Obesity and Sleep

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Objectives

1

Review the relationship between Obesity and OSA

2

Discuss the benefits of OSA treatment for weight management

3

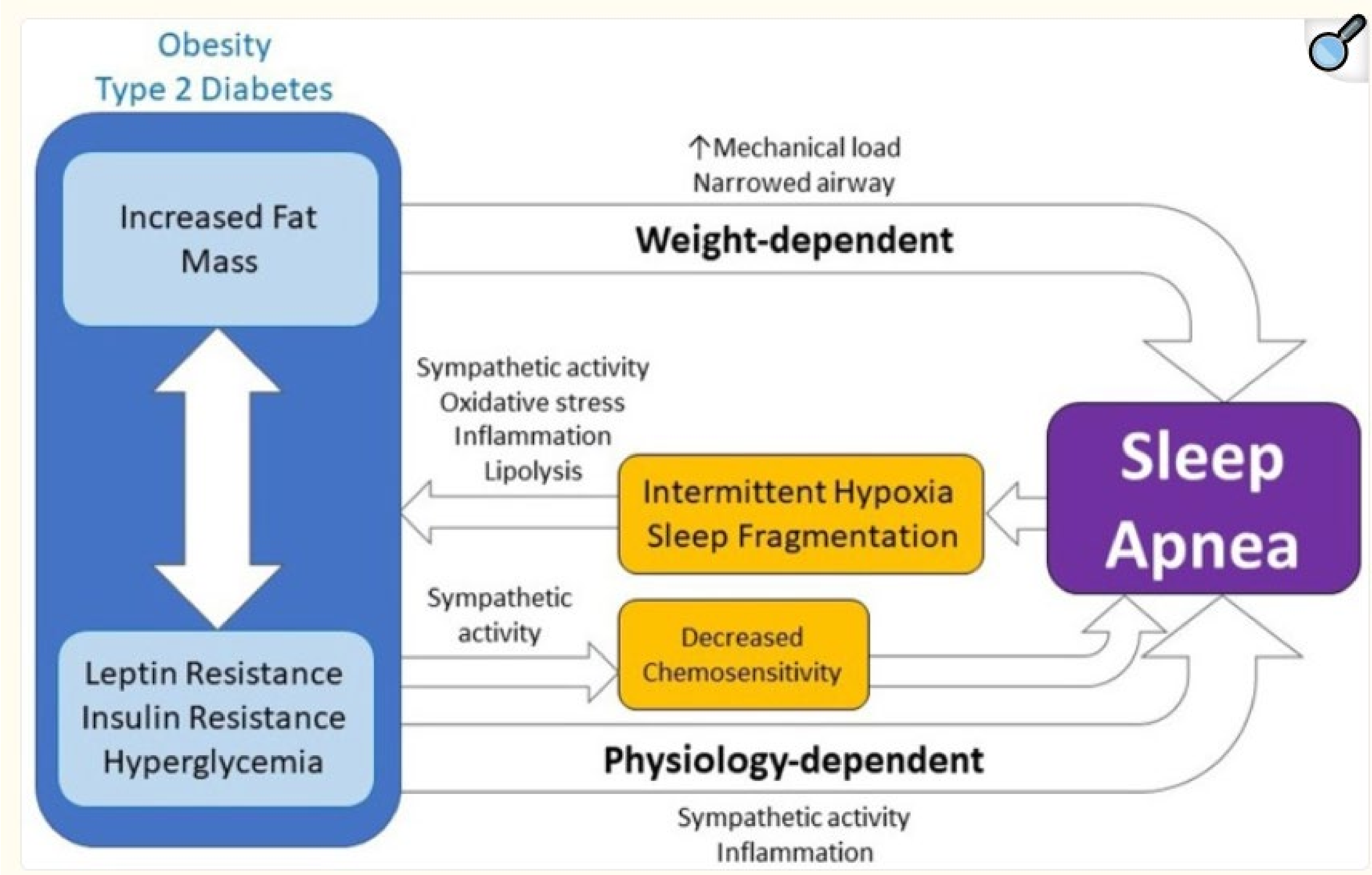
Discuss the effects of behavioral weight loss interventions on OSA

4

Discuss the effects of medical and surgical weight loss interventions on OSA

Disclosures

None- I have no financial interests or relationships to disclose



Frammes & Arble, 2018

Sleep Disturbance in the elderly and NODM

Changes in sleep pattern in elderly patients can indicate metabolic risk

-Related to sarcopenia?

Group	HR (95% CI)	P
Persistent short group	10.673 (1.446-78.789)	0.020
Persistent normal group	1[reference]	
Persistent long group	4.306 (0.568-32.657)	0.158
Low-increasing group	3.978 (0.509-31.060)	0.188
Normal-decreasing group	9.285 (1.136-75.909)	0.038
Normal-increasing group	3.630 (0.404-32.636)	0.250
Long-decrease group	9.120 (1.231-67.595)	0.031

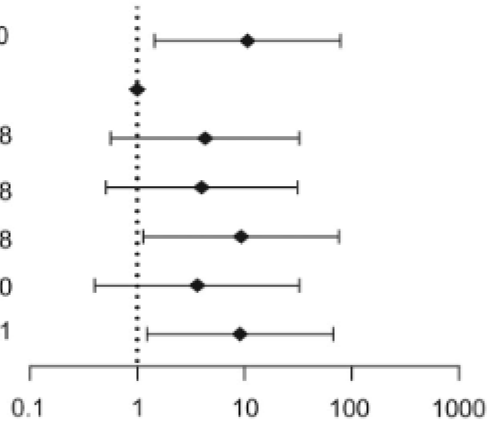


FIGURE 4 Forest plot showing the associations between various sleep duration trajectories and the incidence of new-onset diabetes mellitus in the elderly, adjusted for age, sex, and BMI. The x-axis represents the HR on a logarithmic scale. HR, hazard ratio.

Li et al, 2025

Sleep Disturbance in the elderly

Both OSA and insomnia associated with increased risk of frailty

Table 3.

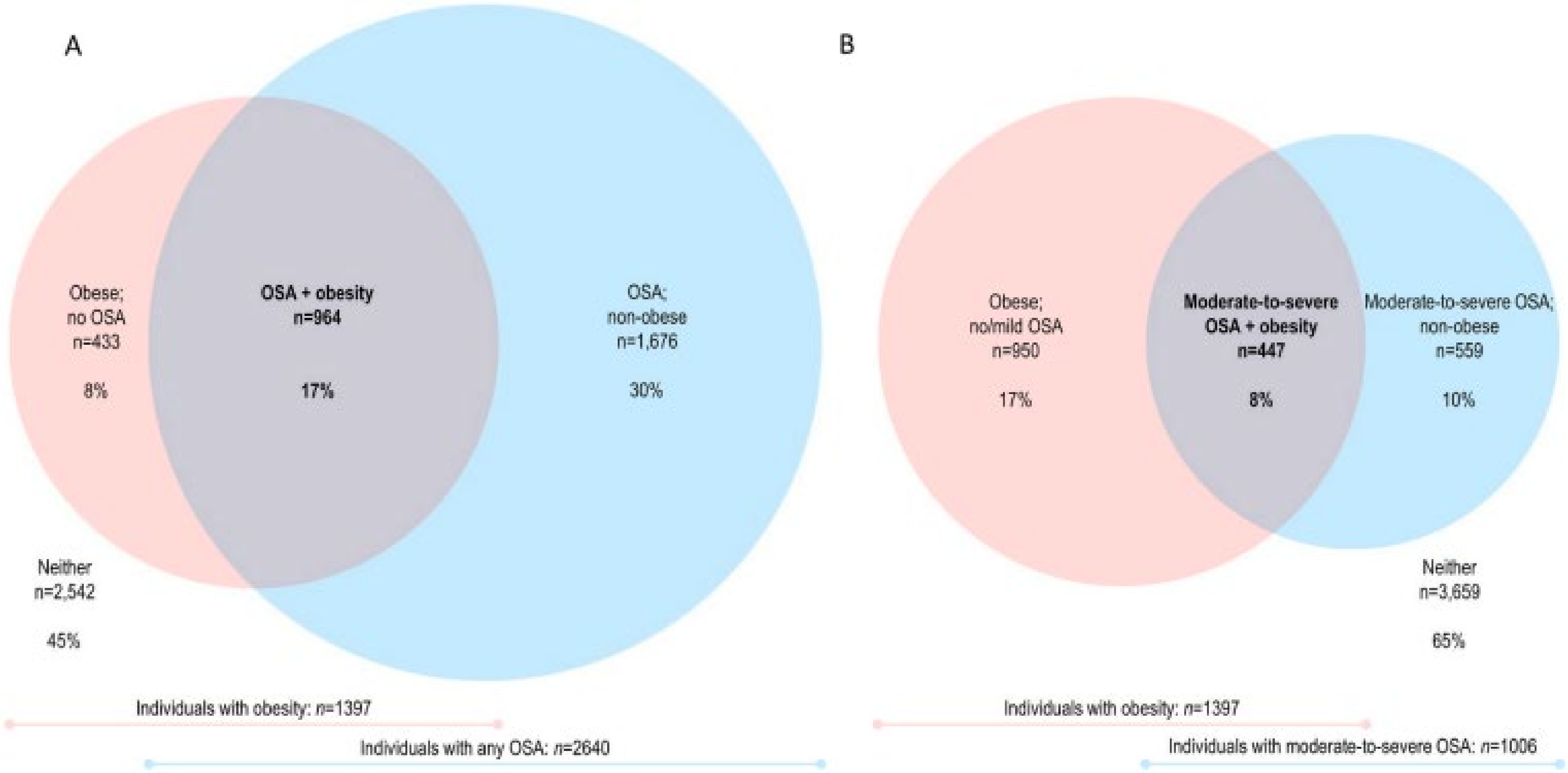
Frailty According to COMISA in Older Adults

Variables	Total n=1643	Without Frailty n=1471	Frailty n=172	p	Unadjusted OR (95% CI)	Adjusted[a] OR (95% CI)
COMISA (n, %)						
No insomnia/ no OSA	872 (53.1)	813 (55.3)	59 (34.3)	<0.001	1.00	1.00
Insomnia-alone	295 (18.0)	250 (17.0)	45 (26.2)		2.48 (1.64, 3.75)***	2.00 (1.23, 3.26)**
OSA-alone[b]	447 (27.2)	389 (26.4)	58 (33.7)		2.05 (1.40, 3.01)***	2.02 (1.29, 3.18)**
Co-morbid insomnia and OSA[b]	29 (1.8)	19 (1.3)	10 (5.8)		7.25 (3.23, 16.30)***	6.46 (2.37, 17.58)***

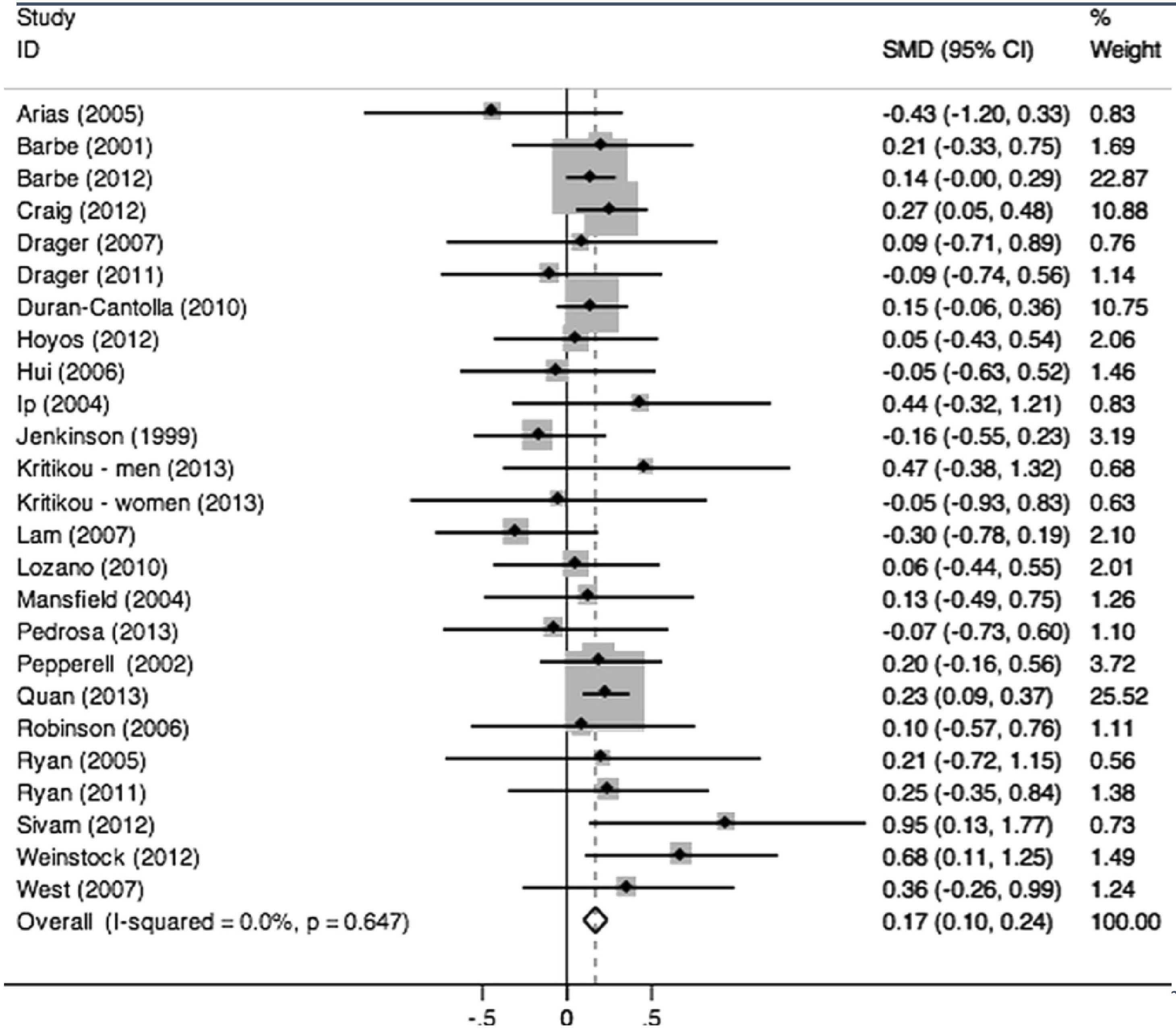
Moreno-Tamayo et al, 2021

Obstructive sleep apnea(OSA)

Does treatment of OSA help with weight loss efforts?



Messineo et al, 2024

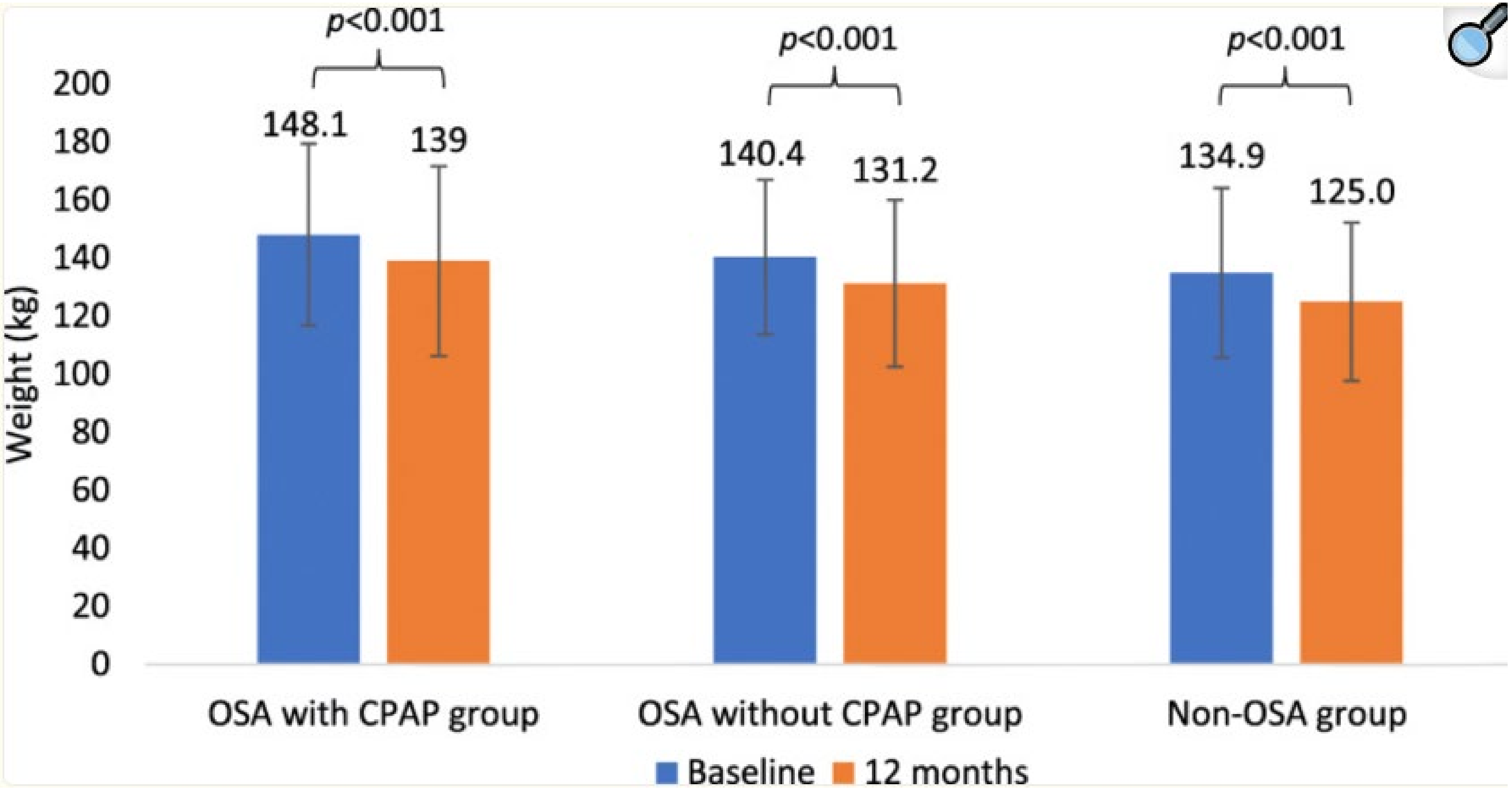


Small, but statistically significant, increase in weight after CPAP initiation. (no weight loss interventions)

Mechanisms proposed:

1. Increase in anabolism due to increasing slow wave sleep (which leads to release of GH and decrease in cortisol)
2. In mice, intermittent hypoxia triggers lipolysis.
3. OSA leads to sympathetic overactivity, which increases energy expenditure

Drager et al., 2015

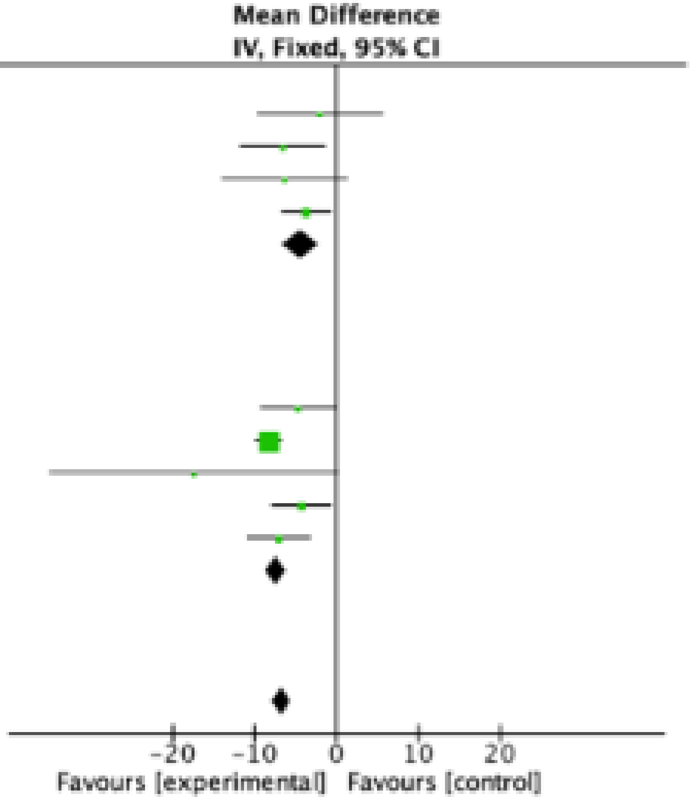


Kobuch et al., 2021

Exercise’s effect on sleep and cognition

Figure 3. Meta-analysis of the pooled effect of exercise training on AHI and sub-analysis of the pooled effect of aerobic training and combined exercise training on AHI [26,27,28,29,30,31,32,33,34].

	Experimental			Control				Mean Difference
Study or Subgroup	**Mean**	**SD**	**Total**	**Mean**	**SD**	**Total**	**Weight**	**IV, Fixed, 95% CI**
1.1.1 Aerobic training								
Garcia 2020	23	13.1	29	25	16.29	29	2.2%	-2.00 [-9.61, 5.61]
Gokmen 2019	13.78	7.48	25	20.33	10.68	25	4.8%	-6.55 [-11.66, -1.44]
Sengul 2011	11.01	5.28	10	17.36	11.18	10	2.1%	-6.35 [-14.01, 1.31]
Yang 2018	16.4	5.2	32	20.1	7	35	14.5%	-3.70 [-6.64, -0.76]
Subtotal (95% CI)			**96**			**99**	**23.6%**	**-4.36 [-6.67, -2.06]**
Heterogeneity: $Chi^2 = 1.53$, df = 3 (P = 0.68); $I^2 = 0\%$								
Test for overall effect: Z = 3.71 (P = 0.0002)								
1.1.2 Combined exercise								
Berger 2018	16.8	10	36	21.5	10	38	6.0%	-4.70 [-9.26, -0.14]
Chen 2018	10.51	3.36	35	18.75	3.32	35	51.2%	-8.24 [-9.80, -6.68]
Desplan 2014	28	19.3	11	45.4	22.5	11	0.4%	-17.40 [-34.92, 0.12]
Kline 2011	24.6	4.4	27	28.9	6.4	16	10.0%	-4.30 [-7.85, -0.75]
Zhao 2021	21.19	5.43	20	28.25	6.74	20	8.7%	-7.06 [-10.85, -3.27]
Subtotal (95% CI)			**129**			**120**	**76.4%**	**-7.36 [-8.64, -6.08]**
Heterogeneity: $Chi^2 = 6.67$, df = 4 (P = 0.15); $I^2 = 40\%$								
Test for overall effect: Z = 11.25 (P < 0.00001)								
Total (95% CI)			**225**			**219**	**100.0%**	**-6.65 [-7.77, -5.53]**
Heterogeneity: $Chi^2 = 13.16$, df = 8 (P = 0.11); $I^2 = 39\%$								
Test for overall effect: Z = 11.64 (P < 0.00001)								
Test for subgroup differences: $Chi^2 = 4.97$, df = 1 (P = 0.03), $I^2 = 79.9\%$								

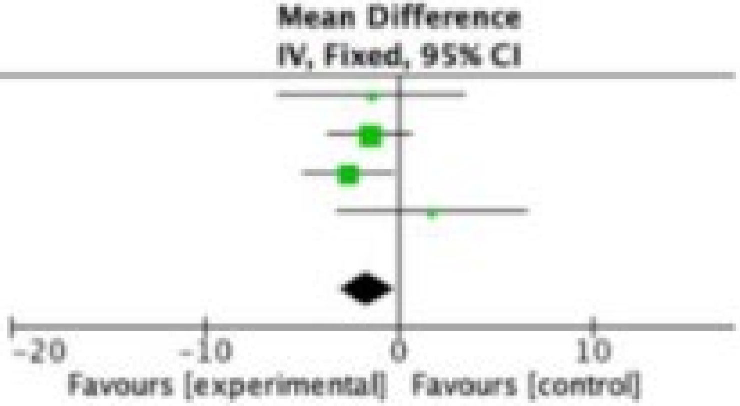


Peng et al., 2022

D. ESS values

Study or Subgroup	Experimental Mean	Experimental SD	Experimental Total	Control Mean	Control SD	Control Total	Weight	Mean Difference IV, Fixed, 95% CI
Desplan 2014	8	5.7	11	9.4	5.8	11	8.8%	-1.40 [-6.21, 3.41]
Garcia 2020	7.7	4.47	29	9.2	3.89	29	43.9%	-1.50 [-3.66, 0.66]
Gokmen 2019	5.76	3.45	25	8.37	4.74	25	38.7%	-2.61 [-4.91, -0.31]
Sengul 2011	7	6.65	10	5.3	4.19	10	8.6%	1.70 [-3.17, 6.57]
Total (95% CI)			**75**			**75**	**100.0%**	**-1.64 [-3.07, -0.22]**

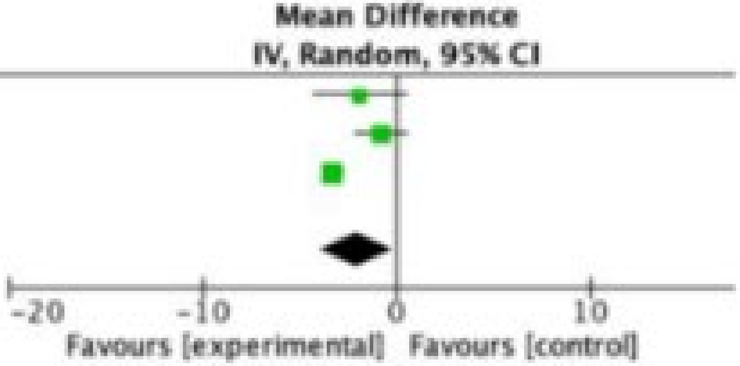
Heterogeneity: $Chi^2 = 2.52$, df = 3 ($P = 0.47$); $I^2 = 0\%$
Test for overall effect: $Z = 2.26$ ($P = 0.02$)



E. Sleep quality

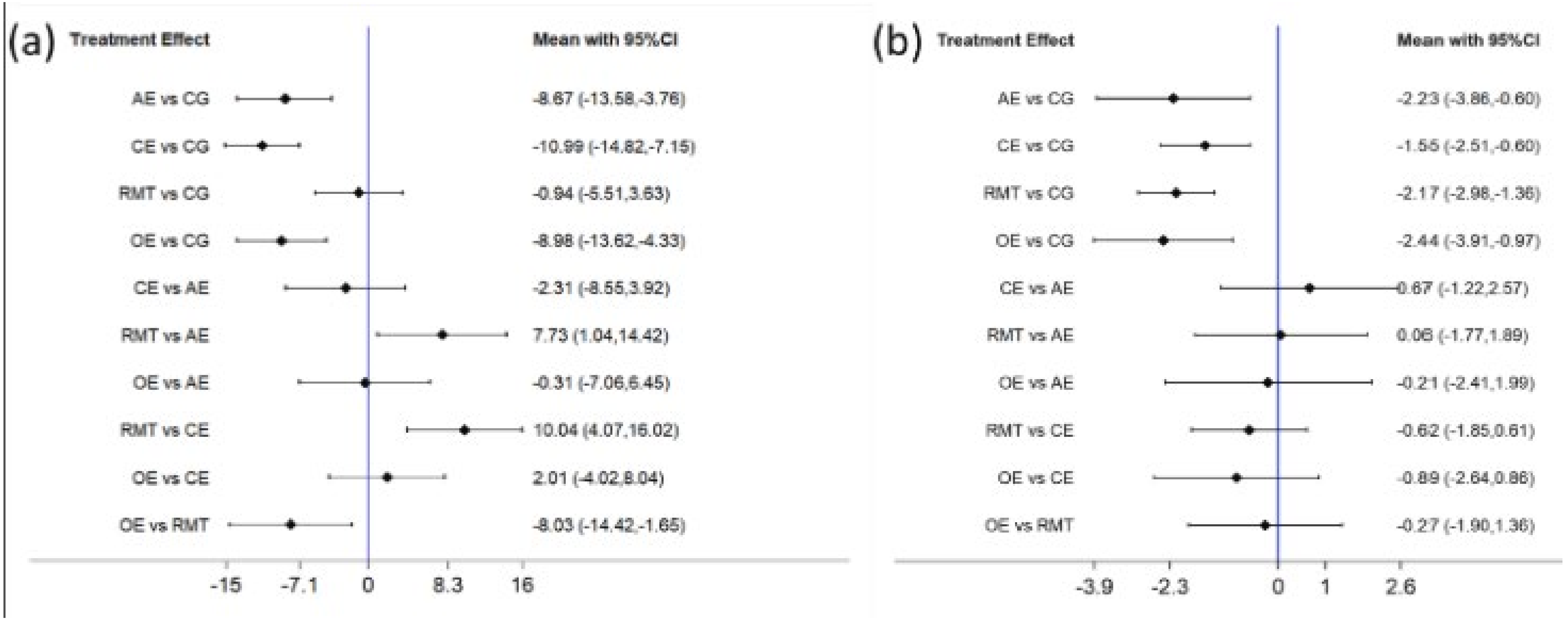
Study or Subgroup	Experimental Mean	Experimental SD	Experimental Total	Control Mean	Control SD	Control Total	Weight	Mean Difference IV, Random, 95% CI
Desplan 2014	6.2	1.5	11	8.1	3.8	11	24.7%	-1.90 [-4.31, 0.51]
Gokmen 2019	5.76	1.88	25	6.56	2.71	25	34.9%	-0.80 [-2.09, 0.49]
Kline 2011	4.7	0.5	27	8	1	16	40.5%	-3.30 [-3.83, -2.77]
Total (95% CI)			**63**			**52**	**100.0%**	**-2.08 [-3.95, -0.21]**

Heterogeneity: $Tau^2 = 2.18$; $Chi^2 = 13.02$, df = 2 ($P = 0.001$); $I^2 = 85\%$
Test for overall effect: $Z = 2.18$ ($P = 0.03$)



Peng et al., 2022

AHI   PSQI



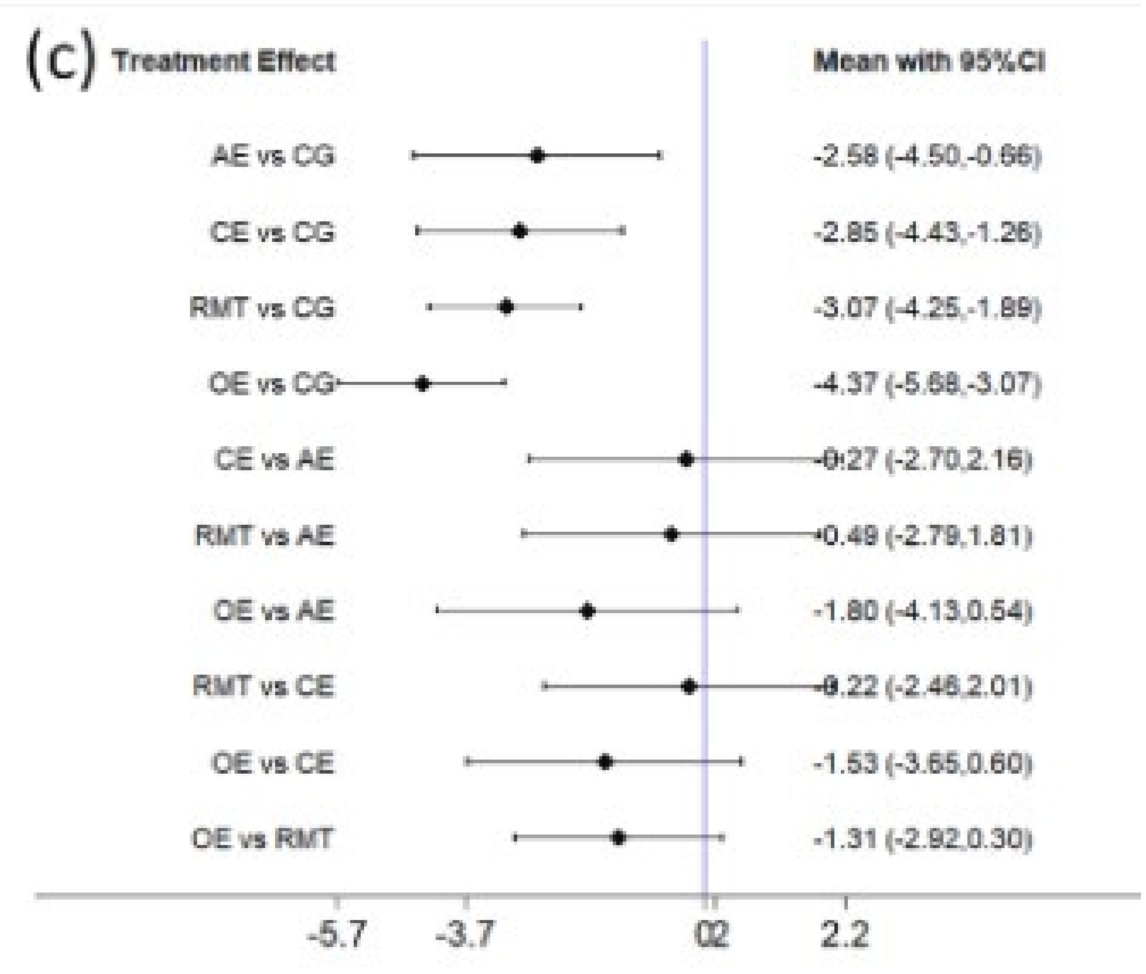
MA of 24 studies with just under 1000 total subjects

CE most likely to impact AHI

OE most likely to impact PSQI and ESS

Tang et al, 2021

ESS



Tang et al, 2024

Does weight loss improve OSA?

Peppard et al., 2000

Figure. Mean Change in the Apnea-Hypopnea Index AHI by Weight Change Category

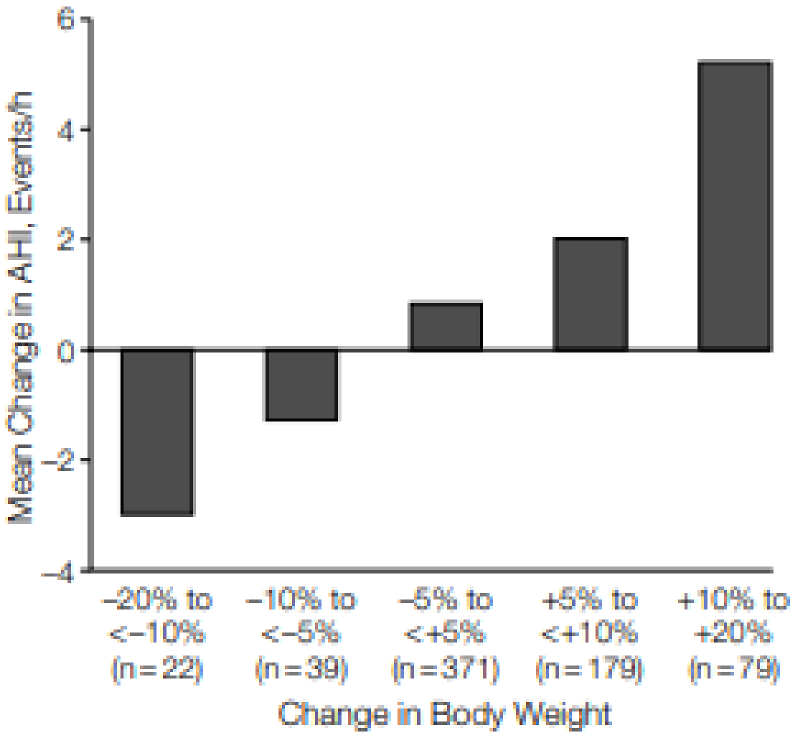
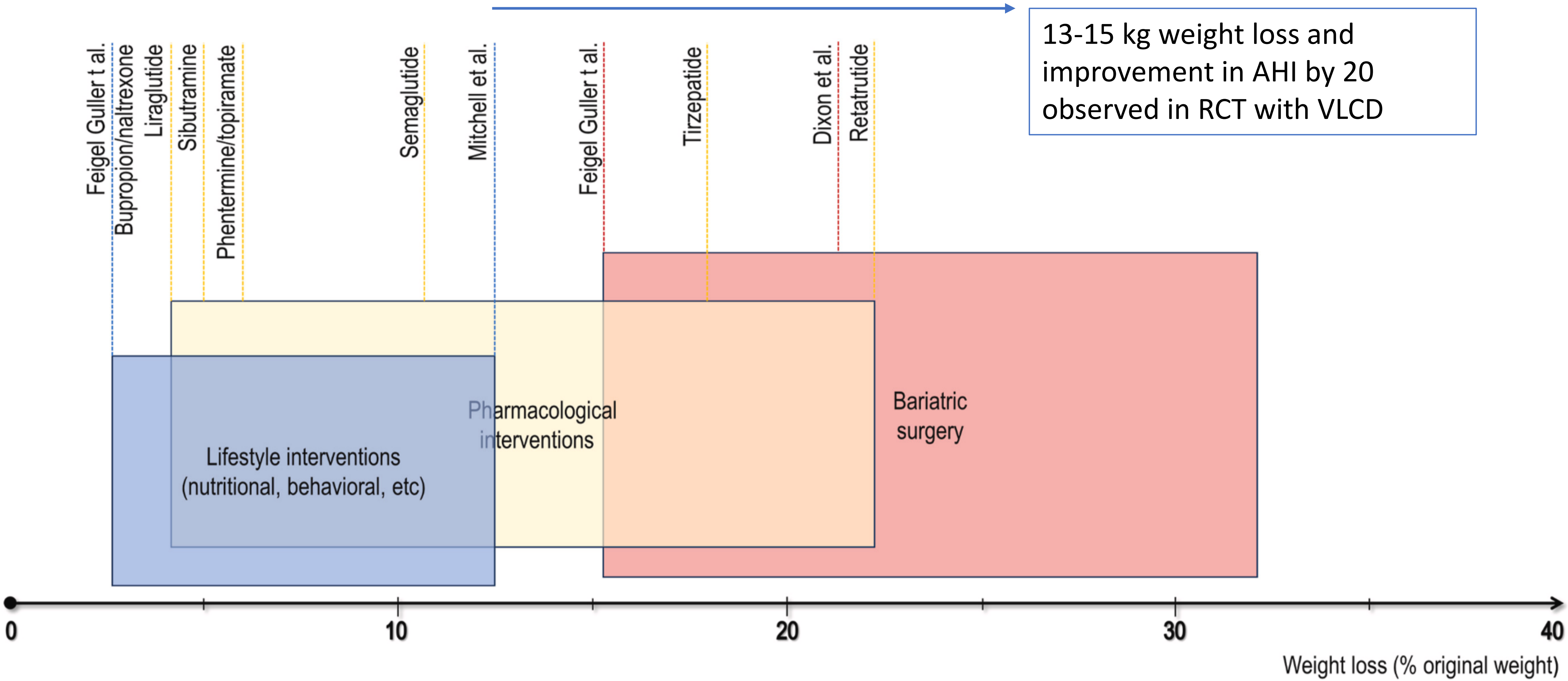


Table 2. Estimated Percent Change in the AHI for Selected Decrements and Increments of Percent Body Weight*

Percent Change in Weight (vs No Change)	Estimated Percent Change in AHI (95% Confidence Interval)†
−20	−48 (−58 to −35)
−10	−26 (−34 to −18)
−5	−14 (−18 to −9)
+5	+15 (+10 to +21)
+10	+32 (+20 to +45)
+20	+70 (+42 to +104)

*AHI indicates apnea-hypopnea index. Adjusted for sex, change in cigarette packs/wk, baseline body mass index (kg/m²), and baseline age. All $P<.001$.
†In addition to change expected if weight remained stable.



13-15 kg weight loss and improvement in AHI by 20 observed in RCT with VLCD

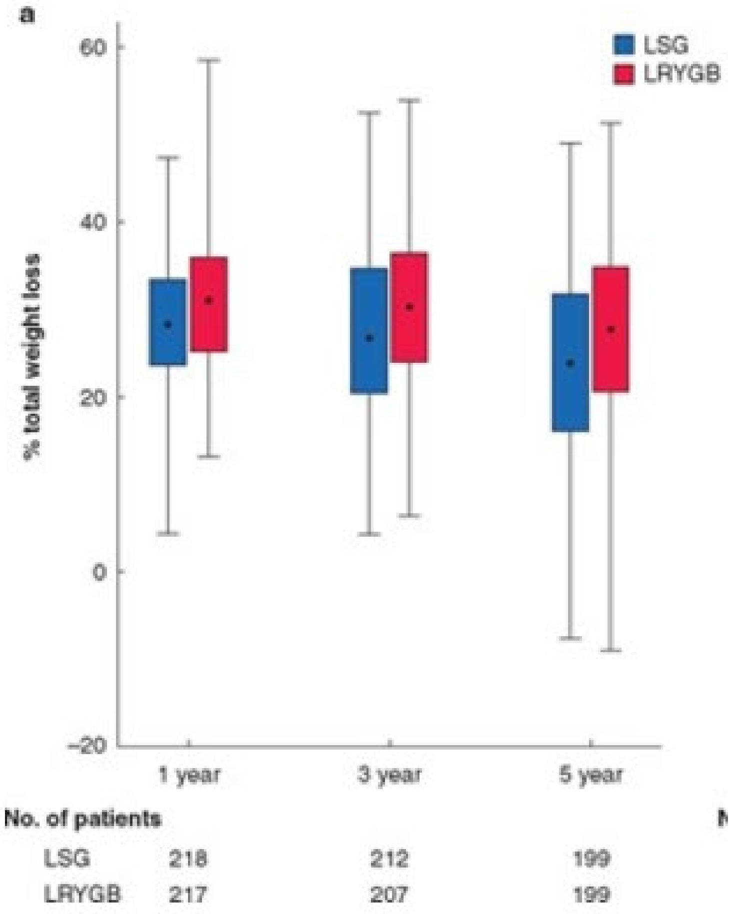
Messineo et al, 2024

Table 2
Changes in weight and apnea hypopnea index in randomized controlled trials of bariatric surgery and incretin agonists (all based on intent to treat analyses).

	Weight baseline in intervention group; kg (Mean ± SD)	Absolute weight change with intervention; kg (Mean; 95 % CI)	Comparator-adjusted weight change; kg (Mean; 95 % CI)	Comparator-adjusted weight change; % (Mean; 95 % CI)	AHI baseline in intervention group; events/hour Mean ± SD	AHI follow-up in intervention group; events/hour Mean ± SD	Absolute AHI change with intervention; events/hour (Mean; 95 % CI)	Comparator-adjusted AHI change; events/hour (Mean; 95 % CI)	Comparator-adjusted AHI change;[a] (Mean; 95 % CI)
Dixon [83]	134.9 ± 22.1	−27.8 (−34.7 to −20.9)	−22.7 (−31.1 to −14.3)	−16.5[a]	65.0 ± 32.8	39.5 ± NR	−25.5 (−36.7 to −14.2)	−11.5 (−28.3 to 5.3)	−14.8[ab]
Feigel-Guiller [84]	135.0 ± 25.3	−17.6[a]	−15.7[a]	−11.5[a]	56.5 ± 24.9	40.7 ± 23.8	−15.8[a]	−13.0[a]	−21.9[a]
Bakker [85]	115.4 ± 16.9	−9.3[a]	−4.2[a]	−3.5[a]	51.5 ± 23.5	34.1 ± 24.6	−17.4	−4.6[a]	−6.8[a]
Winslow [108]	103.7 ± 14.56	−10.8 (−13.5 to −8.0)	−6.5 (−10.0 to −3.0)	−6.1 (−9.4 to −2.7)	44.2 ± 22.4	12.7[a]	−31.5	−14.9 (-∞ to −4.84)	−34.5[a]
Blackman [113]	116.5 ± 23.0	−6.7 ± 0.5	−4.9 (−6.2 to −3.7)	−4.2 (−5.2 to −3.1)	49.0 ± 27.5	36.8[a]	−12.2 ± 1.8	−6.1 (−11.0 to −1.2)	−12.5[a]
Malhotra [123]	115.1 ± 22.7	NR	NR	−17.3 (−19.3 to −15.3)	46.1 ± 22.4	NR	−29.3 (−33.2 to −25.4)	−23.8 (−29.6 to −17.9)	−56.2
Davies [117]	99.9 ± 22.5	−9.7	−6.1 (−7.2 to −5.0)	−6.21 (−7·28 to −5·15)	–	–	–	–	–
Garvey [118]	105.6 ± 20.8	−16.1	−12.9 (−16.1 to −9.8)	−12.6 (−15.3 to −9.8)	–	–	–	–	–
Knop [132]	104.5 ± 22.0	−15.5	−13.0 (−14.6 to −11.5)	−12.7 (−14.2 to −11.3)	–	–	–	–	–
Jastreboff [124]	105.6 ± 22.92	−23.6	−21.2	−17.8 (−19.3 to −16.3)	–	–	–	–	–
Jastreboff [127]	108.0 ± 21.7	−24.2 (−26.6 to −21.8)	−22.1[a] (−23.1 to −21.7)	−22.1 (−24.9 to −19.3)	–	–	–	–	–

LAGB
Qsymia
Liraglutide 3.0
Semaglutide
Tirzepatide
Retatrutide

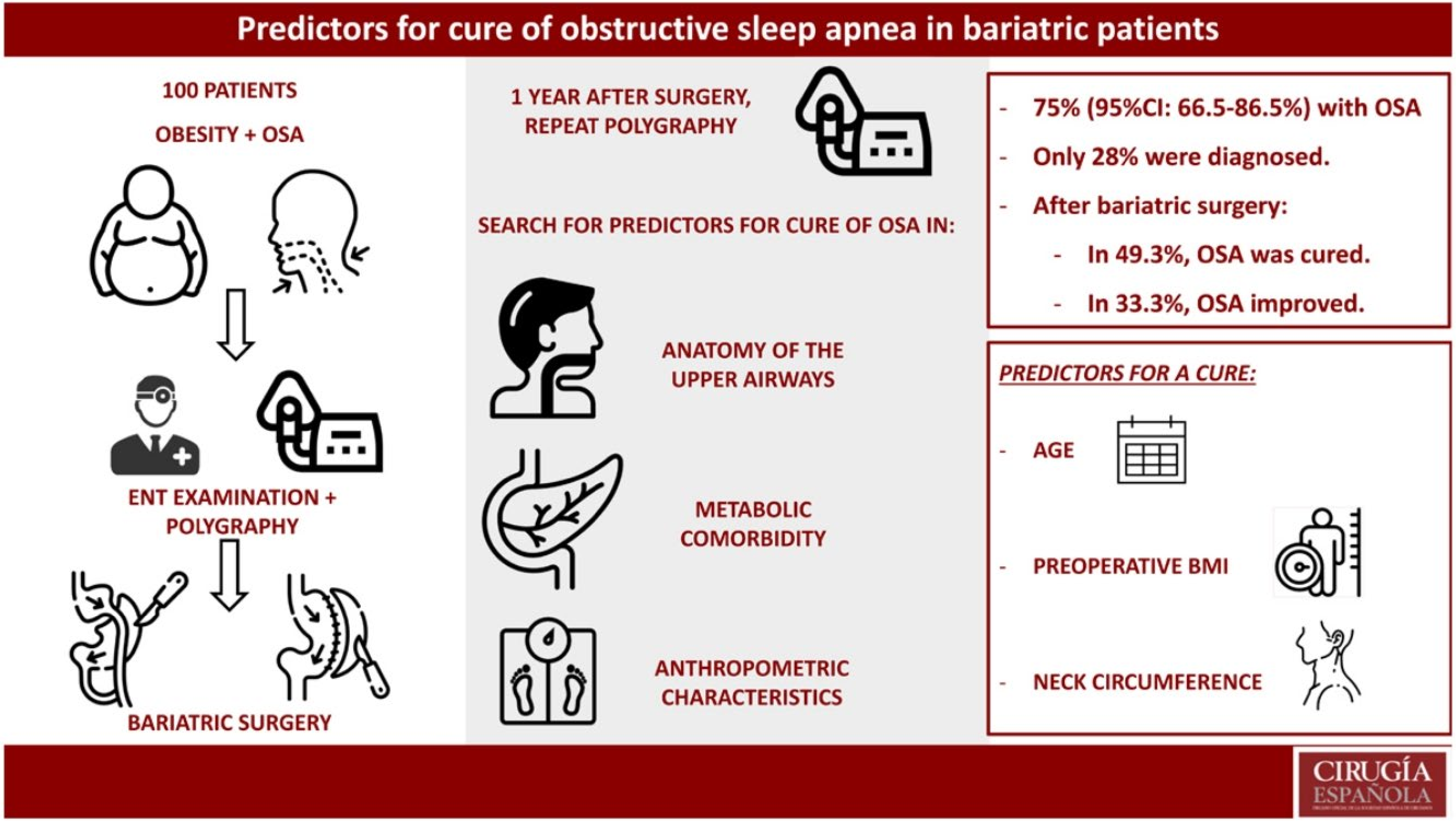
Messineo et al, 2024



Outcome	LSG Group	LRYGB Group
Baseline OSAS prevalence	81 of 215 (37.7%)	80 of 227 (35.2%)
CPAP treatment at baseline	34 of 81 (42%)	43 of 80 (54%)
OSAS remission rate	No significant difference	No significant difference
Off CPAP at 5 years	26 of 43 (60%)	27 of 50 (54%)
Decreased CPAP settings	7 of 43 (16%)	9 of 50 (18%)
No OSAS improvement	6 of 43 (14%)	14 of 50 (28%)
Increased CPAP settings	4 of 43 (9%)	0 of 50 (0%)

Wölnerhanssen et al., 2021

Resolution after bariatric surgery



↓11%

↓14%

↓16%

Navarro-Martinez et al., 2025

GLP1Ra and Dual Agonist Medications

For Type 2 Diabetes

Victoza
Byetta
Bydureon
Trulicity
Ozempic
Mounjaro

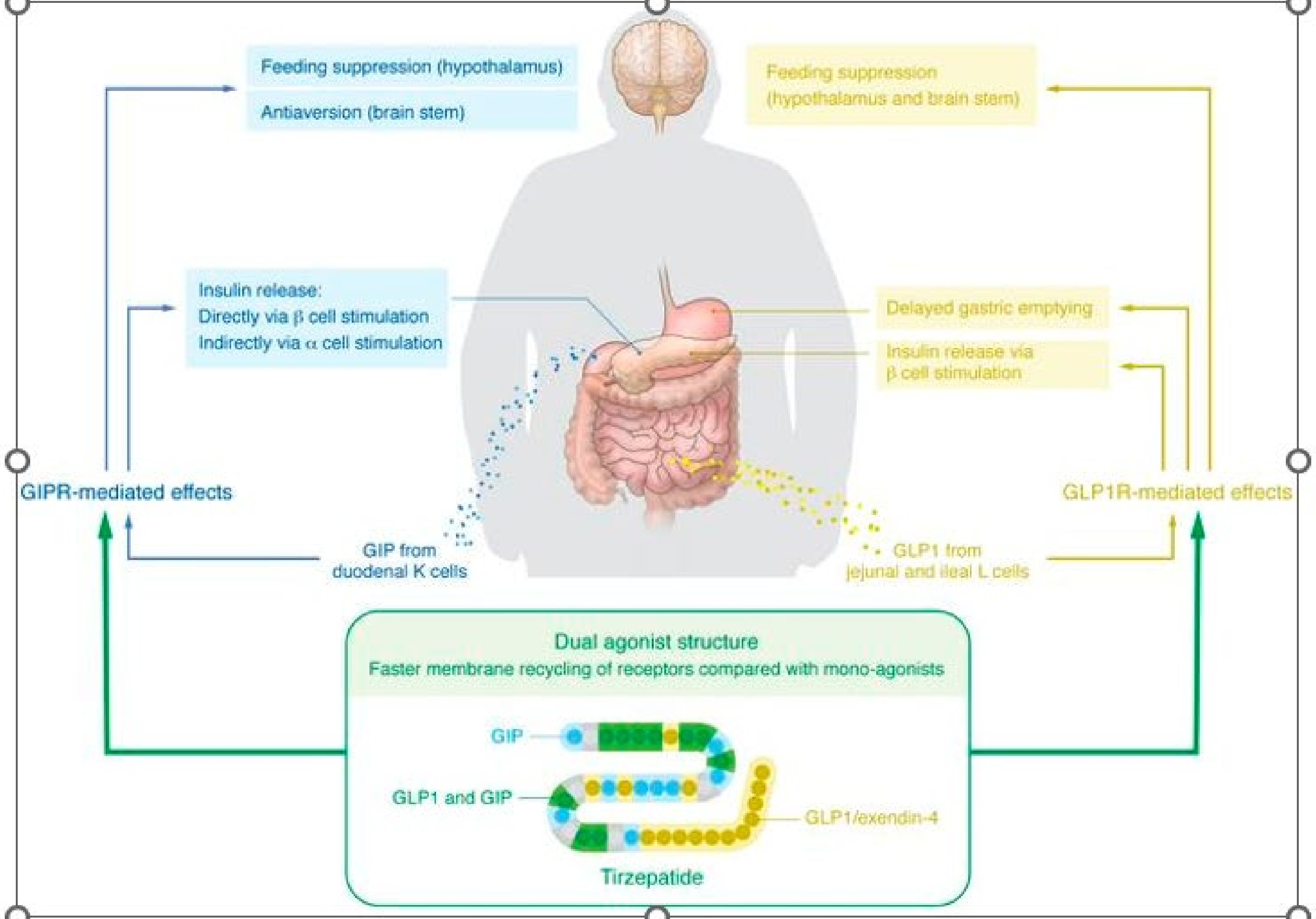
For Weight Loss

Saxenda
Wegovy
Zepbound

Targets of GLP1 and GIP (established in humans)

Bass et al., 2023

Figure 1: Dual gut hormone receptor agonists for diabetes and obesity



J Clin Invest DOI: 10.1172/JCI167952

Qsymia   Winslow et al., 2012

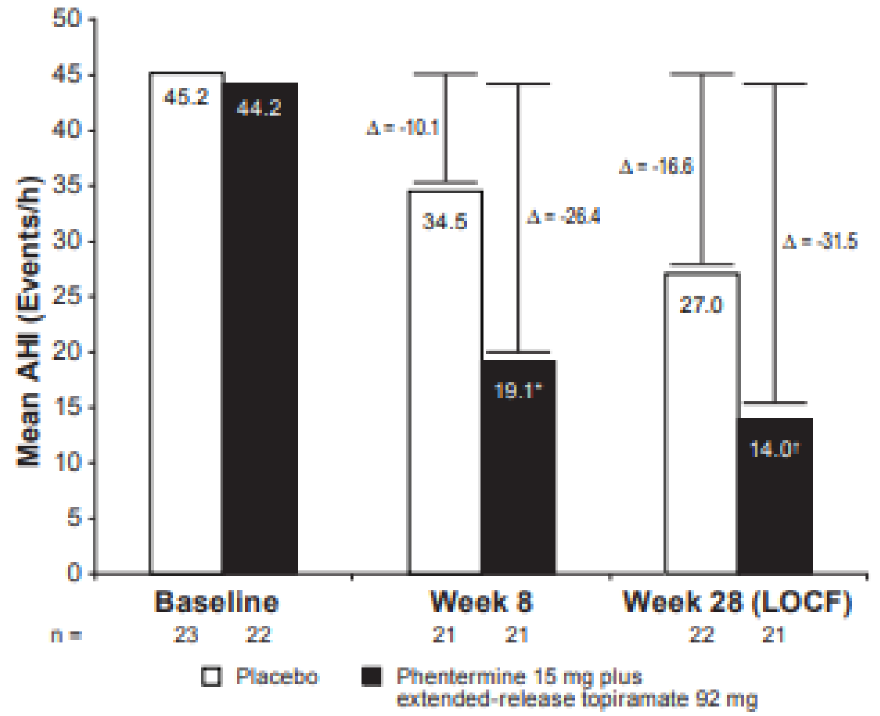


Figure 3—Change from baseline in AHI. Data represent mean values at baseline, Week 8 (ITT), and Week 28 (ITT-LOCF). Change (Δ) represents LS mean change from baseline. Week 28 with LOCF is defined as the last available measurement during the double-blind treatment period. N values represent the number of subjects with values at both time points. AHI, apnea-hypopnea index; CI, confidence interval; ITT, intent to treat; LOCF, last observation carried forward; LS, least-squares. *P = 0.0009 vs placebo (1-sided 95% CI: -∞, -8.1); †P = 0.0084 vs placebo (1-sided 95% CI: -∞, -4.8).

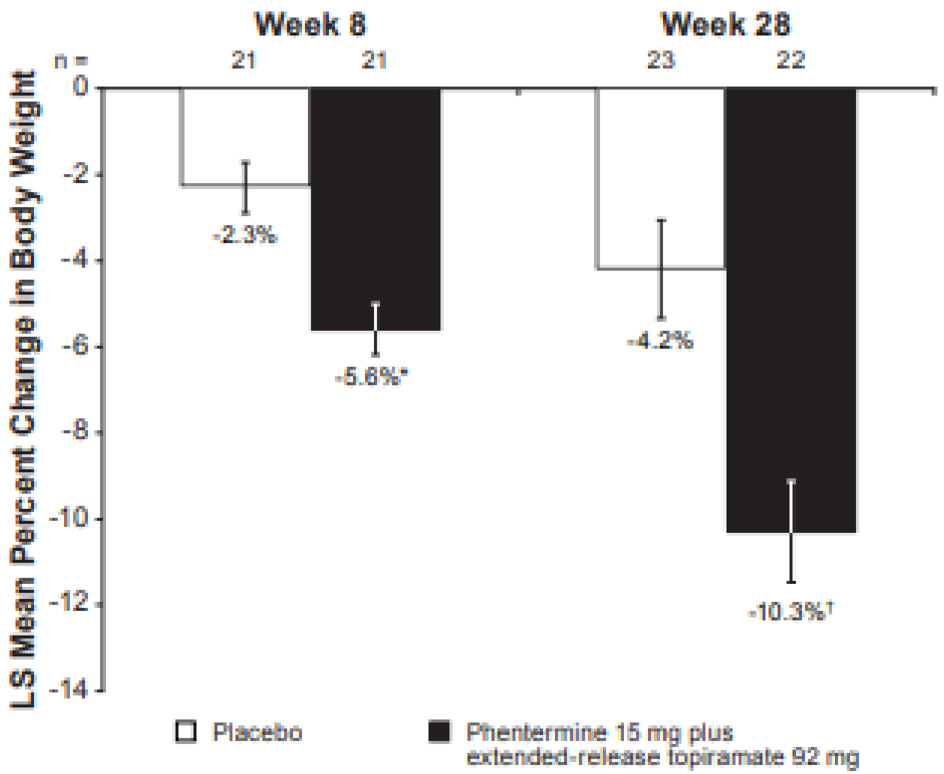
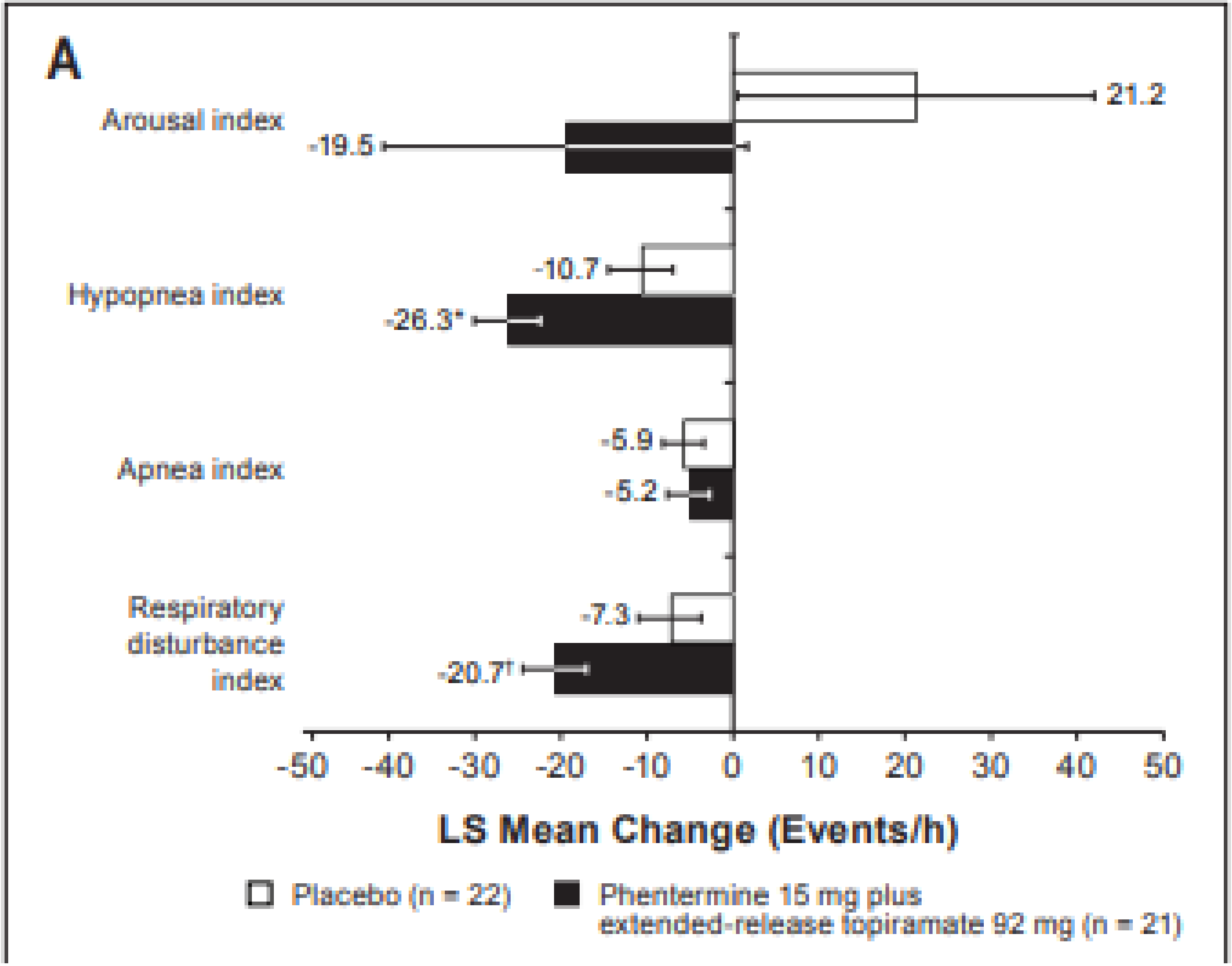


Figure 4—LS mean percent change in body weight from baseline to Week 8 and Week 28 with LOCF. Week 28 with LOCF is defined as the last available measurement during the double-blind treatment period. N values represent the number of subjects with values at both time points. Data represent LS mean change. LOCF, last observation carried forward; LS, least-squares. *P = 0.0003; †P = 0.0006 vs placebo.

Qsymia

Winslow et al., 2012



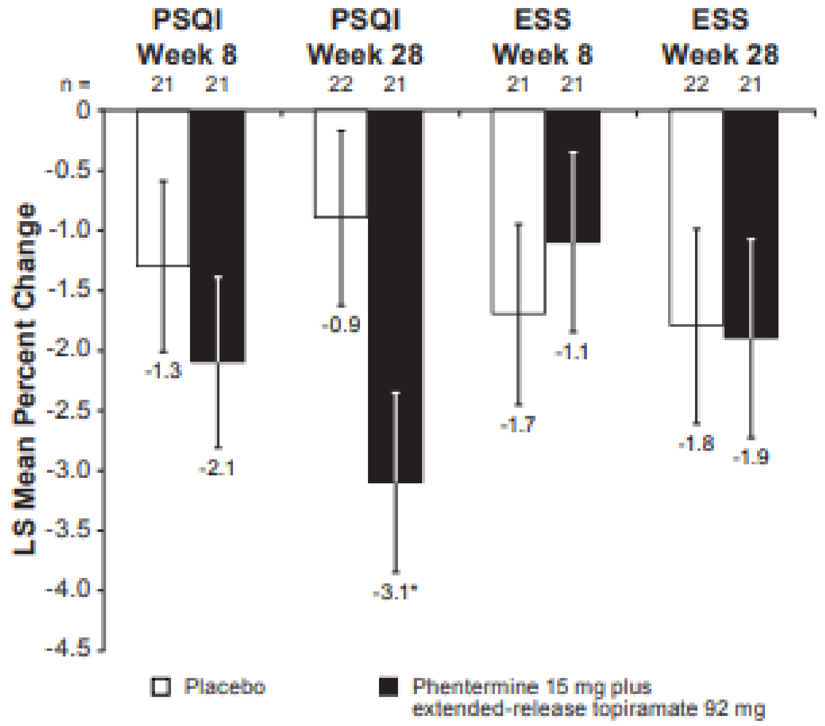
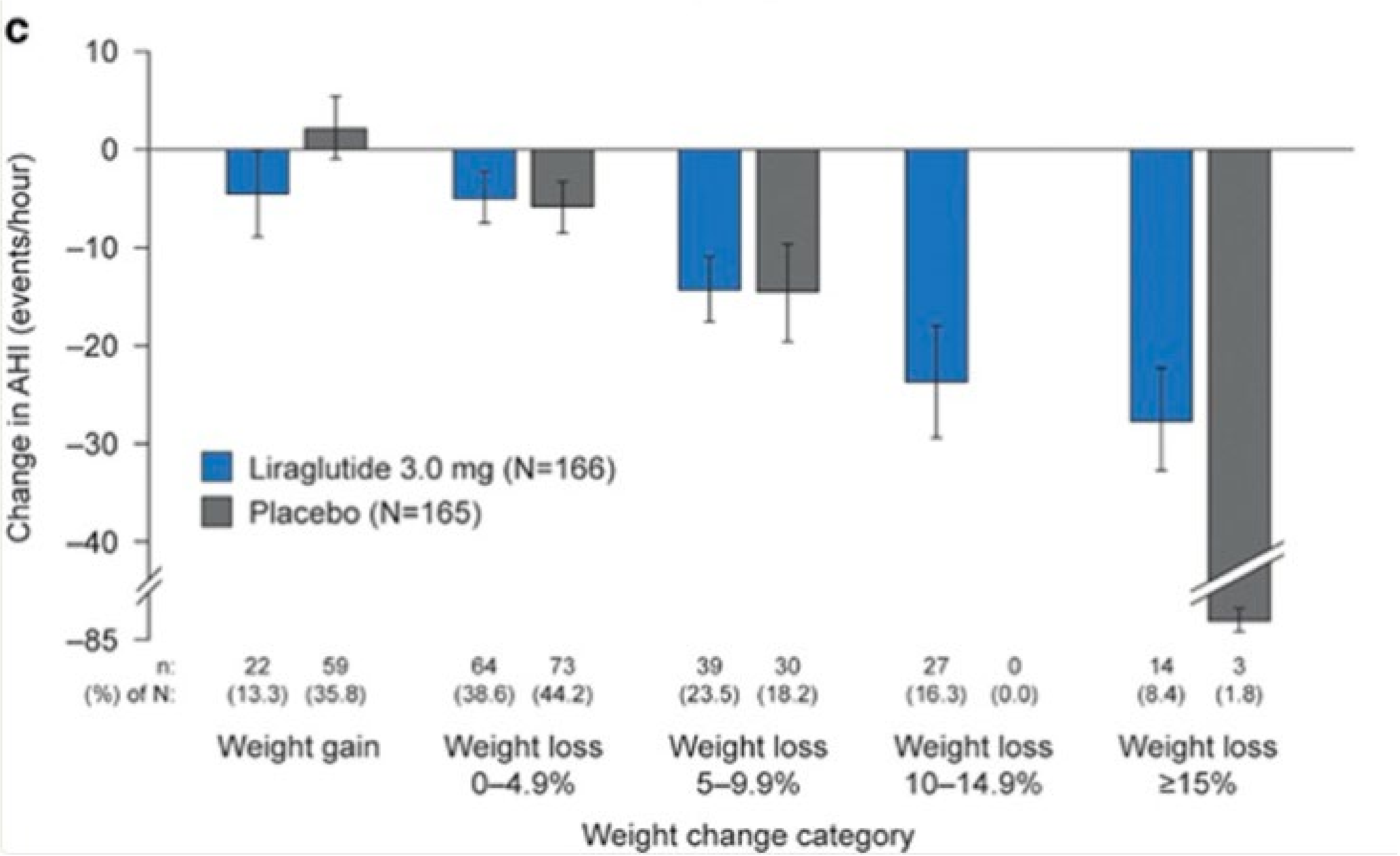


Figure 6—Change in sleep quality indices from baseline to Week 28. Week 28 with LOCF is defined as the last available measurement during the double-blind treatment period. N values represent the number of subjects with values at both time points. Data represent LS mean change. ESS, Epworth Daytime Sleepiness Scale; LOCF, last observation carried forward; LS, least-squares; PSQI, Pittsburgh Sleep Quality Index. *P = 0.0419 vs placebo.

Changes in secondary overnight PSH endpoints

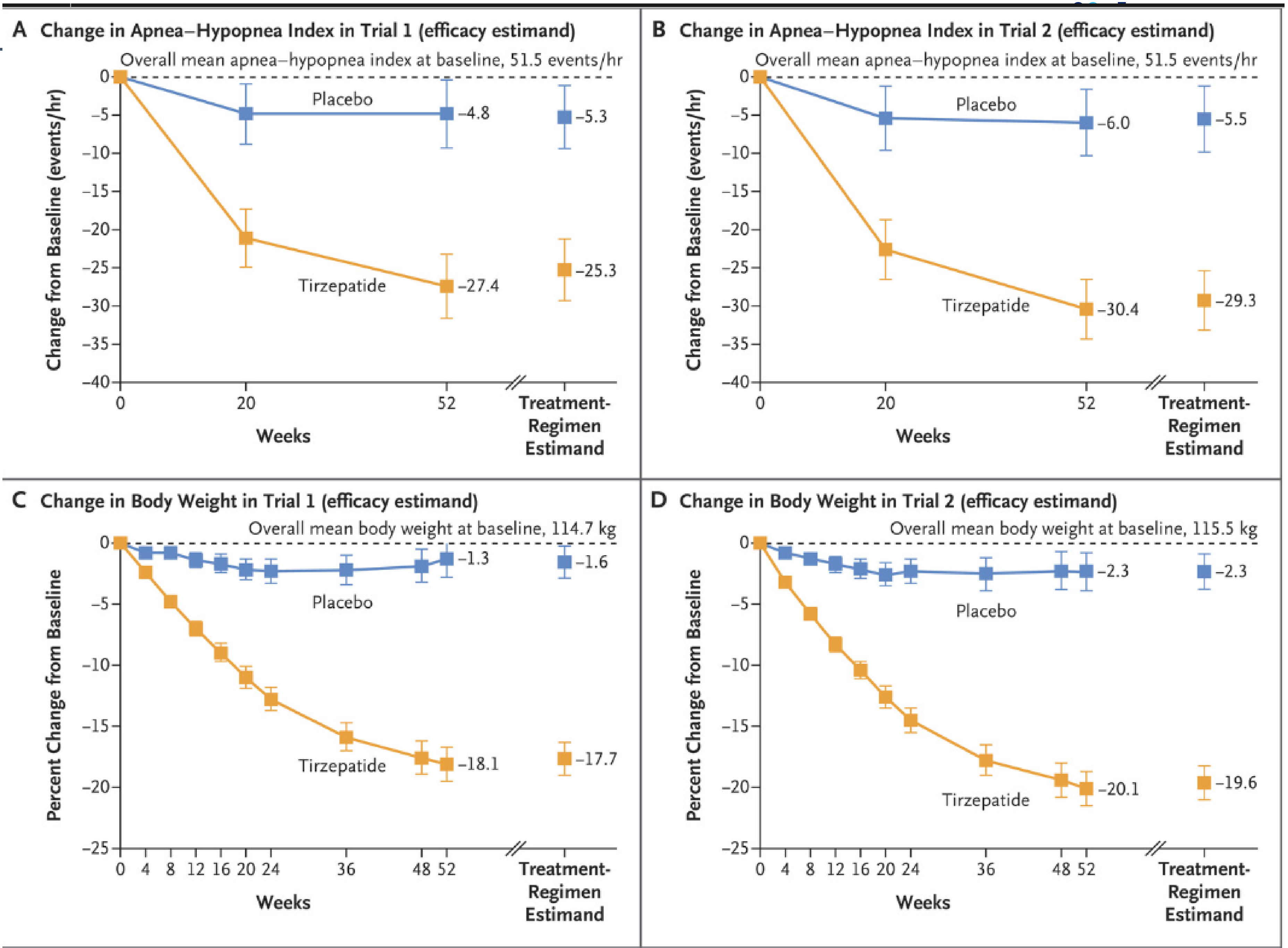
SCALE (Liraglutide)

Blackman et al., 2016



SURMOUNT-OSA (Tirzepatide)

Malhotra, 2024



Insurance Coverage for Zepbound (Tirzepatide)

Commercial	Employer/carrier dependent - All require PA - “Coverage or Plan Exclusion” will not be covered no matter how appealed, for any indication - Some will require trial/intolerance/ongoing symptoms with CPAP therapy
Medicaid	**BMI 38 or greater ONLY** OSA does not change other coverage requirements: - Trial of contraindication to stimulant (phentermine) and trial or contraindication to a non-stimulant therapy (Orlistat and Contrave) - Zepbound not covered until after 6 month failure of Saxenda and 6 month failure of Wegovy - New twist: must be prescribed by sleep medicine provider (skip other trials?)
Medicare Part D/Supplement	**Moderate to Severe OSA** - Must provide documentation of AHI 15 or above

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