THE SLEEP APNEA EPIDEMIC

DIAGNOSE AND TREAT WITH SLEEP TECH IN YOUR OFFICE

Jordan Stern, MD
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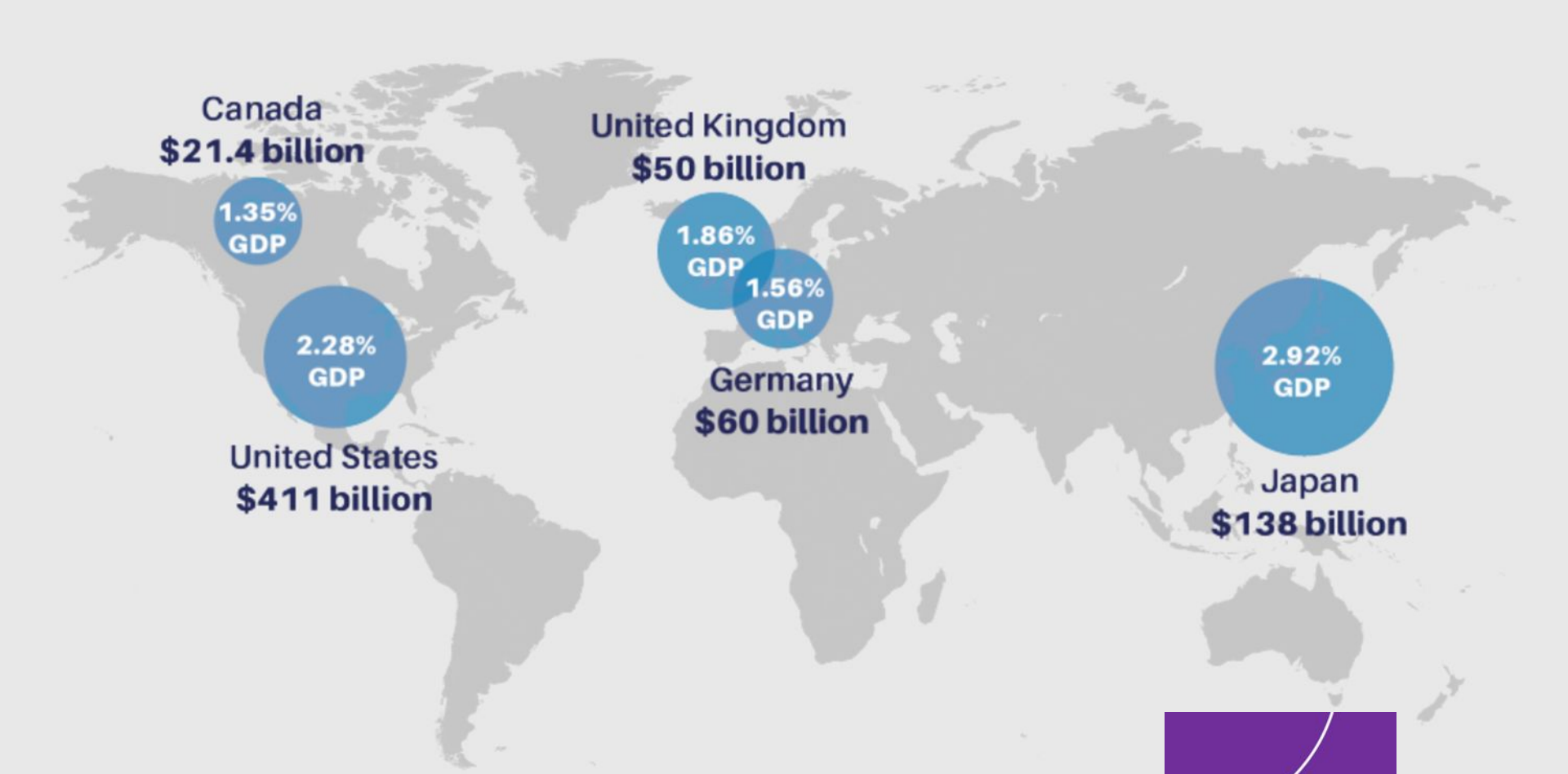
Chief Medical Officer GetSnooze

Founder and CEO of BlueSleep a digital healthcare company for sleep.
Industry sponsored clinical trials for the following companies:
Beddit (Apple)
Fitbit
Bedjet
Prosomnus
Neogia
Olympus Medical
The material in this presentation does not conflict with any of the relationships with the above companies

*Conflict Slide


*30,000 foot view
The Sleep Landscape

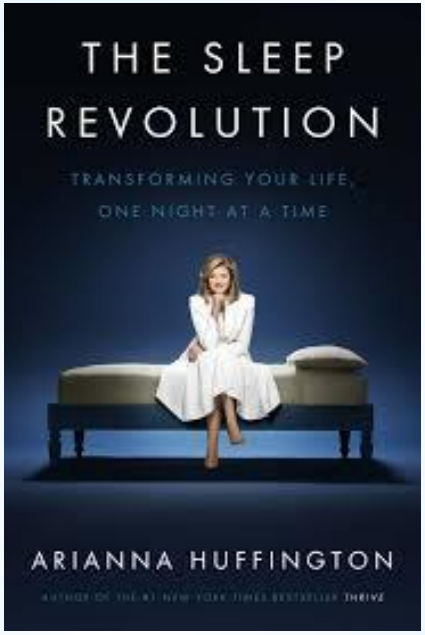


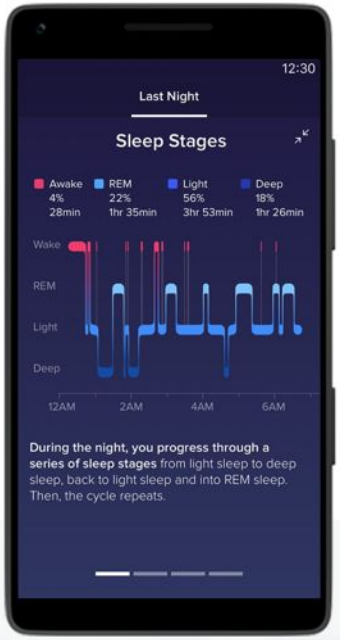
Map showing economic costs of insufficient sleep across five OECD countries

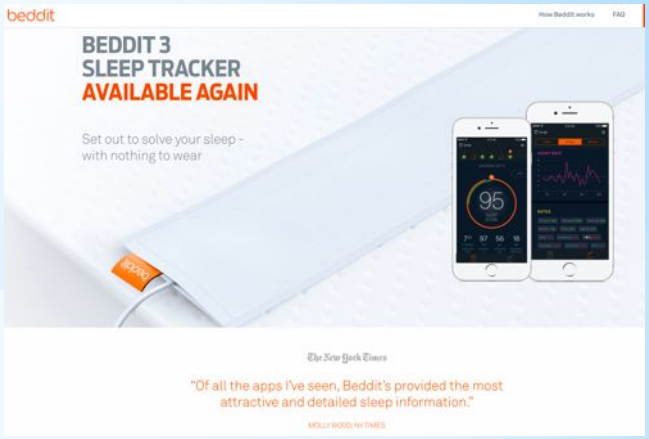
Jess Plumridge/RAND Europe

RAND CORPORATION

*The Global Sleep Problem


THE SLEEP REVOLUTION
TRANSFORMING YOUR LIFE, ONE NIGHT AT A TIME
ARIANNA HUFFINGTON


12:30
Last Night
Sleep Stages
Awake 4% 28min
REM 22% 1hr 35min
Light 56% 3hr 53min
Deep 18% 1hr 26min
Wake
REM
Light
Deep
12AM
2AM
4AM
6AM
During the night, you progress through a series of sleep stages from light sleep to deep sleep, back to light sleep and into REM sleep. Then, the cycle repeats.


beddit
BEDDIT 3
SLEEP TRACKER
AVAILABLE AGAIN
Set out to solve your sleep - with nothing to wear
"Of all the apps I've seen, Beddit's provided the most attractive and detailed sleep information."


13:48
Info
Record
Statistics
Settings
OFF
SnoreLab
Time to Sleep
20 minutes
Snoring Remedies
Side sleeping, Mouthpiece
Factors
Blocked nose, Alcohol
START

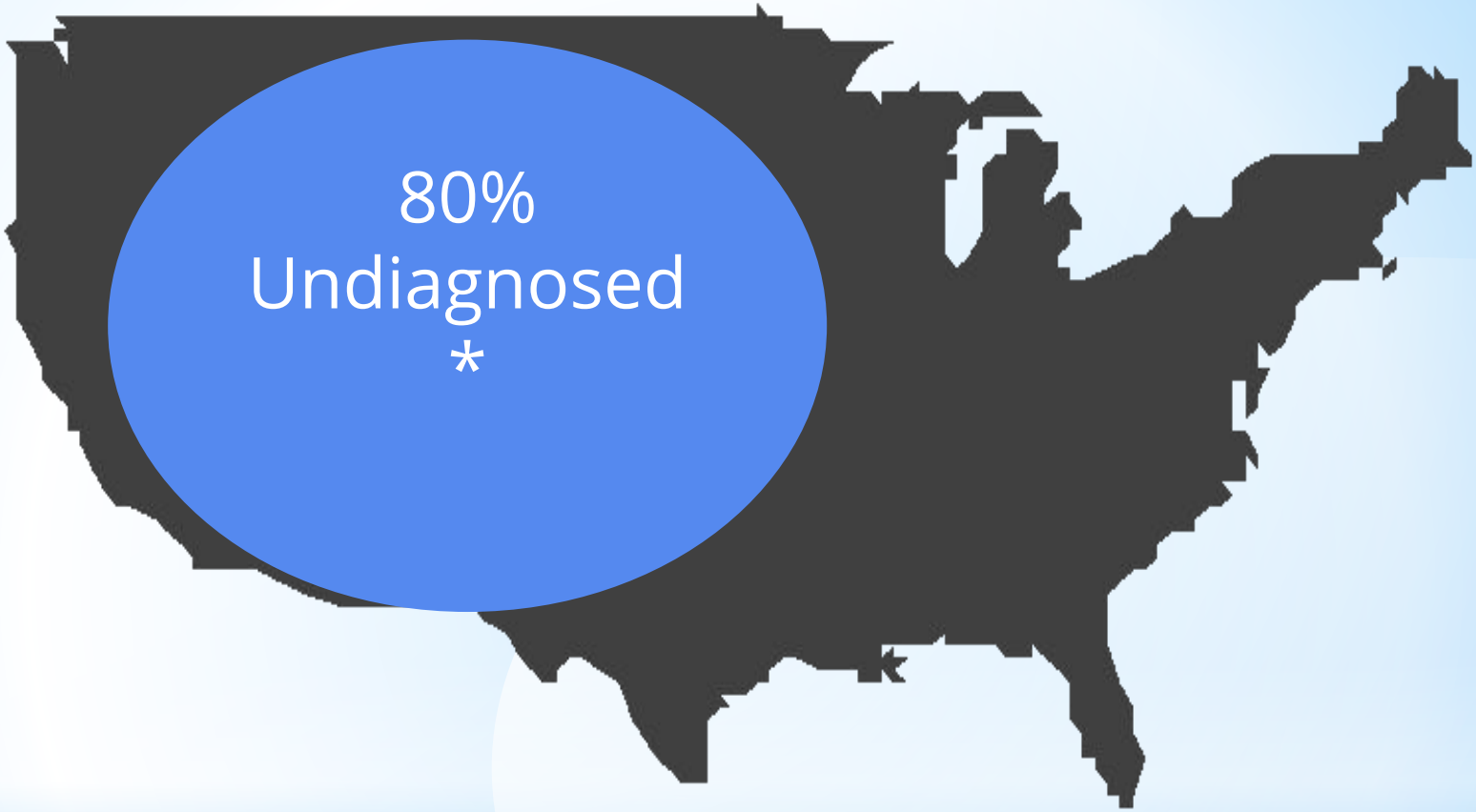

THE PERFECT MATTRESS FOR ECONOMISTS

Sleep NOW

1925. Nathaniel Kleitman. Grandfather of sleep
(PhD, U Chicago. Studies on the physiology of sleep, 1925)

1953. Aserinsky describes REM sleep
1953. William Dement names sleep stages and AHI defines sleep studies
1978. Creation of AASM and certification
1999. Discovery of Hypocretin receptor 2 gene
2008. HST. 2008 CMS accepts HSTs
2008. Sleep Tech takes off with Apps 2008

2018 Connected Sleep
Wearables, sensors, … Apps



*Sleep Apnea Undiagnosed

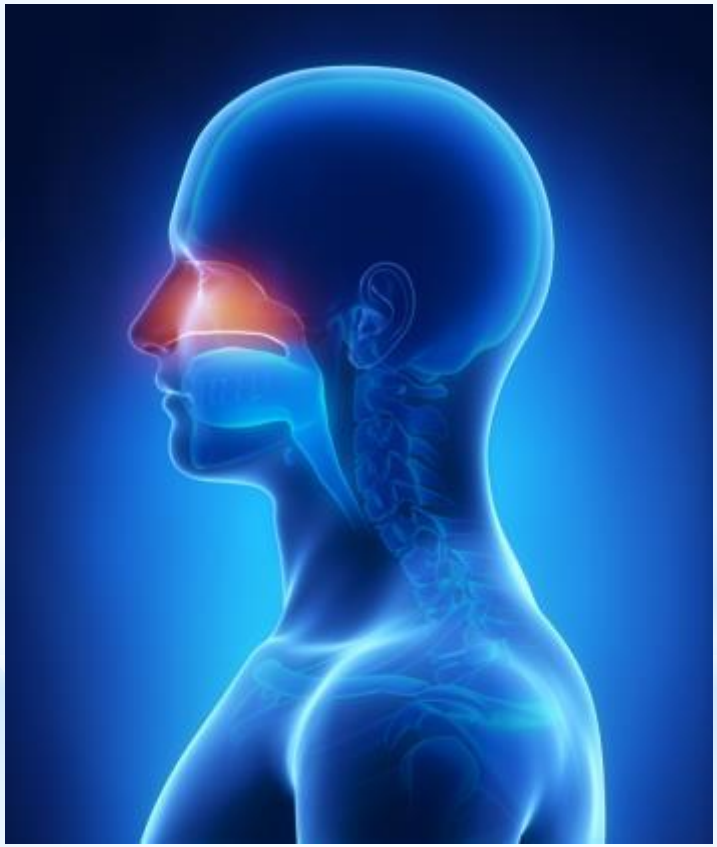
American Sleep Apnea Association

- **80% undiagnosed in US***
- Sleep labs and CPAP poorly tolerated
- Fragmented Care
- Resulting in poor compliance

The SLEEP Apnea Problem

*American Sleep Apnea Association

*WHAT IS sleep apnea? (OSA,OSAS)



Interruptions in breathing during sleep caused by a narrowing of the nose and throat and associated with:

Poor quality sleep

Excessive daytime sleepiness

Serious medical conditions

Transportation/MVA accidents

Absenteeism (and presenteeism)

$160B economic burden in the US

(Sleep Medicine, Harvard Medical School/McKinsey and Co, December 2010)

- Interrupted sleep
- Fragmented sleep architecture
- Decrease REM sleep and Deep Sleep
- Fewer hours of sleep
- Less or absent dreaming

*Effect of OSAS on Sleep

- Excessive Daytime Sleepiness
- Unrested in the morning
- Lack of memory consolidation
- Decreased motor performance (crashes)
- Poor mental function (decision making, concentration)
- Irritability (ADHD in children … and adults?)
- Poor sexual performance

*Direct impact of OSAS on performance

*Effects of sleep apnea

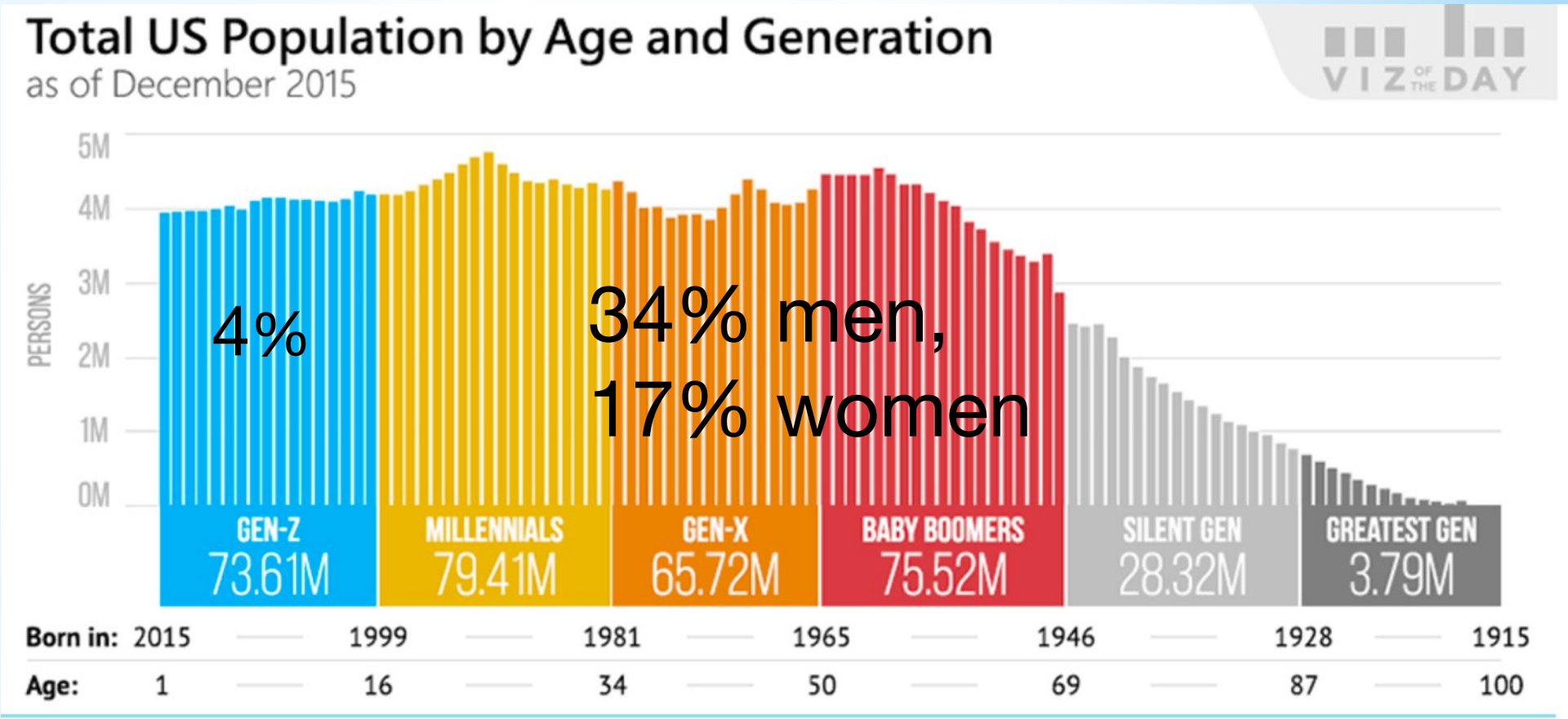
- ADHD
- Sleep maintenance insomnia
- Bruxism
- Morning headaches
- Poor memory
- Unable to lose weight
- Low sex drive, ED, impotence

*Other related signs of OSAS

"Increased Prevalence of Sleep Disordered Breathing in Adults"

American Journal of Epidemiology 2013. Peppard, Barnett, Young, et al.

MEN	**30-70 yrs old.**	**34%**
WOMEN	**30-70 yrs old.**	**17%**
MEN	**50-70 yrs old.**	**43%**
WOMEN	**50-70 yrs old**	**28%**



The Math:
M: 34-70: 23.8M
F: 34- 70: 11.9M
P: 3.0M
Total: >37M

*Most recent sleep apnea numbers

American Journal of Epidemiology 2013. Peppard, Barnett, Young, et al.

Believe the Swiss

23% of women with Moderate to Severe OSAS (AHI>15)

49.7% of men

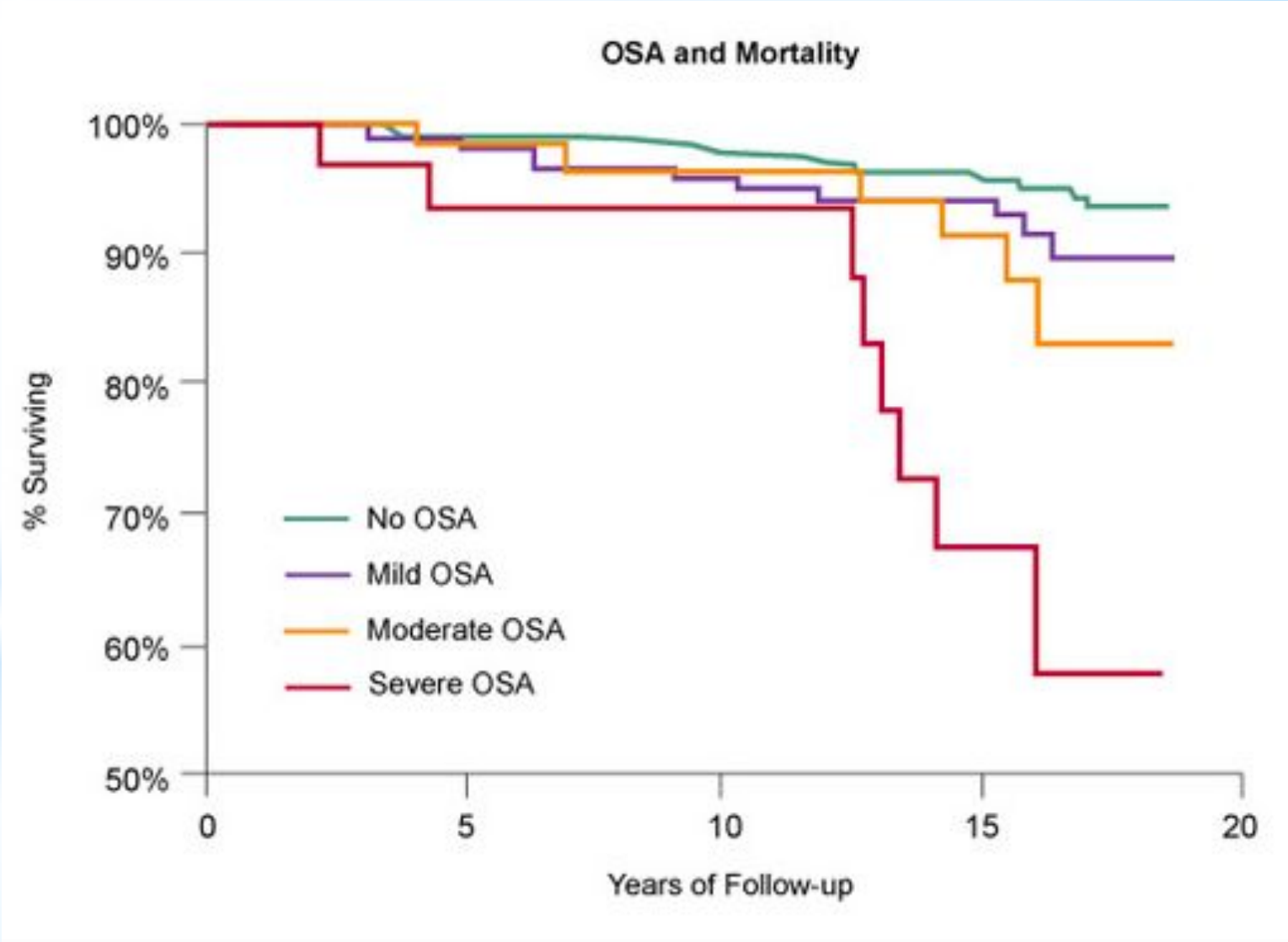
(Average age 57, 40-85 range
Average BMI: 25)

*Prevalence of sleep-disordered breathing in the general population: the HypnoLaus study.

Lancet Respir Med. 2015 Apr;3(4):310-8. doi: 10.1016/S2213-2600(15)00043-0. Epub 2015 Feb 12.

*Health impact of untreated sleep apnea

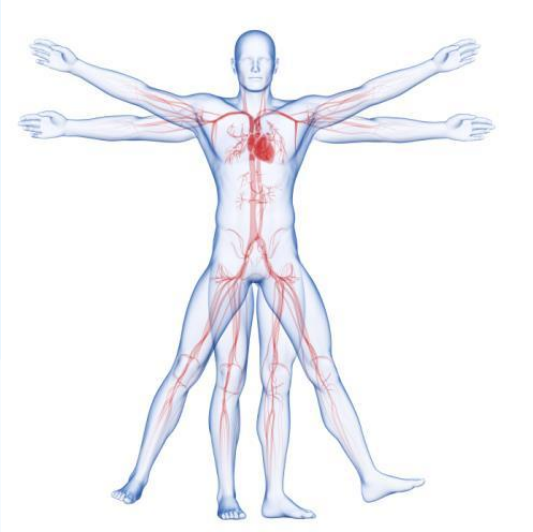
Sleep. 2008 Aug 1; 31(8): 1071–1078.Terry Young, PhD,[1] Laurel Finn, MS,[1] Paul E. Peppard, PhD,[1] et al.



*Sleep apnea and Hypertension

- High blood pressure is a common chronic medical condition.
- It affects over 40% of people between the ages of 50 and 60 years of age in the United States.
- Sleep Apnea is a risk factor for the development of hypertension.
- Approximately 50% of those with sleep apnea have hypertension. In fact, elevated blood pressure might be the only clue that a person has sleep apnea.
- Fortunately, treatment of sleep apnea may result in better control or even resolution of hypertension.

*Stroke and diabetes



Stroke: Sleep apnea might be a risk factor for having a stroke
People who have had a stroke
are at greater risk of having sleep apnea, and a second stroke if their sleep apnea is not treated

Redline S, Yenokyan G, Gottlieb DJ, et al. Obstructive sleep apnea-hypopnea and incident stroke: the sleep heart health study. Am J Respir Crit Care Med 2010;182:269-77.

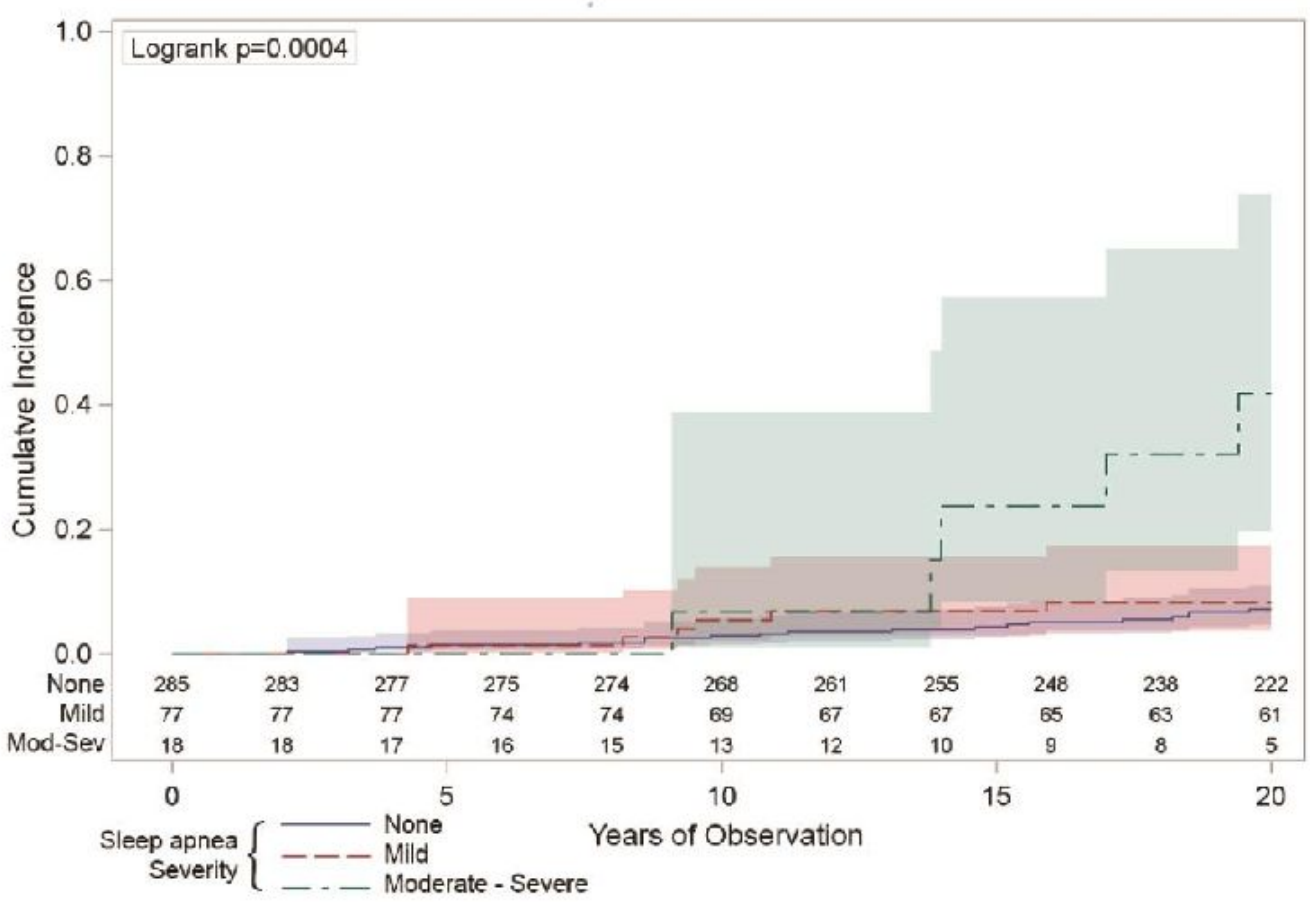
Diabetes:

- Severe OSAS is associated with elevated levels of HbA1c
- Association between gestational diabetes and sleep apnea

Obstructive Sleep Apnea and Diabetes A State of the Art Review.
CHEST 2017; 152(5):1070-1086

The univariate association between sleep apnea and incident stroke.

The vertical axis indicates the cumulative number hospitalizations or deaths from stroke was higher across the 20 years (horizontal axis) in those people with moderate-severe sleep apnea (respiratory disturbance index [RDI] ≥ 15/h: the green line) compared to those with mild sleep apnea (RDI 5-14: the red line) or those with no sleep apnea (RDI < 5: the blue line). The numbers just above the horizontal axis indicate the numbers of people being observed at each 2-year time point in each of the sleep apnea groups. The shaded areas around the lines represent the 95% confidence intervals.

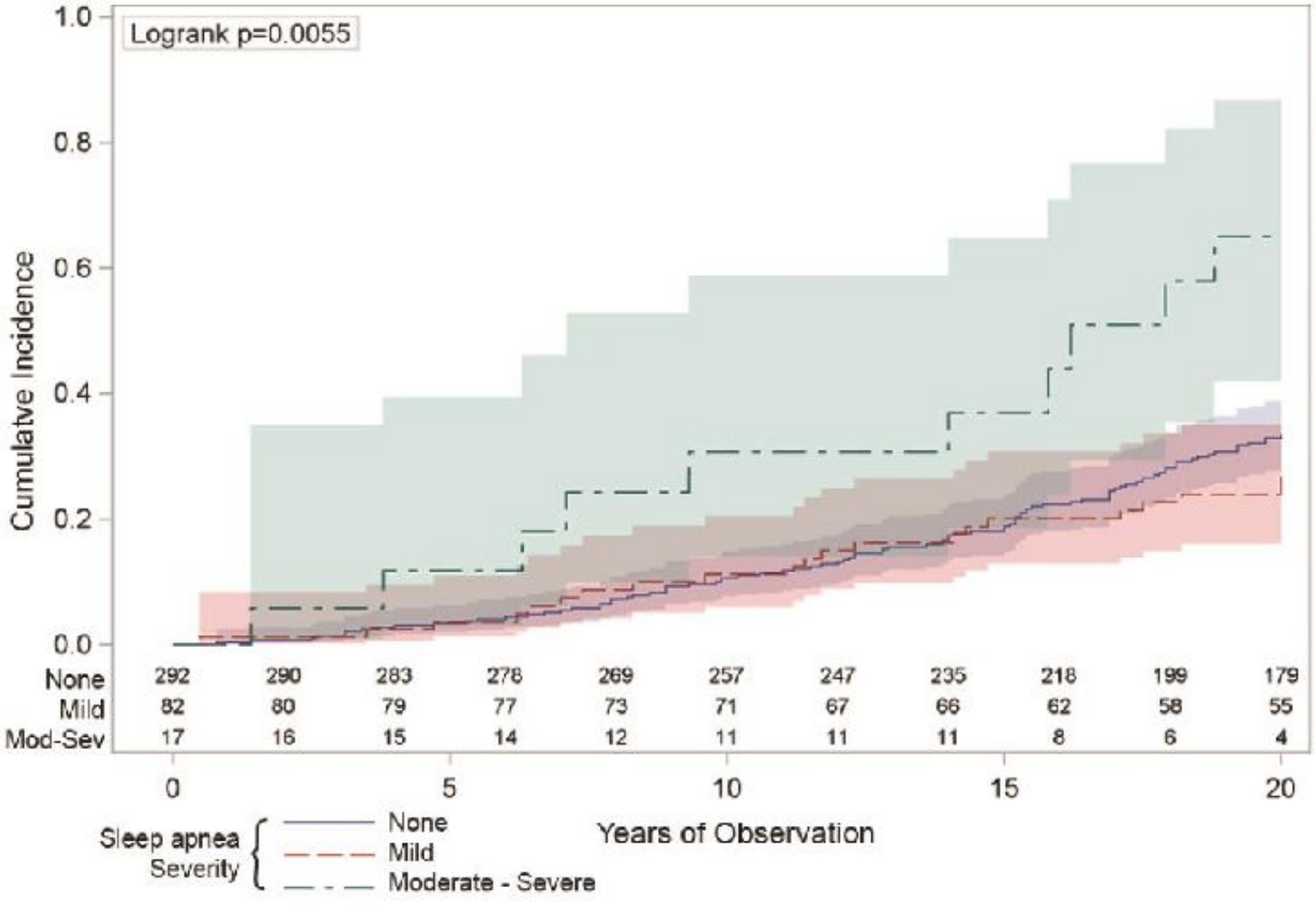


- Ears: Hearing loss
- Eyes: Sudden blindness, glaucoma
- Endocrine: Diabetes, PCOS, obesity
- Pain: Fibromyalgia, narcotics increase OSA
- OB: Third trimester OSAS and fetal risk
- GYN: Post menopausal risk
- Kidneys: Nocturia
- Urology: ED, low testosterone, testosterone replacement
- Dermatology: Psoriasis, premature aging
- Cancer: Increased incidence and decreased response to treatments

*Other risks and findings

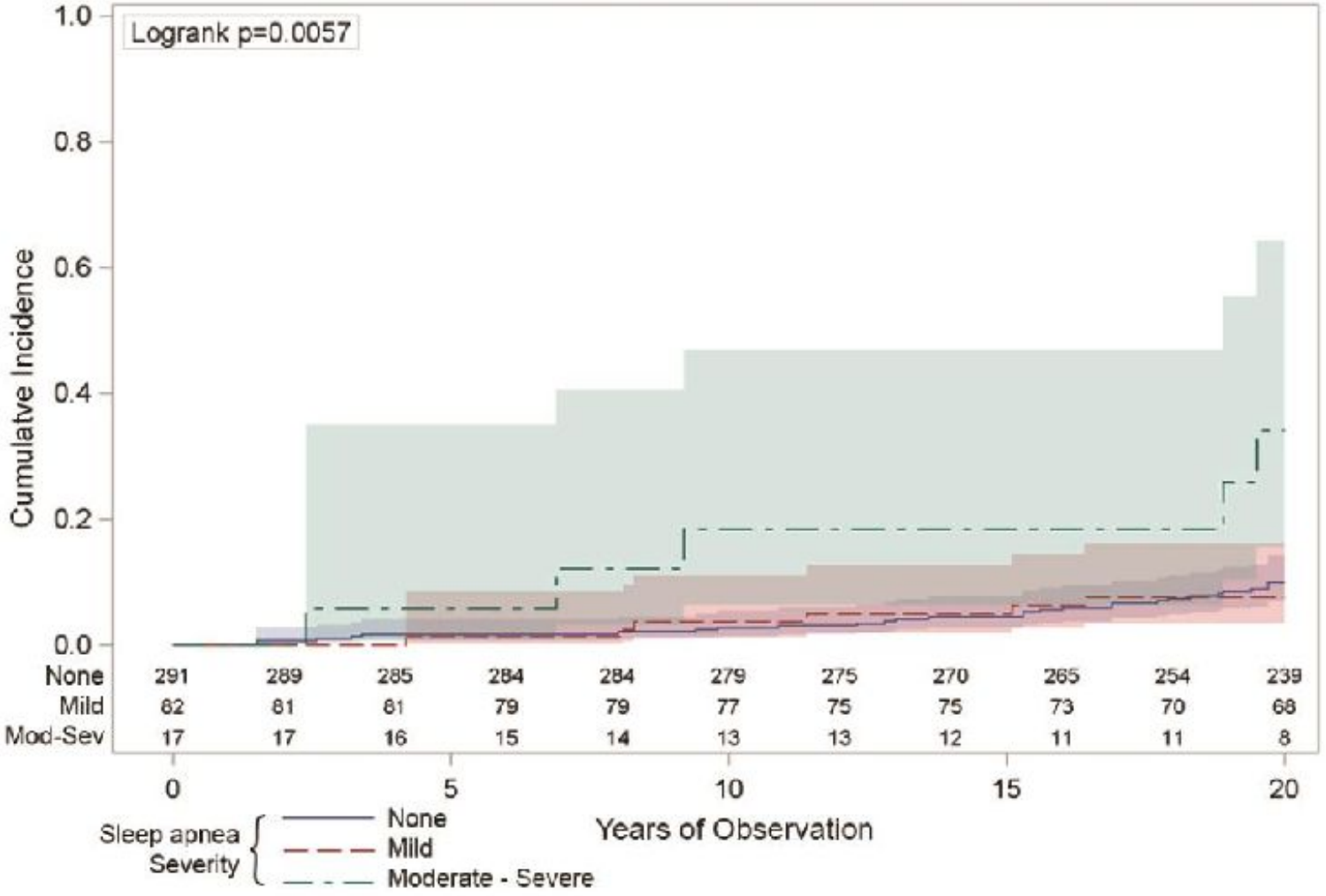
The univariate association between sleep apnea and the incidence of cancer.

The vertical axis indicates the cumulative number cancer diagnoses was higher across the 20 years (horizontal axis) in those people with moderate-severe sleep apnea (respiratory disturbance index [RDI] ≥ 15/h: the green line) compared to those with mild sleep apnea (RDI 5-14: the red line) or those with no sleep apnea (RDI < 5: the blue line). The numbers just above the horizontal axis indicate the numbers of people being observed at each 2-year time point in each of the sleep apnea groups. The shaded areas around the lines represent the 95% confidence intervals.



The univariate association between sleep apnea and cancer mortality.

The vertical axis indicates the cumulative number of deaths attributed to cancer was higher across the 20 years (horizontal axis) in those people with moderate-severe sleep apnea (respiratory disturbance index [RDI] ≥ 15/h: the green line) compared to those with mild sleep apnea (RDI 5-14: the red line) or those with no sleep apnea (RDI < 5: the blue line). The numbers just above the horizontal axis indicate the numbers of people being observed at each 2-year time point in each of the sleep apnea groups. The shaded areas around the lines represent the 95% confidence intervals.



*What Can I Do?

- SCREEN
- TEST
- TREAT

*screening

The Stop Bang Questionnaire

Snoring? Do you snore loudly (heard through closed doors)?

Tired? Fatigued or sleepy during the day, fall asleep driving?

Observed? Gasping or stop breathing during sleep?

Pressure? High blood pressure?

Body Mass Index (more than 35 – severely obese)

Age? Over 50?

Neck size? 17” or above in men, 16” or above in women

Gender? Male?

Yes to 3 or more is an increased risk for sleep apnea

Chung, F., Yegneswaran, B., Liao, P. et al. **STOP questionnaire: a tool to screen patients for obstructive sleep apnea.** *Anesthesiology*. 2008; 108: 812–821

*Lab testing (polysomnography)

The "Old Standard"

*Home sleep testing technology

- **In 2008,** the Center for Medicare and Medicaid Services (CMS) agrees to pay for sleep apnea treatment based on a home sleep test, and reimburses for HST.
- Home sleep testing is replacing the much more costly and disruptive lab test for diagnosing sleep apnea.
- Hundreds of peer reviewed studies including our own; analyzing data from thousands of tests using dozens of portable devices confirms the effectiveness of HSTs

*Home sleep apnea test

*Diagnosis with Home sleep apnea testing technology

Portable home sleep testing costs:

90% less than sleep labs

Studies show that testing with Home Sleep Tests and non-specialized personnel yields same results as more expensive and more time consuming tests

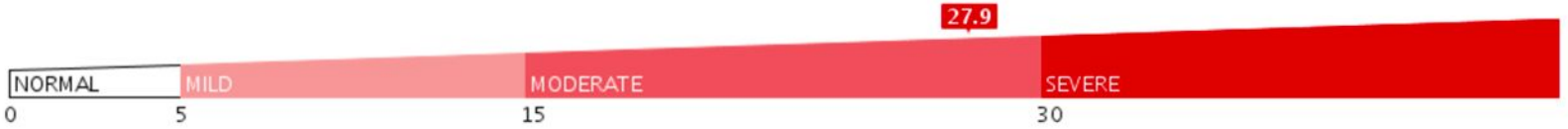
- Lease a kit for about $50/month
- Practice on yourself and your staff
- Instruct patients and test 1-2 nights
- CPT: 95806
- Average Medicare reimbursement: $190
- Obtain an interpretation from a Board Certified Sleep Specialist

*How Do I Do HST?

Recording : Raw data signals

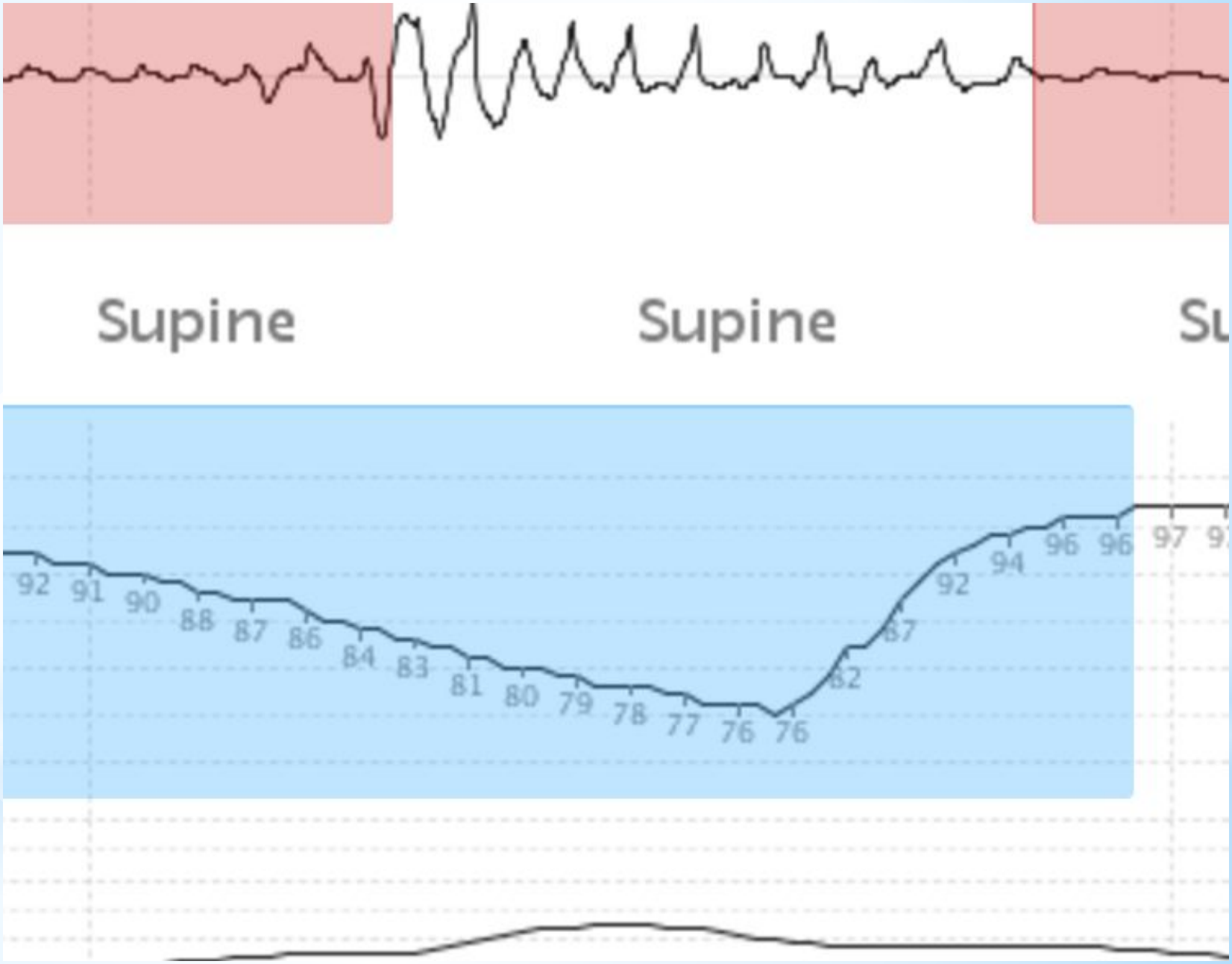
Device						**ApneaLink Air**		Type:	**III**
Recording	Date:	**09/08/2017**	Start:	**11:19pm**	End:	**7:17am**	Duration - hr:	**7:58**	
Flow evaluation			Start:	**11:29pm**	End:	**7:15am**	Duration - hr:	**7:15**	
Oxygen saturation evaluation			Start:	**11:29pm**	End:	**7:17am**	Duration - hr:	**7:39**	

Statistics



Events Index				AHI:	**27.9**	AI:	**24.1**	HI:	**3.9**
Supine	Time - hr	**6:21**	**(87.5%)**	AHI:	**31.9**	AI:	**27.5**	HI:	**4.4**
Non-supine	Time - hr	**0:54**	**(12.5%)**	AHI:	**0.0**	AI:	**0.0**	HI:	**0.0**
Upright	Time - hr	**0:00**	**(0.0%)**	AHI:	**0.0**	AI:	**0.0**	HI:	**0.0**
Events totals						Apneas:	**175**	Hypopneas:	**28**
Apnea index	Obstructive:	**20.6**		Central:	**3.0**	Mixed:	**0.4**	Unclassified:	**0.0**
Cheyne-Stokes respiration						Time - hr:	**0:00**	Percentage:	**0**
Oxygen desaturation						ODI:	**27.4**	Total:	**210**
Oxygen saturation %				Baseline:	**95**	Avg:	**94**	Lowest:	**75**
Oxygen saturation - eval time %				≤90%sat:	**14**	≤85%sat:	**3**	≤80%sat:	**0**
						≤88%sat:	**7**	≤88%Time - hr:	**0:31**
Breaths				Total:	**4423**	Avg/min:	**10.1**	Snores:	**881**
Pulse - bpm				Min:	**45**	Avg:	**54**	Max:	**75**


Patient details
Diagnostic
Prescription
Notes
Logs
Data signals
Save
Cancel
Cheyne-Stokes
Central apneas
Obstructive apneas
Mixed apneas
Unclassified apneas
Snores
Hypopneas
Desaturation
Excluded data
11:19pm
7:17am
12:52am
12:53am
12:54am
Events
Obstructive
Obstructive
Flow
Effort
Body Position
Supine
Supine
Supine
Supine
Supine
Supine
Ox %
Desaturation
Desaturation
Pulse
Snore
Download HST raw data


Supine
Supine
92 91 90 88 87 86 84 83 81 80 79 78 77 76 76 82 87 92 94 96 96 97

*treatment

MILD MODERATE OR SEVERE?

CPAP is not the right treatment for many patients

Oral appliances are as effective as CPAP in many cases

In office procedures are very effective in properly selected patients

The benefits of more invasive and much more costly robotic surgeries and tongue pacemakers remain to be proven

WEIGHT LOSS !!!

Nose: nasal patency is very important

Weight management – can be curative

Sleeping position

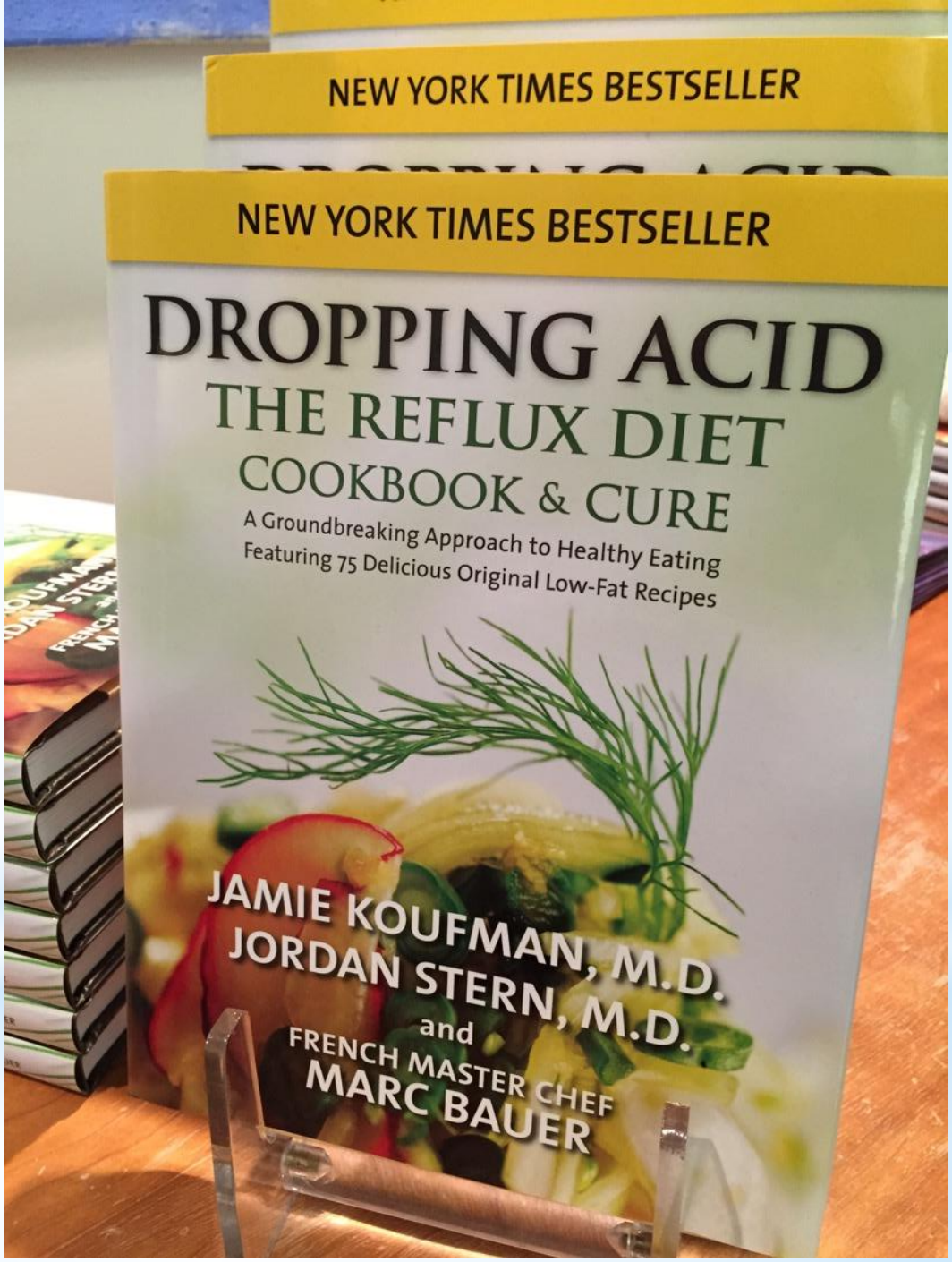
Reflux management

Refer to sleep specialist if no improvement

*Treating Mild OSAS

- Edema of upper airway causes snoring
- Can worsen sleep apnea
- Sleep Apnea causes reflux from smooth muscle relaxation during hypoxia
- Treating sleep apnea improves reflux
- Treating reflux improves snoring

*Acid Reflux & Sleep Apnea

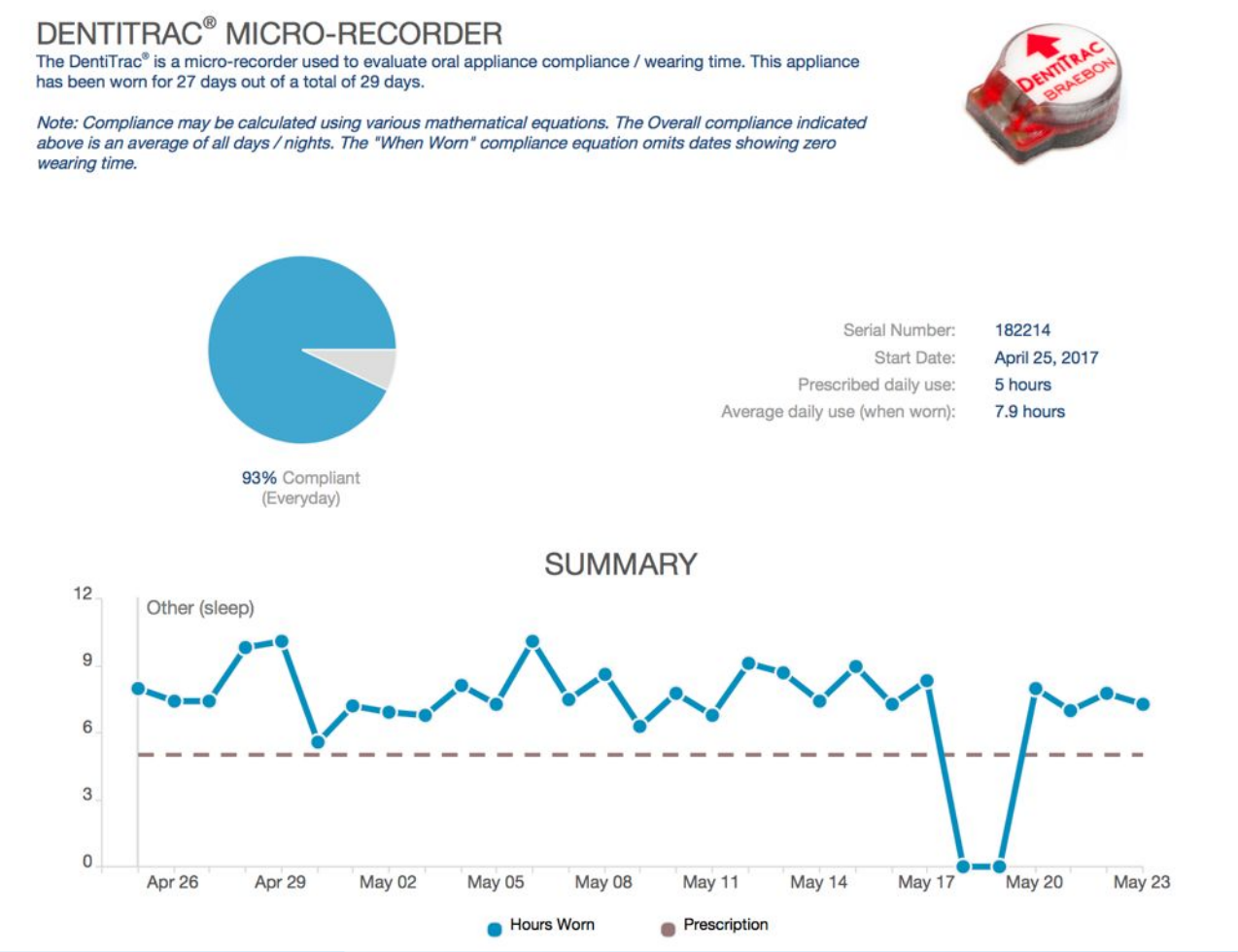

NEW YORK TIMES BESTSELLER
NEW YORK TIMES BESTSELLER
DROPPING ACID
THE REFLUX DIET
COOKBOOK & CURE
A Groundbreaking Approach to Healthy Eating
Featuring 75 Delicious Original Low-Fat Recipes
JAMIE KOUFMAN, M.D.
JORDAN STERN, M.D.
and
FRENCH MASTER CHEF
MARC BAUER

Sleep Specific:

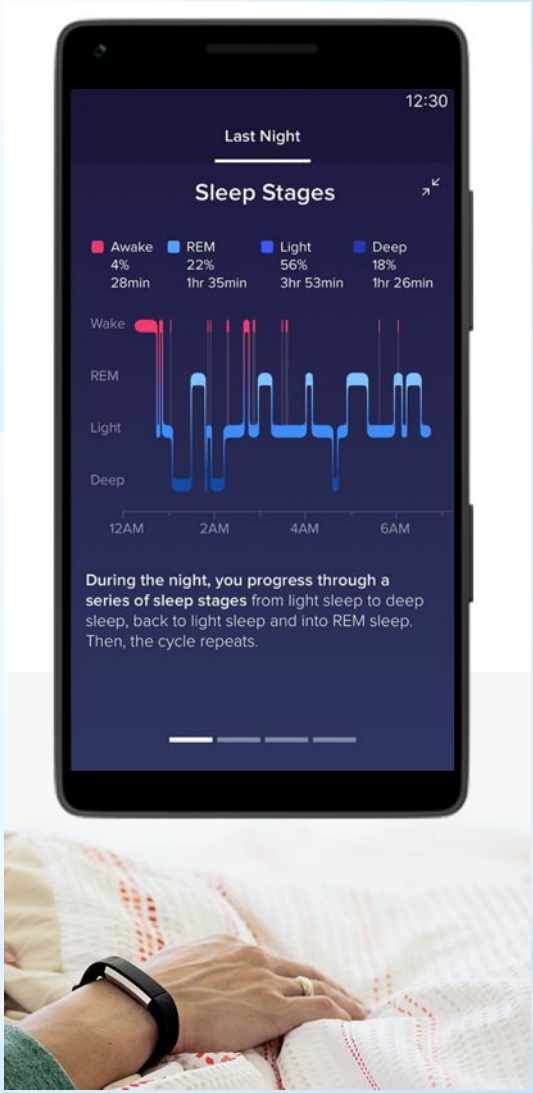
HST/Distance scoring
CPAP/Daily downloads/integrated wireless
OAT compliance & sleep tracking
Sleep tracking with wearables and sensors
Online CBT (Sleepio, Shut i)

Existing Digital Sleep Solutions


DENTITRAC
BRAEBON



*MTA Requiring Tracking In OATs



*Role Of Consumer Sleep Devices

EVALUATION OF SLEEP APNEA DETECTION FROM A SMARTWATCH IN A PILOT STUDY

C. Heneghan[1], J. Stern[2], J Kim[1], S. Gowda[1], L. Niehaus[1]

[1]Fitbit Inc, 199 Fremont Street, San Francisco, CA 94105 [2]Bluesleep, 65 Broadway #901, New York, NY 10006

Background / Objectives

Sleep apnea is believed to be widely underdiagnosed in the general population. Wearable devices provide a consumer accessible way to assess risk of sleep apnea and to encourage users to talk to a medical professional about their sleep apnea risk. This study evaluates the potential performance of automated software to correctly identify subject nights with an Apnea Hypopnea Index above of below the AHI=15 threshold.

Figure 1: The back of a Fitbit Versa illustrating red, green, and infrared LEDs and detectors.

Methods

Fitbit devices are equipped with red and infrared sensors in addition to green photoplethsymogram sensors and accelerometers. Participants wore a wearable smartwatch (Fitbit Versa prototype) while undergoing overnight sleep studies (Watermark ARES or Alice NightOne), which were overscored to produce an Apnea Hypopnea Index based on a 3% desaturation rule. The smartwatch calculated a variety of features every minute based on the relative reflectance of the red and infrared optical sensors, heart rate variability, and movement. Each minute of the night's recording was marked as apneic or non-apneic based on the presence of an event. A machine learning algorithm was developed to match the annotations of the human scorer. We explored two algorithmic approaches (a) optimizing a per-minute accuracy classifier, and (b) performing a regression against the overall nightly score using the minute-level features

Results

Table 1: Demographic characteristics of the study participants in the test set.

Number (M:F)	47 (26:21)
Age (yrs)	46 ± 11
BMI	32.7 ± 6.3
AHI	16.4 ± 15.8

Figure 2:. The scatterplot of the estimated regressor AHI from the smartwatch apnea assessment algorithm versus the AHI estimated from the sleep test.

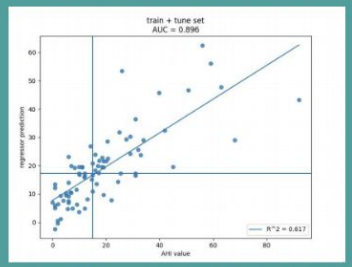
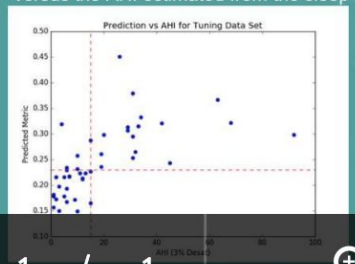


Figure 3:. The scatterplot of the predicted per-minute metric from the smartwatch apnea assessment algorithm versus the AHI estimated from the sleep test.



Conclusions & Discussion

Table 2: Sample operating points for various choices of severity cut-off and algorithm

	Regressor Algorithm		Minute Level Algorithm	
AHI Cutoff	Sensitivity	Specificity	Sensitivity	Specificity
5	0.91	0.67	0.80	0.84
10	0.87	0.89	0.82	0.84
15	0.82	0.80	0.90	0.85

This initial study demonstrated reasonable correlation between AHI estimated from a smartwatch and a home sleep test device[1]. Smartwatches may represent a valid means to notify people of sleep apnea risk, and to encourage them to consult with a doctor. Sensitivity and specificity of a smartwatch assessment may exceed performance of current questionnaire based approaches[2]. A per-minute based algorithm appears to provide superior performance. Challenges include (a) correct choice of severity cut-off for general population guidance, (b) validation against in-lab full polysomnogram in place of home sleep test, and (c) appropriate choice of scoring rules for training and validation.

References

1. Mendonça F, Mostafa SS, Ravelo-García AG, Morgado-Dias F, Penzel T. Devices for home detection of obstructive sleep apnea: A review. Sleep Med Rev. 2018 Oct;41:149-160.
2. Chiu HY, Chen PY, Chuang LP, Chen NH, Tu YK, Hsieh YJ, Wang YC, Guilleminault C. Diagnostic accuracy of the Berlin questionnaire, STOP-BANG, STOP, and Epworth sleepiness scale in detecting obstructive sleep apnea: A bivariate meta-analysis. Sleep Med Rev. 2017 Dec;36:57-70.

World Sleep Congress 2019

leep® TM For the treatment of Obstructive Sleep Apnea – The EFFECTS Study

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David Kuhns Phd. ProSomnus® Sleep Technologies, Pleasanton, CA USA (dkuhns@prosomnus.com), Stephanie Zhu (Columbia University), New York, NY USA

INTRODUCTION

valuates the effectiveness of a new Mandibular
evice (MAD) (Prosomnus® [IA]) fitted with a compliance
line treatment in a population of patients with mild to
ve sleep apnea (OSA). Long term effectiveness was
home sleep testing (HST) and validated sleep and quality of
es.
he mean disease alleviation (MDA) of a treatment is critical
utcomes when comparing known treatment modalities .
pliance is necessary for treatment effectiveness and also
stitutions that regulate and license commercial drivers.
come mainstream treatment for sleep apnea it is important
effectiveness: the combination of efficacy and compliance.
was reported that the ProSomnus® [IA] sleep device
utcome success rate (Remmers) and that a digital workflow
s sleep devices enhanced patient preference and comfort
continues that effort in understanding how effective and
ent of OSA with MAD can improve the quality of life of
scalable platform.

OBJECTIVES

e the effectiveness of the ProSomnus [IA] Sleep
irst line treatment for mild to severe obstructive

e the compliance with the ProSomnus [IA] Sleep
the Dentitrac compliance chip.

he Mean Disease Alleviation value for treated

treatment success of patients using not only AHI
so the Epworth Sleepiness Scale (ESS), (remove)
utcome of Sleep Questionnaire (modified)
ttsburgh Sleep Quality Index (PSQI) and Insomnia
x (ISI) surveys.

STUDY POPULATION

etween 5 and 50, age range of 18-75 were selected from a
ng to a multidisciplinary sleep center for treatment of OSA.
ons IRB # 2017/03/4) was obtained for the study and all
informed consent.

Table 1 clinical profiles

AGE	BMI	AHI (pre)
13.3 yrs +/10.0	27.2 +/- 3.7	20.2 +/- 12.0
52.0 yrs +/- 2.4	35.0 +/- 6.8	21.5 +/- 11.0

Table 2 quality of life profiles

SQI (pre)	ISI (pre)	FOSQ (pre)
.3+/-3.9	11.1 +/- 6.0	29.3 +/- 5.6
.8 +/- 4.0	13.3 +/- 7.2	27.0 +/- 8.4

Materials and Methods

Patients were given HSTs using the Alice Night One(9) in replicate 2-3 nights for the PRE AHI and 2-3 nights for the POST AHI. Patients were treated with the ProSomnus [IA], fig. 1, that was fitted with the Dentitrac (7) compliance chip, fig.1. ProSomnus [IA] Monogram features, fig. 2, were selected for each patient based on their comfort requirement and titrated per the iterative series advancements, fig. 3.

Compliance was calculated on the 4hr/night 5 day/week standard for CPAP. Patients were given two quality of life surveys the Pittsburgh Sleep Quality Index (PSQI) (3) and the Functional Outcomes of Sleep (FOSQ) (4), as well as the Insomnia Severity Index (ISI) . 2 nights of HST were averaged before OAT began (PRE) and at the point of symptom reduction (POST). PSQI and FOSQ surveys were taken at (PRE) and (POST).

Fig. 1 ProSomnus® [IA] Sleep Device

Fig. 2 ProSomnus® [IA] Monogram features

Fig. 3 ProSomnus® [IA] Iterative Titration Advancements

SERIES A: Range = 3 mm

4 DEVICES U0, U2, L0, L1	COMBINATION	ADVANCEMENTS
	Upper 0 + Lower 0	0 mm
	Upper 0 + Lower 1	1 mm
	Upper 2 + Lower 0	2 mm
	Upper 2 + Lower 1	3 mm

RESULTS

Statistically Significant improvement in AHI were measured in patients as detailed in Table 3a. Subjective Quality Of Life (QOL) and sleep measures improved and were statistically significant for FOSQ, PSQI, and ISI as detailed in Table 3b

Table 3a Patient Overall Outcomes

Population	Initial AHI	Post AHI	AVG % Reduction	OVERALL Compliance	MDA
total population (100%	20.48	8.14	60.2%	93.6%	56.4%
% Responded (92.6%)	20.94	7.14	65.9%	93.4%	61.5%
% 50 or greater (72.1%	25.84	7.23	72.0%	98.0%	70.6%

Table 3b Patient Sleep Quality Survey Results

Test	Initial (PRE) Score	Final (POST) Score	Change	Notes
PSQI	6.44	4.85	-1.6	>5 Indicator of poor sleep quality
ISI	11.6	7.9	-3.7	0-7 No clinically significant insomnia
FOSQ	29.8	32.2	2.4	Higher score --> better functional status
SSS	5.3	2.9	-2.4	Lower score --> Increased alertness

Discussion

Patients demonstrated an average reduction in AHI of 60.2 % (Table 3a; 20.5 → 8.1). 92.6% of patients that showed a positive improvement in AHI demonstrated a reduction in AHI of 65.9%. Those patients (72.1%) that had an AHI reduction of greater than 50% showed improvement of 72.0% in AHI reduction. **Average compliance rate was 93.6% using Medicare CPAP compliance criteria of 4hrs/night and 5 days/week. For all patients this produces a Mean Disease Alleviation of 56.4% as calculated by Fig. 4. as proposed by Sutherland(2).**

Fig. 4 Mean Disease Alleviation Calculation

$$\text{MDA} = \text{Therapeutic Efficacy} * \text{Compliance}$$

$$\text{MDA} = \frac{(\text{AHI}_{(\text{untreated})} - \text{AHI}_{(\text{treated})}) * 100 * \text{4hr/5day comp. \%}}{\text{AHI}_{(\text{untreated})}}$$

Table 4 MDA by Severity and Success

⚠

Table 4 shows that patients with the most severe sleep apnea had the greatest mean disease alleviation (72%), compared to patients with mild sleep apnea (MDA of 44%). Contrary to current beliefs and common clinical practice, this study shows that given the close to 100% compliance with oral appliance therapy, MAD is an effective first line treatment for patients with severe sleep apnea.

Figure 5 SARAH Index Calculation

$$\frac{(\text{TST}_{(\text{Treated})} * \text{AHI}_{(\text{Treated})}) + (\text{TST}_{(\text{untreated})} * \text{AHI}_{(\text{untreated})})}{\text{Total Available Sleep Time}} = \text{SARAH Index}$$

Patient #1 example:

((407hrs * 6.0) + (29.6hrs * 23.0)) / 436.6 hrs = 7.2 SARAH Index

Discussion (cont.)

The SARAH index as proposed by Sutherland(1) takes into account the time of treated sleep apnea compared to the total sleep time. This index can be used to compare effectiveness of different treatment modalities for sleep apnea. We calculated the compliance adjusted AHI (fig.5) and the overall effectiveness of treatment by calculating the MDA (Table 3). Patients often report that while wearing CPAP they may remove the mask in the middle of the night, therefore there is only partial treatment each night.

Table 5 SARAH Index

	Days worn	Days not worn	Reported Sleep Time	% of Days worn	Days worn % above 4 hours	5 of 7 days %	SARAH index (AHI)
Average	85.88	11.52	7.08	87.3%	83.5	96.1%	9.8
STDEV	68.04	15.56	0.92	15.2%	66.9	5.1%	6.3

When looking at the data for MAD, most patients wear their appliances all night. Seldom were the appliances removed during the night. Therefore, calculating the true impact on compliance each night and everyday using the SARAH index provides a better picture of successful treatment. Considering all of the time available for the patient to be treated with MAD, total available sleep hours, produces an overall SARAH index of AHI = 9.8, very close to the average overall Post AHI of 8.14.

CONCLUSIONS

- MAD is an effective first line treatment for mild, moderate, and severe sleep apnea with excellent compliance rates, similar to or better than CPAP; with equal or better MDA of 56.4% compared to literature values for CPAP of 50.0%
- MAD can be successfully used as initial treatment for severe sleep apnea
- Treating the patient with a CAD/CAM custom appliance, the ProSomnus® [IA] sleep device, can optimize comfort and efficacy to ensure excellent compliance
- SARAH index indicates and overall average AHI of 9.8 for the patients considering wear time and was close to the non-adjusted average of an AHI of 8.1.
- Use of a tracker provides compliance with this form of treatment, much like CPAP.
- Success rates for treatment with the ProSomnus [IA] device are comparable to published references with other MADs.
- MAD with tracker is an effective first line treatment for mild and moderate sleep apnea, and for severe sleep apnea for patients who prefer an oral appliance or refuse or cannot tolerate CPAP

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Review Article

Epidemiological aspects of obstructive sleep apnea

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