, they measured the brains with MRIs of individuals with severe obstructive sleep apnea and compared them to healthy individuals with no sleep apnea. Of critical note is that the individuals tested were 30 to 55 years old. Before the age when they would have symptoms of cognitive impairment.

Spots on the brain develop in individuals with sleep apnea, well before dementia occurs. The spots are reversed with sleep apnea treatment.

They performed neurocognitive assessments which are a series of memory and executive function tests. The individuals with severe obstructive sleep apnea generally scored lower on the tests than individuals without apnea.

They performed MRI which showed damage to the brain tissue that was evident by the "spots" in the brain.

These individuals who had sleep apnea were then put on CPAP for 12 months. as early as three months after initiating treatment, there was a slight improvement of the brain damage. But one year, there was a complete reversal of the brain damage visible on MRI and their brains look just like individuals who never had severe sleep apnea in the first place. Additionally, their cognitive deficits resolved similarly to the appearance of their brain.

These individuals were quite young and not at risk for Alzheimer's or clinical dementia. Yet they had lesions in their brain, and they had impairments in their cognitive function that were evident with specific testing but maybe missed in day-to-day life.

We will review the importance of identifying sleep apnea and treating it before permanent irreversible damage has started. This is a key element to longevity. You must protect your brain and you need to do it at a young age.

Amazingly the US Preventative Services Task Force recommends against screening for cognitive impairment in older adults. Even though cognitive impairment in older adults have a massive economic impact in our country, can generally only be modified when caught in the earliest stages, and it's rising at an alarming rate, the government's advisors recommend we just ignore it.

Your Genes and Sleep Apnea

This next section is a brief overview of the genetic risk of sleep apnea. Alzheimer's has multiple causes, but there is a gene that puts individuals at increased risk.

APOE (apolipoprotein E) Gene has three Forms. There are e2, e3, and e4. each of us has two copies of the e gene.

APOE e3 is the most common and doesn't seem to affect the risk of developing Alzheimer's disease.

APOE e2 is the least common and reduces the risk of Alzheimer's disease.

APOE e4 increases the risk of Alzheimer's disease, particularly at a younger age. About 15 to 25% of people carry this gene covering either one or two copies of it. If you have one copy you have about double or triple the rate of developing Alzheimer's disease over the general population. If you have two copies of APOE e4, you have 10 times increased risk of developing Alzheimer's disease over everybody else.

Insurance does not cover genetic testing for Alzheimer's disease, but that doesn't mean you can't do it. The test typically costs about \$25 to \$150, depending on the laboratory. I am APOE3 (2 copies of e3) so an average risk of Alzheimer's disease.

Sleep Apnea in Association with Alzheimer's Disease and Dementia

The study published in 2016 assessed 7547 male subjects by the University of Kentucky. Participants were given a Memory Impairment Screening (MIS) test, an APOE genetic test, and a questionnaire for known sleep apnea. This was a multiyear observational study.

Individuals with APOE e4 developed dementia or Alzheimer's independent of their sleep apnea. All others had a significantly

increased risk of dementia if they had pre-existing known sleep apnea. It was 66% higher.

Another study evaluated the effect of sleep apnea and brain age. Brain age is generally calculated with volumetric measurements of the brain tissue relative to the dead space. As we age, our brains tend to shrink, and the more the brain shrinks the more cognitive impairment we will have. Someone at a younger age whose brain has shrunk down to the age of a person 20 years older will likely develop Alzheimer's and dementia. Another study was published in 2021 by the Sleep Research Society. 690 participants had both MRI of their brain and overnight sleep studies. The average age was 52 1/2 years old \pm 13 1/2 years. They found a linear relationship between the degree of sleep apnea and the age of the brain. That is to say that if they had more significant sleep apnea, their brain tended to be older than their chronological age, putting them at more risk for dementia and neurocognitive decline.

To determine brain age, they looked at 169 regional brain volumes in each individual. They compared the volumes of those regions to average populations of a similar age. This is basically how we determine brain age did you take a large population and measure the volume of areas of the brain and get an average of each area for each year of life. The individuals with obstructive sleep apnea had older brains than those who did not have sleep apnea.

Incidence of Sleep Disturbance in Mild Cognitive Impairment and Dementia

A study in 2012 performed in Italy evaluated 431 patients in 10 different neurological centers with some sort of cognitive impairment. They found that the majority of individuals had some

type of sleep disturbance. There are different types of sleep disturbance that include sleep disorder breathing and disorders of stages of sleep commonly associated with sleep apnea. They found that Alzheimer's disease and mild cognitive impairment were associated with any type of sleeping disorder. Parkinson's disease dementia was more associated with a lack of REM sleep.

Published in 2019 in the Journal of Geriatric Society, they identified individuals aged 55 to 89 (average age 70) years old who had mild cognitive impairment and mild to severe sleep apnea. They asked the participants to use a CPAP machine at least 4 hours a

Sleep apnea leads to earlier and more severe cognitive impairment with aging. Treatment of sleep apnea is critical to slow down or prevent dementia risk.

night for one year. Only about half of the individuals complied with the treatment, and the other half didn't bother using the CPAP machine regularly.

They performed tests at baseline for psychomotor and cognitive processing speed, a test called Wechsler Adult Intelligence Scale. They also perform tests for attention span, memory, and psychomotor vigilance.

At the end of the year, those treated for their sleep apnea had improved cognition and improved their scores on the same testing. The individuals who are not compliant with apnea treatment continue to decline.

Age of Onset of Dementia

In 2021 the University of Michigan did a retrospective study of 53,321 Medicare beneficiaries who had been diagnosed with sleep apnea Before 2011 with no known history of dementia. This is a

study where they looked at the claims data that it was Medicare billed for a diagnosis of sleep apnea. Only about half of the individuals who were diagnosed with sleep apnea were treated. They went on to compare the incidence of a diagnosis of dementia or Alzheimer's disease between the individuals who were treated and those who were untreated, with both groups having known sleep apnea.

They matched the groups in terms of other diseases or factors and found that treatment of sleep apnea significantly lowered the risk of developing dementia and Alzheimer's disease.

A study published by the American Academy of Neurology sought to determine if the treatment of sleep apnea would alter the age at which individuals develop dementia. Numerous studies have shown that there is a decreased likelihood of developing dementia in apnea sufferers when they are treated for it. This study was a much longer study to determine the scope of protection.

They use a database called the Alzheimer's Disease Neuroimaging Initiative (ADNI), which was started in 2004 and is still going on today. The purpose of this ADNI is to help scientists understand the causes of Alzheimer's disease and other types of dementia. They look at MRI, PET scans, genetic testing, cognitive testing, spinal fluid testing, and blood biomarkers.

Dementia is a disease of age. Only about 3% of adults in their 70s have dementia compared to 22% of adults over 85 and a third of adults 90 and over. So, to study the causes of dementia to determine therapies to reduce the risk the longer studies are much better but, of course, difficult to do.

The ADNI's mission is to identify potential methods to either prevent or cure Alzheimer's disease. In this study, they evaluated the age of onset of dementia which included mild cognitive impairment to Alzheimer's disease.

They identified that individuals with sleep apnea developed dementia at a much earlier age. They found that individuals with sleep apnea tended to develop dementia 10 years earlier than individuals who had no sleep apnea diagnosis. Additionally, they found that individuals with sleep apnea who were treated with CPAP developed dementia 10 years later than those who did not seek treatment. This study showed that treatment of sleep apnea reduces the risk of dementia onset to be the same as people that never had sleep apnea, to begin with.

Summary:

Numerous studies have shown an increase in the incidence of dementia in individuals with sleep apnea who don't seek treatment. This exists in both men and women, in all races, but typically adds older ages. Sleep apnea leads to brain damage and brain damage leads to cognitive impairment or dementia. Not having sleep apnea or treating sleep apnea is protective against dementia and Alzheimer's disease.

The government-sponsored task force recommends that doctors do not routinely screen for sleep apnea because they have determined it's not worthwhile. One in three people that live past 90 years old will develop dementia and healthcare costs skyrocket as a result of caring for individuals with dementia. Technology is allowing us to live longer lives and, in the future, there will be many more adults over age 90 as a percentage of the population than there are now. The government's short-sightedness in recommending against routine sleep apnea screening will have a massive negative impact on the healthcare costs in America, potentially causing an implosion. But just because the government says that it shouldn't be done (routine testing for sleep apnea) you have your own choice.

Testing is inexpensive, easy, and can be done in your own home with the results available immediately upon waking up.

At the time of writing this book, the devices that give an AHI (apnea-hypopnea index) need to be prescribed by a physician. The cost is dropping significantly and, in the future, we will see technology companies creating devices that don't require a doctor's prescription so that people can find out on their own if they have sleep apnea and are at risk for dementia.

CHAPTER 6:

The Gross Injustice of Under-Diagnosing and Under-Treating Sleep Apnea

For the most part, sleep apnea remains an ignored condition. The vast majority of people with sleep apnea don't even know that they have a potentially serious and treatable condition. Snoring is strongly associated with sleep apnea, and oftentimes the bed partner can hear the other person stop breathing during the night, but they just accept it as a burden.

Because the link between sleep apnea and chronic disease is so strong, one could wonder why patients are not bringing it up to their doctors. And why their bed partners are not recommending that they seek treatment. We could wonder why primary health care providers are not routinely at least questioning for or, if not, testing for sleep apnea in their patients.

The chronic conditions that are associated with untreated sleep apnea are so numerous that the cause may not always be questioned. Sleep apnea leads to an increased incidence of obesity, hypertension, diabetes, cardiovascular disease, stroke, accidents, mental health issues, cancer, and premature neurocognitive decline, including Alzheimer's disease.

By no means is sleep apnea the sole cause of those diseases, but it is a significant contributing factor. There's a general lack of awareness amongst the public and healthcare professionals as

to the impact of the negative impact that sleep apnea has on health and longevity.

There are two additional reasons why sleep apnea is so grossly undiagnosed and untreated. First off, testing for sleep apnea has traditionally been somewhat challenging. Insurance companies, including Medicare, put up significant obstacles to avoid paying for sleep testing. Routine testing for sleep apnea is just not permitted by health insurance companies. This is despite the fact of the overwhelming evidence that demonstrates that sleep apnea is quite common, the majority of people who have sleep apnea do not know about it nor treat it, and we would save billions of dollars annually if we did routinely screen and treat sleep apnea.

Secondly, treating sleep apnea has traditionally been done using CPAP, which is a device that one wears at night to help force air into the lungs. These devices tend to be uncomfortable, inconvenient, noisy, and relatively expensive, which leads to poor patient compliance.

Two Things Have Changed That Can Remove Those Barriers

First is the testing. Traditional sleep studies have been done in a hospital or outpatient lab where you're hooked up to machines and monitored while you sleep. Modern technology has solved that. They're wearable devices that can be used at home to accurately measure sleep apnea in most individuals. They cost a fraction of the fees generated by sleep labs, and for people without significant other medical conditions, they work just as well. Using home sleep monitoring devices five or ten years ago was cumbersome, but now there is a simple device that hooks up to

your smartphone and is inexpensive. If your insurance refuses to pay for it, you can just buy one. They're that inexpensive. Second is the treatment. The traditional means of treating sleep apnea has been using a CPAP device which is the gold standard. But compliance is low because of the inconvenience and the cost and hassle associated with these devices. There are some surgical procedures for apnea, and there are several reasons that these are not that common. There's a newer implantable device called Inspire® that gets placed in your chest with wires going up your neck to the hypoglossal nerve to simulate breathing at night. The Inspire®, while effective, is very expensive, in many cases, not covered by insurance, and not everybody is interested in having it implanted device in their body that electrically stimulates their nerves.

In a separate section, we will talk about the NightLase® procedure which are simple outpatient laser procedures that can effectively reduce or reverse sleep apnea and improve snoring. The focus of this book is to talk about the advances in the diagnosis and treatment of sleep apnea which principally involves routine screening with a home sleep test and laser treatment to reverse the condition of sleep apnea.

The American Academy of Sleep Medicine (AASM) is an organization devoted to improving sleep through education and public awareness of the importance of sleep on our health as well as the American economy.

Economic Burden of Untreated Sleep Apnea:

In 2016 this organization (AASM) commissioned a deep dive into the economic impact of the gross underdiagnosis and undertreatment of obstructive sleep apnea. They use very conservative assumptions in doing this analysis. They chose to use

the assumption that 12% of Americans have obstructive sleep apnea, which was based on statistics that were 30 years old. The reason for using this old data was that it was in no way overstating the facts. It was from the Wisconsin cohort study mentioned in another section. As we will talk about in another section, the incidence of sleep apnea in Americans is much higher than 12%. Because of changes in our lives, increased calorie consumption, decreased physical exercise, more interruptions of sleep, and increased use of electronic devices, Americans are more overweight than they ever have been. Therefore obstructive sleep apnea is much more prevalent.

They used the assumption that about 23 million Americans have sleep apnea and are not diagnosed. Again, the number is much higher than that, but they chose to use this very conservative statistic to avoid any controversy.

They looked at the cost associated with untreated obstructive sleep apnea, such as the additional health conditions that arise as a result of untreated sleep apnea, the increased incidence of accidents such as in the workplace or automobiles, and lost productivity due to poor sleep.

They determined that diagnosing and treating sleep apnea cost an average of \$2105 per year per person in 2016 dollars. The costs associated with ignoring sleep apnea and not treating it were much higher at \$6366 per year per individual.

Ignorance of sleep apnea is costing the US economy \$150 billion a year. The US government and health insurance companies have been against routine screening for sleep apnea, and this is an injustice.

Taken collectively, this was a waste of about \$150 billion anyway that burdens the American economy unnecessarily.

Schneider Trucking Initiative

Trucking may be associated with more risk of fatality when accidents occur, and drivers may be more at risk for obesity, which is related to an increased incidence of sleep apnea. We talked about how insurance companies, including Medicare, do not permit routine testing for sleep apnea. Still, many companies are self-insured and are more concerned about the health and welfare of their employees than insurance companies are concerned about the health and well-being of their beneficiaries.

This trucking company began deliberately screening, diagnosing, and treating sleep apnea in truck drivers with its program in 2006. 95% of their commercial drivers denied overt signs and symptoms of sleep apnea (which is the requirement for insurance reimbursement of sleep testing), and the company went ahead and paid for sleep studies anyways. They found that 85% of those tested were tested as positive for having some degree of obstructive sleep apnea.

What they found was that for those who participated in treating their sleep apnea, there was a 73% reduction in preventable driving accidents. Additionally, they found that with the company bearing the cost of diagnosing and treating sleep apnea, they saved \$550 per month per driver in health care costs. They saw that their healthcare costs were reduced by half by diagnosing and treating sleep apnea. Everything from developing the chronic disease to hospitalizations went down by simply treating sleep apnea.

US Preventative Services Task Force



Scan for US Task Force opinion on sleep apnea screening.

USPSTF is a government-funded task force that makes recommendations to insurance companies and organizations such as Medicare as to what should be covered by insurance and what should not.

On March 29th of, 2022 after due diligence of the medical literature, they recommend against routine screening for sleep apnea. They state that “the current evidence is insufficient to assess the balance of benefits and harms of screening for obstructive sleep apnea in the general adult population”.

These are your taxpayer dollars at work. They recommend against routine screening for glaucoma, a leading cause of blindness in adults. They recommend screening for atrial fibrillation, which is a leading cause of stroke. They recommend against screening for chronic lung disease, which is one of the leading causes of death in smokers. They recommend screening of sexually transmitted diseases in women but against screening for sexually active men for sexually transmitted diseases. You just can't make this stuff up. They even recommend against screening for vitamin D deficiency which is known to have major health consequences when ignored. They recommend against screening for occlusion of the arteries that lead to the brain causing strokes.

The task force, which is funded by the government and advises the government, typically is in favor of screening for social behavior issues such as sexually transmitted diseases, drug or alcohol abuse, mental illness, and abuse. And while these are all important, they cost very little money to screen for because it is generally around questioning. Yet they advise against screening for things that can kill you or shorten your life and make you unhealthy because of the cost of the testing.

I hear patients refrain from doing testing or intervention that can have a huge impact on their health and life because their insurance will not cover it. Many times they are not aware of how these insurance companies and the government make decisions on public health. It tends to be more about the political, philosophical, and cost implications of disease rather than solely focused on improving public health.

Another Trucking Report

Published in the medical journal *Chest* in 2006 was a report of 339 commercial truck drivers who received a CPAP machine for newly diagnosed sleep apnea from January 2003 to December 2005. They looked at hospital admissions, emergency room visits, and other health care costs before and after the screening and treatment of those truck drivers.

They found a 57.4% reduction in member health care costs after sleep apnea intervention compared to before the intervention. They also saw a 91% reduction in hospital admissions from a variety of conditions after an intervention. They considered the cost of the medical visits and the medical devices to be an enormous cost saving in the companies that implemented routine screening and treatment.

The Economic Impact of Sleep Apnea Treatment on Cardiovascular Disease

Published in the Mayo Clinic proceedings April of 2022, the researchers looked at Medicare claims data and costs in participants who had cardiovascular disease and the impact of identifying and treating sleep apnea in those individuals. They specifically looked at the economic impact. This study looked at the healthcare costs in the first 12 months after initiating CPAP treatment to manage sleep apnea in people that had known existing cardiovascular disease.

Of the 38 million Medicare beneficiaries in this particular program, more than 23 million had a history of atrial fibrillation, heart failure, stroke, and or hypertension.

In this study, they assessed how many people underwent a sleep study, and it was a small percentage, and then how many people received a treatment such as CPAP, which is even much smaller. An inherent limitation to the current treatment of sleep apnea is that most people do not stick with the treatment. That is they have been prescribed a CPAP machine and don't use it regularly. So they broke the groups down to adherent, meaning they use the CPAP, and not adherent, meaning that they were not compliant. Of the three groups of individuals, those with no sleep apnea, those with sleep apnea and receiving treatment, and those with sleep apnea and not complying with the treatment, they saw differences in healthcare expenditures and use.

Individuals with apnea who underwent treatment had \$4487 annual lower health care costs compared to individuals who have sleep apnea and were not compliant with treatment. Individuals with sleep apnea who underwent treatment had similar health care costs to individuals who had no sleep apnea, to begin

with. This is a solid testament to the importance of treating sleep apnea, that is to say that the treatment is largely effective. They also found their hospital admissions were 27% lower in individuals who received treatment for sleep apnea compared to those who did not treat their sleep apnea. The length of stay in hospitals when admissions occurred was shorter in individuals compliant with sleep apnea treatment than in individuals who were not compliant with CPAP.

Summary:

The majority of individuals with sleep apnea have never had an official diagnosis even though they may suspect it. The majority of people who are diagnosed with sleep apnea are not long term compliant with CPAP treatment due to a variety of reasons.

The US task force that is very influential in changing public health policy has recommended against routine screening for sleep apnea. While this is a disservice to our economy in our population, we do not have to accept their recommendations. This may be an excuse for your insurance company not to pay for a sleep study, but wearable tests are relatively inexpensive and getting cheaper. I have a device called Oura® ring, which monitors for sleep apnea. They're not allowed to come out and say that because then it would become a medical device, and the FDA would prohibit them from selling them. But in the morning, when I wake up, the ring connects with my smartphone, and I can see if I have any apneic episodes.

The WatchPAT® wearable FDA approved sleep apnea device has a wholesale cost of around \$100. It is illogical to not screen everybody with a test that costs about \$100 per person if this could save approximately \$150 billion a year, an economic burden of untreated sleep apnea, even including the additional costs for sleep apnea treatments.

We use the NightLase® laser treatments to reduce or eliminate apnea as an alternative to CPAP for individuals looking for an alternative to wearing these devices at night.

CHAPTER 7:

Sleep and Longevity

The Wisconsin Cohort Study

This study was established in 1988 Through the University of Wisconsin Madison School of Medicine and Public Health, funded by the National Institute of Health. The purpose of the study was for the government to sponsor research into the incidence of sleep apnea and the health risks that may be associated with sleep apnea.

In public health, the goal is to make people healthier, reduce the incidence of disease, and protect people. This is generally considered on a large overall scale, and specific considerations such as the cost of intervention must be weighed against the relative gains in health and wellness.

Sleep apnea, and sleep disorder breathing, have only received attention in the past two or three decades. We may have known about it for longer as it's quite obvious when you're sleeping next to someone and they stop breathing during the night or snore severely, but that doesn't mean it comes to the attention of healthcare personnel.

The presence of a condition such as apnea doesn't receive medical attention unless we know there is a bad outcome associated with not treating it. The FDA would not approve devices to treat conditions such as apnea unless we can demonstrate to the FDA that this condition can be considered a disease.

For example, the FDA does not consider aging a disease. There is a substantial clinical trial called TAME that involves using a

common medication to see if it delays the onset of age-related conditions such as diabetes, heart disease, hypertension, and cardiovascular disease. It will also assess whether or not people on active medication live longer and have a healthier span of life. The goal of the TAME trial is not so much to get a new medication approved for a drug company to make billions of dollars. It is to demonstrate that if aging can be slowed down or delayed, chronic health conditions can have less of an impact on people. The drug they are using, by the way, is metformin. To consider apnea a disease, it must be demonstrated to the FDA that modifying apnea alters the human condition or that the presence of apnea harms human health. In the Wisconsin Cohort Study, they aimed to determine if apnea had an impact and overall health and longevity.

The Study Setting

The investigators selected a random sample of men and women aged 30 to 60 from the payroll records of the state of Wisconsin. They randomly selected 2,940 participants (who didn't have a prior diagnosis of apnea) to go through an overnight sleep study called a polysomnography test.

Of those asked to participate, 1,522 people agreed and underwent testing. The main thing they were looking at was called the AHI or apnea-hypopnea index. A score of less than five is normal, 5 to 15 is mild apnea, 15 to 30 is moderate apnea, and over 30 is severe apnea.

This study was an observational study to assess the outcome on people's lives based on their absence of apnea or the presence and degree of apnea. Because it was primarily an observational study, they did not do any intervention. However, people that had a score of moderate to severe were advised that frequent

interruption of breathing at night may be linked to health problems and they should talk to their healthcare provider about their sleep report.

Follow Up

20 years later, in March of 2008, the investigators went back and looked at the death records from the US Social Security Death Index and the Wisconsin State Bureau of Health Information and Policy. They reviewed the causes of death among the people who had died over the prior 20 years. Keep in mind these people were 30 to 60 years old at the start of this study, so they would have been in the range of 50 to 80 at the end of the study.

They grouped their deaths into four categories.

Category one was cardiovascular disease which included stroke, heart attack, heart failure, sudden cardiac arrest, and other related conditions. Category 2 was fatal accidents injuries, or suicide. Category 3 was cancer. Category 4 included all other causes.

They considered individuals with no sleep apnea to be the reference range. They found that sleep apnea, regardless of the degree of sleep apnea, was associated with an increased risk of being dead in the subsequent 20 years.

Those with mild and moderate apnea had about a 50% increase likelihood of dying in the intervening 20 years compared to the individuals who had no sleep apnea. The individuals with severe sleep apnea, which is an AHI score of greater than 30, were three times as likely to have passed away compared to the people that had no sleep apnea.

They went one step further by using a Hazard Ratio which further compares individuals within the groups (mild, moderate, and severe sleep apnea) to people without apnea and grouping

them in terms of having diseases such as hypertension, diabetes, coronary artery disease, heart failure, and stroke as well as by age, sex, body mass index.

Because the original survey was randomized and they did not have exclusion criteria for prior diseases, some people in the group would be expected to pass away in the next 20 years because of other chronic medical conditions. So to make this study even stronger, they looked at people having similar ages with similar baseline health risks and independently determined if the addition of sleep apnea had a significant impact and their likelihood of surviving in the next 20 years.

What they found was quite compelling. Those with mild and moderate sleep apnea had nearly a 50% increased likelihood of being dead in the next 20 years, and those with severe sleep apnea were three times as likely to be dead in the next 20 years. This scientific method allows us to pinpoint the causation of death in this group of people because they group them based on so many other factors, such as their weight, their age, and other chronic health conditions.

This study was not intended to assess the impact of treating sleep apnea, but they looked at it anyways. The gold standard at the time was using a breathing machine called CPAP. The CPAP machine is a device that assists people breathing at night who have conditions such as sleep apnea.

In the 80s and 90s, treating sleep apnea was not that common in health care. So individuals who went to their doctors with their sleep study may have had a forward thinking doctor who recommended treatment because they suspected sleep apnea is associated with chronic illness.

When they separated individuals with severe sleep apnea who were never treated with CPAP, the results were even more

staggering. They were about four times as likely to have died in the intervening 20 years.

This study was a landmark study that is referenced repeatedly even though there was completed well over a decade ago. It made it clear that individuals with severe sleep apnea should undergo treatment or risk premature death. It has been estimated that treating or reversing sleep apnea when it is severe adds about 6 to 7 healthy years to one's life.

For the individual with mild to moderate sleep apnea, there was a trend toward increased death rate, but due to the size of the original group and the lower number of deaths that occurred in those with mild and moderate sleep apnea, it was not considered statistically significant. This means that there was a good chance that mild to moderate sleep apnea shortens your life, but this study did not definitively demonstrate that based on statistics. With severe sleep apnea, there remains no question.

Busselton Health Cohort Study

Two years after the Wisconsin study was initiated, another study was done in Australia starting in 1990 and followed through 2010. In this study, they track people who are a little older, aged 40 to 65. Since the individuals who entered the studies tend to be a little bit older than the Wisconsin Cohort study, we can expect to see a slightly higher death rate overall.

Mirroring the Wisconsin study, this Australian study showed that severe sleep apnea was significantly associated with subsequent death. They also saw an increased incidence of death in people with moderate sleep apnea, but mild sleep apnea did not correlate with subsequent death versus individuals without sleep apnea.

Increased risk of death in those with moderate to severe sleep apnea was mainly linked to increased incidence of cancer, stroke, and other cardiovascular diseases.

Why Does Sleep Apnea Shorten Life?

This is due to multiple factors, and research is ongoing. Sleep apnea disturbs restorative deep sleep, and it is generally felt that this is a primary cause of why sleep apnea leads to a shortened lifespan and an increase in chronic diseases. Studies looking at sleep duration discovered pretty much the same thing if somebody has less sleep, they develop more chronic illnesses. If people have interrupted sleep due to apnea, they have more chronic illnesses and a shorter lifespan.

Scientists have looked at markers of aging in our body chemistries and our genes. Obstructive sleep apnea leads to less stable copying of genetic information and has a negative effect (shortening) on our telomeres, which can be thought of as protecting units of our DNA. Sleep apnea also appears to lead to alteration of the methylation of our DNA which is closely related to the lifespan of individuals.

Additionally, sleep apnea has a negative effect, and our mitochondria, the energy machines that our body needs to survive, harm our stem cells which we need to repair tissues continually and leads to chronic inflammation, which is a precursor to our cells wearing out.

Cellular senescence (think senile) is a condition where our cells become old and no longer replicate into new younger, healthier cells. This is currently understood as a primary reason for the aging and dysfunction of our organs. Sleep apnea accelerates cellular senescence, which is equal to accelerating aging.

Sleep apnea, particularly severe sleep apnea, shortens our life and leads to the earlier onset of chronic disease.

CHAPTER 8:

Testing for Sleep Apnea

Diagnosing sleep apnea can be done with a questionnaire, a hospital laboratory center, and home wearable devices. Each has its pros and cons.

Questionnaire

Questionnaires are the most practical way to identify at risk individuals, and while it isn't as specific as actual testing, they can be very useful. The most widely accepted screening questionnaire is the STOP-BANG:

Snoring (do you snore loudly)?

Tiredness (do you often feel tired, fatigued, or sleepy during the daytime)?

Observed apnea (has anyone observed that you stop breathing or gasp or choke during the night)?

High Blood **P**ressure (do you have high blood pressure)?

BMI (is your body index more than 35 kg/m²)?

Age (are you older than 50)?

Neck circumference (is your neck circumference greater than 15 ³/₄ inches)?

Gender (are you male)?

If you answer two or fewer as "YES", then you are at low risk. A score of 5 or more "YES" is a higher risk. 3-4 is indeterminate. This test is very basic, but it is still useful. If we just take men over 50, then any "YES" to any one of the other 6 questions would put them at indeterminate risk. This screening is just a level of risk and is a broad net.

Of the 8 STOP BANG questions, there are 2 "YES" for which either being noted is very highly associated with concerning sleep apnea. Observed cessation of breathing (ie the definition of apnea) and loud snoring. Someone who sleeps alone would answer "No" to these two important questions.

The questionnaires are nice because your doctor can ask them without permission from your insurance carrier.

The next level of testing is, well, actual tests.

Traditionally, sleep apnea testing is done in a hospital, or medical facility with the patient hooked up to sensors, tubes, and wires while observed sleeping (polysomnogram). This has been the "gold standard" of sleep apnea testing for decades.

There are inherent problems with in-lab sleep studies. They are relatively expensive, and insurance companies put up barriers to coverage (including Medicare) and make your doctor jump through hoops to get them covered. And even if your doctor can document all the medical necessities for the study, people just hate the idea of being hooked up to machines and being in a strange environment to be graded on their sleep when they already sense there is a problem.

Within the last 10 years, wearable devices have been invented that allow the individual to have the test done in their own home,

with no one watching, and being monitored by their smartphone vs a technician watching from another room.

These wearable devices may be covered by your insurance plan, but there are still obstacles that your doctor has to deal with to get the study covered. This has led to a new market of inexpensive, easy to obtain sleep devices that can be purchased with or without a prescription.

WatchPAT® and NightOwl® are simple wearable devices that can assess your sleep at home in your bed. Each requires a doctor's prescription. For your insurance to cover them, you need to meet the requirements that your insurance puts in the way of your diagnosis.

Since the Medicare guidelines for doctors to review before prescribing you a sleep study are between 20-33 pages long, and commercial carriers can be shorter or longer than that, the problem can be solved for about \$100.

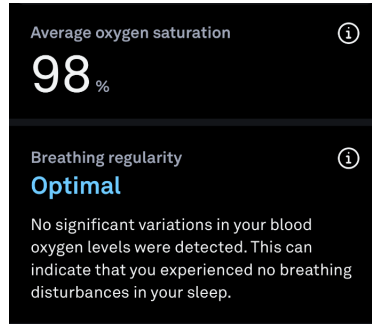
These newer sensitive tests are inexpensive and readily available. Non medical devices are also starting to measure sleep, such as the Oura® ring that I wear to monitor my sleep. Since Oura® is not a medical device, they are not allowed (by the government) to say if you have evidence of apnea or not, but they can give useful information.

Here is my Oura®

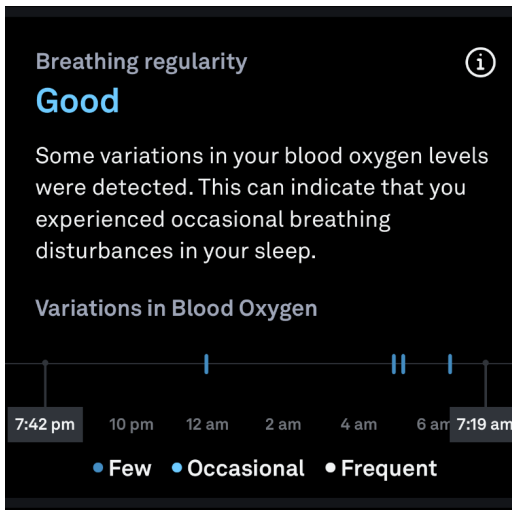
This is my Oura® ring.



On a typical night, I have virtually no apnea:



A night when I was sick with a cold, I had some minor episodes of disordered breathing noted by the blue hash marks:



You can see the four hash marks with apnea or decreased oxygen. These are actual apnea/hypopnea events that may or may not meet the diagnostic criteria, but very useful, nonetheless. These are infrequent events that we all may have, and a diagnosis of apnea requires 5 of these per hour. I did have apnea (never

measured but witnessed by my wife as occasional observed events) and was treated with our NightLase® 7 years ago. My most recent medical apnea test (WatchPAT®) was negative for clinical apnea.

WatchPAT® is an FDA-cleared home sleep study device that is a very good replacement for an in hospital or laboratory observe sleep study. This device connects to your smartphone, and you put it on at night and sleep alone so it doesn't pick up snoring from your bed partner, and it records your oxygen, your movement, your stages of sleep, apnea or hypopnea events, and heart activity.

When you wake up, the report automatically goes to your doctor, who can review the results with you. These wearable apnea devices require a doctor's prescription.

After a sleep study, whether in a lab or an at home device, your doctor will go over the results of this study with you. There are multiple readings that the sleep study records, but for this topic, we were looking at snoring, interruption of sleep, levels of sleep, and disturbances of breathing which is recorded as AHI or Apnea-Hypopnea Index. The definition of apnea is ceasing breathing for at least 10 seconds with a drop of oxygen of 3% or greater. Hypopnea means reduced breathing for 10 seconds or longer with a decrease in the oxygen of at least 3%.

The index is the number of events that occur in an hour. Normal is an AHI index of less than five, which is less than five times per hour if the person has significant breathing alterations. Mild apnea is a score of 5 to 15. Moderate apnea is greater than 15 and less than 30, and severe apnea is a score greater than 30. A score of 50, for example, means that the person has periods where they don't get enough oxygen for at least 10 seconds 50 times per hour or almost every minute.

As we will talk about, these interruptions in breathing lead to disturbed sleep patterns and decreased periods of deep sleep, which is necessary for the restoration of most organs in our bodies, particularly our brains and our cardiovascular system.

In most cases, a sleep study is done on a single night, so it can be said that different conditions can affect the study. Somebody with moderate to severe sleep apnea on any night likely has it on all nights unless there is something unusual, like a bad cold affecting breathing.

In summary screening for sleep apnea is done with a questionnaire. The diagnosis of sleep apnea is done with a test either in a lab or an at home test. The at home tests are certainly the easiest, the least expensive, the most practical, and are suitable for most people. Individuals with major systemic diseases such as heart failure, advanced lung disease, and other conditions may be better suited to having a hospital or laboratory based sleep study.

CHAPTER 9:

NightLase[®] and NightLase[®] C3

The gold standard of treatment for obstructive sleep apnea is CPAP. There are other treatments, such as dental appliances, that move the jaw forward or pull the tongue out of the throat while sleeping. There's a newly developed device called Inspire[®], which is a pacemaker-like device surgically installed in the chest with wires leading up through the neck into the hypoglossal nerve. The nerve stimulation aids with breathing, and apnea are reduced by about 67% with the Inspire[®] surgery.

There's also a surgical procedure called a uvulopalatoplasty (developed in 1981), where the tissue of the throat is surgically removed to aid breathing in improving apnea. This surgery is met with significant complications and is not performed particularly often. In 1990, attempts were then made with a carbon dioxide laser to perform the same surgery, but because of the aggressive nature of the laser, significant scarring would occur, and the results were not long-lasting, and complications were high.

The new technology came out of an erbium laser that is nonablative, meaning tissue is not removed with the laser the tissue is simply altered, in this case, tightened. In 2010 this nonablative of erbium laser was reported to have a very good effect of reducing snoring and habitual snorers.

Over the past decade, the protocols have changed with the nonablative beam laser and the addition has been another type of laser called an ND:YAG laser, which is a very deep tissue tightening laser. While this technology was initially developed for

snoring, physicians noted that patients were sleeping better and having fewer apnea symptoms.

These lasers developed by Fotona® have been FDA approved for this use (laser-assisted uvulopalatoplasty).

The original study done about 10 years ago showed that after two sessions of the procedure now called NightLase®, snoring severity would drop by 50%. They also noted that sleep disorder breathing would reduce by 46%. With these earlier protocols, only about one out of four people would not see any significant improvement. After these initial developments of reducing snoring and sleep-disordered breathing, the question is proposed "what if we treat patients more times". A study published in 2015 went over a modification of the process using the same original treatment but treating patients three times. They also did sleep tests to determine if the patients had sleep apnea, whereas previous studies mostly assessed snoring and symptoms of disturbed sleep. In this study, they did three treatments two weeks apart and followed the patients for three years. They found a 50% reduction after a single treatment, a 60% reduction after two treatments and an 85% reduction after three treatments. The results persisted for three years.

Another study published in 2018 found pretty much the same thing. The majority of patients had a significant reduction in their sleep apnea and snoring severity, and the results were durable, with the majority persisting with the reduction for about two years. In 2021 Dr. Harvey Shiffman, a dentist who focused his practice on managing sleep apnea, began the dual wavelength laser treatment that we use currently published his results. He also found that by treating the base of the tongue in the floor of the mouth in addition to the back of the airway, he could get better results for patients with apnea.

The patients were tested for sleep apnea and were treated three times, two weeks apart with this more advanced protocol, they saw a reduction of sleep apnea severity of 66.3%. In his case series, all patients had some degree of improvement, with the range being 32 to 100% improvement after three treatments. In his clinical practice, he noted that people with severe sleep apnea need more than three treatments. Still, to publish a study you must control all variables, so in this case, automatically he just did three and assessed it.

We have found that people with severe sleep apnea have a very crowded airway and the laser doesn't get as much surface area to treat as somebody that has mild apnea and a wide open airway. This is why we recommend people with severe apnea do the three treatments, retest and if they still have moderate or more sleep apnea do another series of three sessions.

The NightLase® procedure is very tolerable, sometimes topical anesthetic is used. It is done in the office with no downtime. The throat may feel a little dry afterward, but it is not significant, and you can resume eating and normal activity right away.

It could be done as soon as every two weeks, and for the most part, we start with three treatments and reassess to see if additional treatments are necessary.

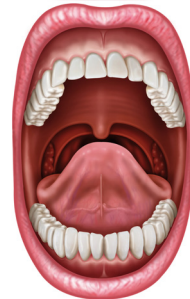
We combine the WatchPAT® sleep apnea measuring device with the SnoreLab smartphone app to assess the resolution of sleep apnea or snoring.



Areas treated include the back of the throat and base of the tongue to remodel and tighten tissues.



And floor of the mouth to pull the tongue forward by supporting the muscles that have weakened and allow the tongue to collapse in the airway:



The reduction of sleep apnea is expected to be long-lasting but some variables affect it. If people gain weight their apnea would naturally rise a little bit so we consider that weight gain may be associated with some worsening of sleep apnea even after treatment. and we know that sleep apnea tends to get worse with age or life changes such as menopause. So it is reasonable that after somebody's had successful treatment with NightLase® that they check a sleep study every year or so after apnea is returning go ahead and do another treatment.

From personal experience, I had the NightLase® procedure done in my office in 2015 and home testing was not widespread at that time. My wife noted that I snored a moderate amount, not loud, and I felt I'd occasionally wake up with apnea symptoms. After treatment, it was observed by my wife that my snoring had pretty much resolved they no longer had episodes of clinical apnea. I tested myself with the WatchPAT® and I did not have apnea, but I was snoring about 30% of the night. It wasn't loud but it was audible and picked up by the machine. I did one additional NightLase® procedure, and this was seven years later, and my snoring reduced by 70%. It's insignificant enough that I'll just retest in a year or so.

I am not recommending NightLase® as the only treatment for sleep apnea or the preferred treatment for sleep apnea. It is a personal choice based on who's going to pay for it, what kind of outcome you want and what your options are. NightLase® isn't covered by insurance and it's not likely to be in the near future. If you have great insurance, your CPAP machine may be covered and there's usually a cost associated with the consumable or disposable parts which aren't all that expensive, maybe a couple thousand dollars per year. The Inspire® implantable device that goes from your chest to the back of your throat is FDA approved for apnea and it costs about \$40,000 is good for about 10 years, and some insurance companies are starting to cover it but in general, coverage is not common at the time of this writing.

Summary:

I feel that everybody should have the opportunity to be screened for sleep apnea, particularly because it is now so inexpensive, and has such a massive impact and longevity and health. men should be screened starting in their 30s, earlier if they are heavy.

Women should be screened if they are overweight or when they approach the age of menopause when the incidence of apnea rises significantly.

Since the majority of people over 60 will have apnea, everybody of that age should be screened even though the government does not recommend it and your insurance company will not automatically pay for it unless you have medical necessity findings determined by your doctor.

If you do have sleep apnea, particularly moderate to severe sleep apnea, it should be treated. Cessation of smoking, weight loss, and physical activity have all been shown to reduce the severity of sleep apnea and these should be part of the program to make you healthier.

NightLase® is the only treatment that our clinic gets involved with so this is what people come to see us for, but there are other options such as dental appliances that open the airway up and CPAP.

The inherent problem with CPAP is not that it doesn't work, it works great. It is that it needs to be used pretty much every night all night long, including when traveling to be effective. CPAP does not alter sleep apnea it simply forces air into your lungs, so you have less of the detrimental effects of not breathing well while sleeping.

This is why I favor the NightLase® procedure. Once it is done, sleep apnea is reduced on an order of magnitude that is seen with the Inspire® surgery and with CPAP. But you don't have to travel with any device you don't have to wake up with a dry mouth and a sore face from the mask that is strapped on your face. The sound of the machine doesn't keep your spouse awake or keep you awake and you don't have to keep buying supplies and cleaning

the machine if your apnea is reduced or resolved with laser procedure.

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