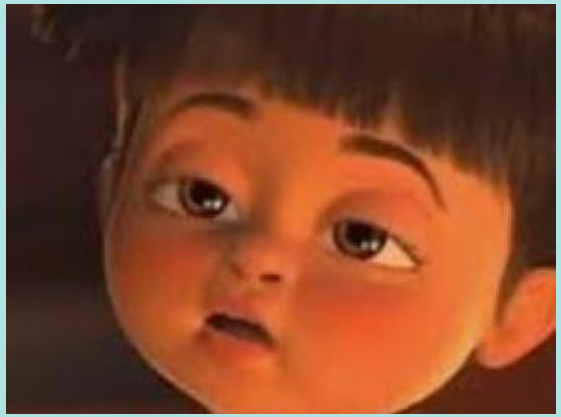
Brigham and Women's Hospital
Founding Member, Mass General Brigham

Selecting the Right Therapy for Obstructive Sleep Apnea.



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HARVARD MEDICAL SCHOOL
TEACHING HOSPITAL

CONTINUING MEDICAL EDUCATION
DEPARTMENT OF MEDICINE

- Conflict of Interest: None
- Disclosures-None

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- All India Institute of Medical Sciences, India
- Medicine Residency at Upstate Medical University, Syracuse, NY
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- Sleep Medicine Fellowship at Henry Ford Hospital, Detroit, MI
- Assistant Professor of Medicine at HMS
- Clinical and Research focus: Obstructive Sleep Apnea

Risk Factors

PAP therapy

Other treatments

Conclusion

Learning Objectives

Upon completion of this activity, participants will be able to:

- Recognize the less well-known risk factor for OSA


- Identify the factors that can compromise the adherence to PAP therapy


- Describe the alternative therapies of sleep apnea

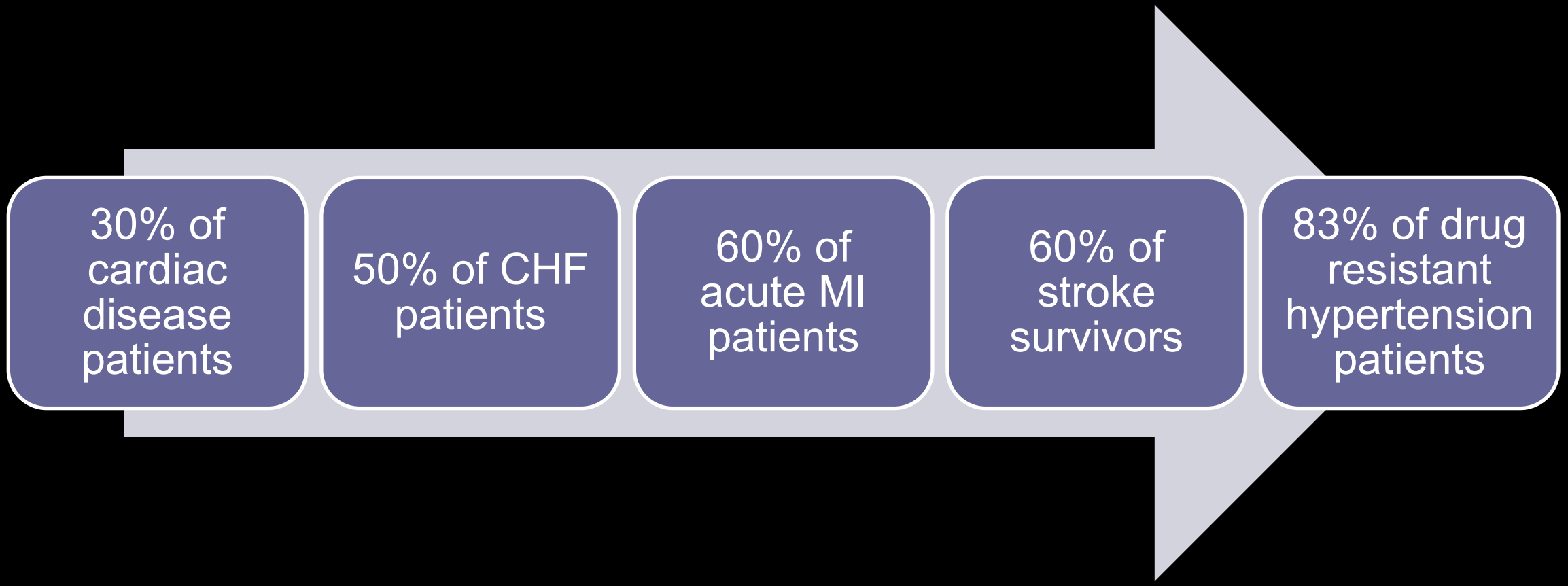

- Discuss the other factors that can worsen the quality of sleep


Prevalence of OSA: Adults 30–70 years of age

Severity of OSA	Prevalence (%)
None (AHI <5)	67.3
Mild (AHI 5–14)	21.4
Moderate to Severe (AHI≥15)	11.3

Peppard, Paul, et al. "Increased prevalence of SDB in adults." Am journal of epidemiology 177.9 (2013): 1006-1014.

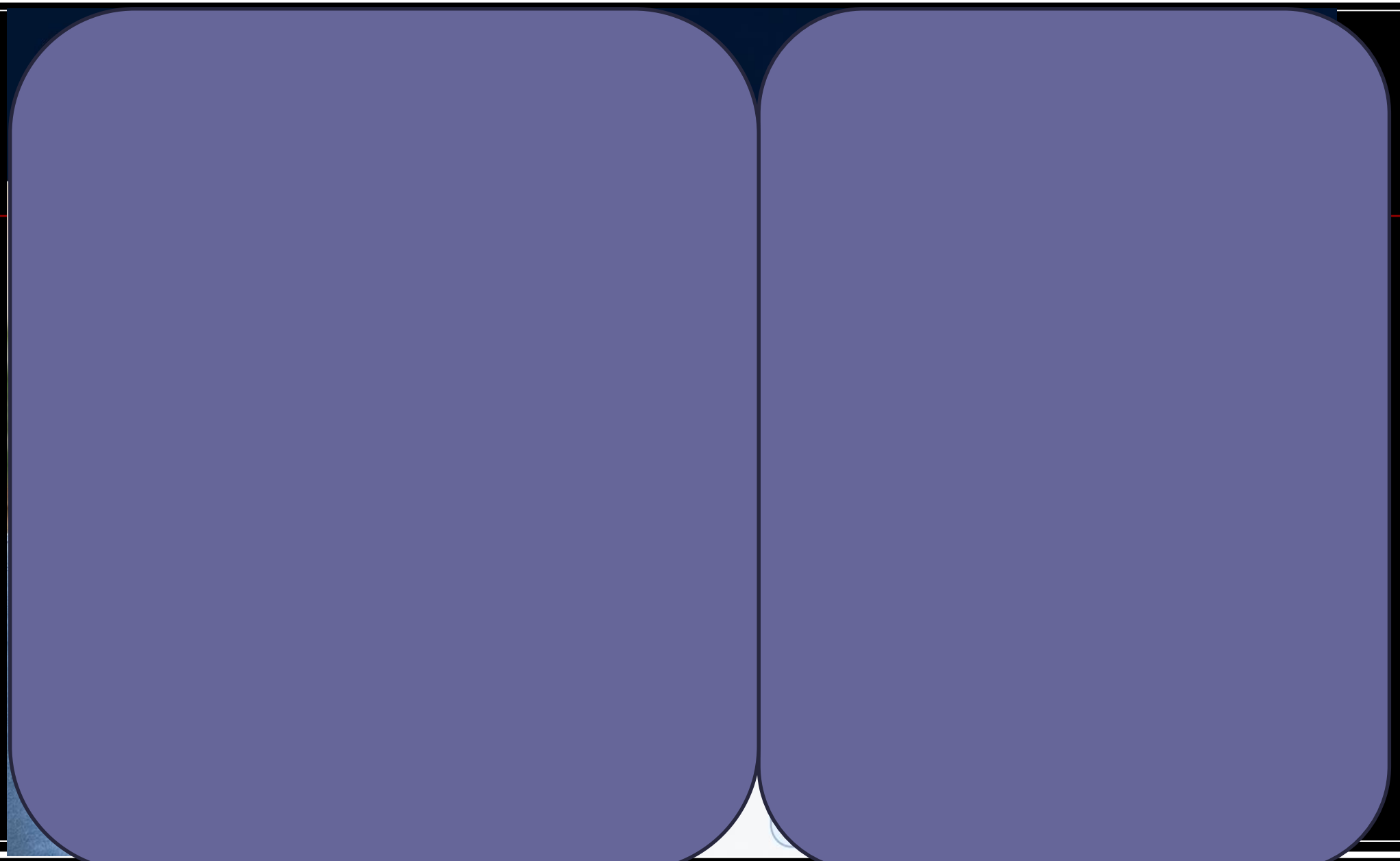
Prevalence of Significant SDB in Cardiovascular Disease



Obesity and OSA

- 10% weight gain: 32% increase in AHI
- 10% weight loss: 26% decrease in AHI
- 20-40% are not obese

Peppard et al, “Longitudinal study of moderate weight change and SDB” JAMA, 284 (23)



What would you recommend as initial therapy?

A. CPAP

B. Mandibular advancement device

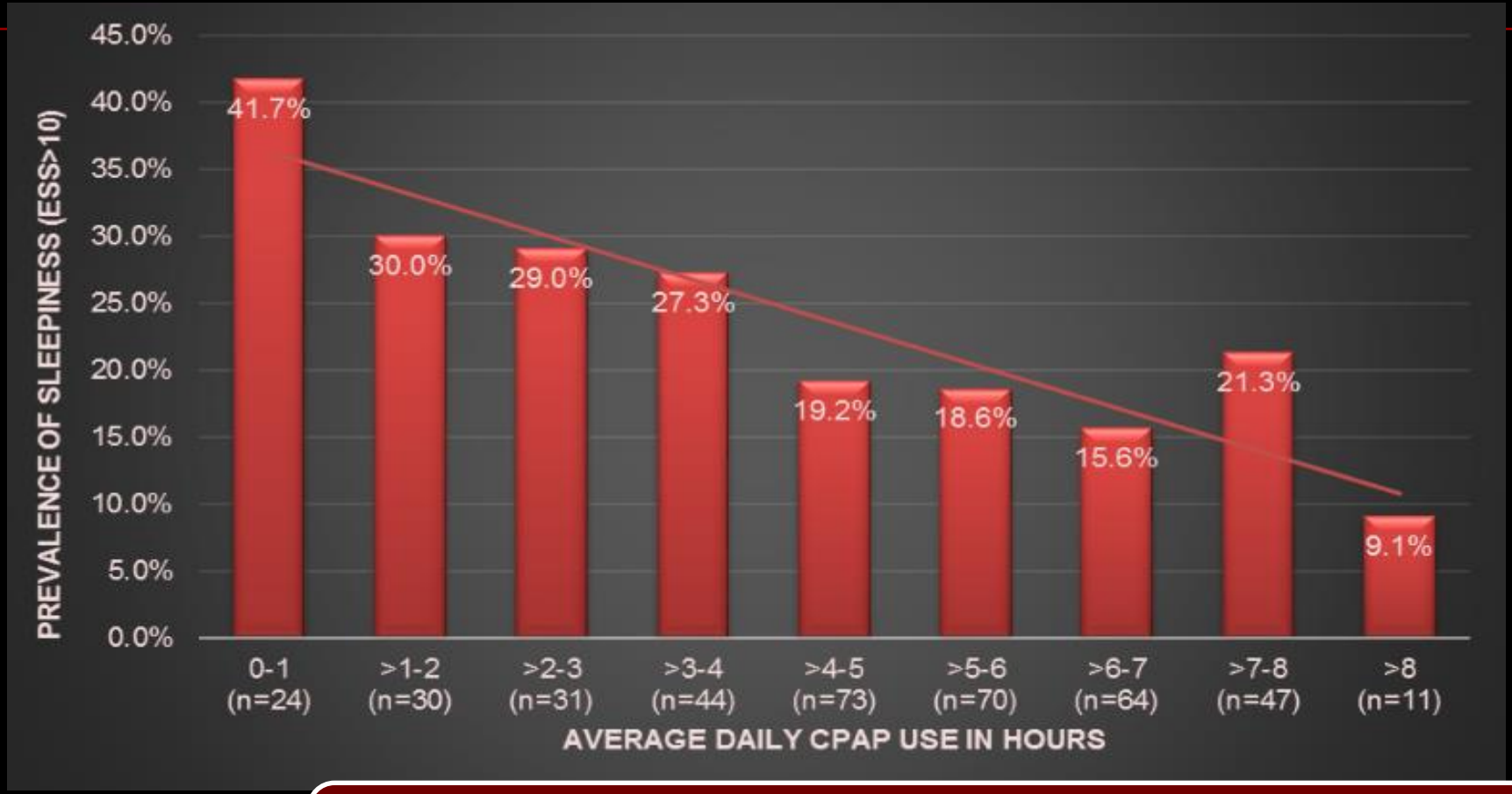
C. Hypoglossal nerve stimulation

D. GLP-1 therapy

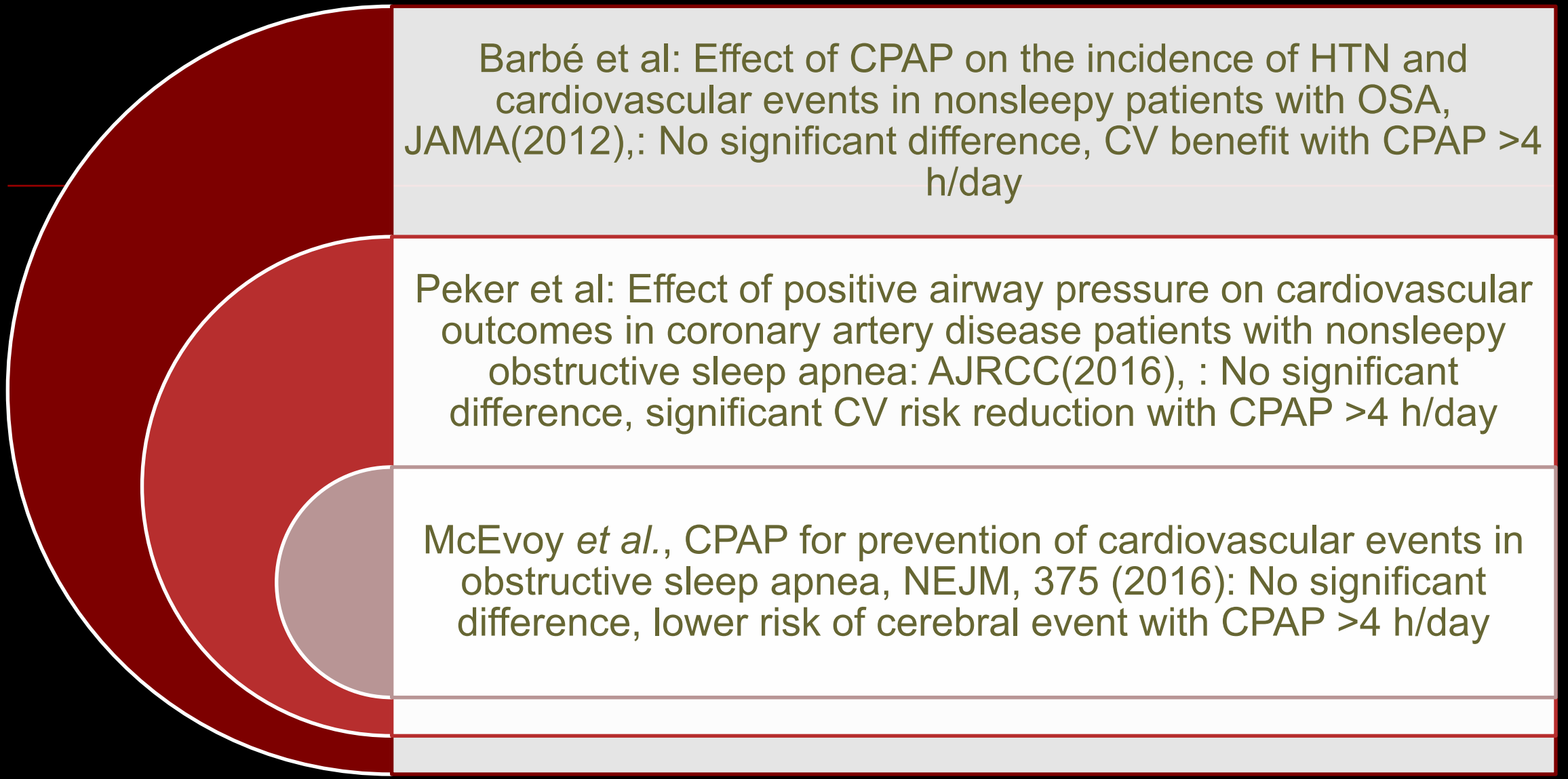
E. Positional therapy

A new guest in the bedroom…

Improvement in Sleepiness with CPAP



Budhiraja, Rohit, et al. "Predictors of sleepiness in obstructive sleep apnoea." *European Respiratory Journal* 50.5 (2017): 1700348.



Javaheri, Shahrokh, et al. "Sleep apnea: types, mechanisms, and clinical cardiovascular consequences." *Journal of the American College of Cardiology* 69.7 (2017): 841-858.

Effect of CPAP on CV outcomes

Adherence Analysis

Patients who used CPAP for ≥4 h/night did achieve significant cardiovascular benefits with an incidence density ratio 0.72 [0.52-0.98; p = 0.04]

Javaheri, Shahrokh, et al. "Sleep apnea: types, mechanisms, and clinical cardiovascular consequences." *Journal of the American College of Cardiology* 69.7 (2017): 841-858.

Case Update: Despite Nightly CPAP Use...

Persistent Symptoms and Impact

Clinical Update

After several months of consistent CPAP use,
the patient reports no meaningful improvement.

Persistent Symptoms

- Excessive daytime sleepiness
- Profound fatigue
- Brain fog / Poor concentration
- Non-restorative sleep
- Low energy and motivation

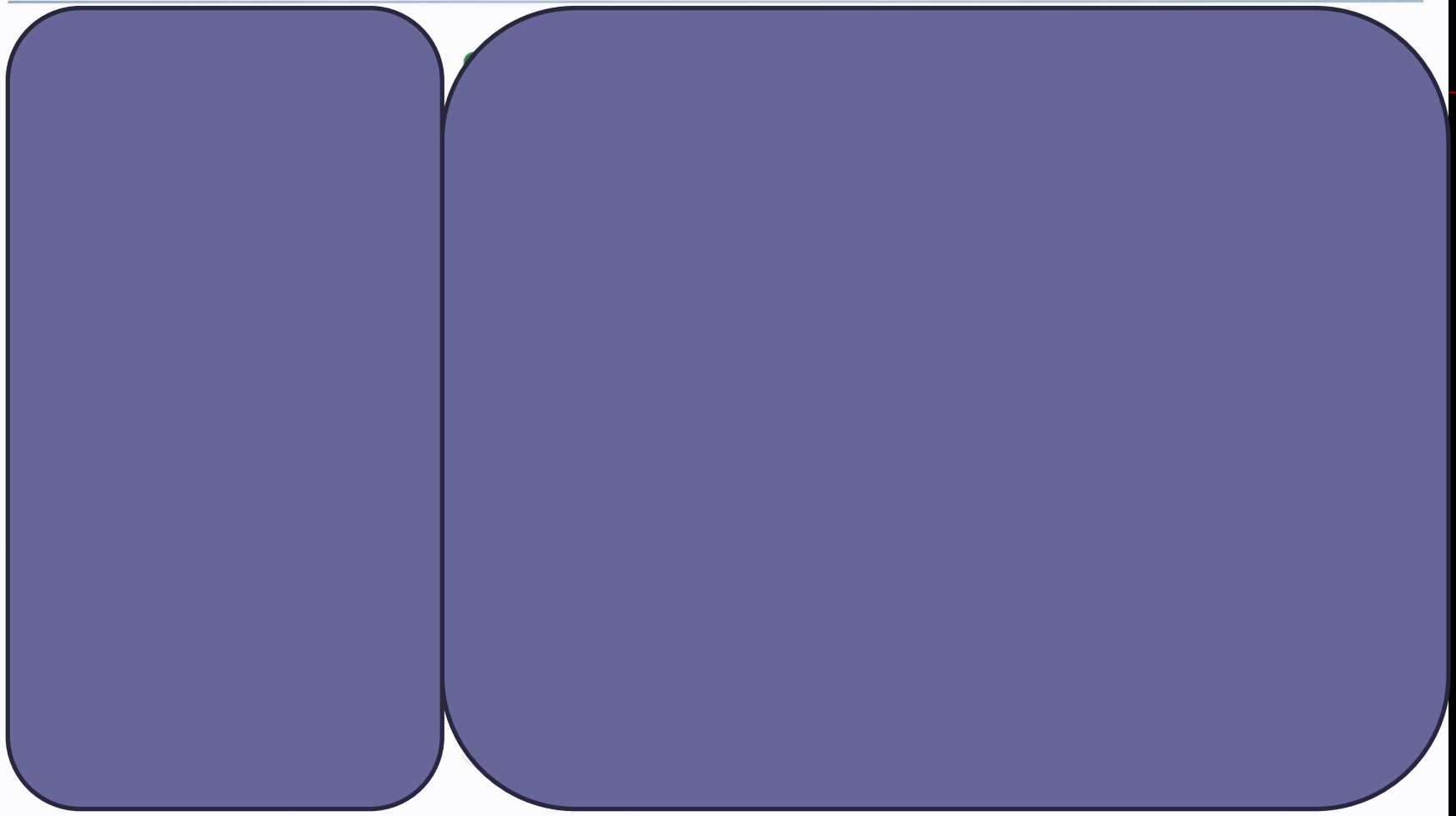
Impact on Daily Life

- Difficulty staying alert at work and during meetings
- Forgetfulness and difficulty with multitasking
- Avoids driving long distances
- Affecting productivity and quality of life

> “I use the CPAP every night, but I still feel exhausted and foggy during the day.”

CPAP Therapy: Objective Data

3-Month CPAP Download Summary

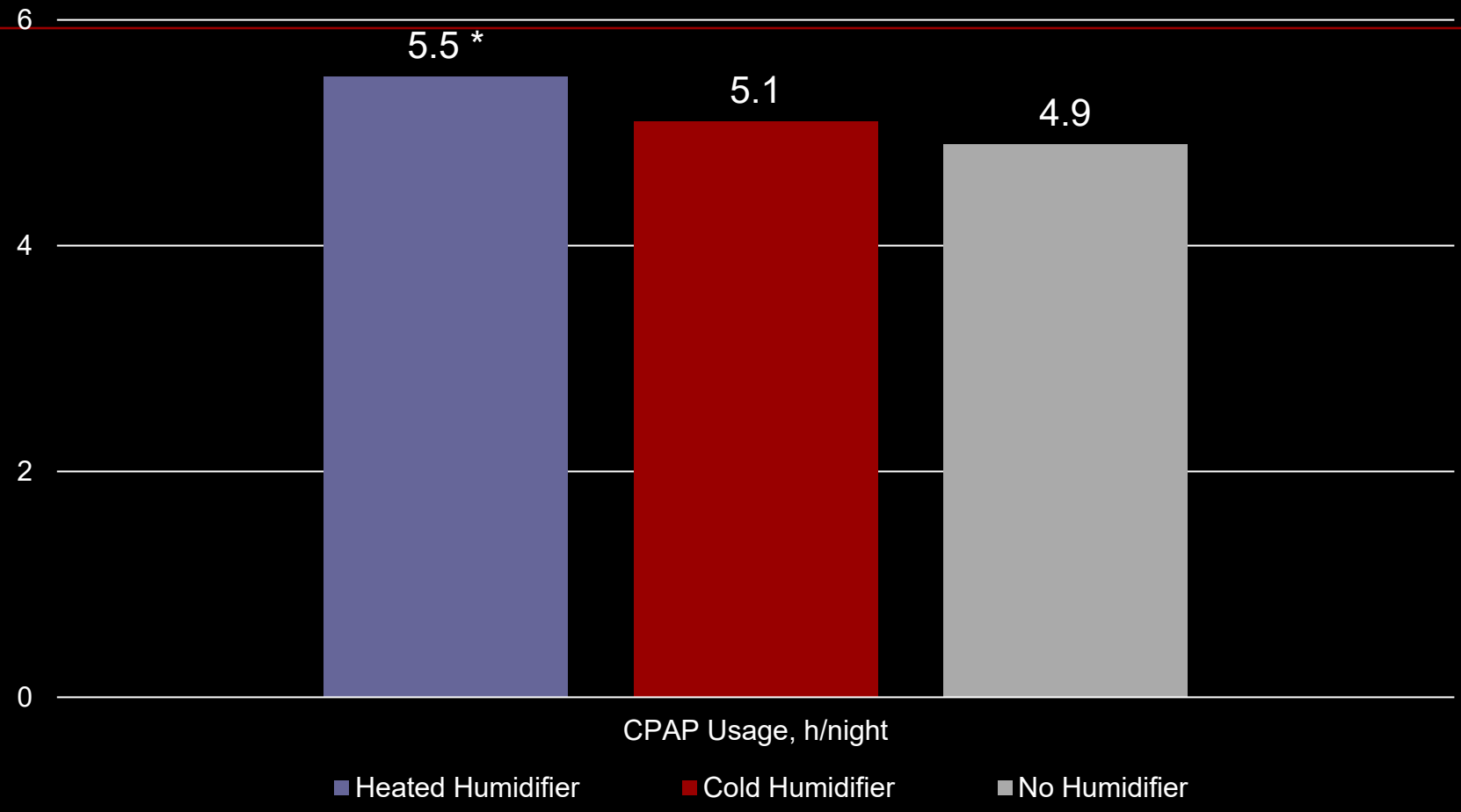


Full Face Mask
(versus Nasal Mask)

- Higher Leak
- Mean Pressures
- Residual AHI

“My nose is so congested/ dry since I started using CPAP”

Heated Humidification and CPAP use



Massie, Clifford A., et al. "Effects of humidification on nasal symptoms and compliance in sleep apnea patients using continuous positive airway pressure." *Chest* 116.2 (1999): 403-408.

- Steroid/ anticholinergic/ anti-allergy nasal spray
- Anti-allergic drugs
- Nasal Saline Irrigation
- Full face or hybrid masks

“My mouth feels like cotton balls in the morning”


CAFFEINE
PILLS
COFFEE
ENERGY
SODA
CAFFEINE


ALLERGY
MEDICINE


AIR-O-SWISS

Aerophagia

Swallowing of air with CPAP use.

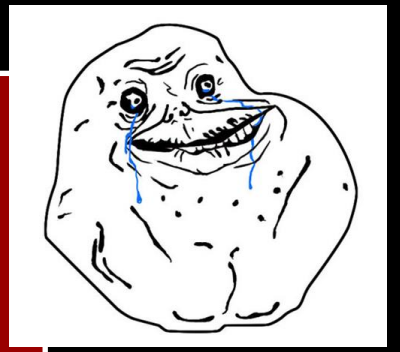
More common in those with GERD

Bloating

Gastric distension

Flatulence

Belching,
Stomach Ache



Treat GERD

Add incline while sleeping

Dietary advice: avoid chewing gum and carbonated drinks

Simethicone/
Activated Charcoal tablets

Consider decreasing pressure or APAP

Factors Associated with Adherence at 6-Months

Variable	T	P
Age	3.6	<0.001
AHI	2.2	0.03
Anxiety	-2.2	0.02
Decrease in ESS Scores	3.11	0.002

R Budhiraja, et al. CPAP Adherence in Obstructive Sleep Apnea, *Journal of Clinical Sleep Medicine, Vol. 12, No. 3, 2016*

Claustrophobia/ Anxiety

- Nasal Masks (compared to full face mask)
- Wear the CPAP while awake
- Relaxation techniques
- Cognitive behavior therapy
- Anxiety medications

"Take it off without knowing it"

Mask leak, Persistent sleep apnea, Too high or too low a pressure

Nose congestion

What else do you got?

Which therapy would you recommend?

A. Oral appliance

B. Inspire

C. GLP-1

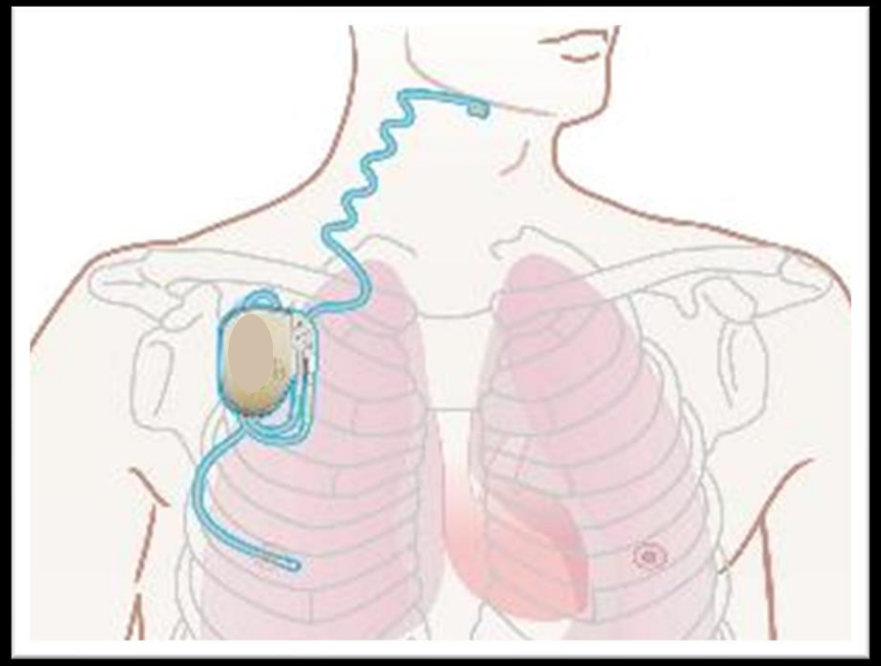
D. UPPP

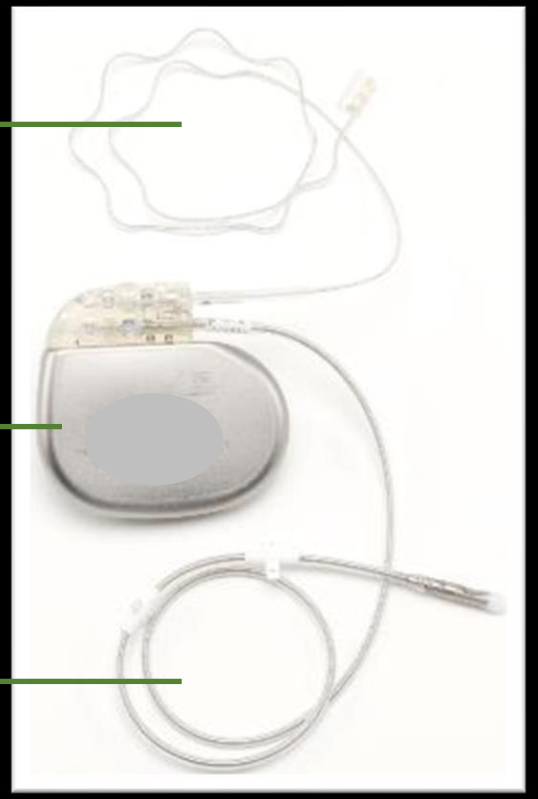
E. Positional therapy

PATIENT:

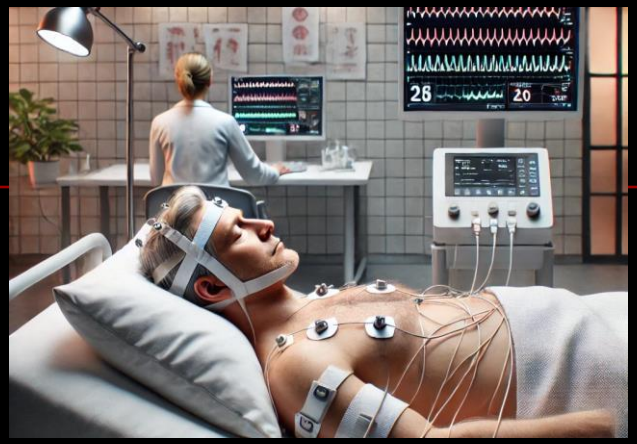
- Severe OSA
- CPAP intolerance
- TMJ disease
- BMI 31

Hypoglossal Nerve Stimulation





AHI



BMI

CPAP

DISE

HNS Therapeutic Outcome (The Resolution)

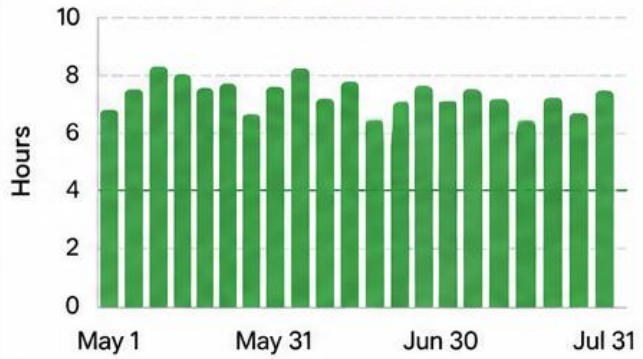
6-Month HNS Outcomes

1. THERAPY ADHERENCE

Excellent, consistent nightly use

6.8
hours/night

Nightly Usage (Hours)



2. RESIDUAL AHI

Down from a baseline of 48

6.2
events/hour

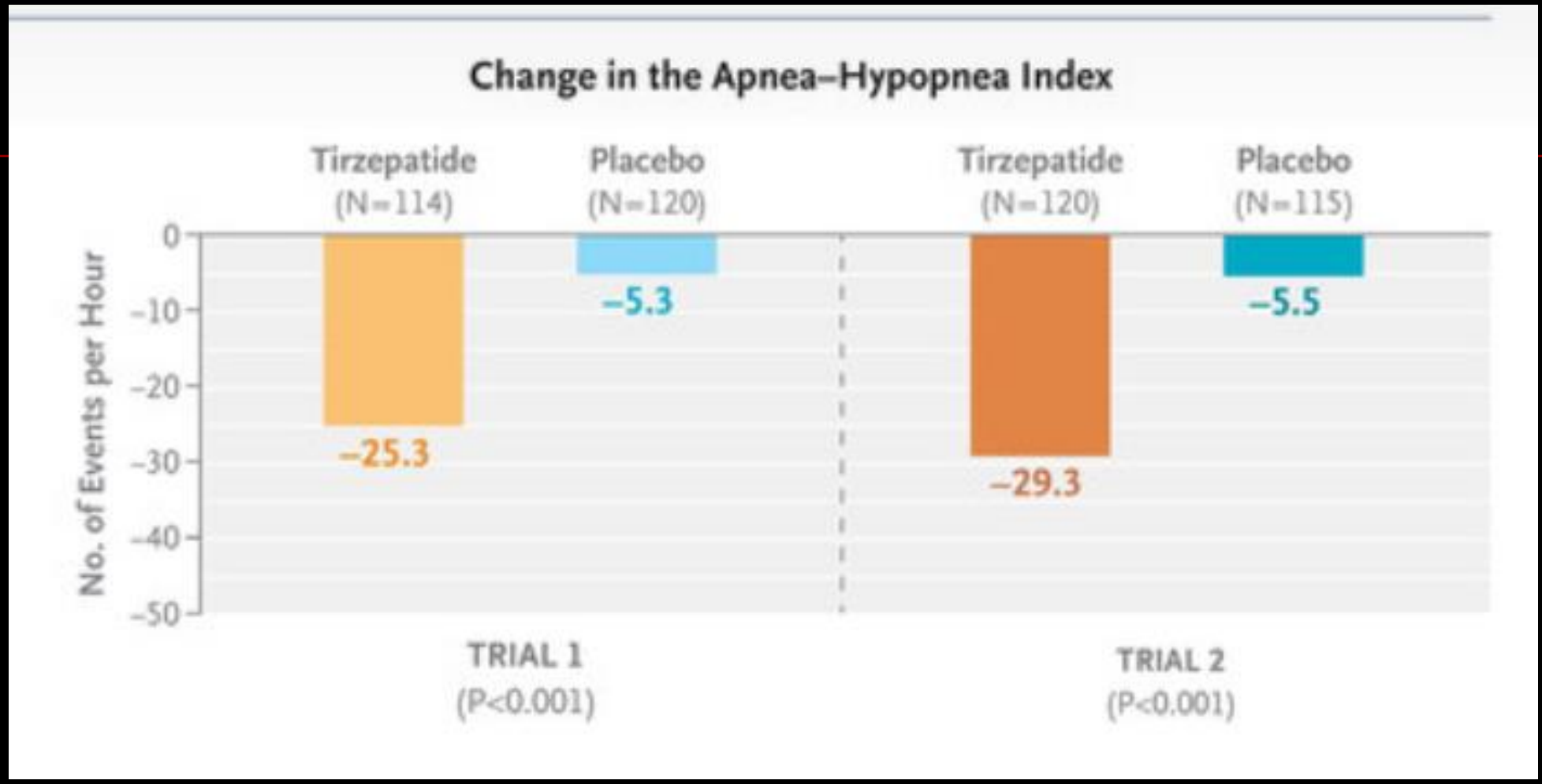
AHI Comparison

Patient reports: Restored energy, clear thinking, and improved quality of life. No bed-partner complaints. Sleeping through the night.

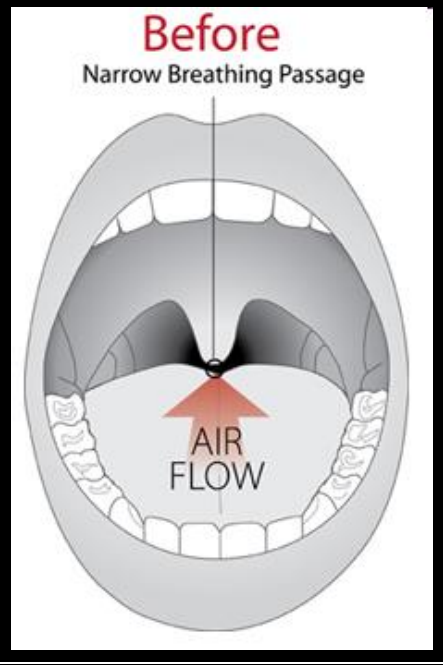
GLP-1 Agonists

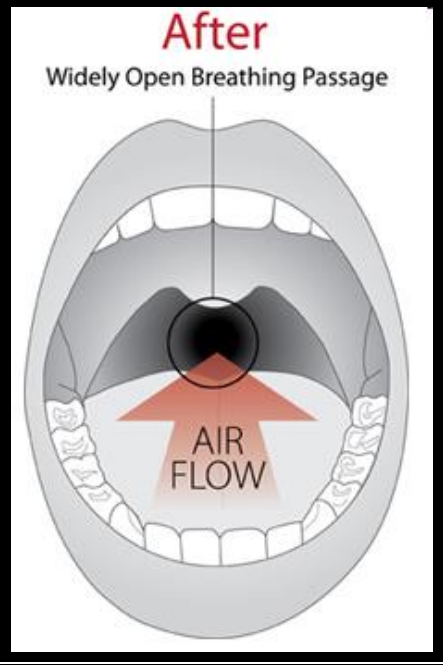
Weight Loss: Glucagon-like peptide-1 receptor agonists (GLP-1 RAs) promote weight loss by reducing appetite and caloric intake, leading to significant reductions in body weight.

Upper Airway Function: Weight loss can decrease fat deposition around the upper airway, reducing its collapsibility during sleep and thereby mitigating OSA severity.


Change in the Apnea–Hypopnea Index
Tirzepatide
(N=114)
Placebo
(N=120)
Tirzepatide
(N=120)
Placebo
(N=115)
No. of Events per Hour
0
−10
−20
−30
−40
−50
−25.3
−5.3
−29.3
−5.5
TRIAL 1
(P<0.001)
TRIAL 2
(P<0.001)

Surgery





Didgeridoo

HNS Therapeutic Outcome (The Resolution)

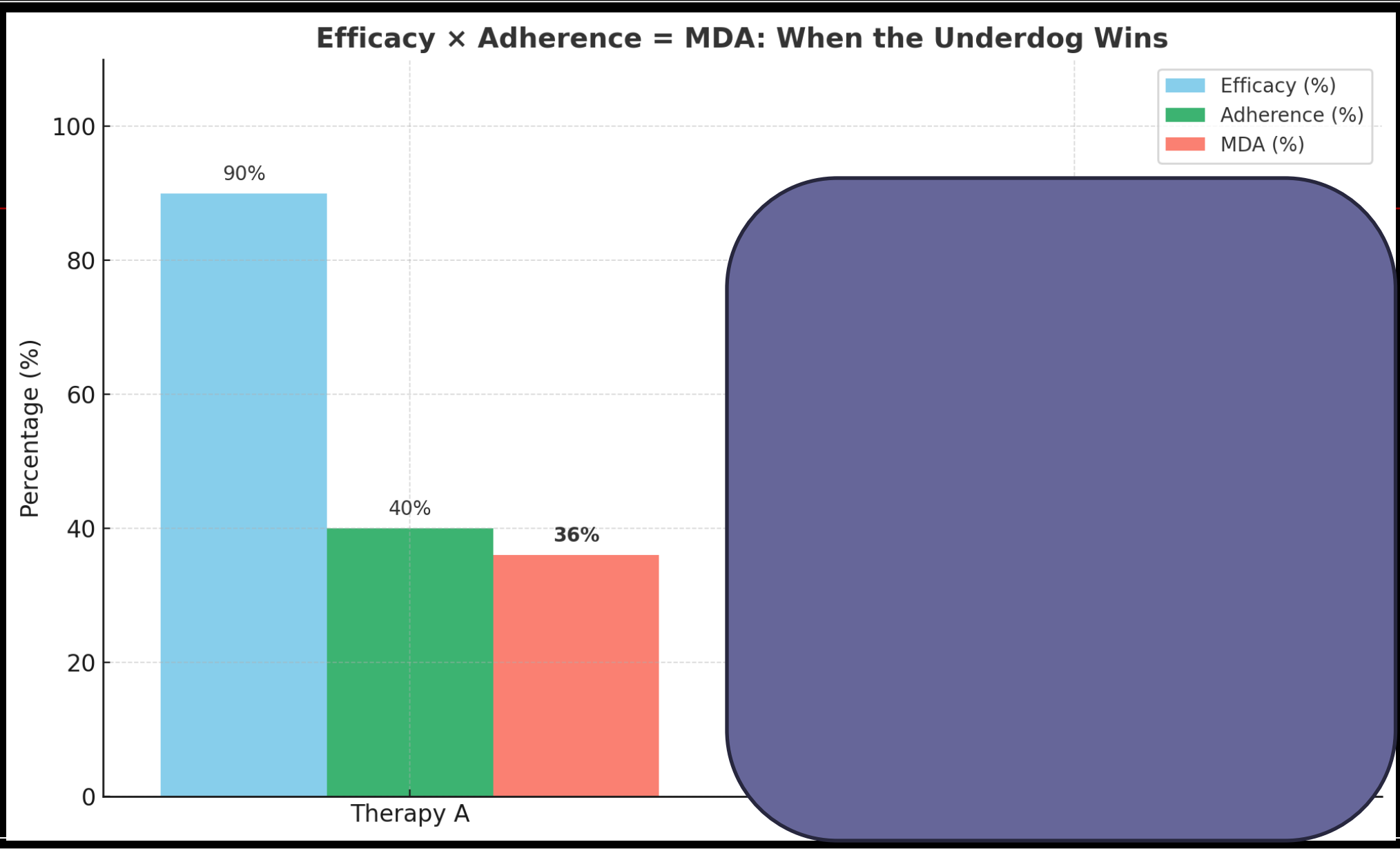
6-Month HNS Outcomes

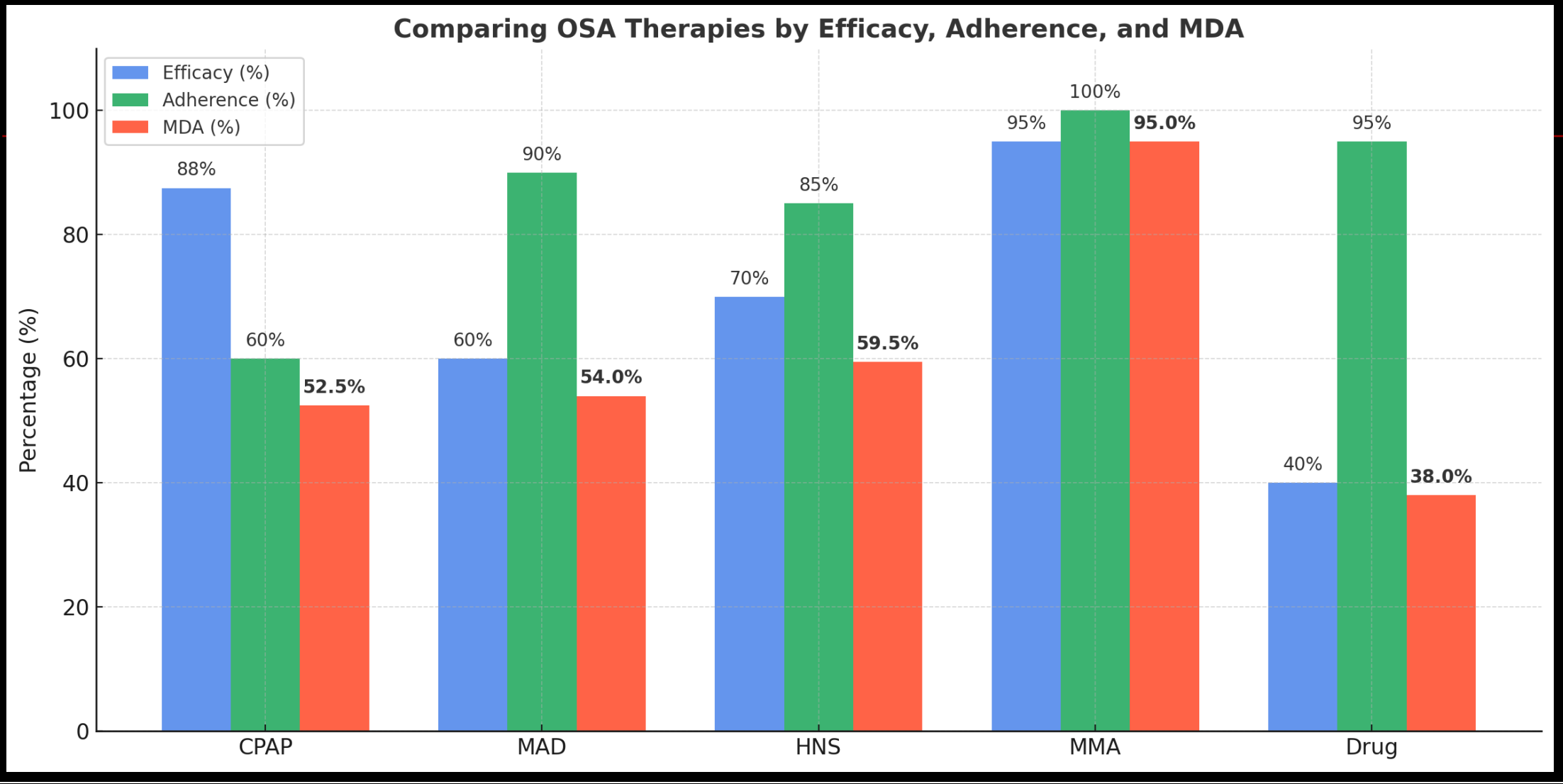
2. RESIDUAL AHI

Down from a baseline of 48

6.2
events/hour

Mean Disease Alleviation (MDA)


Efficacy × Adherence = MDA: When the Underdog Wins
Efficacy (%)
Adherence (%)
MDA (%)
Percentage (%)
100
80
60
40
20
0
90%
40%
36%
Therapy A


Comparing OSA Therapies by Efficacy, Adherence, and MDA
Efficacy (%)
Adherence (%)
MDA (%)
Percentage (%)
0
20
40
60
80
100
88%
60%
52.5%
60%
90%
54.0%
70%
85%
59.5%
95%
100%
95.0%
40%
95%
38.0%
CPAP
MAD
HNS
MMA
Drug

Key clinical trials support effective alternative pathways to CPAP when matched to the right patient.

ORAL APPLIANCES (MAD)

Effective for many. Simple. Well-tolerated.

Phillips et al., 2013 (AJRCCM) CPAP vs MAD

- MAD is non-inferior to CPAP for blood pressure reduction.
- Moderate-to-severe OSA patients

Sutherland et al., 2014 (Sleep) CPAP vs MAD (MDA)

- Similar Target Disease Alleviation (MDA) despite lower MAD efficacy.
- OSA patients (MDA-specific focus)

Gagnadoux et al., 2014 (Sleep Med) CPAP vs MAD

- Comparable improvements in sleepiness and overall quality of life.
- OSA patients, clinical endpoints focus

Good option for patients who prefer non-PAP therapy.

NEUROSTIMULATION (HNS)

For selected CPAP-intolerant patients.

STAR Trial (Strollo '14, NEJM) CPAP vs HNS

- HNS reduced AHI by 68% and significantly improved patient QoL.
- CPAP-intolerant, AHI 15–65, BMI <32

ADHERE Registry (Thaler '20) CPAP vs HNS

- Demonstrated sustained improvements in both AHI and ESS scores.
- >1,000 real-world HNS-implanted patients

Van de Heyning et al., 2023 (Sleep) CPAP vs HNS

- Sustained durable adherence and robust clinical outcomes over 1 year.
- Long-term follow-up cohort from STAR trial

Powerful option for the right patient.

SURGICAL & PHARMACOLOGICAL

Important tools in the right patient.

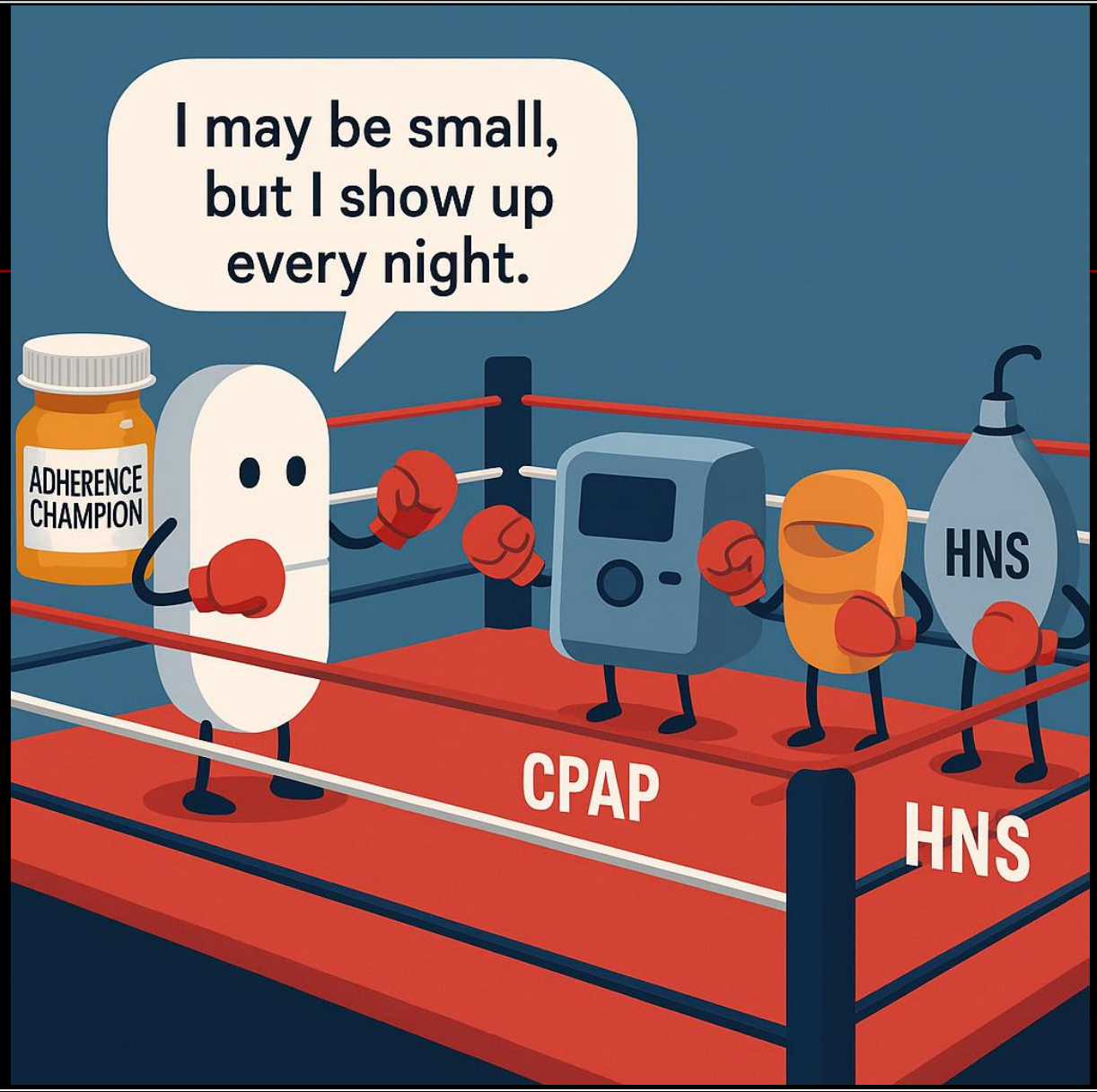
Weaver et al., 2019 (JAMA) CPAP vs BARIATRIC

- Bariatric surgery achieved significantly greater OSA remission rates.
- Obese OSA patients

Blackman et al., 2016 (SCALE Sleep Apnea Trial) CPAP vs GLP-1

- Liraglutide group showed major weight reduction and improved AHI.
- Obese with poor baseline CPAP adherence

Consider for obesity-related OSA or when other therapies are not suitable.


I may be small, but I show up every night.
ADHERENCE CHAMPION
CPAP
HNS
HNS

J Clin Sleep Med. 2025 Feb 7. doi: 10.5664/jcsm.11592. Online ahead of print.

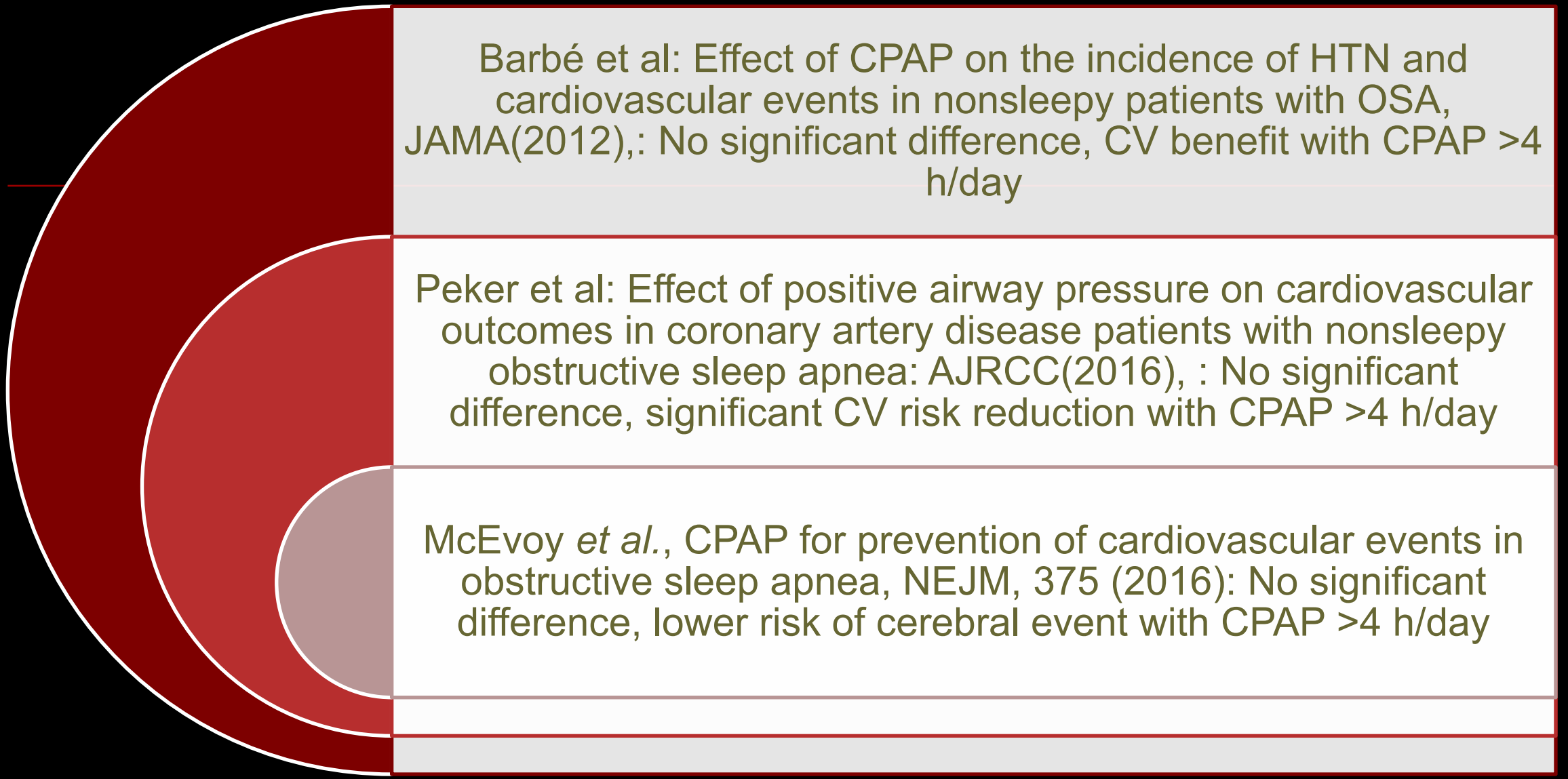
Mean disease alleviation as a comprehensive metric for evaluating continuous positive airway pressure therapy in obstructive sleep apnea: establishing reference values and clinical significance

Rohit Budhiraja [1], Salma Batool-Anwar [1], Stuart F Quan [1 2]

Table 6: Odds of Epworth Sleepiness Scale (ESS >10) with Different MDA Thresholds

MDA Threshold (%)	Wald	Odds Ratio (95% CI)	p-value
MDA ≥ 25%	6.207	0.440 (0.231–0.839)	0.013*
MDA ≥ 30%	5.279	0.490 (0.267–0.901)	0.022*
MDA > 35%	4.692	0.524 (0.291–0.940)	0.030*
MDA ≥ 40%	10.335	0.400 (0.228–0.699)	0.001*
MDA ≥ 45%	8.055	0.456 (0.265–0.784)	0.005*
MDA ≥ 50%	4.735	0.550 (0.321–0.942)	0.030*

BMI: body mass index; **ESS:** Epworth Sleepiness Scale; **HAMD:** Hamilton Rating Scale for Depression. *p < 0.05.



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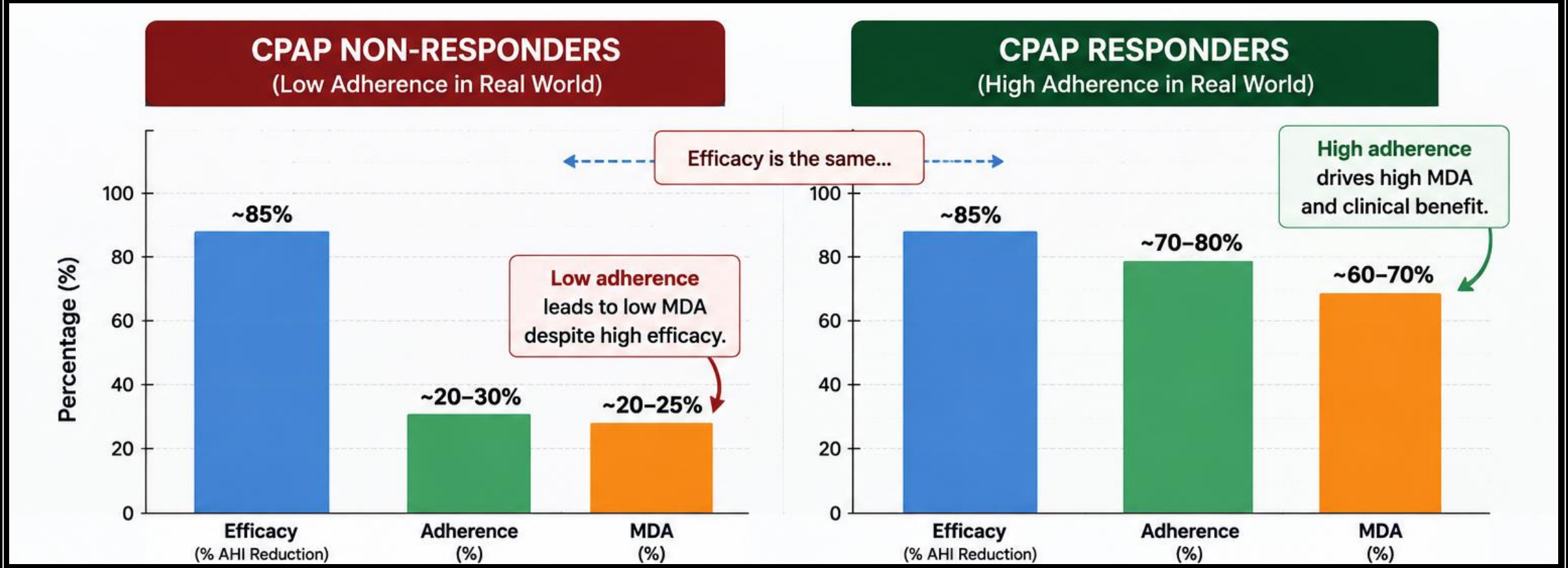
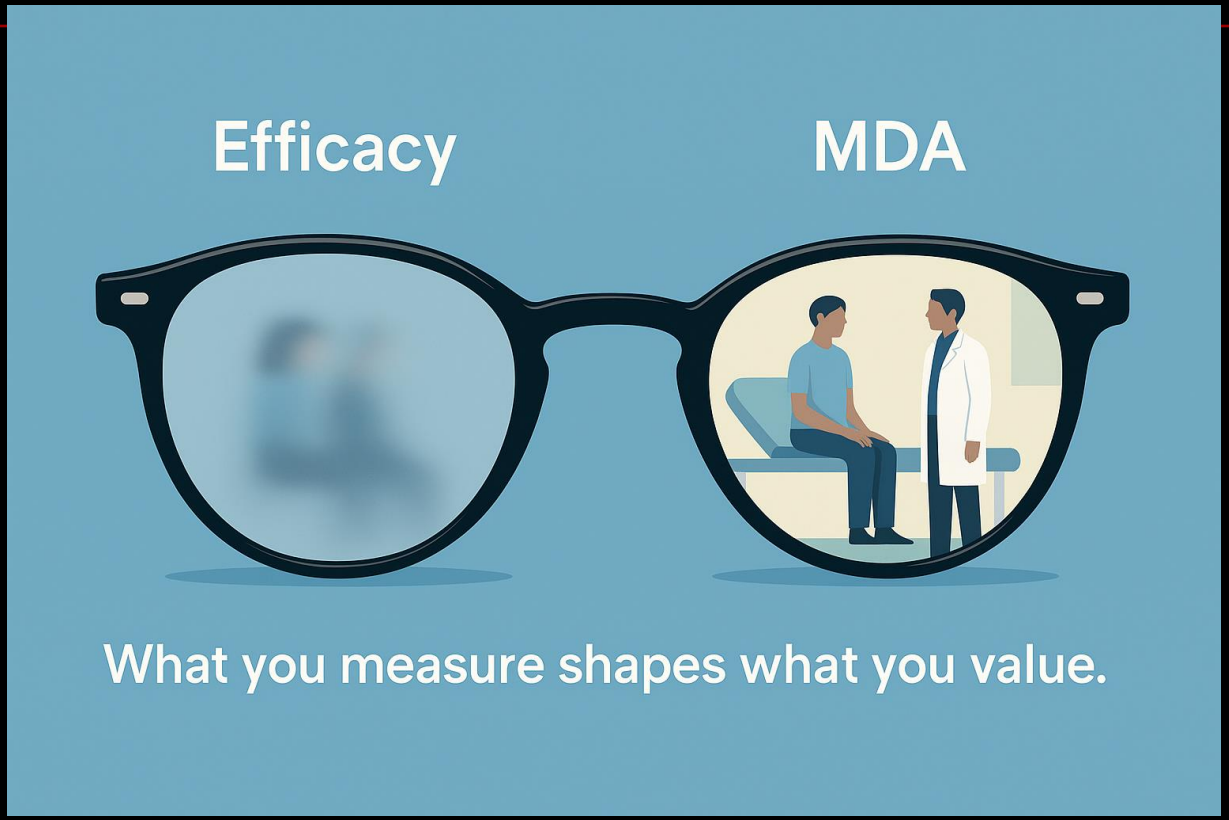
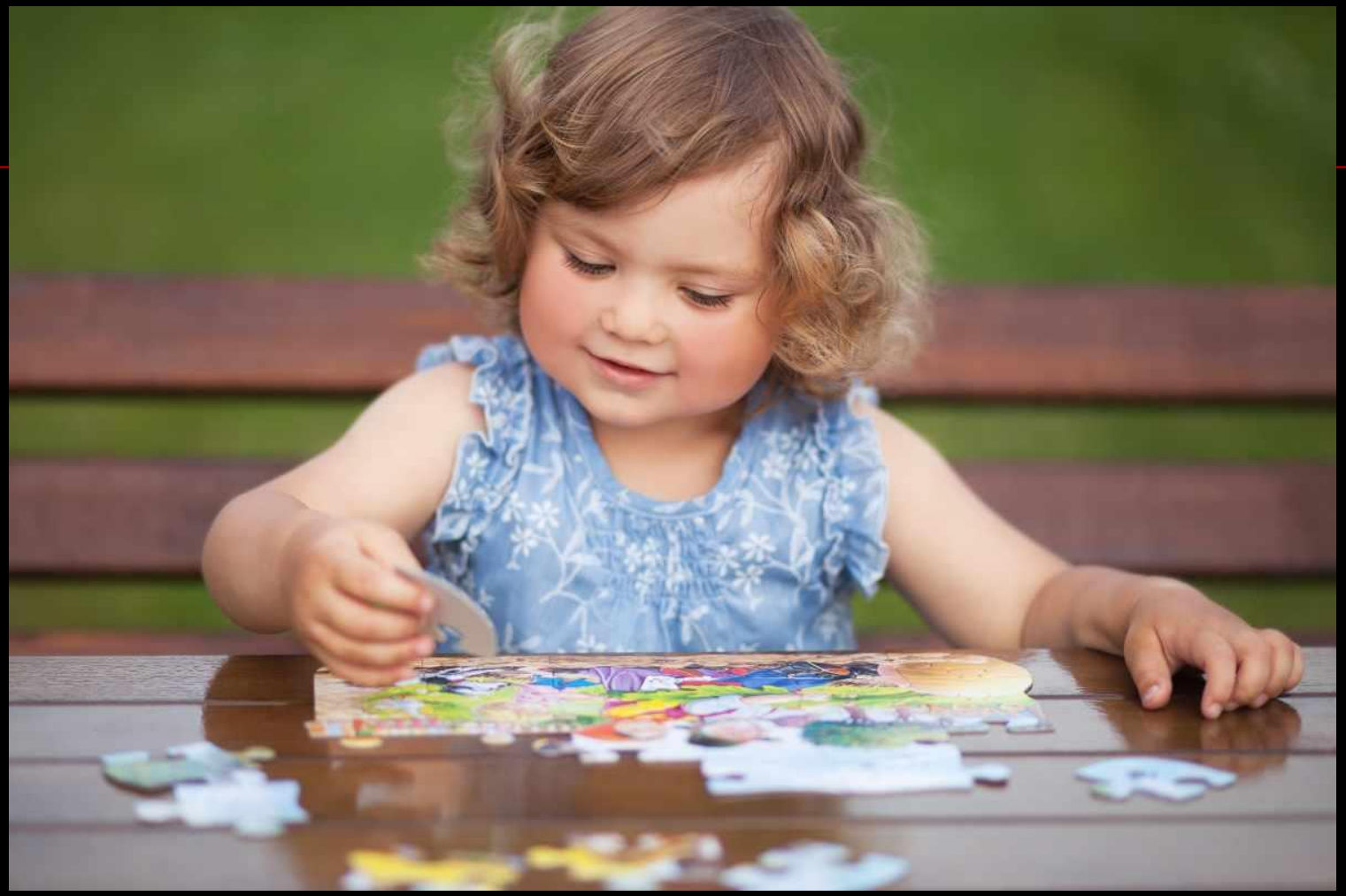

CPAP NON-RESPONDERS
(Low Adherence in Real World)
CPAP RESPONDERS
(High Adherence in Real World)
Efficacy is the same...
Low adherence
leads to low MDA
despite high efficacy.
High adherence
drives high MDA
and clinical benefit.
Percentage (%)
100
80
60
40
20
0
~85%
~20–30%
~20–25%
~85%
~70–80%
~60–70%
Efficacy
(% AHI Reduction)
Adherence
(%)
MDA
(%)
Efficacy
(% AHI Reduction)
Adherence
(%)
MDA
(%)

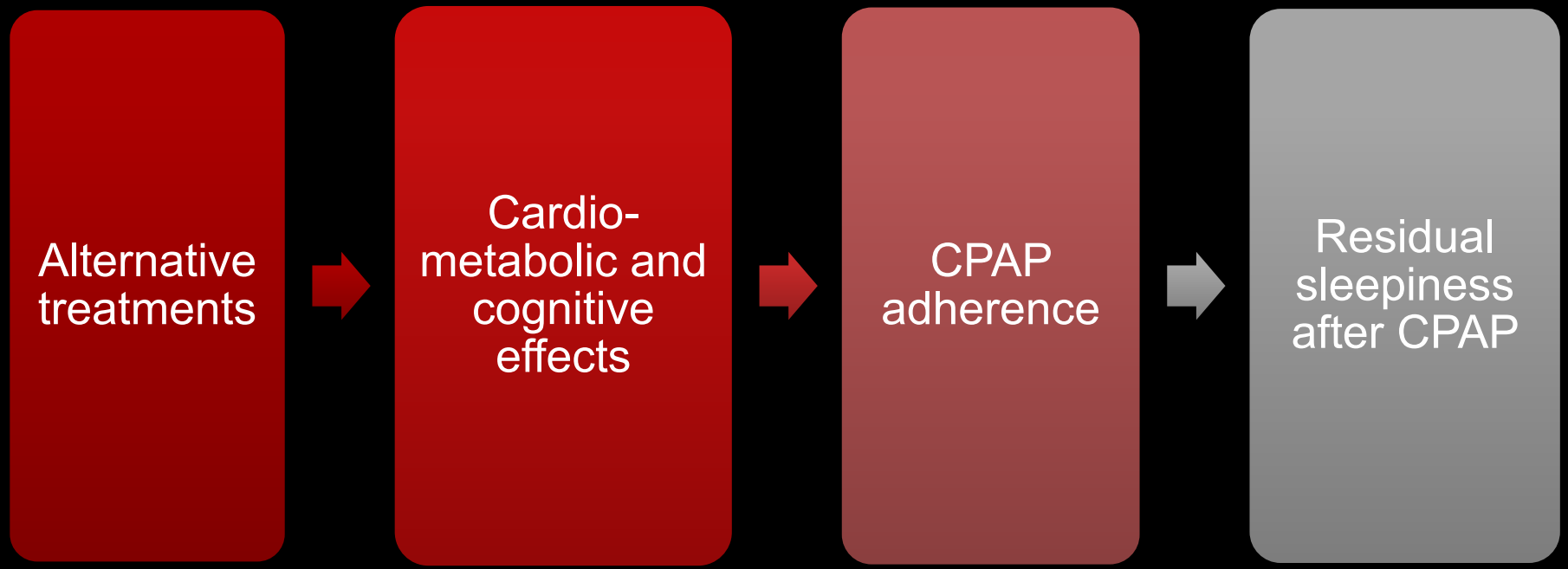

Efficacy
MDA
What you measure shapes what you value.


Severity
Hypoxia Burden
Adherence History
Convenience
Lifestyle Fit
Cost & Coverage
CPAP
HNS
SURGERY
Pharmacotherapy
COMING SOON


N
E
S
W
A



Gaps in OSA Knowledge



Big Data and AI

- Voluminous databases with numerous datapoints
- Allow exploration of the effects of individual differences and complex interactions
- Facilitate identification and management of individuals according to their unique characteristics
- “Personalizing” medicine or pursuing “Precision” medicine

Budhiraja et al Sleep medicine clinics 11 (2), 241-255

Big Data Sources

Electronic health records (EHR)

Mobile phones, wearable health devices

Large clinical trials

OSA TREATMENT: 2010 vs 2035

From One-Size-Fits-All to Personalized Care

ONE SIZE FITS MOST

Limited Options
Variable Results

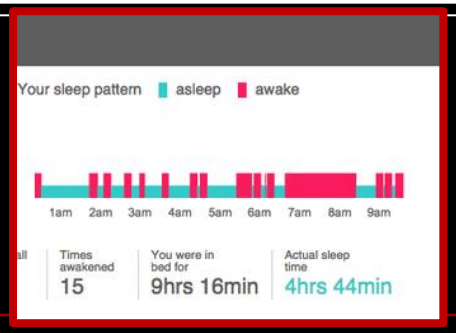
2010		vs.		2035
CPAP for almost everyone		APPROACH		Personalized therapy
Trial and error		STRATEGY		Predicted response
Therapy switching		TREATMENT SELECTION		Right therapy, right patient, right time
Sleep study		DATA		Sleep study + AI + wearables
AHI-driven		OUTCOME FOCUS		Symptom, quality of life & long-term health

THE RIGHT TREATMENT FOR YOU

Data-Driven
Personalized
Better Outcomes

Better match → Better adherence → Better outcomes

Transforming the future of sleep medicine


Your sleep pattern
asleep
awake
1am 2am 3am 4am 5am 6am 7am 8am 9am
Times awakened
15
You were in bed for
9hrs 16min
Actual sleep time
4hrs 44min

MOC TAKE HOME SUMMARY

Risk Factors for OSA

Monitor and Improve CPAP Adherence

Other treatments MAD, HNS, GLP-1, Medications, Positional Therapy

MDA

References

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- Budhiraja, Rohit, and Stuart F. Quan"Sleep-disordered breathing and cardiovascular disorders." Respiratory care 55.10 (2010): 1322
- Javaheri, Shahrokh, et al. "Sleep apnea: types, mechanisms, and clinical cardiovascular consequences." JACC 69.7 (2017): 841-858.
- Strollo Jr, Patrick J., et al. "Upper-airway stimulation for OSA." NEJM 370.2 (2014): 139-149.
- Budhiraja, Rohit, et al. "Predictors of sleepiness in obstructive sleep apnoea at baseline and after 6 months of continuous positive airway pressure therapy." European Respiratory Journal 50.5 (2017).

The woods are lovely, dark and deep.
But I have promises to keep,
And miles to go before I sleep,
And miles to go before I sleep.

Robert Frost