Sleep Apnea and Obesity

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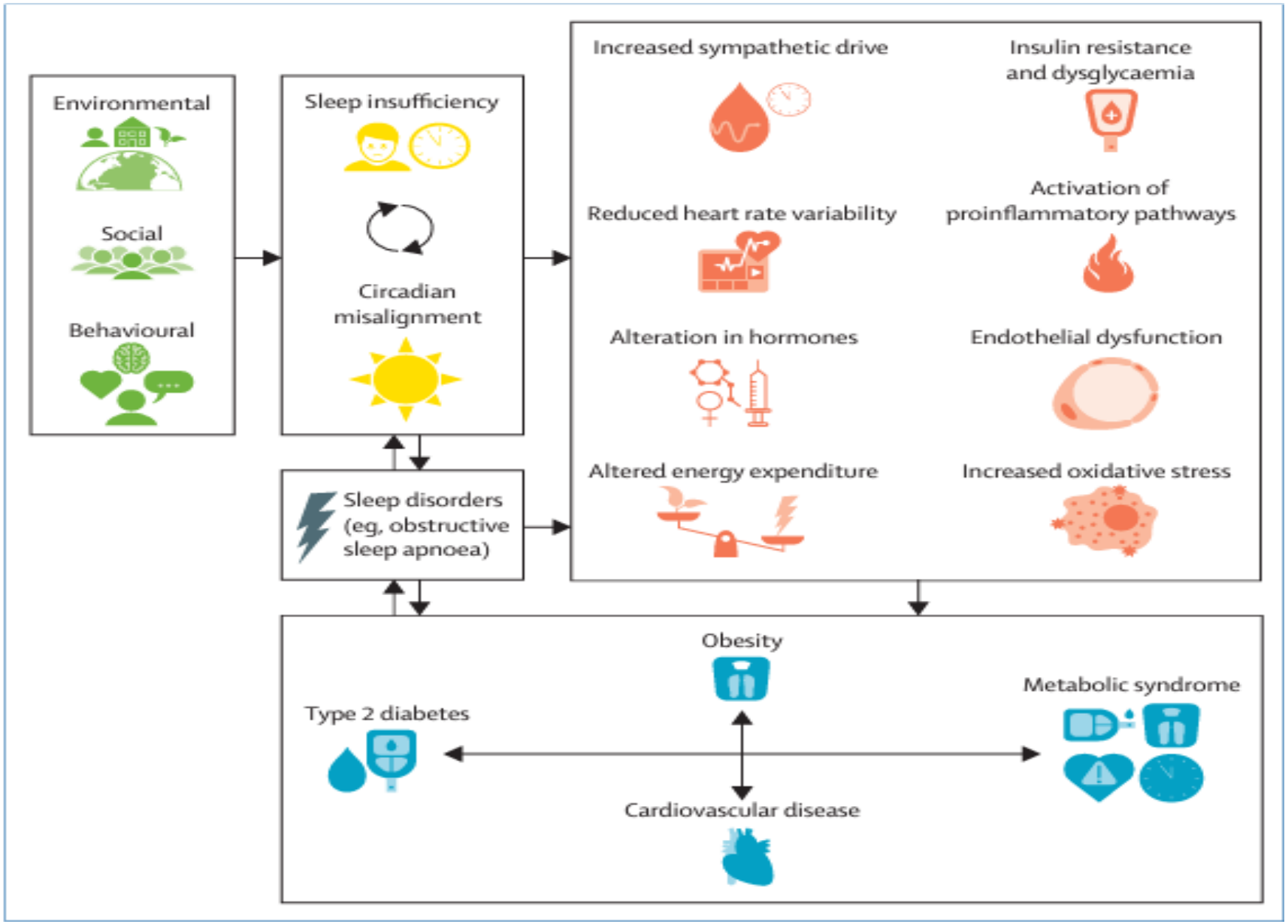
Case

- A 42 year old patient with BMI of 42 presents to the sleep clinic for a bariatric surgery consultation. The patient does not feel that they are symptomatic and “just needs to get this done for surgery” and is going to “lose weight anyways” after surgery.

- Concerning?
- Typical?

Objectives

- 1. Highlight the importance of sleep in cardiometabolic health and obesity management.
- 2. Outline screening, diagnosis, and treatment of sleep apnea
- 3. Discuss strategies to improve sleep duration and quality.


Environmental
Social
Behavioural
Sleep insufficiency
Circadian misalignment
Sleep disorders (eg, obstructive sleep apnoea)
Increased sympathetic drive
Insulin resistance and dysglycaemia
Reduced heart rate variability
Activation of proinflammatory pathways
Alteration in hormones
Endothelial dysfunction
Altered energy expenditure
Increased oxidative stress
Obesity
Type 2 diabetes
Metabolic syndrome
Cardiovascular disease

Lancet 2023

Obesity in turn raises the risk of morbidity from hypertension, hyperlipidemia, type 2 diabetes mellitus, coronary heart disease (CHD), stroke, gallbladder disease, osteoarthritis, sleep apnea and respiratory problems, and some cancers.

Why Is Sleep Important?

- We Spend 1/3 of our lives asleep!

- “If sleep doesn’t serve an absolutely vital function, it is the biggest mistake evolution ever made.
- ALLAN RECHTSCHAFFEN

What is the recommended amount of sleep?

- American Academy of Sleep Medicine and Sleep Research society 2015 Consensus Panel
  - Panel 16 experts, 12-month process
  - Reviewed 5,314 articles
  - Oxford grading system, RAND Appropriateness
- Conclusions:
  - **≥ 7 hours sleep per night on regular basis are required for optimal health among adults 18-60 yrs.**
    - Weight gain, obesity, diabetes, hypertension, heart disease, stroke, depression, death.
    - Impaired immune function, increased pain, impaired performance, increased errors, accidents
    - > 9 hours sleep per night on regular basis may be appropriate for young adults, those recovering from sleep debt or individuals with disease.
    - Uncertain if > 9 hr. in others is associated with risk
- *Sleep recommendations for children/adolescents
  - Infants (4-12 mo.) 12-16 h.
  - Toddlers (1-2 y.) 11-14 h.
  - Preschoolers (3-5 y.) 11-13 h.
  - Children (6-12 y.) 9-12 h.
  - Teenagers (13-18 y) 8-10 h.
  - Regularly sleeping more than recommended amounts may be associated with adverse health outcomes

Consensus Conference Panel. Sleep 2015:38(6):843-844 and *J Clin Sleep Med 2106;6:785-786.

HEALTH RISKS OF NOT SLEEPING

7-9 HRS THE RECOMMENDED AMOUNT; IMPROVES HEALTH AND DAILY ALERTNESS

5-7 HRS THE AVERAGE AMOUNT THAT AMERICAN ADULTS SLEEP EACH NIGHT

0-5 HRS PUTS YOU AT HIGH RISK FOR A NUMBER OF HEALTH PROBLEMS:

- 2.5X HIGHER RISK FOR DIABETES
- 45% HIGHER RISK FOR HEART ATTACK
- 12% HIGHER RISK OF DEATH UNDER ANY CIRCUMSTANCE

Prevalence of Sleep Loss

- It is estimated that at least 36% of the US population suffers from sleep loss
- 1/3 of young adults secondary to chronic partial sleep deprivation
- 7% of Adults secondary to sleep disorders
- 2% of Adults secondary to shift work

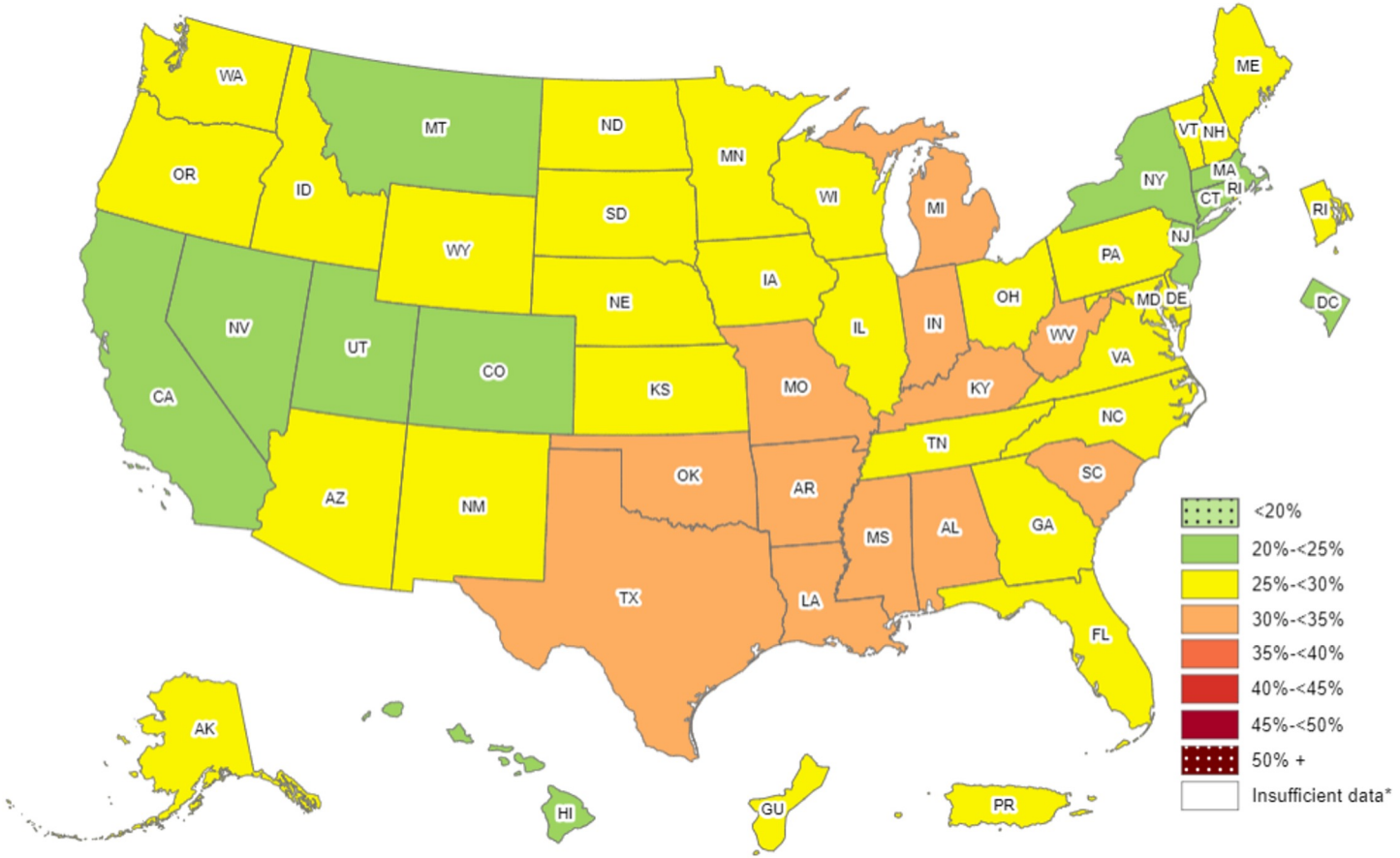
Daytime Sleepiness

- Reducing total sleep time in normal young adults by 1-1.5 hours can decrease objective alertness by up to 33%

Rosenthal et al., 1993; Bonnet et al., 1995

Prevalence¶ of Self-Reported Obesity Among U.S. Adults by State and Territory, BRFSS, 2011

¶ Prevalence estimates reflect BRFSS methodological changes started in 2011. These estimates should not be compared to prevalence estimates before 2011.



***Sample size <50, the relative standard error (dividing the standard error by the prevalence) ≥30%, or no data in a specific year.**

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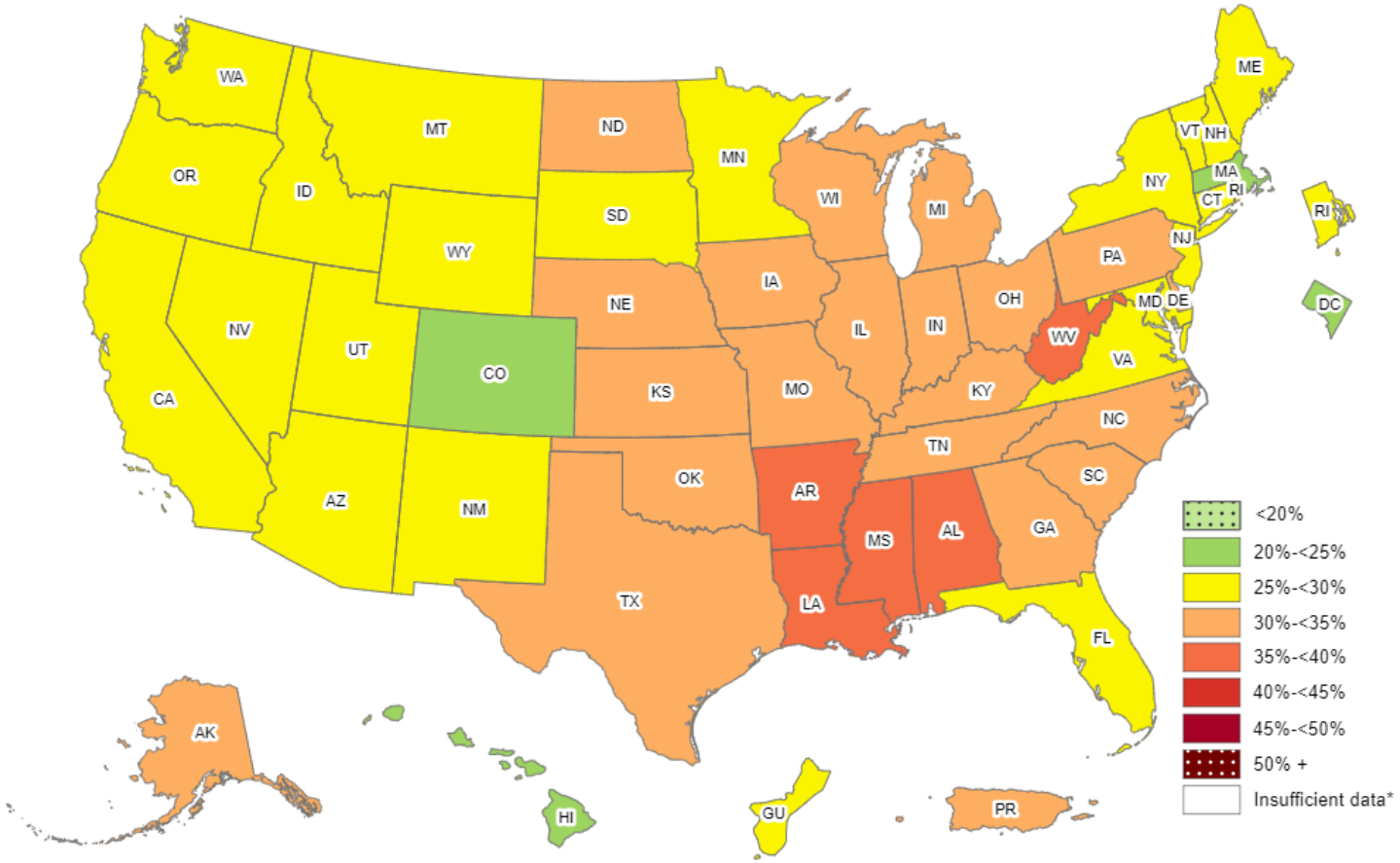

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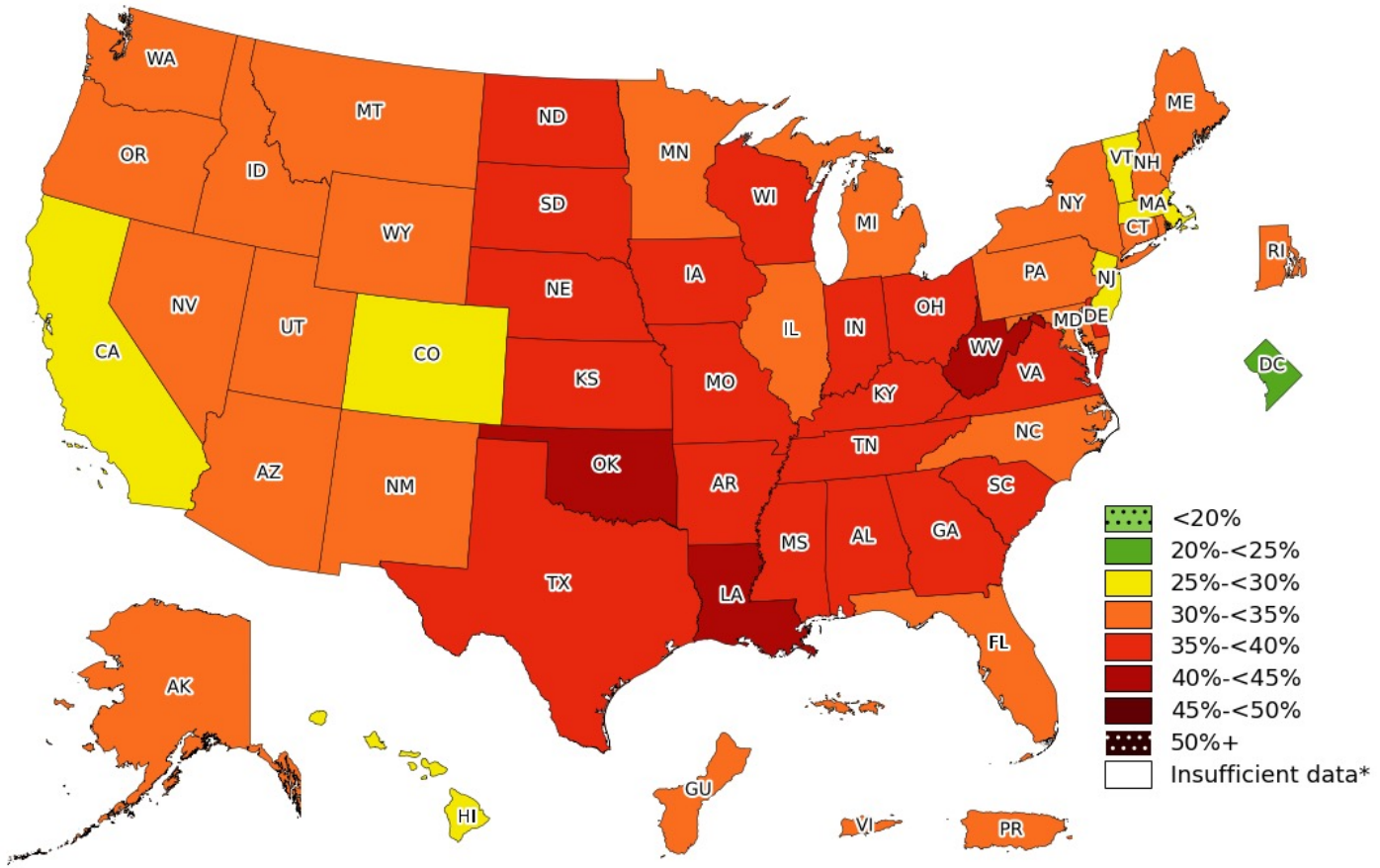
Prevalence¶ of Obesity Based on Self-Reported Weight and Height Among US Adults by State and Territory, BRFSS, 2022

¶ Pre
com



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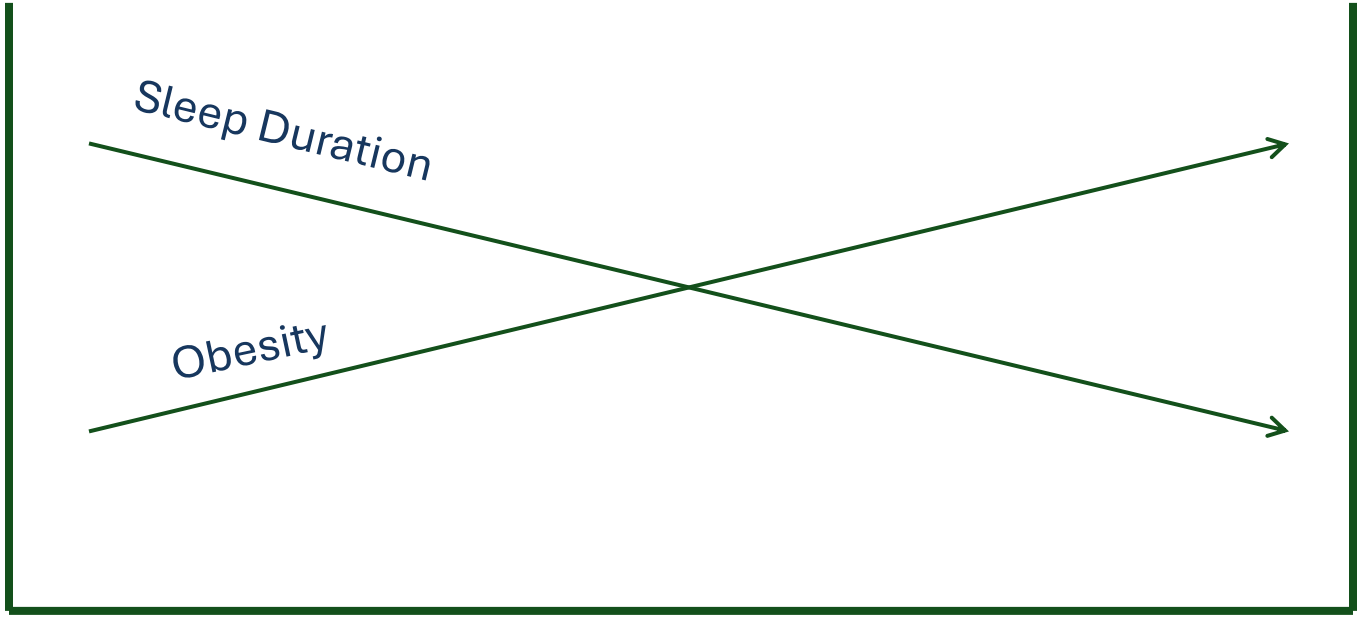
Sleep Duration and Obesity



Very short sleepers (<5 hours) twice as likely to be obese.
Short sleepers (5–6 hours) 57% greater odds of being obese.

Jean-Louis G et al. 2014; Gangwisch JE et al. 2005

Obesity, Sleep, and Metabolic Hormones:

Obesity, and changes in sleep parameters and/or sleep disorders (e.g., sleep apnea) may impact metabolic hormones.

Leptin and Ghrelin

Leptin:

A satiety hormone produced primarily by subcutaneous white adipose tissue. It interacts with receptors in the hypothalamus to inhibit eating and control body weight and fat distribution.

Ghrelin:

A peptide, produced predominantly by the stomach, stimulates appetite.

Leptin and Ghrelin

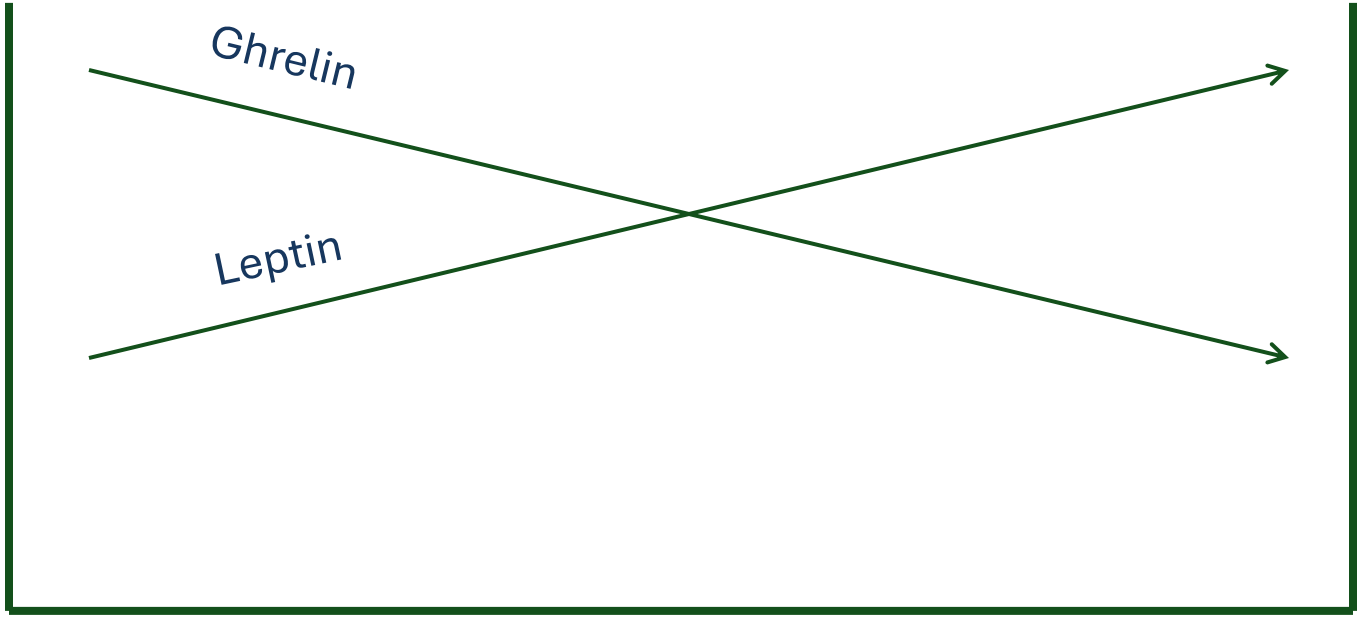
Leptin:

The satiety hormone leptin is largely dependent on meal intake and therefore shows a morning minimum and increasing levels throughout the daytime culminating in a nocturnal maximum.

Ghrelin:

During the daytime, the levels increase in anticipation of a meal and then decrease after meal ingestion.
The hunger hormone ghrelin increases initially but then decreases during the second part of the night.

Ghrelin, Leptin, and Obesity



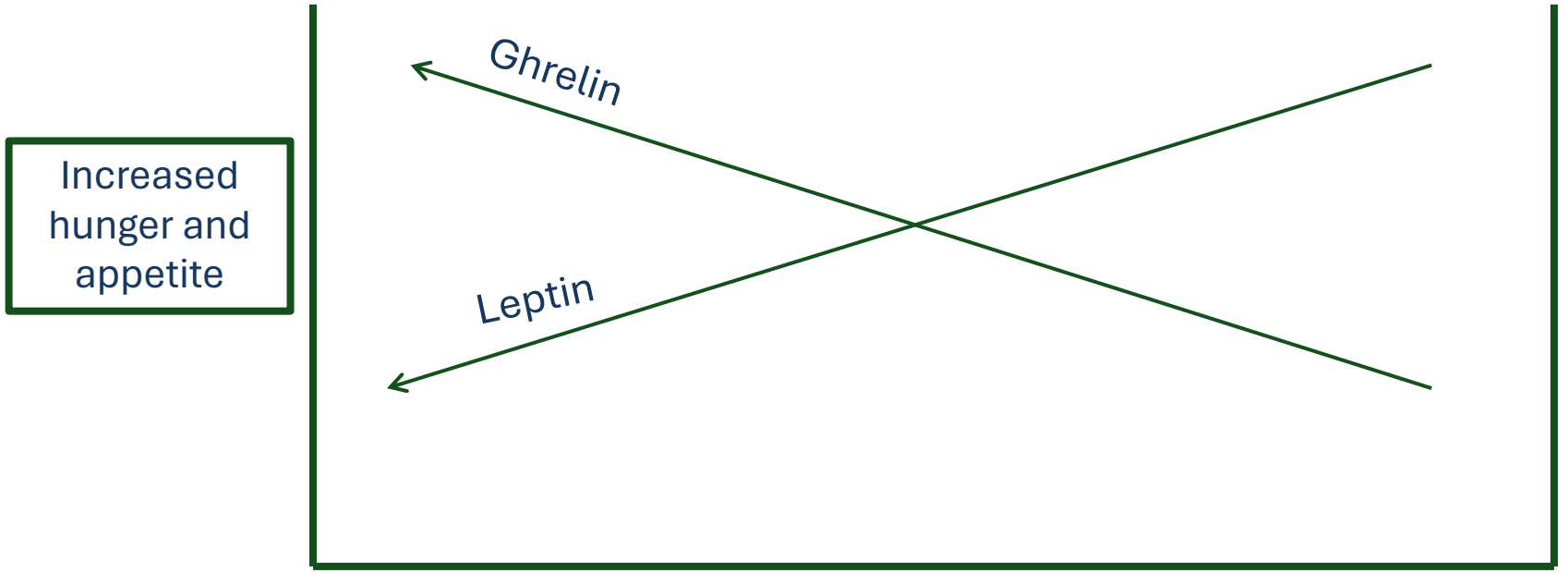
Leptin Resistance : “Satiety Hormone” Resistance

Obesity

Ghrelin levels are decreased in obesity.
Leptin levels are increased in obesity.

Tschop M et al. 2001

Ghrelin, Leptin, and Sleep Duration



Appetite for calorie-dense nutrients with high carbohydrate content (e.g., sweets, salt, and starch) increased; and, appetite for fruits, vegetables, and high-protein nutrients was less affected

Taheri T et al. 2004; Mullington et al. 2003; Spiegel K et al. 2003; Guilleminault et al. 2003

Short Sleep and Obesity:

- Influences weight through effects on appetite.
- Causes excessive daytime sleepiness and, therefore, lead to decreased physical activity, and a decrease in energy expenditure.
- Causes increased energy intake to counter excessive daytime sleepiness.
- Provides more time to eat.

Stern JH et al. 2013; Knutson et al. 2007

Sleep Restriction, Slow-Wave Sleep, and Glucose Regulation:

- Poor sleep quality associated with increase risk of type 2 diabetes.
- Sleep restriction significantly impairs glucose tolerance.
- All-night selective suppression of SWS led to marked decreases in insulin sensitivity without adequate compensatory increase in insulin release.
- Reduced sleep quality (e.g., low levels of SWS) may contribute to increased risk of diabetes.

Tasali E et al. 2008; Knutson et al. 2007; Van Cauter E. et al 2008

Obstructive Sleep Apnea

- Age
- **Obesity (50-80% Prevalence in this population) – Our Patient Case**
- Male Gender
- Anatomic Abnormalities
- Hypothyroidism
- Medications, Alcohol

Obstructive Sleep Apnea - Symptoms

- Excessive daytime sleepiness
- Awakening during the night
  - Gasping/choking
- Snoring
- Associated with DM, HTN, stroke, A. Fib, CHF
- Associated with Obesity, Large Neck

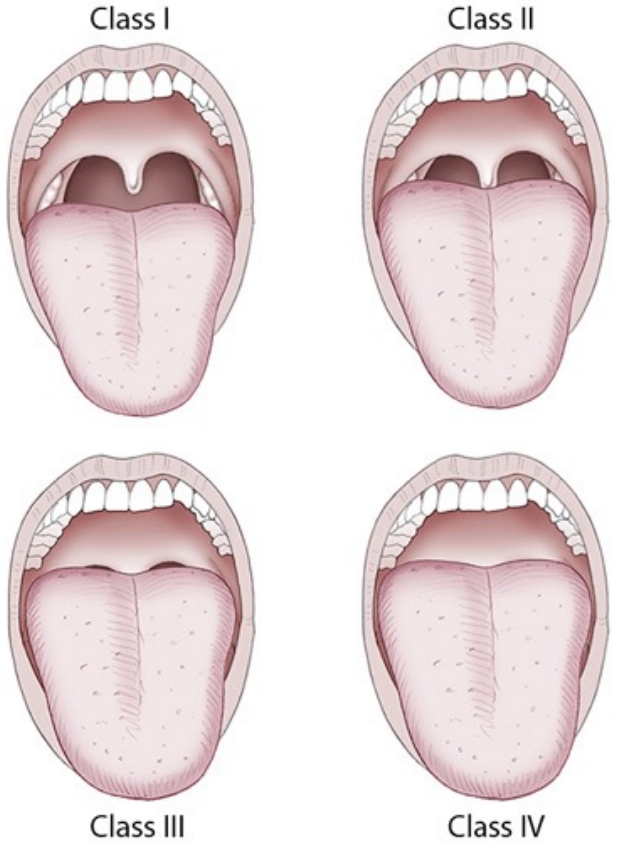
OSA- Evaluation

- Symptoms – Snoring, EDS, Gasping/Choking, ask Bed Partner!
- HEENT exam
  - Deviated septum
  - Nasal polyps
  - Micrognathia, Retrognathia
  - Short Thick Neck (>16 in women, >17 in men)
- Cardiovascular Exam
- Medications
- Think about Patient populations

Blythe J, Doghramji PP, Jungquist CR, Landau MB, Valerio TD, Ancoli-Israel S, et al. Screening & treating patients with sleep/wake disorders. JAAPA. 2009 Dec;Suppl Sleep:1-17

OSA- Evaluation

- Mallampati Score
  - Class I
    - Full visibility of tonsils
  - Class II
    - Upper portion of tonsils/uvula
  - Class III
    - Soft/hard palate visible
  - Class IV
    - Only hard palate visible



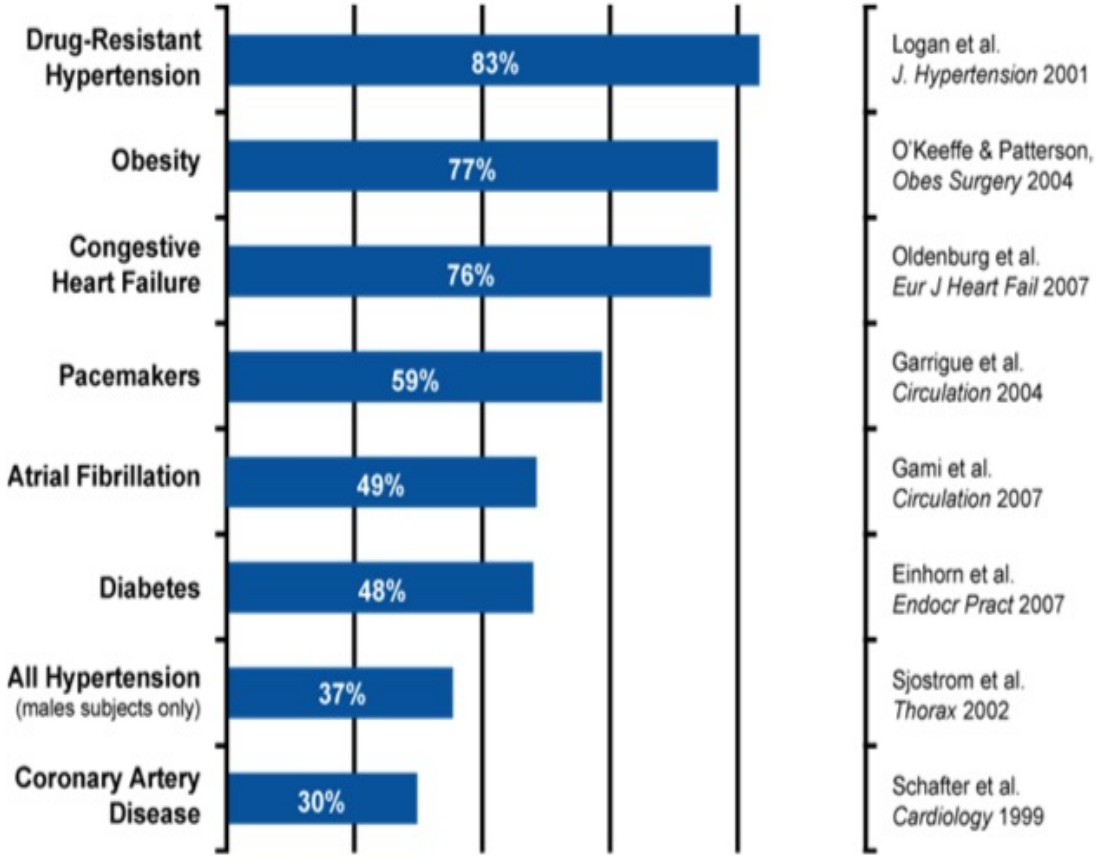
Brodsky J, Margarson M. Weighing In On Surgical Safety. Agency for Healthcare Research and Quality. http://www.webmm.ahrq.gov

What can you tell patients about OSA and Obesity?

- Up to 75 % of individuals with OSA are obese.
- > 70 % of severe obese (i.e., grade 2) have OSA.
- At least 70 % of obese women with polycystic ovarian syndrome (PCOS) have OSA.
- Over 86 % of obese patients with type 2 diabetes have OSA.

Foster G et al. 2009; Lopez P et al. 2008; Health Quality Ontario, 2006

Prevalence of OSA



Types of Sleep Studies

- Home Sleep Study (CPT 95806, 95800, 95801)
  - Only for OSA
  - Due to the known rate of false negative PM tests, attended PSG pshould be performed in cases where PM is technically inadequate or fails to establish the diagnosis of OSA
- Overnight Attended PSG (CPT 95810, 95811)
  - Diagnostic PSG/Split Night PSG
  - Used to evaluated sleep disorders such as RBD, PLMD, OSA (patients with conditions where HST not indicated), CSA

Treatment Options

- PAP Therapy
- Surgery
- Dental Appliances
- **Weight Loss/Behavioral Modifications**

Obesity is a Major, Modifiable Risk Factor for OSA

What can you tell patients about weight changes and OSA?

- 10 % decrease in weight correlates with an AHI reduction of 26 %.
- 20 % decrease in weight correlates with an AHI reduction of 48 %.
- 10 % increase in BMI associated with an increase in AHI of 32 %.

Peppard PE et al. 2000

Obesity Interventions and Impact on OSA

- Lifestyle
- GLP-1 (liraglutide/tirzepatide)
- Bariatric Surgery

SLEEP AHEAD 2021 - AJRCCM

- 10 year follow up PSG of 134/264 adults with overweight/obesity, DM2 and OSA randomized to intensive lifestyle intervention (ILI) vs diabetes support and education (DSE)
- PSG performed at 1,2, 4, and 10 years (caveat substantial number of PSG not obtained at f/u) – common issue in practice!

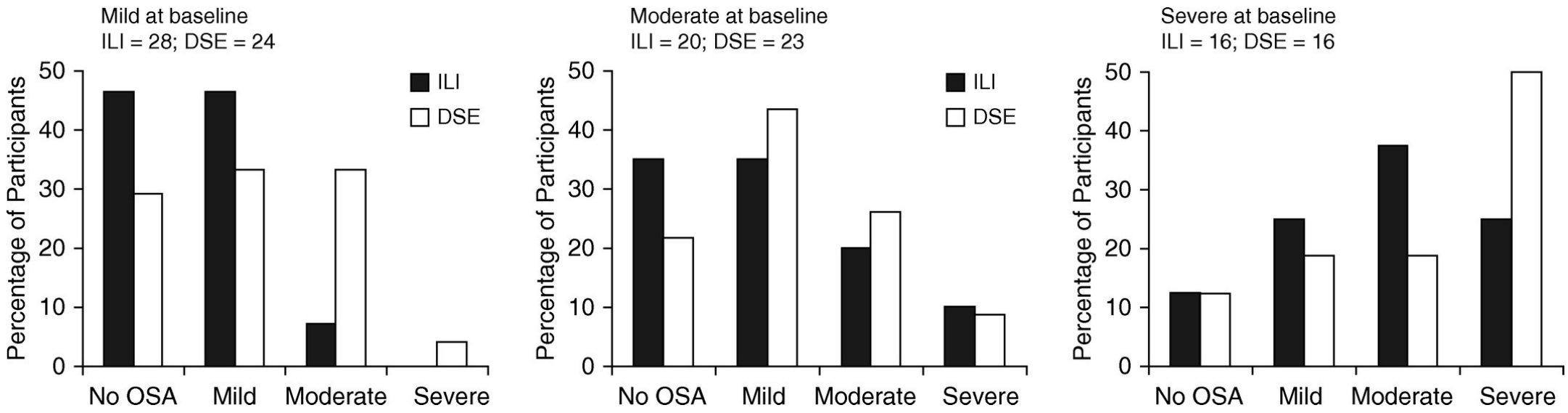


Figure 4. Percentage of ILI (solid bars) and DSE (open bars) participants without OSA and with mild, moderate, and severe OSA at 10 years compared with their OSA severity at baseline. For definition of abbreviations, *see* Figure 3.

Am J Respir Crit Care Med, 2021
https://www.atsjournals.org/doi/abs/10.1164/rccm.201912-2511OC

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DOI: 10.1164/rccm.201912-2511OC

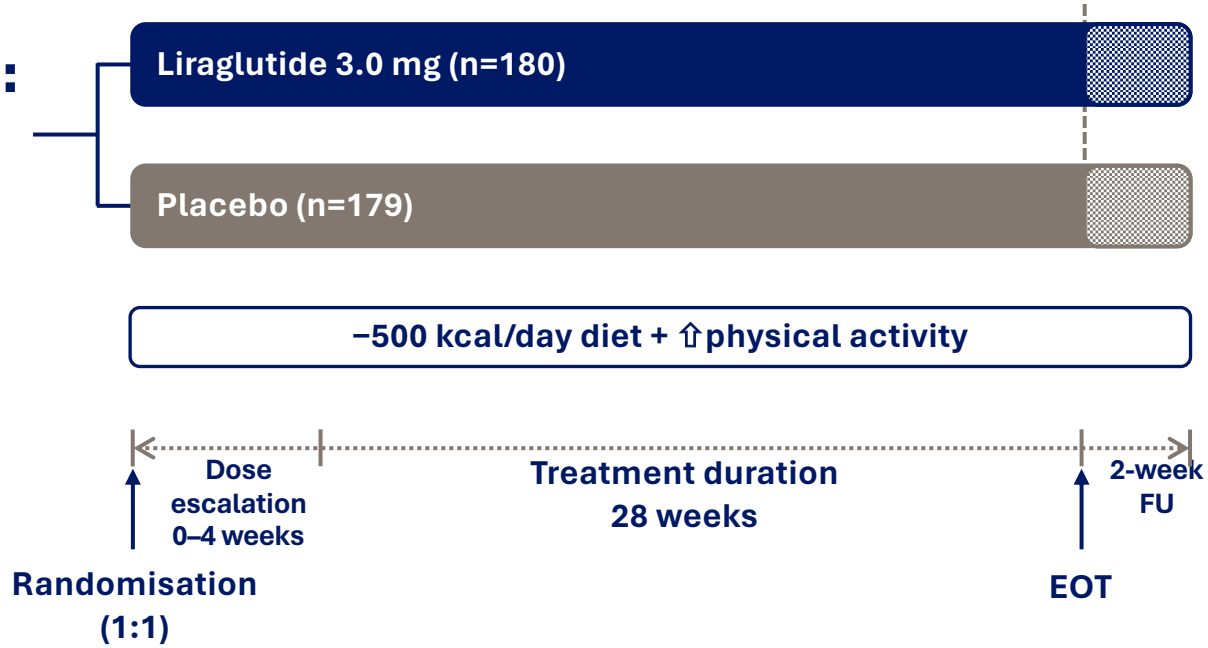
AOM

Trial Design: SCALE Sleep Apnoea

Effect of Liraglutide 3.0 mg on Obstructive Sleep Apnoea Severity

359 participants:

- **BMI ≥30 kg/m²**
- **Stable BW**
- **18–64 years**
- **Moderate or severe OSA**
- **No CPAP**



Trial information:

- **June 2012 to June 2013**
- **Randomised controlled double-blind study**
- **40 sites in the US and Canada**

Trial objective:

- **Efficacy of liraglutide 3.0 mg in reducing severity of OSA vs. placebo in obese participants with moderate/severe OSA**

Key endpoints:

- **Primary: Change in AHI from baseline to week 32**
- **Secondary: Sleep parameters, body weight measurements, glycaemic parameters, cardiometabolic risk factors, patient-reported outcomes**

AHI, apnoea–hypopnoea index; CPAP, continuous positive airway pressure; EOT, end of treatment; FU, follow-up; OSA, obstructive sleep apnoea

Blackman et al. Int J Obes (Lond). 2016;40:1310-9

Baseline Characteristics

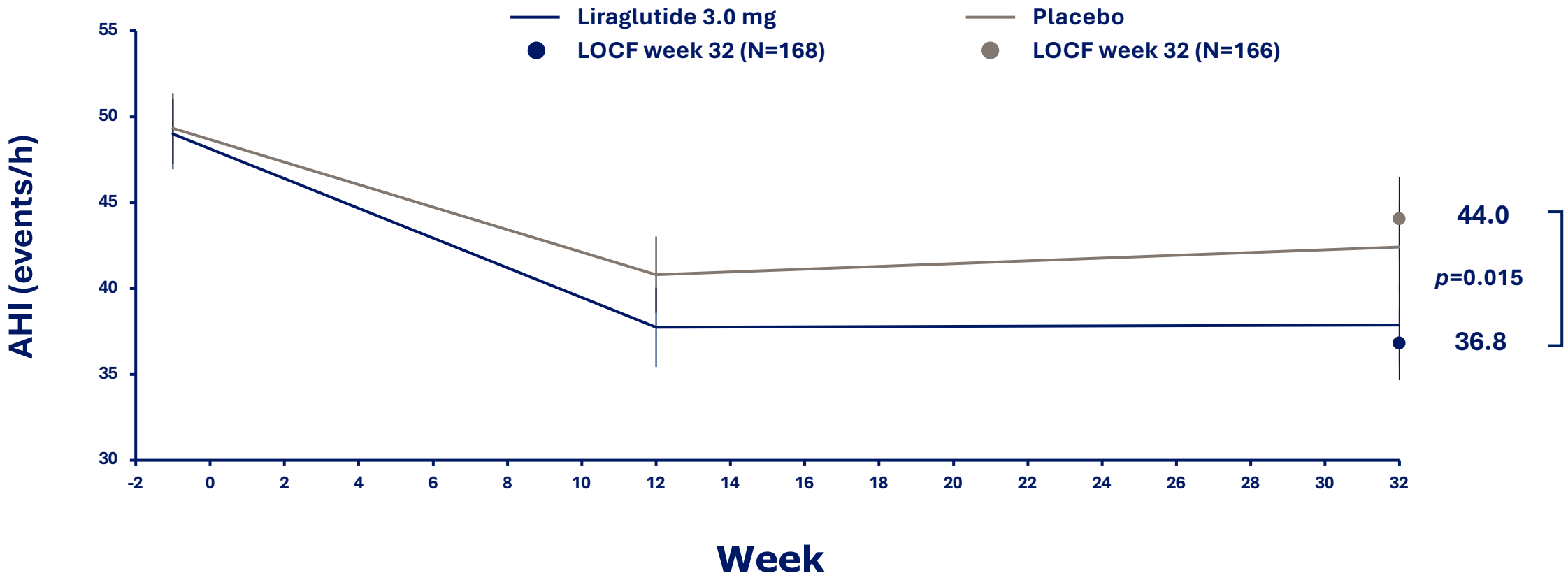
	Liraglutide 3.0 mg N=180		Placebo N=179	
	n	(%)	n	(%)
Completed	134	74.4	142	79.3
Mean AHI (events/h)	49.0		49.3	
Moderate OSA	60	(33.3)	58	(32.4)
Severe OSA	120	(66.7)	121	(67.6)
Mean age (years)	48.6		48.4	
Gender (female %)		(28.3)		(27.9)
Mean body weight (kg)	116.5		118.7	
Mean BMI (kg/m^2)	38.9		39.4	
HbA_{1c} (%)	5.7		5.6	
SBP (mmHg)	125.8		127.1	
Dyslipidaemia	65	(36.1)	55	(30.7)
Hypertension	75	(41.7)	77	(43.0)
Prediabetes	115	(63.9)	112	(62.6)

Blackman et al. Int J Obes (Lond). 2016;40:1310-9

Change in AHI (Events/h)

0–32 Weeks

Mean baseline AHI: 49.2 events/h

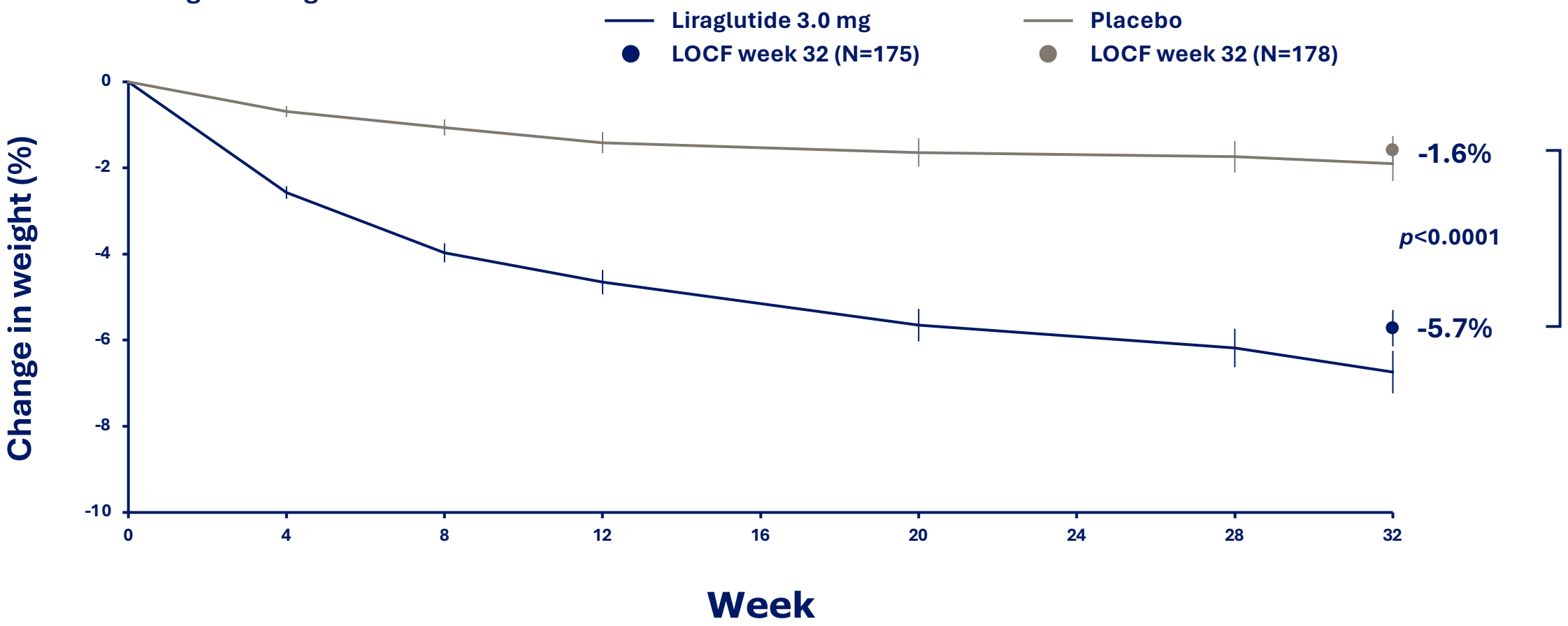


Blackman et al. Int J Obes (Lond). 2016;40:1310-9

Change in Body Weight (%)

0–32 Weeks

Mean baseline weight: 118 kg



Blackman et al. Int J Obes (Lond). 2016;40:1310-9

SCALE Sleep Apnoea

Summary

- Liraglutide 3.0 mg, as an adjunct to diet and exercise, produced significantly greater reductions in AHI and body weight than placebo
- Safety profile was consistent with other trials in the liraglutide 3.0 mg phase 3 programme
    - Gastrointestinal AEs were the most commonly reported AEs; they were mostly mild or moderate in severity and transient
    - SURMOUNT TRIAL UNDERWAY WITH TIRZEPATIDE

Blackman et al. Int J Obes (Lond). 2016;40:1310-9

Bariatric Surgery (Our Case)

- Several studies
- Nastalek et al – 44 patients treated with Bariatric Surgery (31 sleeve gastrectomy, 13 RYGB)
  - Only 16% with normalization of AHI, majority with stabilization or 41% with decrease in severity
- Lettieri et al – 24 patients evaluated with PSG before and 1 year following bariatric surgery
  - Only 1 patient with resolution of OSA (4%) with majority 71% still having moderate to severe disease

General Sleep Tips and Strategies

Sleep Disruption

- **Medications**
  - Caffeine/Energy Drinks
  - Nicotine
  - Alcohol
- **Medical Conditions**
  - Anxiety/Depression
  - Sleep Disorder
  - Menopause
- **Lifestyle**
  - Large meals
  - Vigorous Exercise
- **Environment**
  - Cell Phone
  - TV
  - Computer

Sleep Tips

The Single Most Effective thing you can do to reset your brain and body health is....

GET A GOOD NIGHT SLEEP

Sleep Tips

- Regular Wake Time and Bed Time
- Keep your bedroom cool
- Keep your bedroom dark
- Keep your bedroom quiet
- Keep media and technology out of the bedroom
- Make the bedroom a haven
- Avoid alcohol, nicotine, caffeine (stop by 2pm or earlier)
- Get out of bed, go to another room, do something relaxing until you are sleepy and then GO BACK TO BED (not couch!)

Sleep Hacks

- Before you can hack, track!
  - Consider using your phone, wearable, etc to monitor your sleep duration over a period of time
  - Light control – try to limit light close to bedtime especially light within the blue spectrum
    - F-lux – for electronic devices
    - “NightShift” mode for Iphone
    - Light bulbs without blue light

CME Question 1

- A 42 year old patient with BMI of 36 is diagnosed with Severe Obstructive Sleep Apnea with an AHI of 52. You advised CPAP therapy and also recommend initiating a GLP-1 to help with weight loss. You counsel the patient that a 10% reduction in weight is expected to correlate with an AHI reduction of:
- A: 15%
- B: 26%
- C: 30%
- D: 36%

Sleep Well!