

AO dei Colli
UOC Cardiologia-Utic
Direttore dr Pio Caso
Napoli



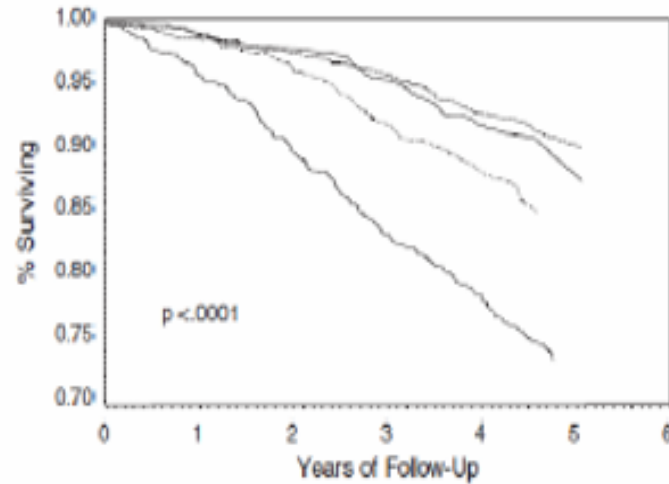
Epidemiologia della Sleep Apnea

Tobia Ravà

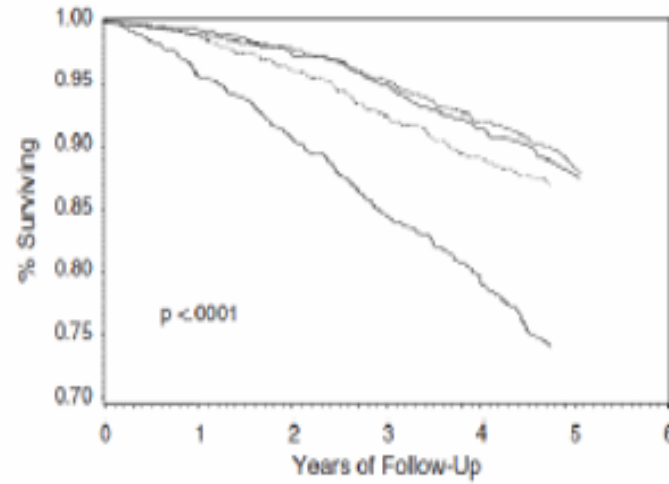
dr Fortunato Arenga



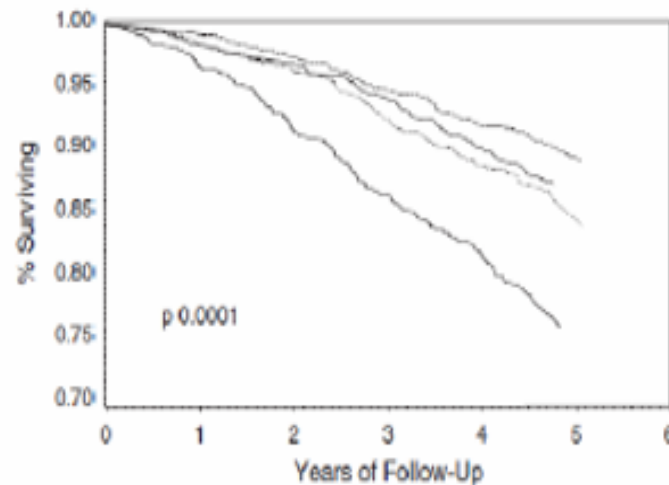
L'alterazione dei bioritmi predice la morte (Tranah GJ et al JAGS 2010;58:282)



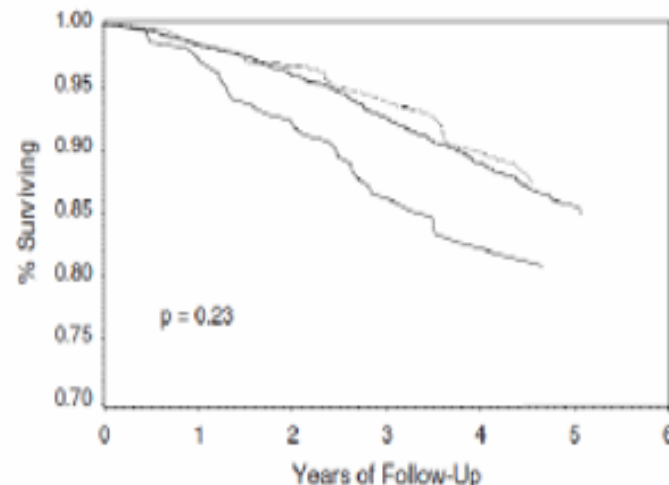
Amplitude (counts/min.) - $<2,743$ - $2,743$ - $3,412$ - $3,413$ - $4,045$ - $\geq 4,046$



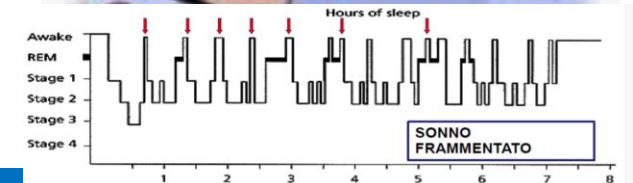
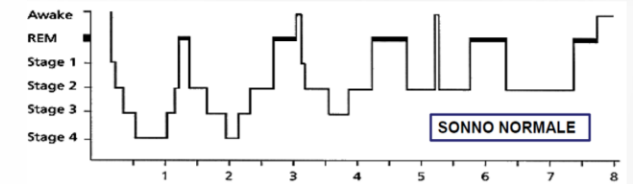
Robustness (Pseudo F-value for goodness of cosine fit)
- <523 - 523 to 773 - 774 to $1,096$ - $\geq 1,097$



Mesor (counts/min.) - $<1,796$ - $1,796$ - $2,091$ - $2,092$ - $2,386$ - $\geq 2,387$



Acrophase (hours) - $<12:50PM$ - $12:50PM$ - $4:33PM$ - $>4:33PM$



έπί, δῆμος, λόγος

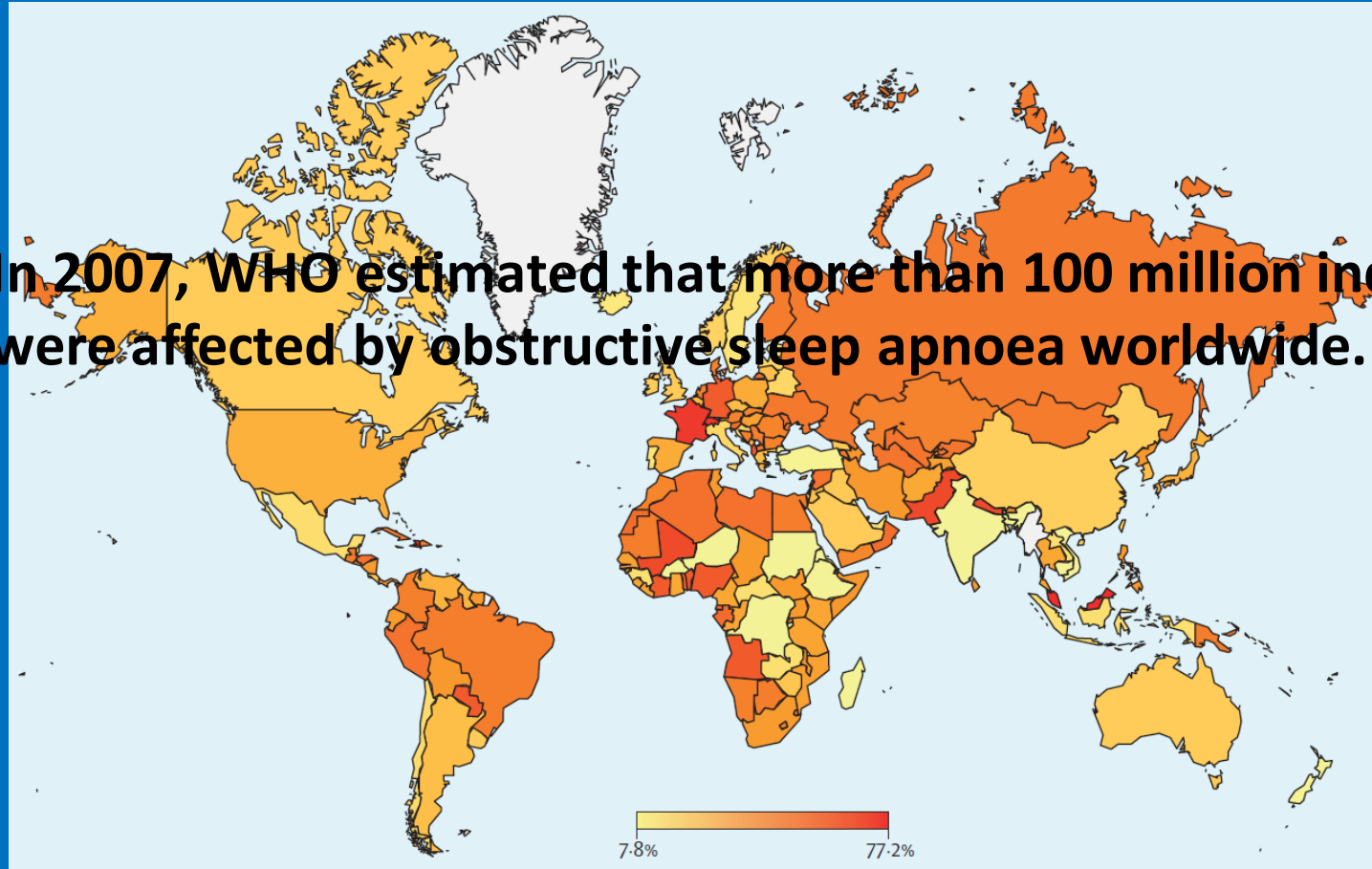


COLIN SULLIVAN

Estimation of the global prevalence and burden of obstructive sleep apnoea: a literature-based analysis

www.thelancet.com/respiratory Vol 7 August 2019

In 2007, WHO estimated that more than 100 million individuals were affected by obstructive sleep apnoea worldwide.



Definizione degli eventi respiratori

- **Apnea** è la **cessazione** temporanea come la
soppressione dei suoni respiratori.
- **Ipopnea** è una riduzione transitoria del
respiro (riduzione del flusso del
respiro), una riduzione del flusso
respiratorio (strumentale) di almeno
il 50% per almeno 10 secondi
con una desaturazione di almeno 3%.
- **Respiratory effort-related arousal (RERA)**
is an event characterized by increasing
respiratory effort for 10 seconds or longer
leading to an arousal from sleep but one that
does not fulfill the criteria for a hypopnea or
apnea.



AMERICAN ACADEMY OF SLEEP MEDICINE

Hypopnoea criteria

1999 guideline	≥50% decrease in flow OR a clear reduction in flow that does not reach ≥50% AND is associated with either an oxygen desaturation of ≥3% or an arousal
2007 guideline	≥30% decrease in flow from baseline with an associated oxygen desaturation of ≥4%
2012 guideline	≥30% decrease in flow from baseline with an associated oxygen desaturation of ≥3% OR an associated arousal

Table 1: Differences in hypopnea scoring rules between American Academy of Sleep Medicine guidelines^{19,22}

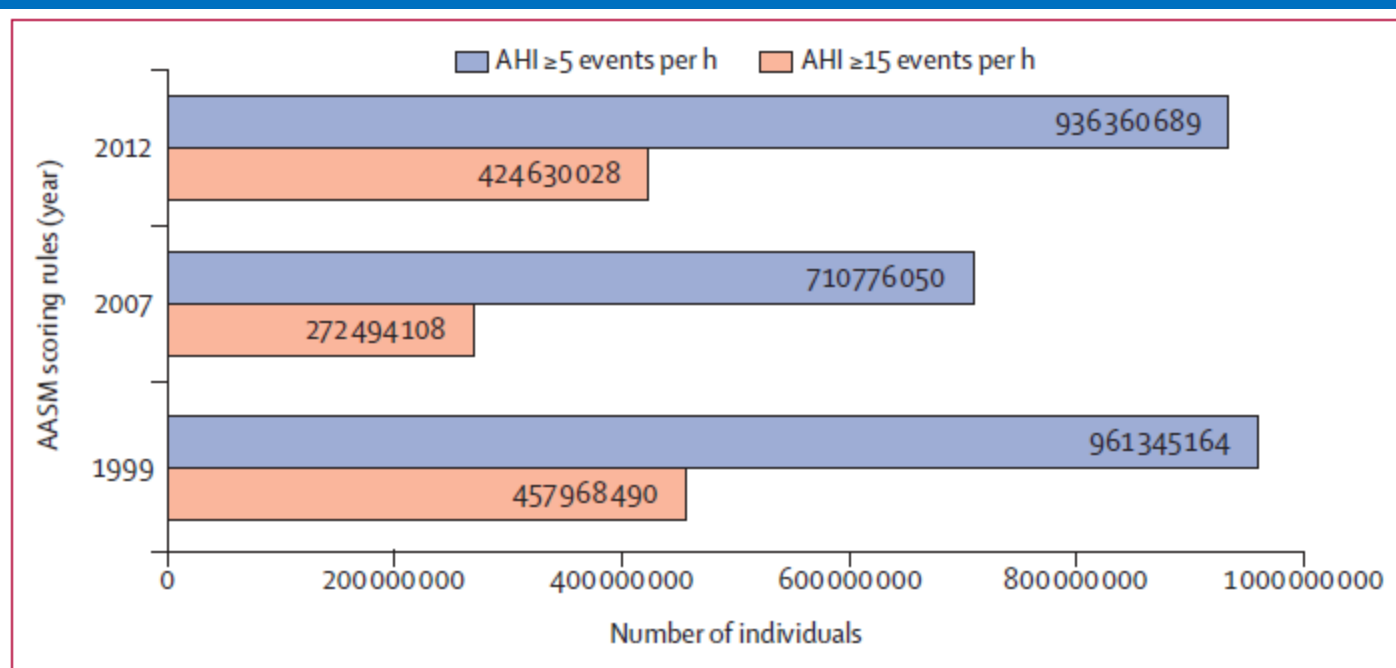


Figure 1: Estimated prevalence of obstructive sleep apnoea based on different scoring rules
AASM=American Academy of Sleep Medicine. AHI=apnoea-hypopnoea index.

I DISTURBI RESPIRATORI NEL

SONNO

4% ♂ 2% ♀

OSAS



Severità



Apnea

Ipopnea

RERA

24% ♂ 9% ♀

Russamento abituale e persistente

Russamento saltuario

Respiro normale

Obstructive sleep apnea (OSA): The more common of the two forms of apnea, it is caused by a blockage of the airway, usually when the soft tissue in the back of the throat collapses during sleep.

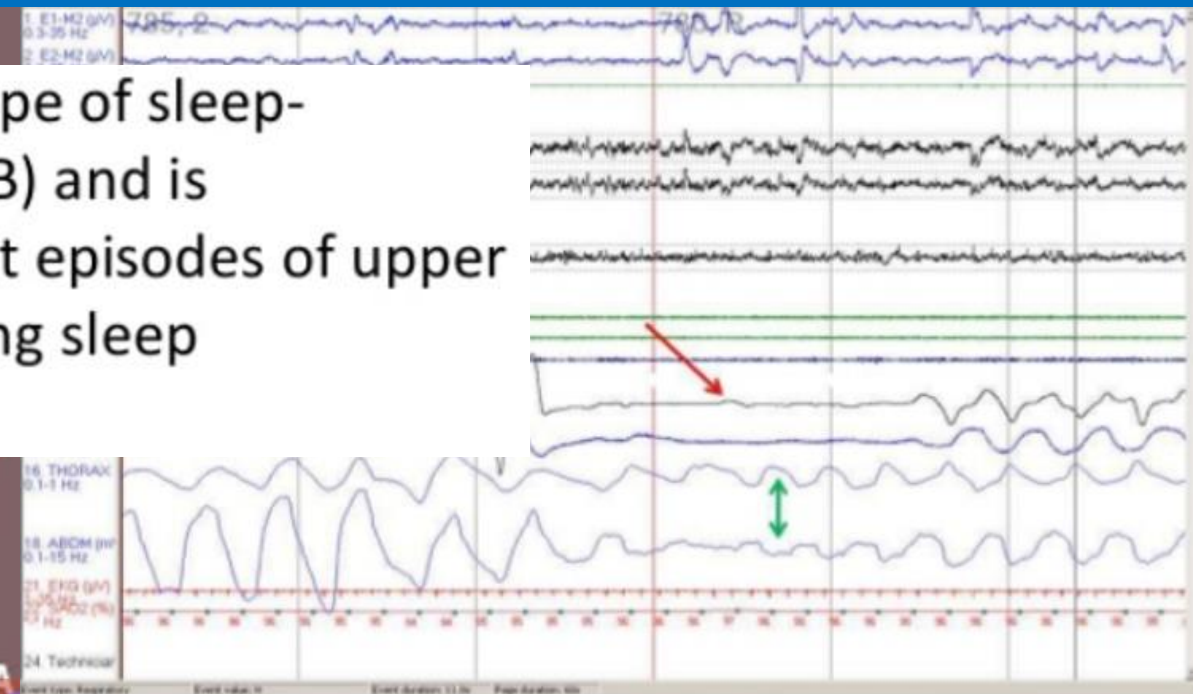


NORMAL BREATHING

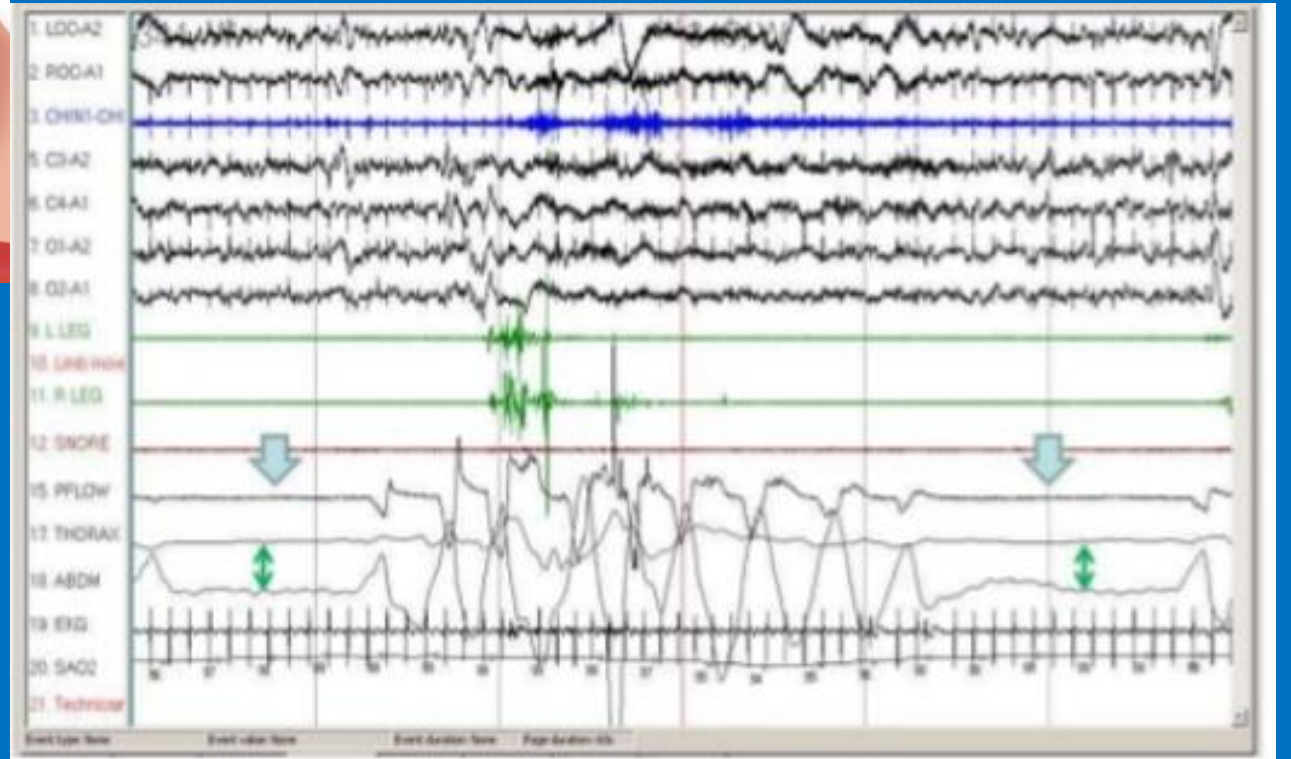
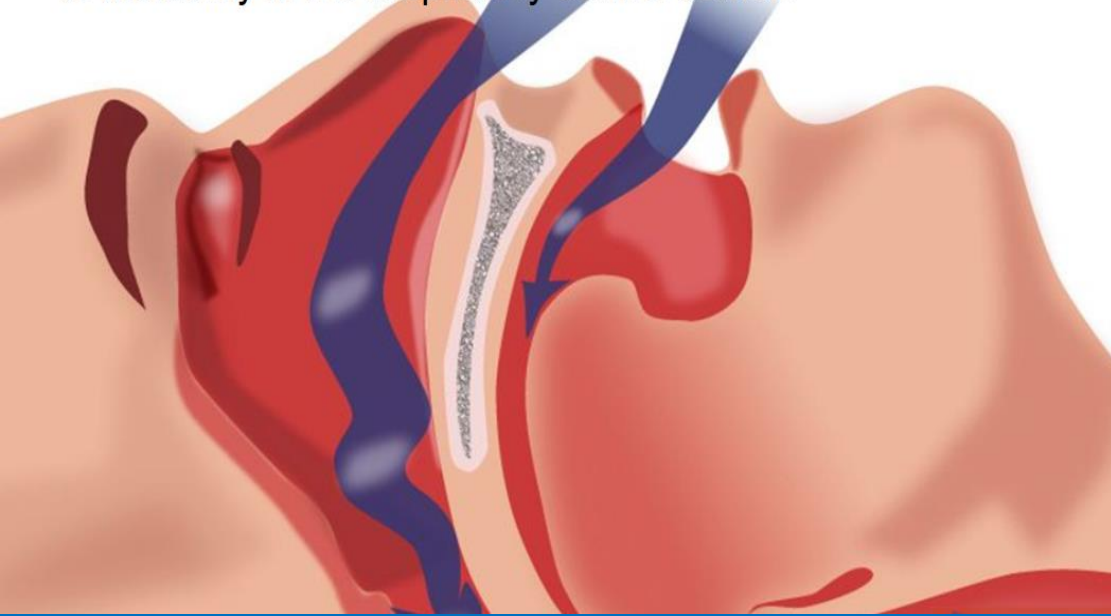
It is the most common type of sleep-disordered breathing (SDB) and is characterized by recurrent episodes of upper airway (UA) collapse during sleep



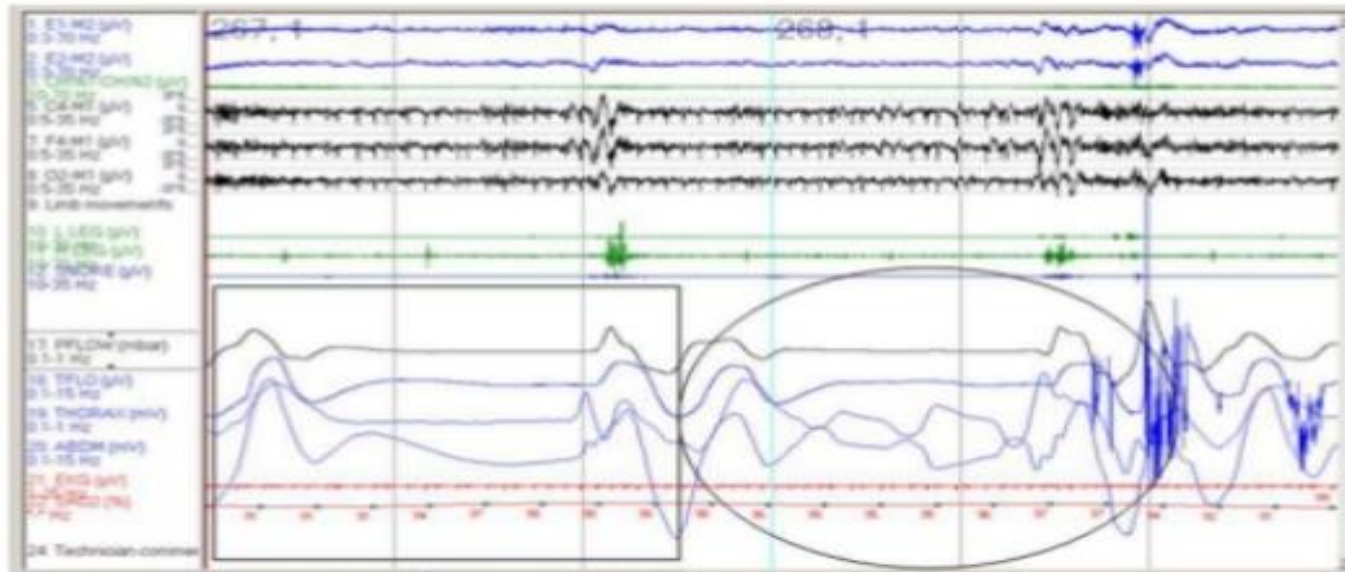
OBSTRUCTIVE SLEEP APNEA



Central sleep apnea (CSA): Unlike OSA, the airway is not blocked, but the brain fails to signal the muscles to breathe due to instability in the respiratory control center.



Mixed apnea is an apnea that begins as a central apnea and ends as an obstructive apnea



Comparison of a central apnea (box) and obstructive apnea (circle).

Come è stata fatta la diagnosi?

AASM guidelines for performance of PSG

- Sleep stages are recorded via an EEG, electrooculogram, and chin electromyogram (EMG).
- Heart rhythm is monitored with a single-lead ECG.
- Leg movements are recorded via an anterior tibialis EMG.
- Breathing is monitored, including airflow at the nose and mouth (using both a thermal sensors and a nasal pressure transducer), effort (using inductance plethysmography), and oxygen saturation.
- The breathing pattern is analyzed for the presence of apneas and hypopneas

dr Fortunato Arenga



HOME TESTING

- 3 levels of portable monitors are
- (a) level 2, a portable monitor with the same parameters as a full attended PSG (includes EEG)
- (b) level 3, with at least 4 channels, including flow, effort, oximetry and heart rate
- (c) level 4, with fewer than 4 channels, often oximetry with flow or oximetry alone.
- level 3 monitors are best used to confirm the diagnosis of OSA



Epworth Sleepiness Scale (ESS) questionnaire

- In contrast to just feeling tired, how likely are you to doze off or fall asleep in the following situations? :
- **0 = Would never doze or fall asleep**
- **1 = Slight chance of dozing**
- **2 = Moderate chance of dozing**
- **3 = High chance of dozing**
- ESS score of 12 is associated with a greater propensity to fall asleep on the Multiple Sleep Latency Test (MSLT) (i.e. a theater or a lecture hall for 2 hours without break or a car trip for 2 hours without break)
- ESS is useful for evaluating responses to treatment; the ESS score should decrease with effective treatment. (e.g. after treatment of obstructive sleep apnea, narcolepsy, or chronic insomnia)
- In a car, while stopping for a few minutes in traffic

Diagnostic criteria for OSA

- Individuals must fulfill criterion **A or B, plus criterion C** to be diagnosed with OSAS:
- **A.** Excessive daytime sleepiness that is not explained by other factors
- **B.** Two or more of the following that are not explained by other factors:
 - Choking or gasping during sleep
 - Recurrent awakenings from sleep
 - Unrefreshing sleep
 - Daytime fatigue
 - Impaired concentration

15-30	Moderate
>30	Severe SI

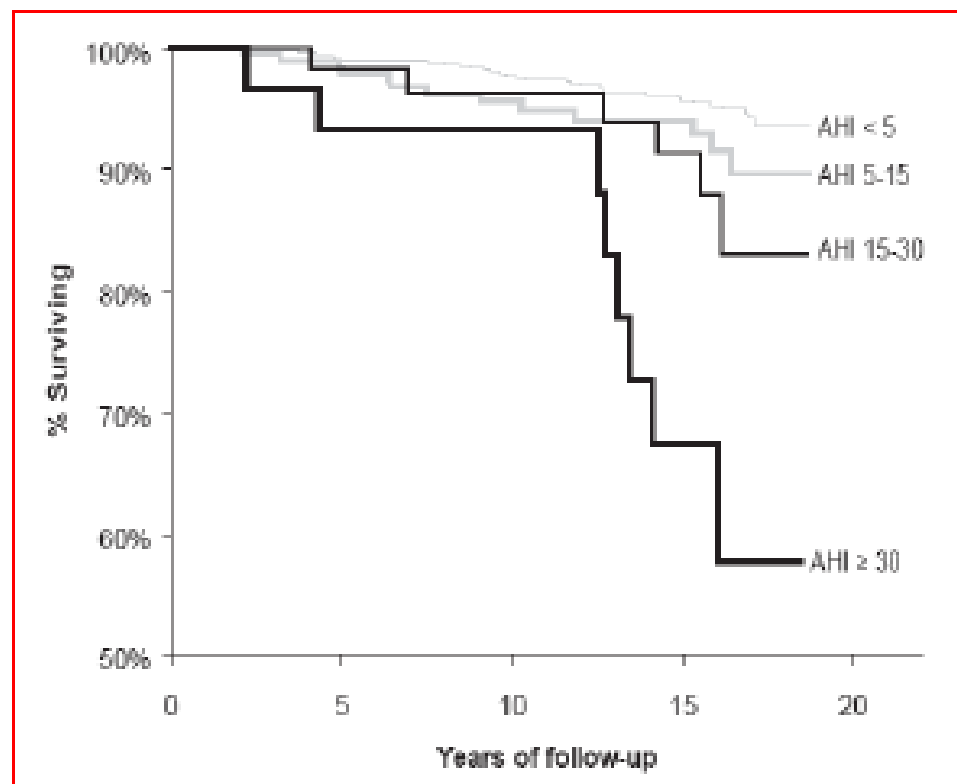
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- **C.** Overnight monitoring demonstrates 5 to 10 or more obstructed breathing events per hour during sleep
- or
- greater than 30 events per 6 hours of sleep.
- These events may include any combination of obstructive apnea, hypopnea, or respiratory effort-related arousals.

Sleep Disordered Breathing and Mortality: Eighteen-Year Follow-up of the Wisconsin Sleep Cohort

Terry Young, PhD¹; Laurel Finn, MS¹; Paul E. Peppard, PhD¹; Mariana Soldo-Cox, PhD¹; Dawn Austin, MS¹; F. Javier Nieto, PhD¹; Robin Stabler¹, BS;
K. Moxham, MD²



SLEEP 2008;31(8):1071-1078.

Sleep Apnea as an Independent Risk Factor for All-Cause Mortality: The Busselton Health Study

Nathaniel S. Marshall, PhD^{1,2}; Keith K. H. Wong, MBBS^{1,2}; Peter Y. Liu, MBBS, PhD¹; Stewart R. J. Cullen, MBBS²; Matthew W. Knuiman, PhD¹; Ronald R. Grunstein, MD, PhD^{1,2}

¹Westmead Institute of Medical Research, University of Sydney, Sydney, Australia; ²National Health and Medical Research Council Centre for Clinical Research Excellence in Respiratory and Sleep Medicine, Australia; ³Western Australian Sleep Disorders Research Institute, Perth, Australia; ⁴School of Population Health, University of Western Australia, Perth, Australia

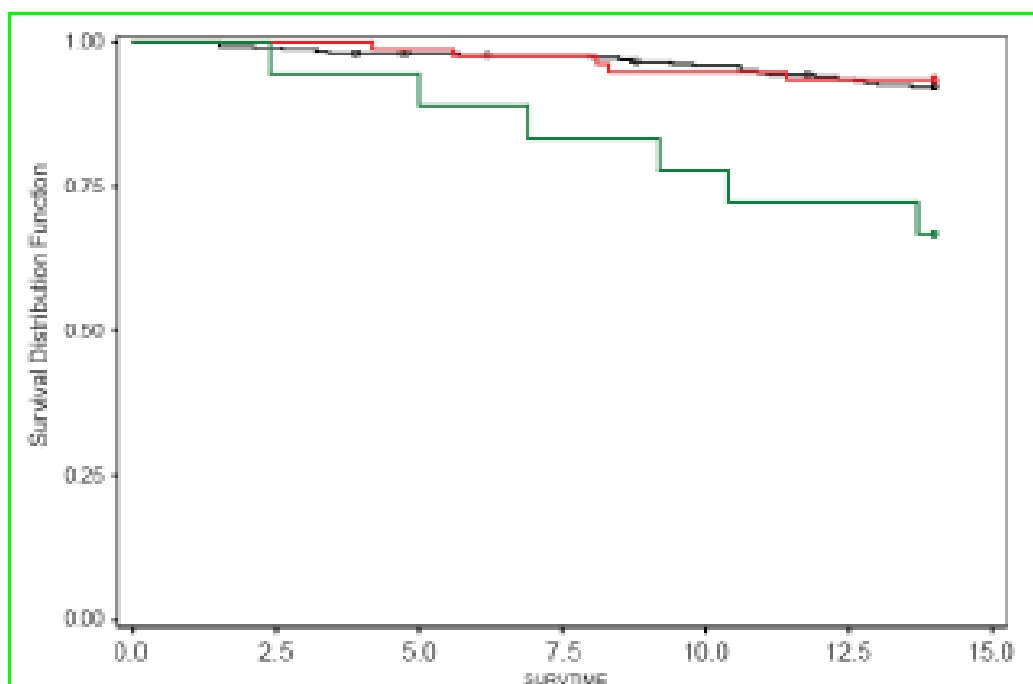


Figure 1—Green line indicates the survival distribution for participants with moderate-severe sleep apnea (RDI ≥ 15), the Red line those with mild sleep apnea (RDI 5-14) and the Black line those with no sleep apnea (RDI < 5). Circles indicate censored observations

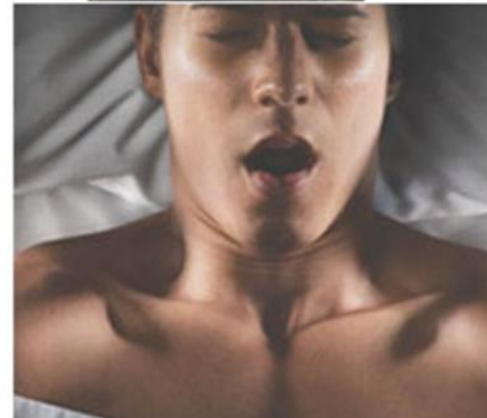
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SLEEP 2008;31(8):1079-1085.

SLEEP APNEA SYMPTOMS



**Choking, snoring,
gasping during
sleep**



SLEEP APNEA SYMPTOMS

Depression Moody



Fatigue



Nocturia



Impotence



Insomnia



SLEEP APNEA SYMPTOMS

Snoring



Dry Mouth Throat



Morning Headache



Memory Loss



Attention Deficit



E per Paesi senza studi?

- Si è preso in considerazione il paese confinante con studi confrontandoli per
- Età,
- Razza,
- Sesso (laddove mancanti 1:1)
- BMI



Algoritmo

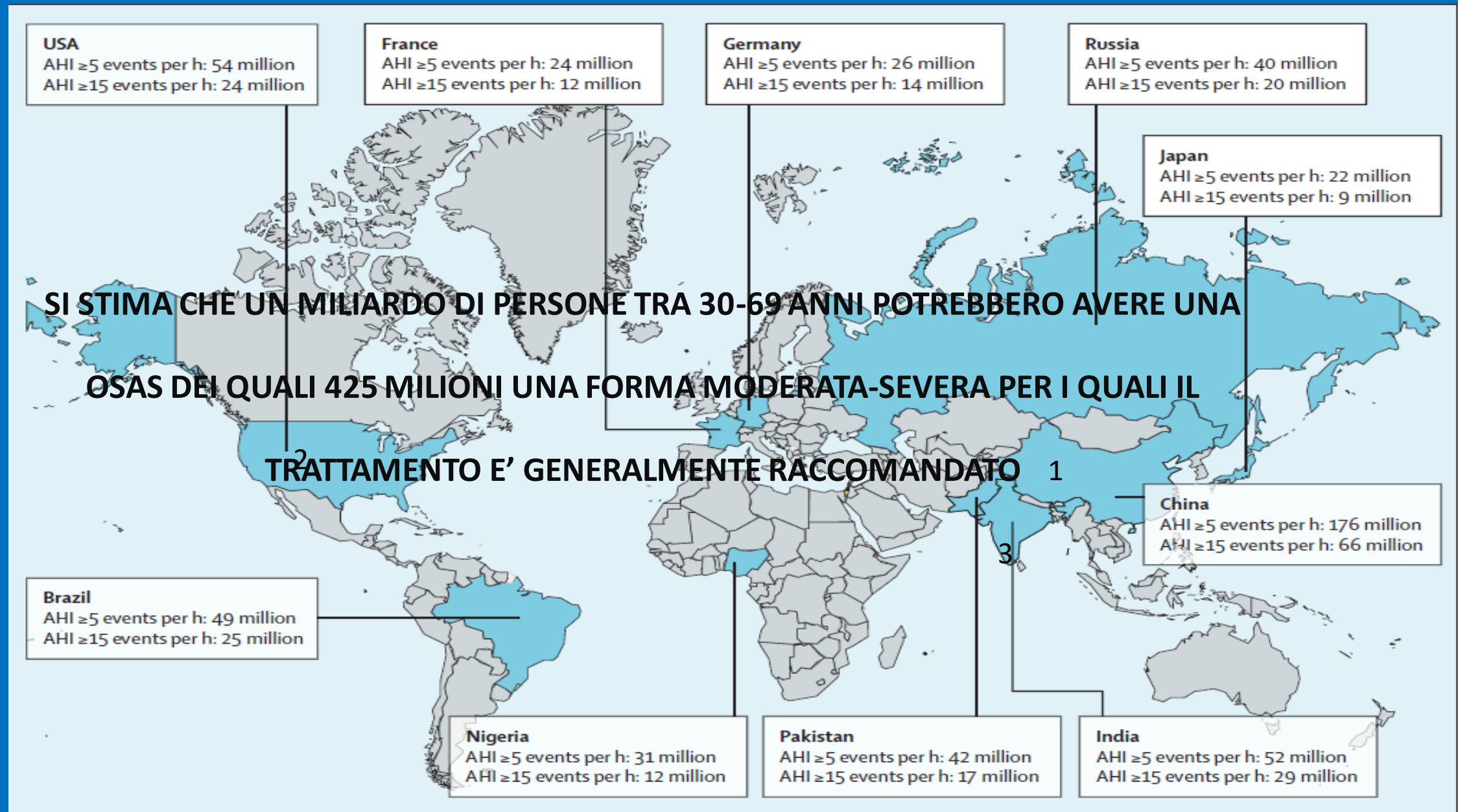


Figure 2: Top ten countries with the highest estimated number of individuals with obstructive sleep apnoea based on the American Academy of Sleep Medicine 2012 criteria¹⁹
AHI=apnoea-hypopnoea index.

E in Italia?

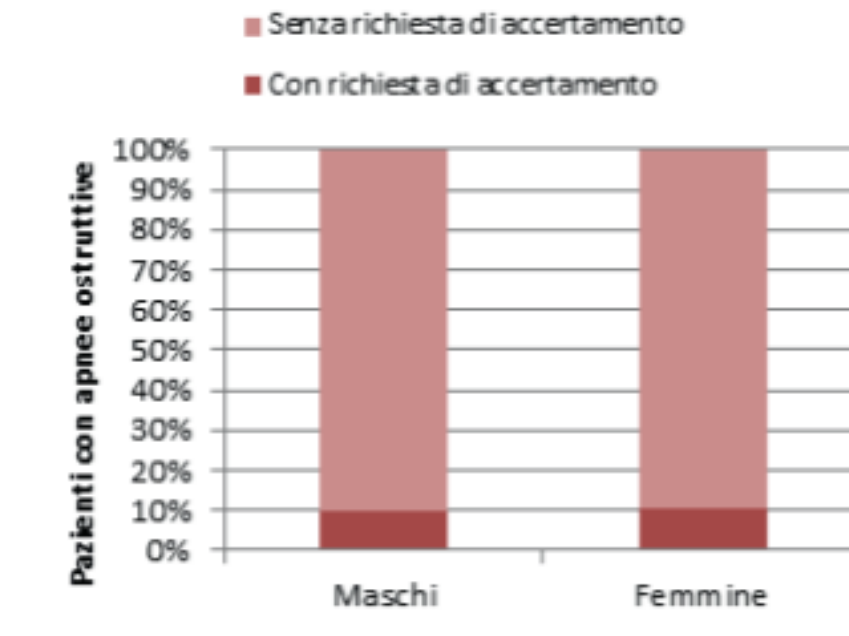
	Population aged 30-69 years	AHI ≥ 5 events per h	AHI ≥ 15 events per h
India	534 676 709	51 556 642 (9.6%)	28 831 856 (5.4%)
Indonesia	114 334 042	21 020 883 (18.4%)	7 940 317 (6.9%)
Iran	36 179 787	15 136 458 (41.8%)	7 739 991 (21.4%)
Iraq	10 771 896	2 734 061 (25.4%)	1 303 288 (12.1%)
Ireland	2 447 445	599 525 (24.5%)	117 487 (4.8%)
Israel	3 465 330	848 255 (24.5%)	166 411 (4.8%)
Italy	33 020 571	6 774 829 (20.5%)	3 959 253 (12.0%)
Jamaica	1 176 758	483 534 (41.1%)	274 482 (23.3%)
Japan	67 496 374	22 092 507 (32.7%)	9 435 205 (14.0%)
Jordan	2 636 480	751 598 (28.5%)	413 338 (15.7%)
Kazakhstan	7 774 654	3 779 915 (48.6%)	1 862 950 (24.0%)
Kenya	13 024 588	4 838 661 (37.2%)	1 863 525 (14.3%)
Kiribati	38 538	12 573 (32.6%)	5486 (14.2%)
Kuwait	2 012 453	377 748 (18.8%)	146 612 (7.3%)
Kyrgyzstan	2 226 975	1 170 950 (52.6%)	590 266 (26.5%)

Tabella 1 Prevalenza (%) di apnee ostruttive notturne al 2013 nella popolazione attiva del campione dei 700 medici Health Search. Distribuzione per genere, età e BMI

GENERE	N	%
Maschi	6351	1,4
Femmine	2324	0,5
ETA'		
15-24	83	0,1
25-34	298	0,2
35-44	865	0,5
45-54	1804	1,1
55-64	2425	1,7
65-74	2119	1,8
>=75	1081	0,9
BMI		
SOTTOPESO	33	0,2
NORMOPESO	1025	0,5
SOVRAPPESO	2345	1,4
OBESITA' CLASSE I	1893	2,7
OBESITA' CLASSE II	877	4,6
OBESITA' CLASSE III	529	7,6
TOTALE	8675	0,9

Le OSAS interessa circa il 4-6% della popolazione adulta

Prevalenza di apnee ostruttive notturne e percorsi diagnostico - strumentali nella popolazione in carico alla Medicina Generale Italiana



L'epidemia sommersa

- 1.800.000 Italiani affetti dalla patologia conclamata e almeno altrettanti da apnee senza sonnolenza diurna evidente, sufficienti tuttavia a rappresentare un rischio per la salute e, in parte, alla guida.

OSA/OSAHS una malattia maschile?



- **Male:female ratios** ranging from 3:1 to 5:1 in the general population and from 8:1 to 10:1 in selected clinical populations

Wimms A, Woehrle H, Ketheeswaran S, et al. Obstructive sleep apnea in women: specific issues and interventions. Biomed Res Int 2016; 2016: 1764837.

- Despite this, females **now represent up to 40–50%** of presentations at sleep clinics

Franklin KA, Sahlin C, Stenlund H, et al. Sleep apnoea is a common occurrence in females. Eur Respir J 2013; 41: 610–615.

La diagnosi nelle donne è sottostimata perché?

- **Le donne tendono più degli uomini a lamentarsi di:**
- **Stanchezza, insonnia, mal di testa mattutino, perdita di energia, disturbi dell'umore, incubi notturni e questo porta a una diagnosi in tarda età o solo in presenza di un BMI alto rispetto ai maschi .**
- Kapsimalis F, Kryger MH. Gender and obstructive sleep apnea syndrome, part 1: clinical features. Sleep 2002; 25: 412–419.
- Sforza E, Chouchou F, Collet P, et al. Sex differences in obstructive sleep apnoea in an elderly French population. Eur Respir J 2011; 37: 1137–1143.
- Levartovsky A, Dafna E, Zigel Y, et al. Breathing and snoring sound characteristics during sleep in adults. J Clin Sleep Med 2016; 12: 375–384.

Sex Differences in Obstructive Sleep Apnoea

- **The ESS does not correlate well with objective measures of daytime sleepiness .**
- Maria R. Bonsignore , Tarja Saaresranta and Renata L. Riha.
- Sensitivity and specificity of the multiple sleep latency test (MSLT), the maintenance of wakefulness test and the Epworth sleepiness scale: failure of the MSLT as a gold standard. J Sleep Res 2000; 9: 5–11

Rispetto ai maschi:

- Più basso AHI, episodi di apnea più brevi.
- Quindi hanno un corredo sintomatologico con valori più bassi di AHI
- Un trattamento con CPAP nelle donne con basso AHI porta ha un miglioramento della sonnolenza durante la guida.

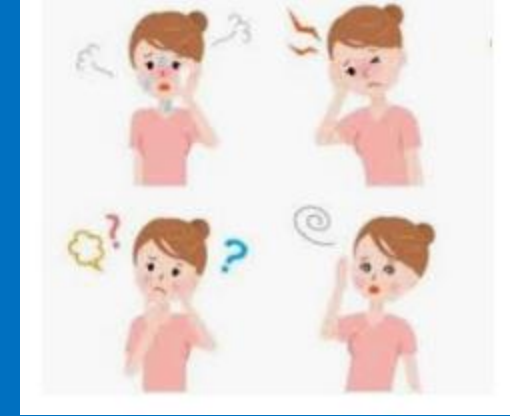
Svensson M, Franklin KA, Theorell-Haglöw J, et al. Daytime sleepiness relates to snoring independent of the

- apnea-hypopnea index in women from the general population. Chest 2008; 134: 919–924.

McNicholas WT, Bonsignore MR, Lévy P, et al. Mild obstructive sleep apnoea: clinical relevance and approaches

- to management. Lancet Respir Med 2016; 4: 826–834

Menopausa



- L' OSA/OSAHS raddoppia dopo la menopausa indipendentemente dall'età e dal BMI.

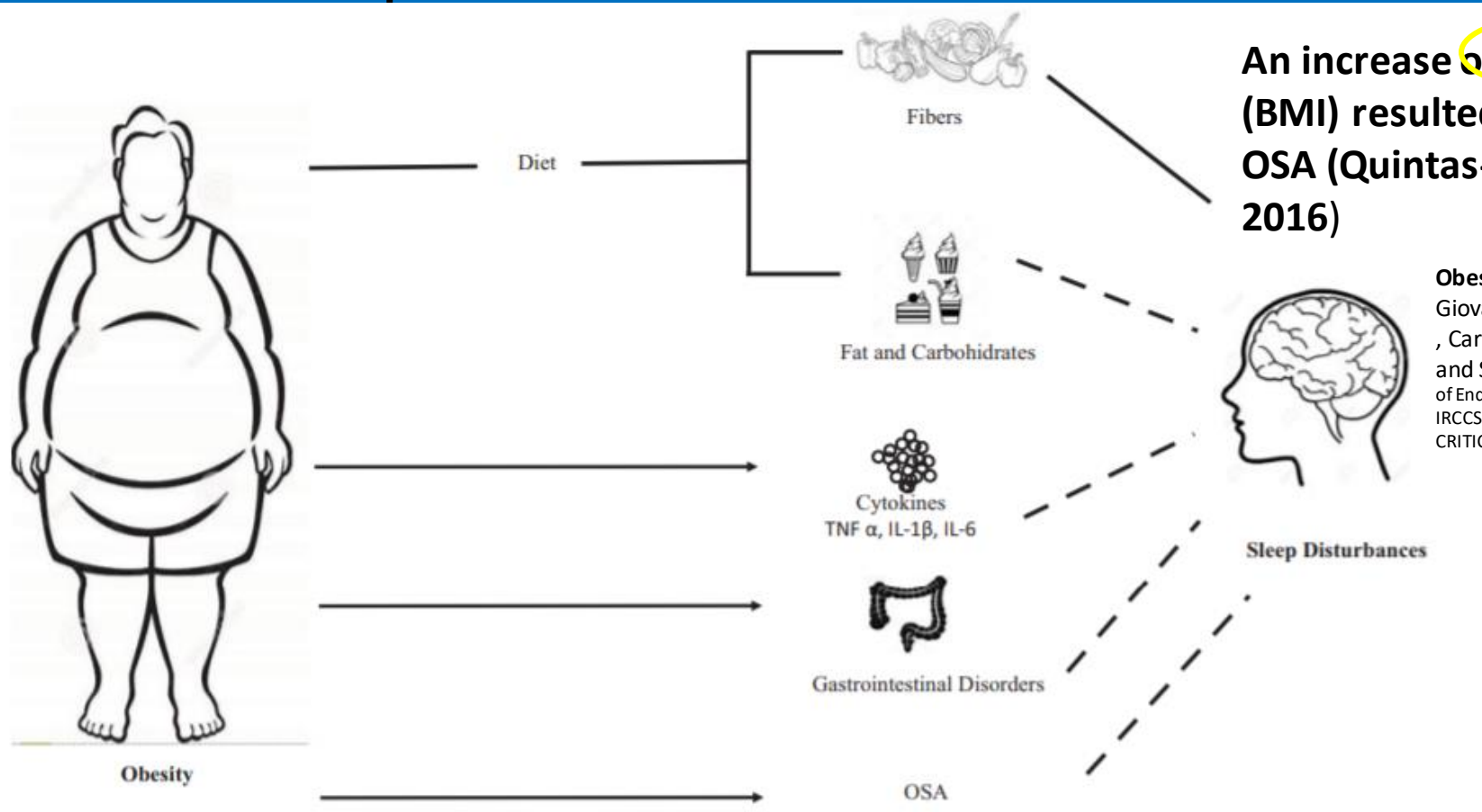
Young T, Finn L, Austin D, et al. Menopausal status and sleep-disordered breathing in the Wisconsin Sleep Cohort Study. Am J Respir Crit Care Med 2003; 167: 1181–1185.

Gravidanza



- Pochi studi disponibili
- OSA con un $AHI \geq 5$ events/h prevalenza del 3.6% primo trimestre e del 8.3% in dal 3 al 6 mese di gravidanza.
- Louis JM, Koch MA, Reddy UM, et al. Predictors of sleep-disordered breathing in pregnancy. Am J Obstet Gynecol 2018; 218: 521.e1–521.e12.populations .

- . Obesity as cause of sleep disturbance
- . Sleep disturbance as cause of obesity



An increase of 6 units in body mass index (BMI) resulted in **four time** greater risk of OSA (Quintas-Neves, Preto, and Drummond 2016)

Obesity and sleep disturbance: the chicken or the egg?

Giovanna Muscogiuria , Luigi Barreaa , Giuseppe Annunziataa , Carolina Di Sommab , Daniela Laudisioa , Annamaria Colaoa , and Silvia Savastanoa a Dipartimento di Medicina Clinica e Chirurgia, Unit of Endocrinology, Federico II University Medical School of Naples, Naples, Italy; b IRCCS SDN, Napoli Via Gianturco 113, Naples, 80143, Italy
CRITICAL REVIEWS IN FOOD SCIENCE AND NUTRITION 2018

short sleep persistent exposure leads to an 1.45 times increase in obesity

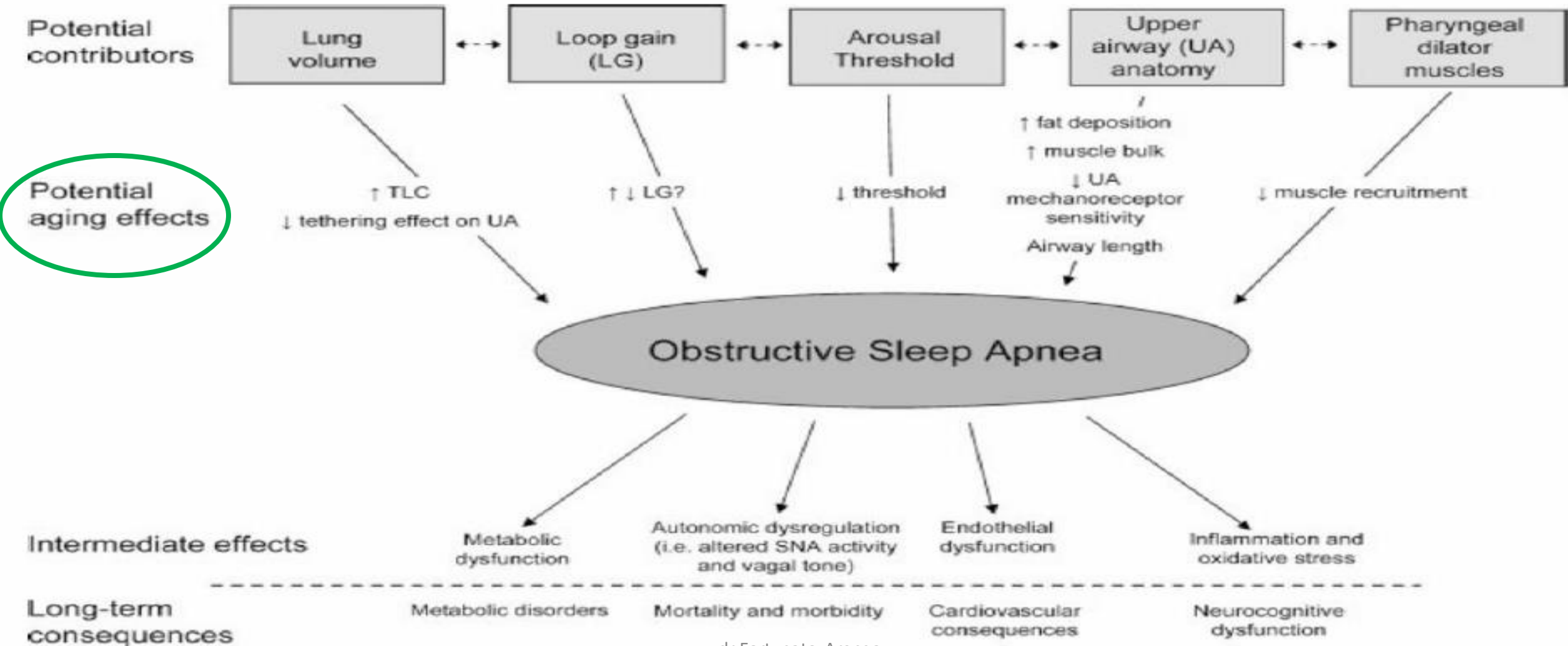
Social Jet-lag

Table 1. Mechanism of action of sleep disturbance-related hormones in promoting obesity.

Hormones	Sleep disturbance – related changes	Mechanism of action
Cortisol	↑	High cortisol levels causes overeating, impairs glucose homeostasis, insulin-resistance, and increases visceral fat accrual
Ghrelin	↑	High ghrelin levels increase calorie intake, mostly sweet foods
Leptin	↑	Sleep disturbance has been associated to leptin-resistance and consequent increased leptin levels which results in increased hunger.
Endocannabinoid System	↑	2-arachidonoylglycerol (one of the most abundant ligand of endocannabinoid receptors) rhythm is amplified and the peak is delayed and extended, increasing hunger
Melatonin	↓	Decreased levels of melatonin causes weight gain, chronic inflammation and increased oxidative stress, thus blunting glucose metabolism.

Il rapporto Età-OSA

(Edwards BA et al. Semin Respir Crit Care Med. 2010; 31:618)



Le stigmati classiche dell'OSA spesso mancano nell'anziano...

(Endeshaw YW. JAGS 2006; 54:1740)



Table 2. Traditional Risk Factors of Obstructive Sleep Apnea According to Obstructive Sleep Apnea Status

Characteristic	AHI < 15 (n = 67)	AHI ≥ 15 (n = 27)	P-value
Age, mean ± SD	77.3 ± 6.1	76.9 ± 7.4	.74
Snoring, n (%) (N = 89)			
< 1 time a week	16 (26)	5 (19)	
≥ 1 times a week	9 (14)	7 (27)	.25
Don't know, n (%)	38 (60)	14 (54)	
Told to be snoring, %	41	56	.22
Body mass index, kg/m ² , mean ± SD	25.1 ± 3.6	26.7 ± 4.6	.08
AHI/hour of sleep	7 ± 4	32 ± 16	.001

AHI = apnea-hypopnea index; SD = standard deviation.

...e la presentazione dell'OSA può sfuggire

Table 3. Subjective Sleep Characteristics According to Obstructive Sleep Apnea* (OSA) Status

Self-Reported Symptoms	Female (n = 67)		Male (n = 27)		Total (N = 94)	
	OSA –	OSA+	OSA –	OSA+	OSA –	OSA+
Problem falling asleep, %	22	17	17	7	21	11
Time to fall asleep, minutes, mean $\pm$ SD	27.5 $\pm$ 27.1	26.4 $\pm$ 19.9	23.0 $\pm$ 28.8	29.1 $\pm$ 32.4	26.8 $\pm$ 27.2	27.1 $\pm$ 28.0
Number of times you wake up, n, mean $\pm$ SD	2.3 $\pm$ 1.4	2.5 $\pm$ 1.3	2.3 $\pm$ 0.5	2.8 $\pm$ 1.3	2.3 $\pm$ 1.3	2.7 $\pm$ 1.3
Problem getting back to sleep, %	21	21	0	40 [†]	17	31
Do not feel well rested in the morning, %	27	75 [‡]	18	39	25	56 [‡]
Number of naps/day, n, mean $\pm$ SD	0.8 $\pm$ 0.6	1.0 $\pm$ 0.5	1.1 $\pm$ 0.3	1.4 $\pm$ 0.9	0.8 $\pm$ 0.6	1.2 $\pm$ 0.8 [†]
Epworth Sleepiness Scale, mean $\pm$ SD	5.1 $\pm$ 2.6	9.2 $\pm$ 4.8 [‡]	7.7 $\pm$ 2.5	7.3 $\pm$ 3.8	5.6 $\pm$ 2.8	8.3 $\pm$ 4.4 [‡]
Nocturia frequency per night, n, mean $\pm$ SD	1.7 $\pm$ 0.9	2.1 $\pm$ 1.4	1.1 $\pm$ 1.0	2.1 $\pm$.7 [†]	1.6 $\pm$ 1.0	2.1 $\pm$ 1.1 [†]

* Apnea-hypopnea index ≥ 15 per hour of sleep.

P < [†].05, [‡].01.

L'OSA è causa importante di nicturia

(Endeshaw YW et al. JAGS 2004; 52:957)

Table 2. Selected Demographic and Clinical Findings by Sleep-Disordered Breathing Category

	A AHI 0–9 (n = 26)	B AHI 10–24 (n = 21)	C AHI ≥25 (n = 11)	
Finding	Mean ± Standard Deviation			P-value*
Age	76.9 ± 6.0	79.7 ± 6.9	76.5 ± 7.3	.260
Body mass index, kg/m ²	24.5 ± 3.8	23.4 ± 3.0	28.0 ± 5.7	.010 [†]
Epworth Sleepiness Scale	5.5 ± 3.8	6.6 ± 2.4	8.4 ± 5.4	.100
Geriatric Depression Scale	1.8 ± 1.4	1.8 ± 1.8	2.6 ± 1.9	.380
Mean arterial blood pressure, mmHg	99.9 ± 11.5	91.9 ± 11.3	105.2 ± 14.7	.015 [‡]
Nocturia episodes	1.7 ± 1.1	1.6 ± 0.9	2.6 ± 1.4	.028 [§]

* Analysis of variance.

[†] C > A ($P = .040$); C > B ($P = .008$); (Tukey honestly significant difference (HSD)).

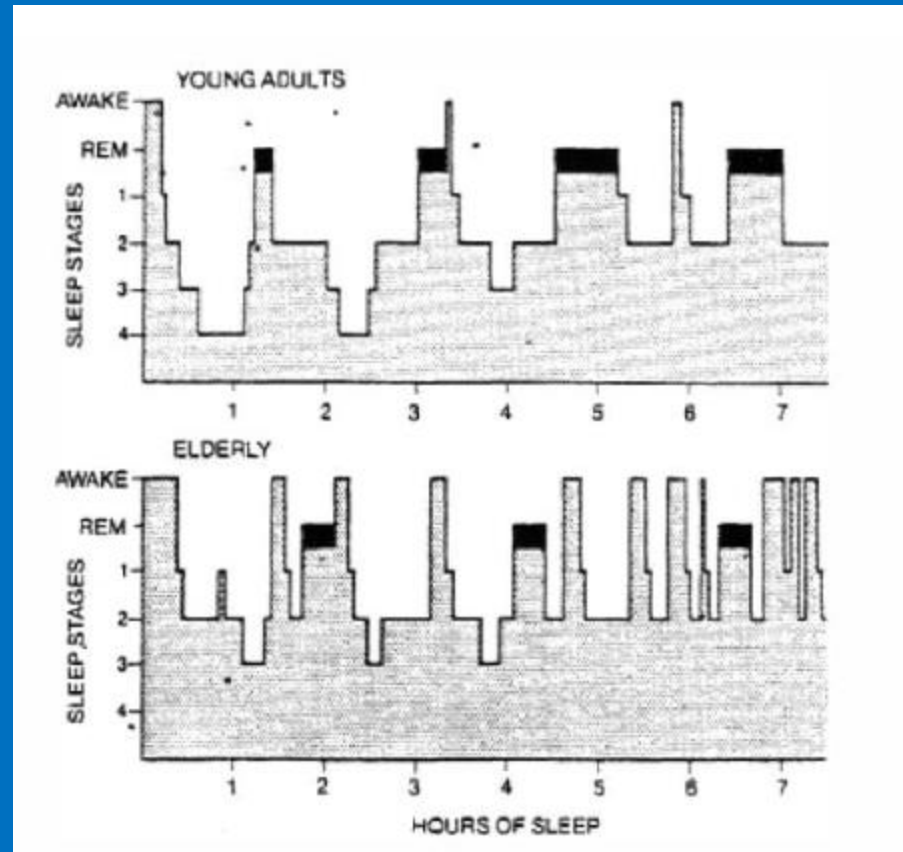
[‡] C > B ($P = .021$); (Tukey HSD).

[§] C > A ($P = .050$); C > B ($P = .021$); (Tukey HSD).

AHI = Apnea Hypopnea Index.

Sonno e invecchiamento

(Vaz Fragoso CA et al. JAGS 2007; 55:1853)

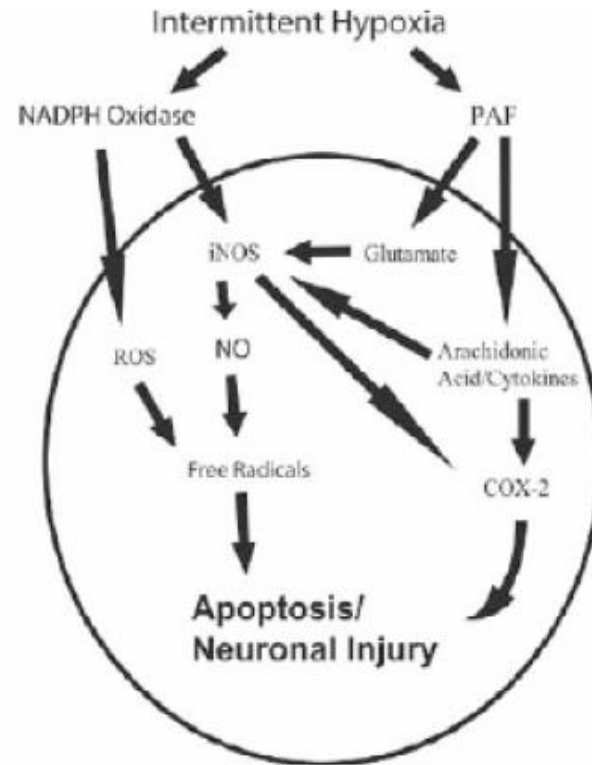




**La Sleep apnea ostruttiva: una
fonte spesso misconosciuta
di problemi cognitivi e
comportamentali nell'anziano**

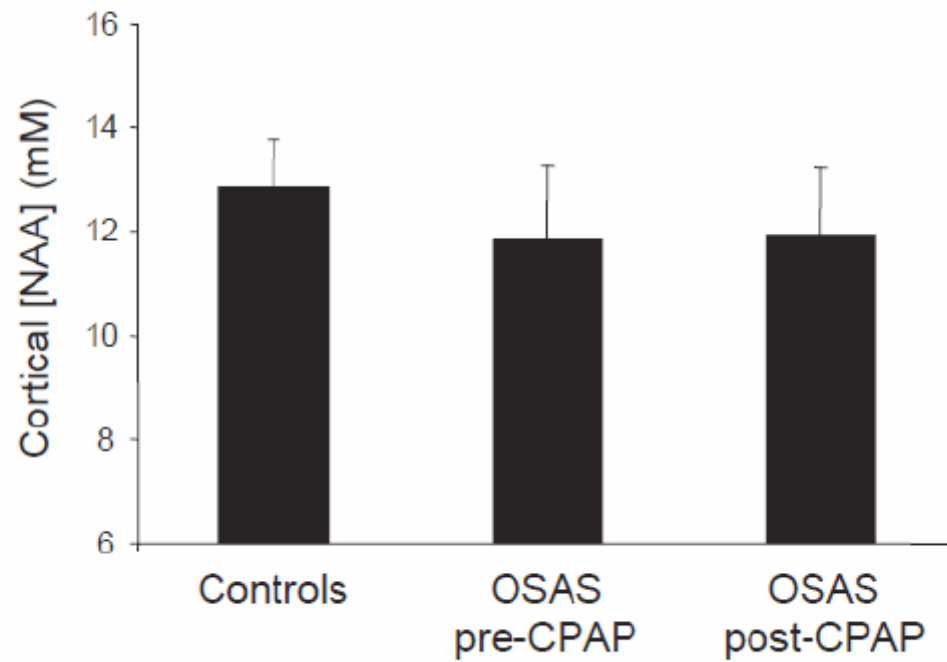
Danno cerebrale da ipossia intermittente

(Row BW: Chapter 5 in *Hypoxia and the Circulation*, edited by R.C. Roach *et al.* Springer, New York, 2007)



Il danno neuronale è in parte irreversibile...

(Tonon C et al *SLEEP* 2007;30:305)

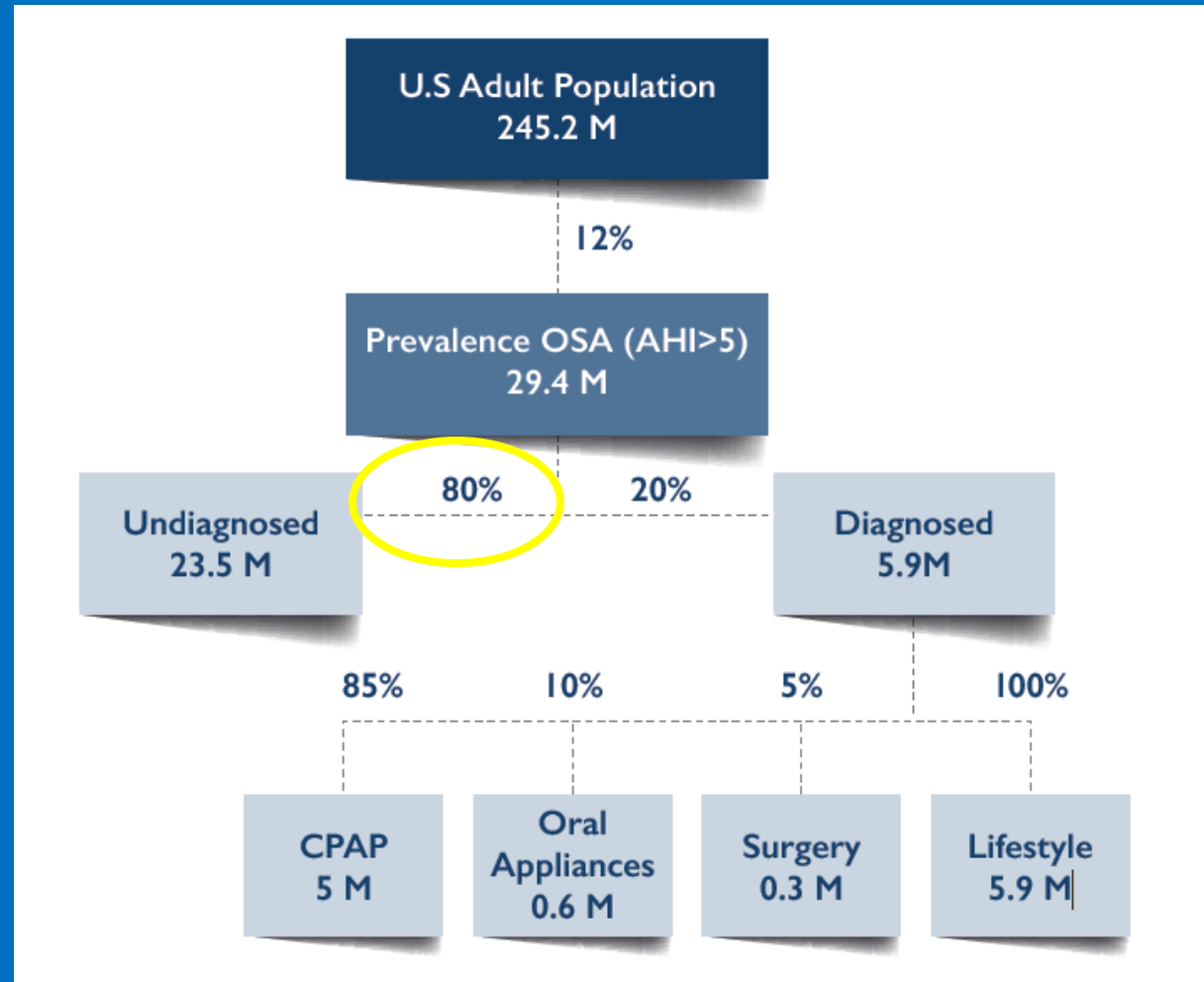


Costi effettivo o potenziale se tratto in profilassi?

Epidemiology

- Prevalence in US has been 2-4% for women and 4-9% for men.
- SDB remains undiagnosed in approximately 93% of affected women and 82% of affected men.

Epidemiology



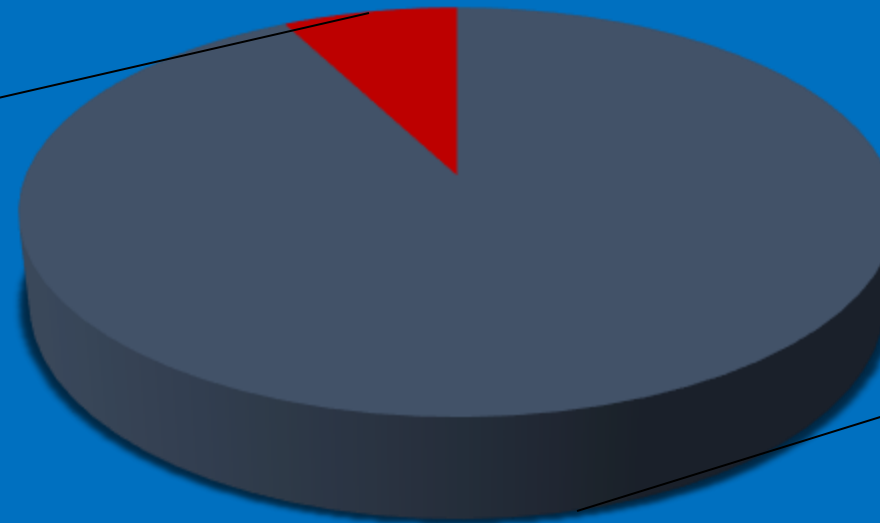
Source: Primary research with experts, U.S. Census (2014), Peppard "Increased Prevalence of Sleep-disordered Breathing in Adults." American Journal of Epidemiology (2013)

Costs Associated with OSA in United States in 2015

\$162.0 B

Annual per patient diagnosis and treatment costs are 67% less than leaving patients undiagnosed.

**Diagnosed/
Treated**
5.9 M People,
\$12.4B



**Undiagnosed/
Untreated,**
23.5 M People,
\$149.6B

Source: ¹Primary research with experts, secondary clinical research, U.S. Census (2014), Peppard "Increased Prevalence of Sleep-disordered Breathing in Adults." American Journal of Epidemiology (2013), Frost & Sullivan Patient Survey

Undiagnosed		Diagnosed	
# People with OSA	23,500,000		5,900,000
	Cost of Undiagnosed OSA (\$US Bil)		Cost of Diagnosed OSA (\$US Bil)
Comorbidities & Mental Health	\$30.0	Diagnosis, Testing and Follow Up	\$0.8
Motor Vehicle Accidents	\$26.2	Non-surgical Treatment	\$6.2
Workplace Accidents	\$6.5	Surgical Treatment	\$5.4
Lost Productivity	\$86.9		
Total Costs (\$US Bil)	\$149.6		\$12.4
Cost per Person	\$6,336		\$2,105

Source: ¹Primary research with experts, secondary clinical research, U.S. Census (2014), Peppard "Increased Prevalence of Sleep-disordered Breathing in Adults." American Journal of Epidemiology (2013), Frost & Sullivan Patient Survey,

Diagnosing and Treating All 29.4M Americans with OSA Could Save \$100.1 Billion

Today

Where 80% of OSA Patients Are Undiagnosed

Total: \$162.0B

Cost per Person: \$5,511

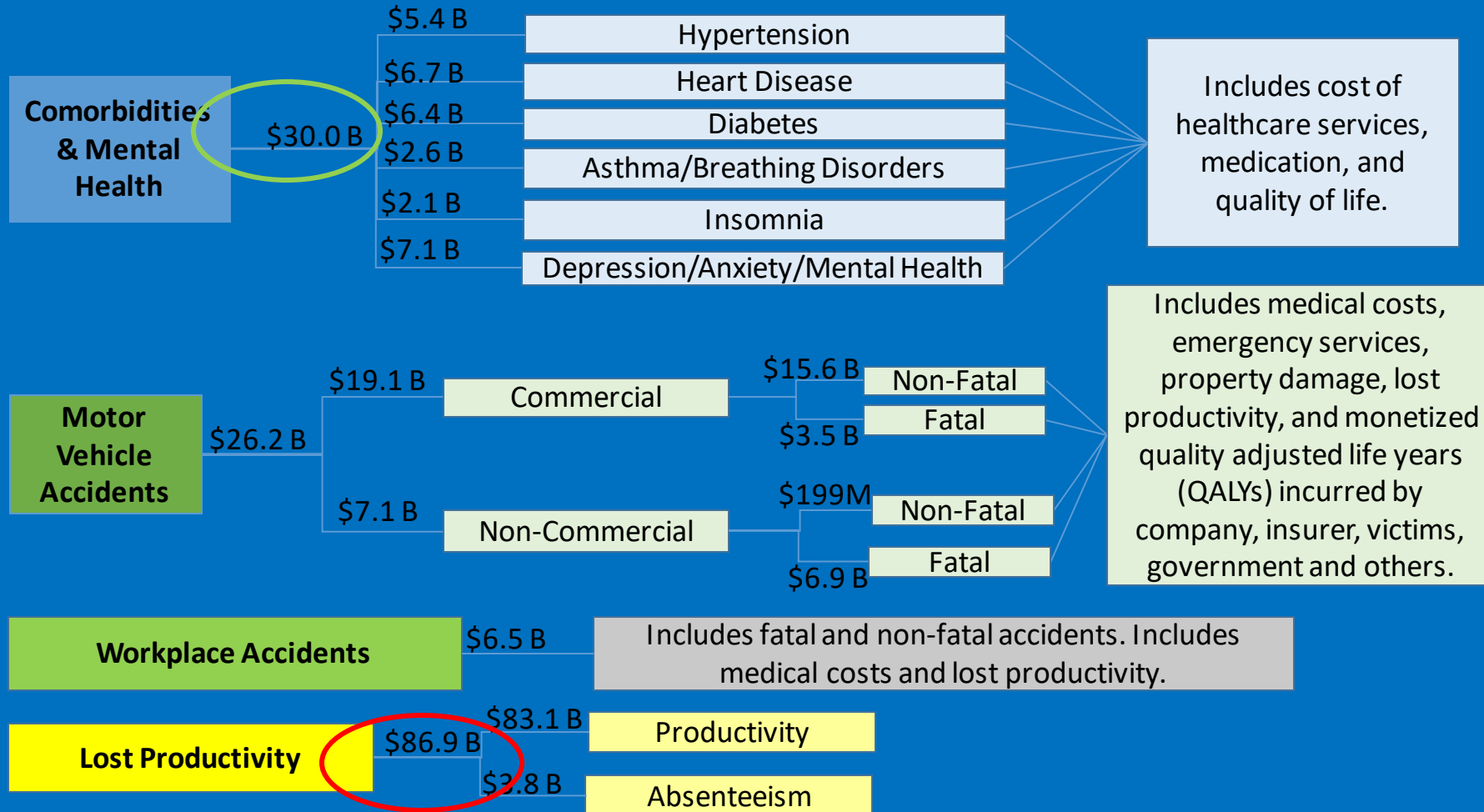
Future

Where No OSA Patients Are Undiagnosed

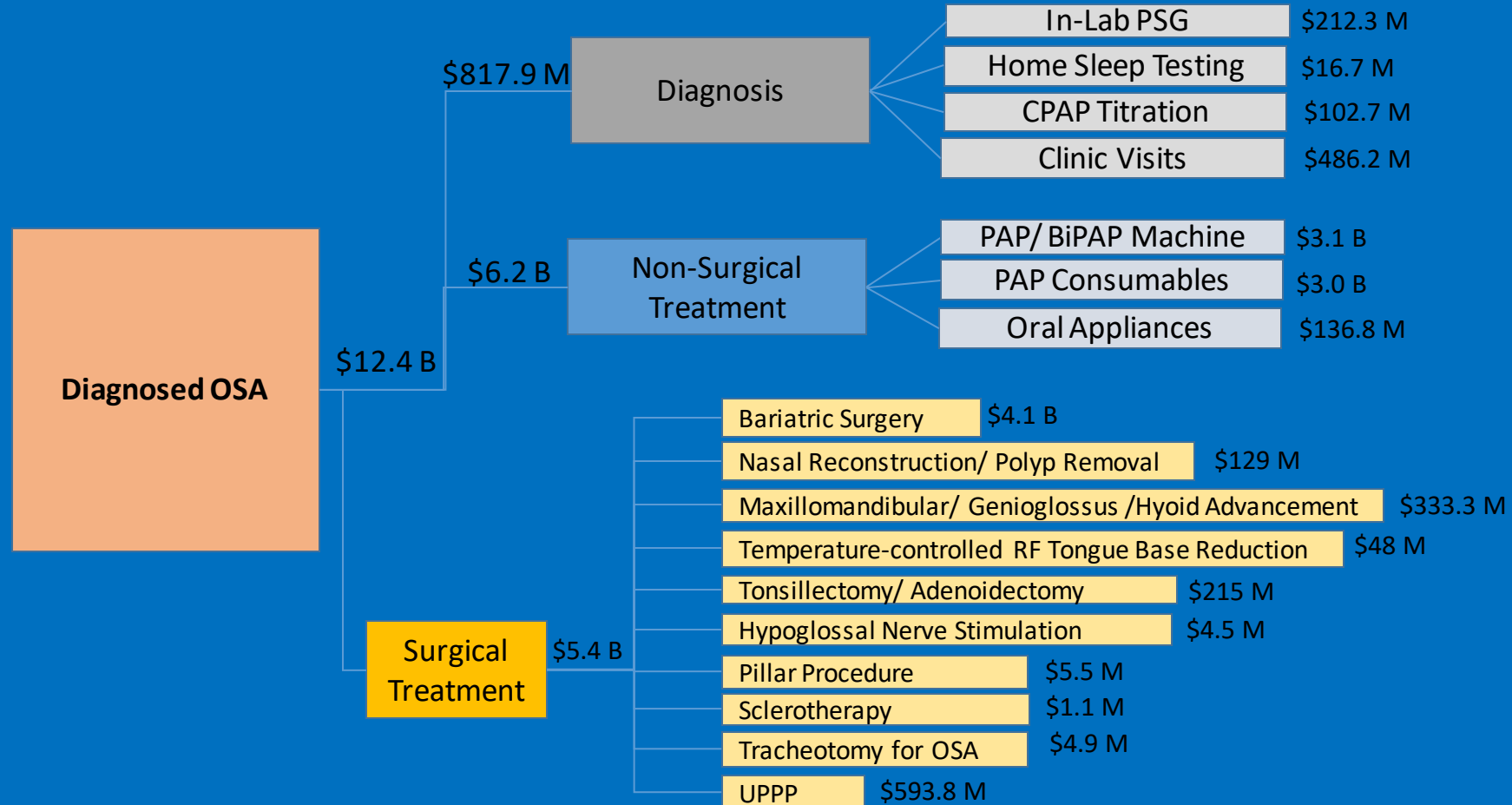
Total: \$61.9B

Cost per Person: \$2,105

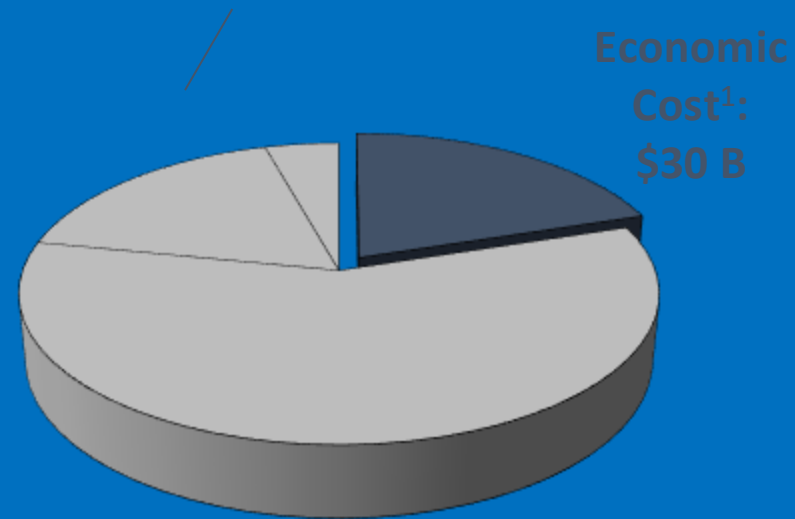
Sources of Cost for Undiagnosed OSA



Three Sources of Cost for Diagnosed/Treated OSA

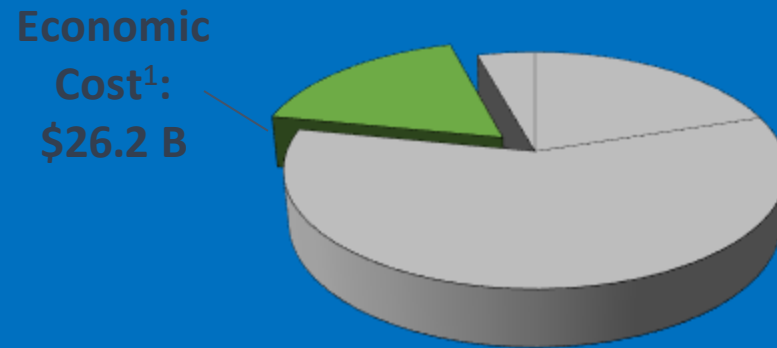


Comorbidities & Mental Health



Source: ¹Primary research with experts, secondary clinical research, U.S. Census (2014), Peppard "Increased Prevalence of Sleep-disordered Breathing in Adults." American Journal of Epidemiology (2013), Frost & Sullivan Patient Survey

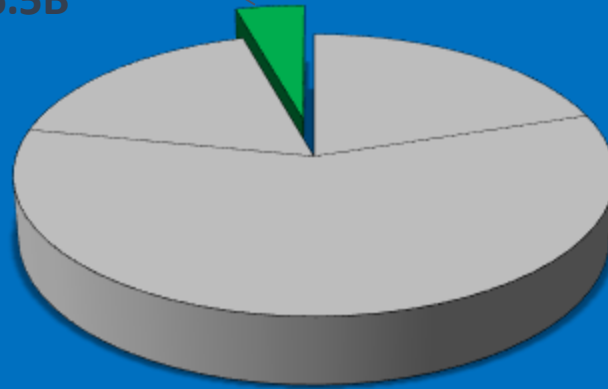
Motor Vehicle Accidents



Source: ¹Primary research with experts, secondary clinical research, U.S. Census (2014), Peppard "Increased Prevalence of Sleep-disordered Breathing in Adults," American Journal of Epidemiology (2013), ²Tefft, Brian C. "Prevalence of Motor Vehicle Crashes Involving Drowsy Drivers, United States, 2009-2013," AAA Foundation for Traffic Safety, ³Berger, MD. "A Corporate-Driven Sleep Apnea Detection and Treatment Program: Results and Challenges." (2006), Frost & Sullivan Patient Survey

Workplace Accidents

**Economic
Cost¹:
\$6.5B**

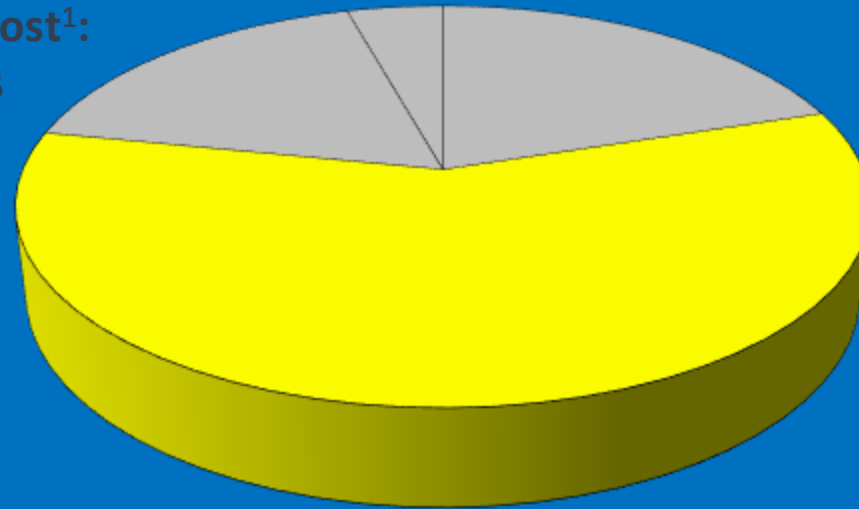


Source: ¹Primary research with experts, secondary clinical research, U.S. Census (2014), Peppard "Increased Prevalence of Sleep-disordered Breathing in Adults." American Journal of Epidemiology (2013), Frost & Sullivan Patient Survey

² Barnes ""Changing to Daylight Saving Time Cuts Into Sleep and Increases Workplace Injuries." (2009)

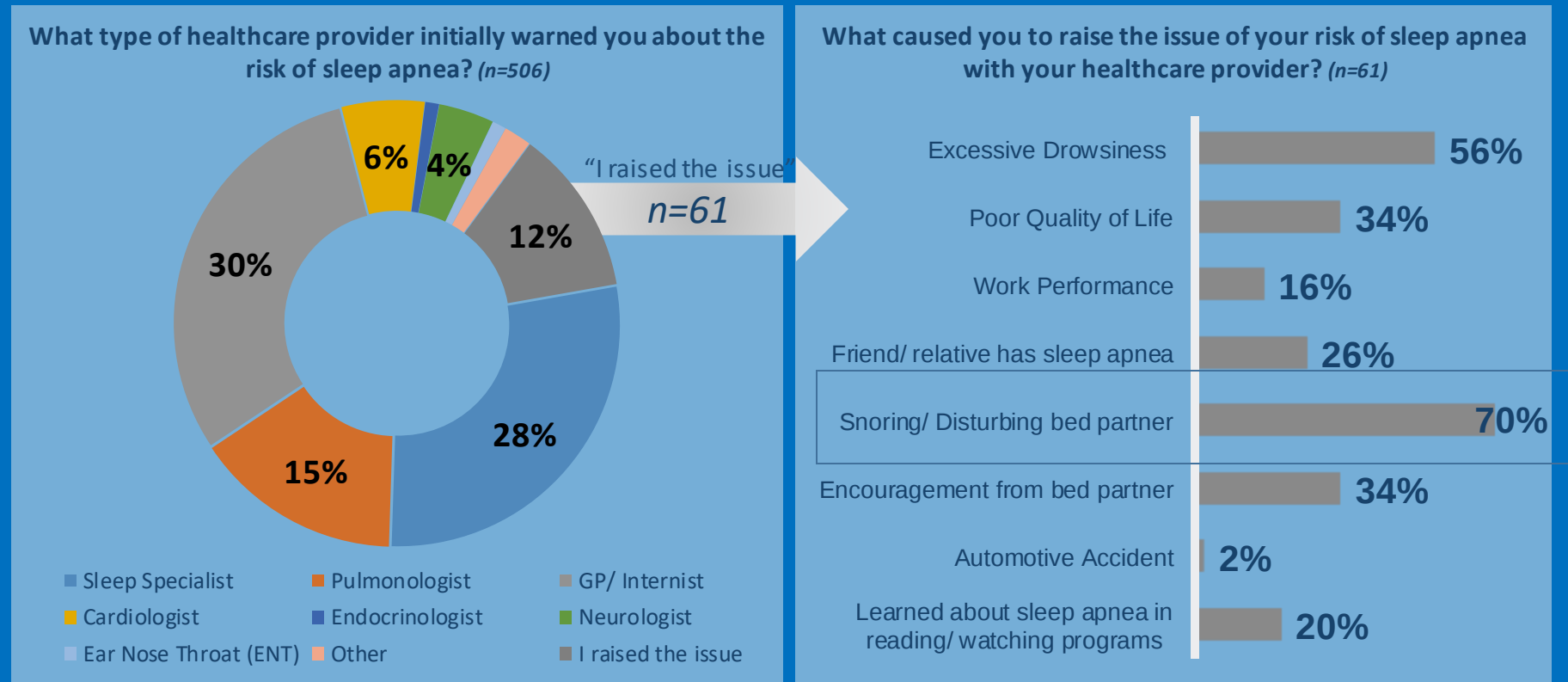
Lost Productivity

Economic Cost¹:
\$86.9 B



Source: ¹Primary research with experts, secondary clinical research, U.S. Census (2014), Peppard "Increased Prevalence of Sleep-disordered Breathing in Adults." American Journal of Epidemiology (2013), Frost & Sullivan Patient Survey

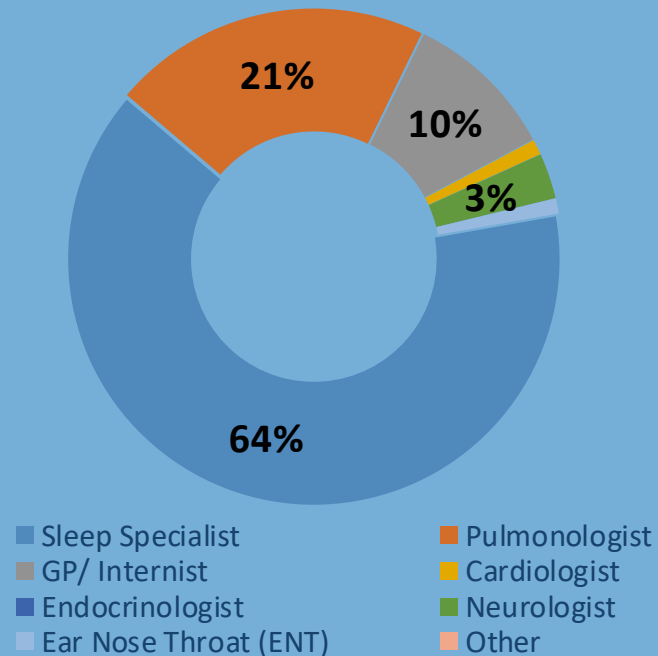
Quale figura professionale ti ha indirizzato alla diagnosi?



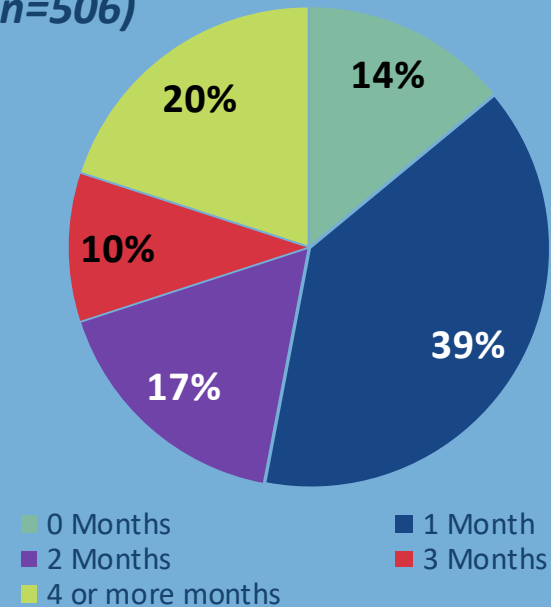
(Percentages under 3% not shown for transparency).

Diagnosis and Treatment

What type of doctor diagnosed you with sleep apnea? (n=506)

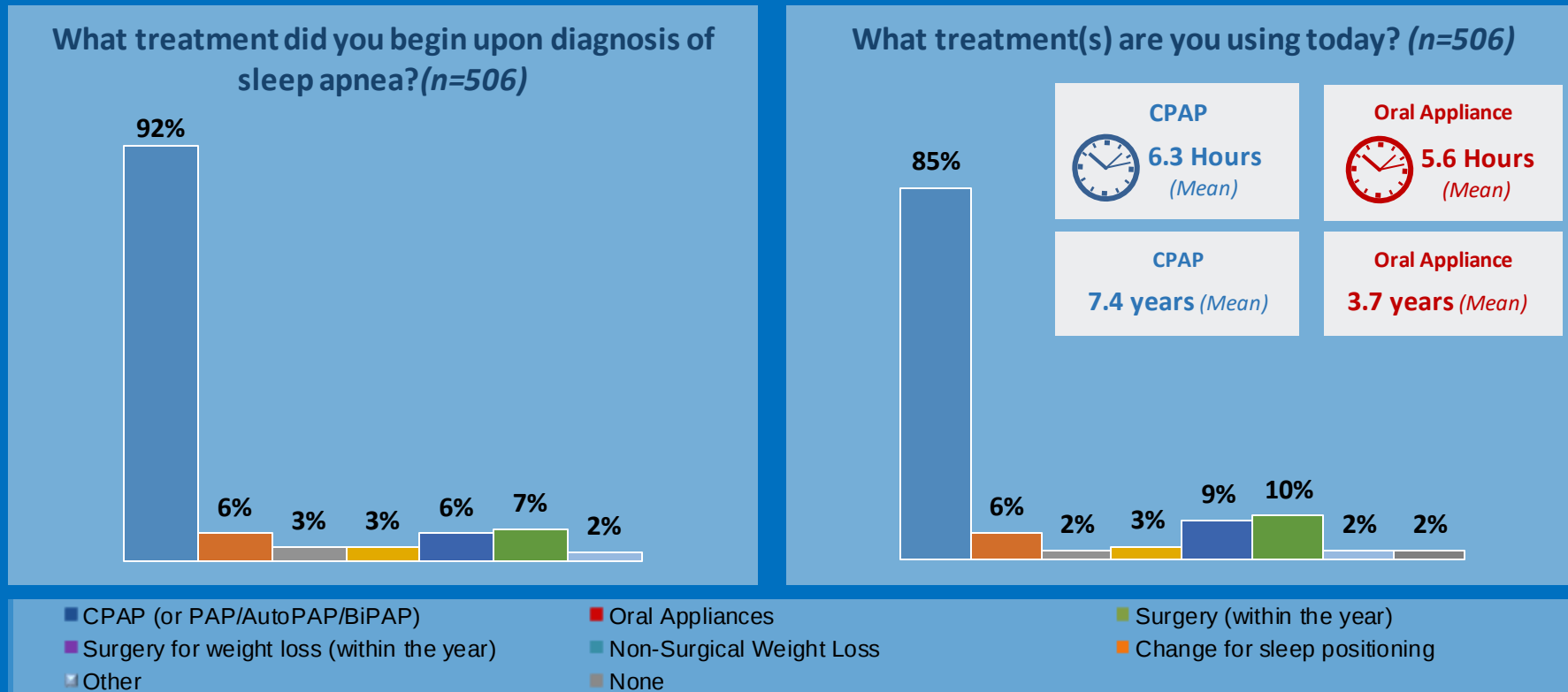


Time between initial warning about sleep apnea risk and diagnosis following a sleep study (n=506)



(Percentages under 3% not shown for transparency).

OSA Treatment



In an average night, for how many hours of sleep do you wear your CPAP/Oral Appliance.
For how many years have you been using the following treatments?

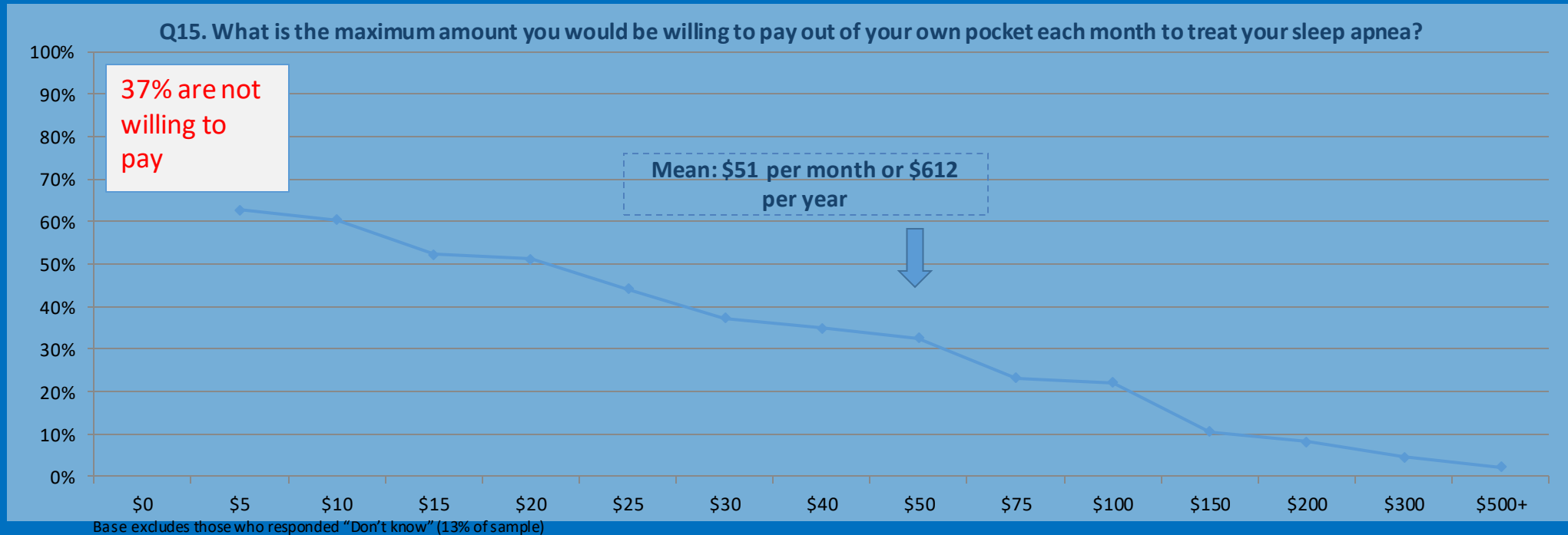
Productivity and Absenteeism

Before and after sleep apnea treatment



Base: n=354

Quanto sei disposto a spendere per trattare la tua sleep apnea?

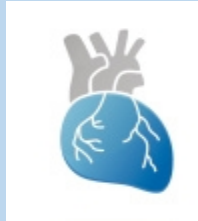


When you consider how much money you have spent treating your sleep apnea, do you feel like that investment was worth the benefits you received?



Base: (n=506)

OSA Treatment Has a Major Impact on Comorbidities



After one year, patients surveyed state OSA treatment delivers...

Hypertension

- **41% report blood pressure improvement**
- **17% report decrease in medication usage**

Diabetes

- **31% report improved HbA1c**
- **14x increase in “good quality” sleep**

Asthma & Breathing Conditions

- **54% report improved respiratory function**
- **70% increase in patients reporting symptoms as mild**
- **8x increase in “good quality” sleep**

OSA Treatment Has a Major Impact on Comorbidities

Zzz



After one year, patients surveyed state OSA treatment delivers...

Insomnia

- 7x increase in good quality sleep
- Decline from 54% to 1% reporting “very bad” quality sleep

Depression, Anxiety and Mental Health

- 12x increase in “good quality” sleep
- 4x reduction in reported life threatening mental health condition
- 49% report improved mental health

Heart Disease

- 56% report reduced heart disease risk
- 5x decrease in self-reported life-threatening heart disease
- Decline from 50% to 3% reporting “very bad” quality sleep
- Increase from 0% to 26% reporting “very good” quality sleep

Home

Decrease in direct medical costs and co-pays:

3% of OSA patients with hypertension able to stop and another 17% decrease medication
Diabetics with treated OSA report nearly half (2.8 vs. 1.5) the annual hospital visits

Reducing use of depressives and stimulants to manage symptoms:

31% **fewer alcoholic drinks** = \$187.20 savings per year (\$4 per drink)
62% **fewer cigarettes** = \$197.70 savings per year (\$0.28 per cigarette)
21% **fewer sleeping pills** = \$31.20 savings per year (\$2 per pill)

Reducing cost of auto accidents and higher insurance premiums

Workplace

1.8 days fewer workplace absences per year = \$363.46 new earnings per year for hourly workers

1.2 hours of increased productivity per day = Equivalent to \$4,274.25 more value per employee and contributing to promotions, bonuses, and greater job stability for patients



Grazie per l'attenzione



..live your dream