Additional Treatment Tools for Obesity Management: Pharmacotherapy and Bariatric Surgery

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Division of Endocrinology

Hospital for Sick Children

Project ECHO®

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Faculty/Presenter Disclosure

- Faculty: Dr. Jill Hamilton
- Relationships with commercial interests:
  - Rhythm Pharmaceuticals, Pfizer, Eli Lilly, Novo Nordisk
  - SunLife Financial
  - This program has received financial support from the Ministry of Health (MOH)
- I hold the SickKids U of T Mead Johnson Chair in Nutritional Sciences which provides unrestricted research funding
- I assume responsibility for ensuring the scientific validity, objectivity, and completeness of the content of my presentation.

1

- Describe the efficacy of pharmacological and surgical treatment tools for adolescents with obesity.

2

- Identify patient considerations when recommending pharmacotherapy or bariatric surgery

3

- Describe the patient process of going through surgery

Treatment

Lifestyle modification and behaviour change

Pharmacology

Bariatric Surgery

Effectiveness o
Interventions

[Intervention Review]

Interventions for treating obesity in cl

Hiltje Oude Luttikhuis[1], Louise Baur[2], Hanneke Jansen[3], Vanessa A Shrewsbu
Summerbell[5]

[1]Beatrix Children's Hospital and Department of Epidemiology, University Me
[2]Department of Paediatrics and Child Health, The University of Sydney, Westmead
Medical Center Groningen, Groningen, Netherlands. [4]School of Medicine and He
, Stockton-on-Tees, UK. [5]School of Medicine and Health, Wolfson Research Inst

Contact address: Hiltje Oude Luttikhuis, Beatrix Children's Hospital and Depa
Groningen, PO Box 30.001 (CA80), 9700RB, Groningen, Netherlands. h.oudel

Editorial group: Cochrane Heart Group.
Publication status and date: Edited (conclusions changed), published in Issue 1
Review content assessed as up-to-date: 10 October 2008.

Effectiveness of

Mandy Ho, Sarah

Pediatrics 201

Adolescents:

BMI of -1.25 kg/m2 **[-2.18, -0.32]**

BMI z score of -0.1 **[-0.18, -0.02]**

Ho et al. 2012

TRICS®

ERICAN ACADEMY OF PEDIATRICS

Interventions in Children: A Targeted
w for the USPSTF
nor, Selvi B. Williams, Tracy L. Beil and
W. Lutz
ly published online January 18, 2010;
peds.2009-1955

atic Review

wart, Melinda

19, 2012;

How effective is pharmacotherapy in children and adolescents with obesity?

Clinical trials for weight loss medications in children and adolescents

Drug	Sample size	Age range (years)	Treatment duration (weeks)	Targeted mechanism	Pediatric trials	Outcomes	Common side effects
Orlistat	n=20–539	10–18	12–54	Inhibits gastric and pancreatic lipase, reducing dietary fat absorption	3 RCTs, 2 open-label trials	BMI change –4.09 to +0.31	Loose stools, oily stools, flatulence, fecal urgency, vitamin deficiency, cholelithiasis
Metformin	n=24–173	10–16	12–96	Lipogenesis, insulin sensitivity, appetite satiety, leptin signaling	2 systematic review; 14 RCTs	Systematic review: mean BMI change –1.38 (95% CI –1.93 to -0.82)	Loose stools, abdominal pain, nausea; no reported liver or kidney toxicity in children
Topiramate	n=30	12-18	24	Inhibition of carbonic anhydrase, glutamate R inhibition reduction in neuropeptide Y, dysgeusia	1 clinical trial	BMI change T: –1.16 (1.58) vs. P –0.30 (2.0) *NS	Sedation, hyperthermia, paresthesias, confusion
Liraglutide 2020	n=251	12–18	56	Glucagon-like peptide-1 receptor agonist -Reduces glucagon and gastric emptying; increases insulin, leptin secretion, appetite and satiety	1 clinical trial	BMI change ETD -0.22 (4.6%) Weight L -2.7 kg vs P +2.1 kg	Nausea, vomiting,
Semaglutide 2022	N=192	12-18	68	GLP-1RA weekly injection	1 clinical trial	% BMI change ETD -16.7 % (-20.3 to -13.2) Weight S -15.3 kg vs P +2.4 kg	Nausea, vomiting, constipation/diarrhea, cholethithiasis
Phentiramine/ topiramate 2022	n=223	12–18	56	Topiramate – as above Phentiramine - CNS stimulant, unclear mechanism of action for weight loss	1 clinical trial	% BMI change ETD -8.1% mid dose vs -10.4% top dose Weight P/T -5.4 (mid dose) and – 9.2 kg (top dose) vs P + 6.6 kg	Paresthesia, dry mouth, constipation

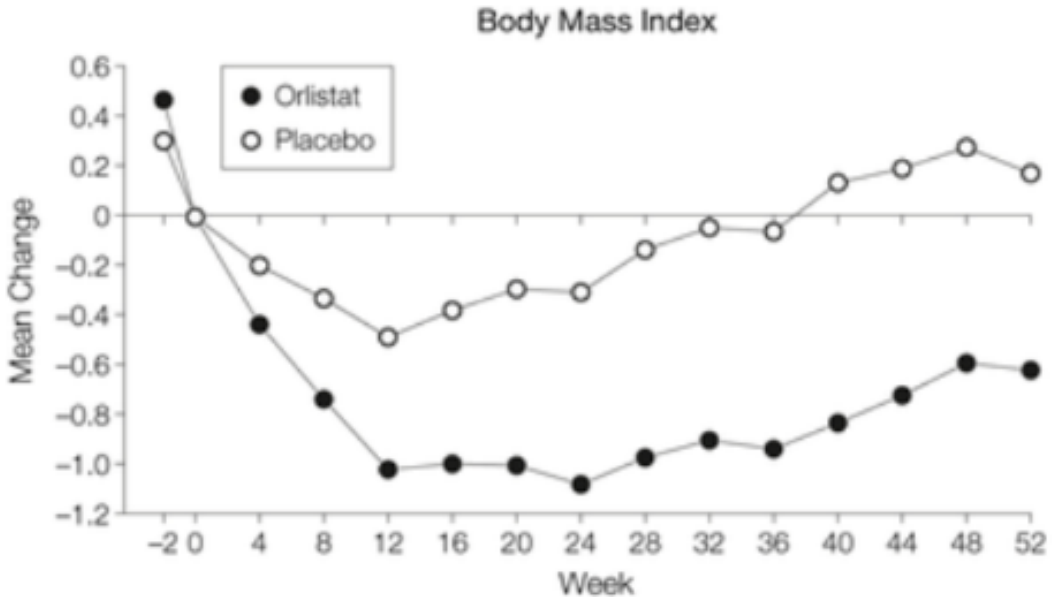
Excluded: exenatide, setmelanotide

1. Coles N, Birken C & Hamilton J. BMJ 2016; 354:i4116; 2. Kelly AS et al. N Engl J Med 2020; 382:2117–28.

Lipase inhibitor - orlistat

- Orlistat was the only approved medication for pediatric weight management until 2022
- Inhibits fat absorption through inhibition of enteric lipase
- Needs to be taken several times per day
- Two RCTs

- PROMS – no data
- Metabolic – some improvement in BP
- Anthropometric – EST -1.0 BMI z-score
- Adverse events – diarrhea, loss of continence

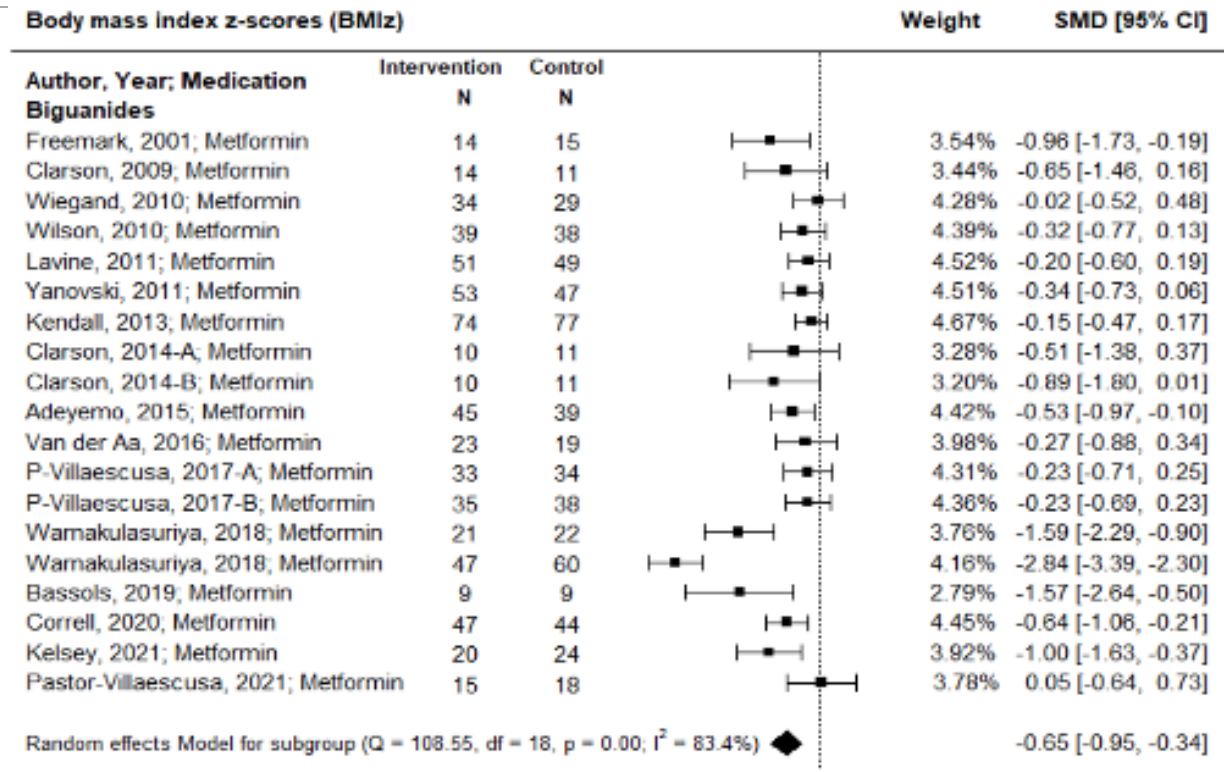


Chanoine JP et al, JAMA, 2005

Metformin

- Reduces hepatic glucose production, increases insulin sensitivity and may reduce appetite
- NOT approved for obesity treatment (approved for treatment of Type 2 diabetes in adolescents)

- PROMS – no impact on HRQoL
- Metabolic –improves insulin sensitivity, reduces TG, reduce ALT
- Anthropometric – see figure
- Adverse events – GI upset

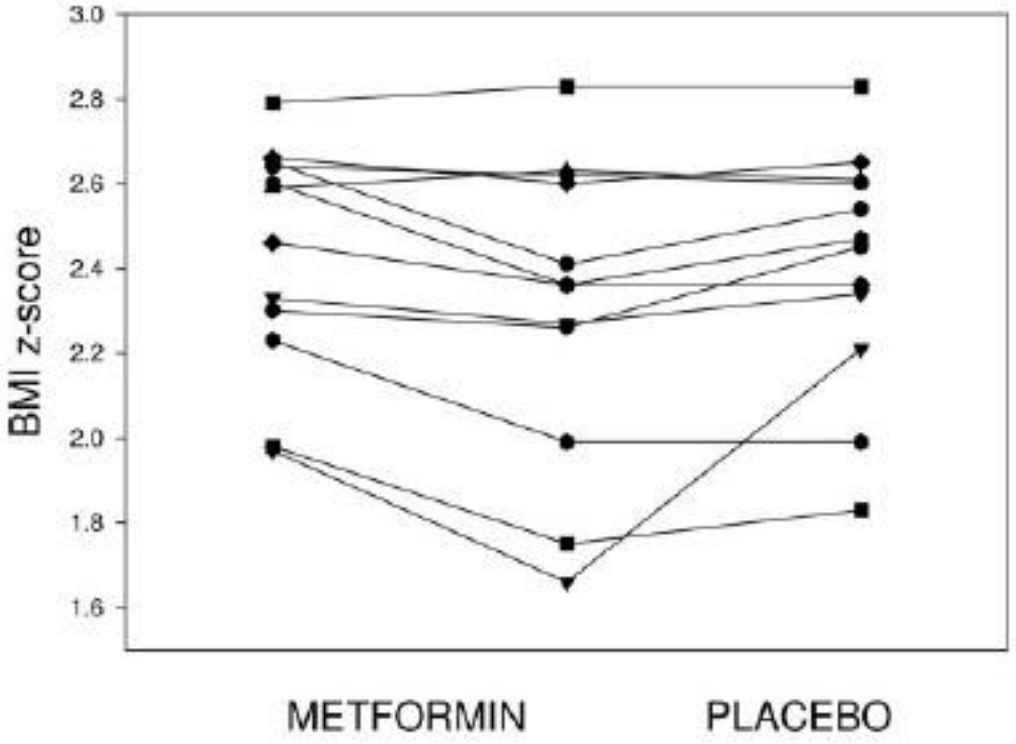


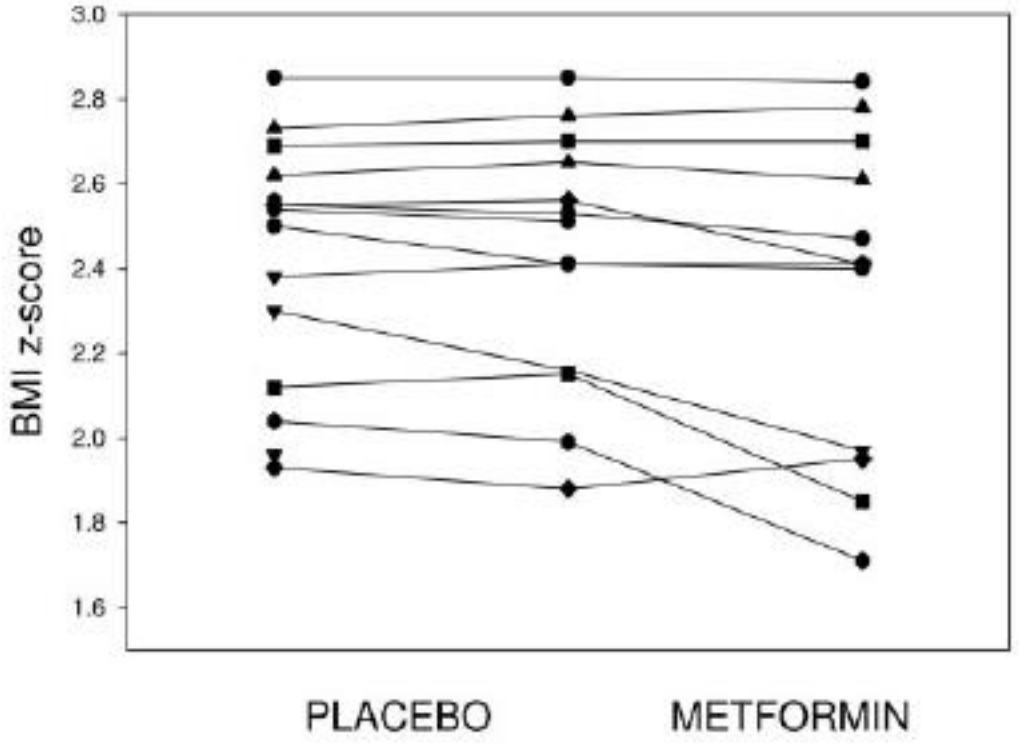
BMI z score: -0.65
95% CI -0.95 to -0.34

Randomized, Controlled Trial of Metformin for Obesity and Insulin Resistance in Children and Adolescents: Improvement in Body Composition and Fasting Insulin

Shubha Srinivasan, Geoffrey R. Ambler, Louise A. Baur, Sarah P. Garnett, Mirijana Tepsa, Fabian Yap, Glenn M. Ward, and Christopher T. Cowell

J Clin Endocrinol Metab, June 2006, 91(6):2074–2080

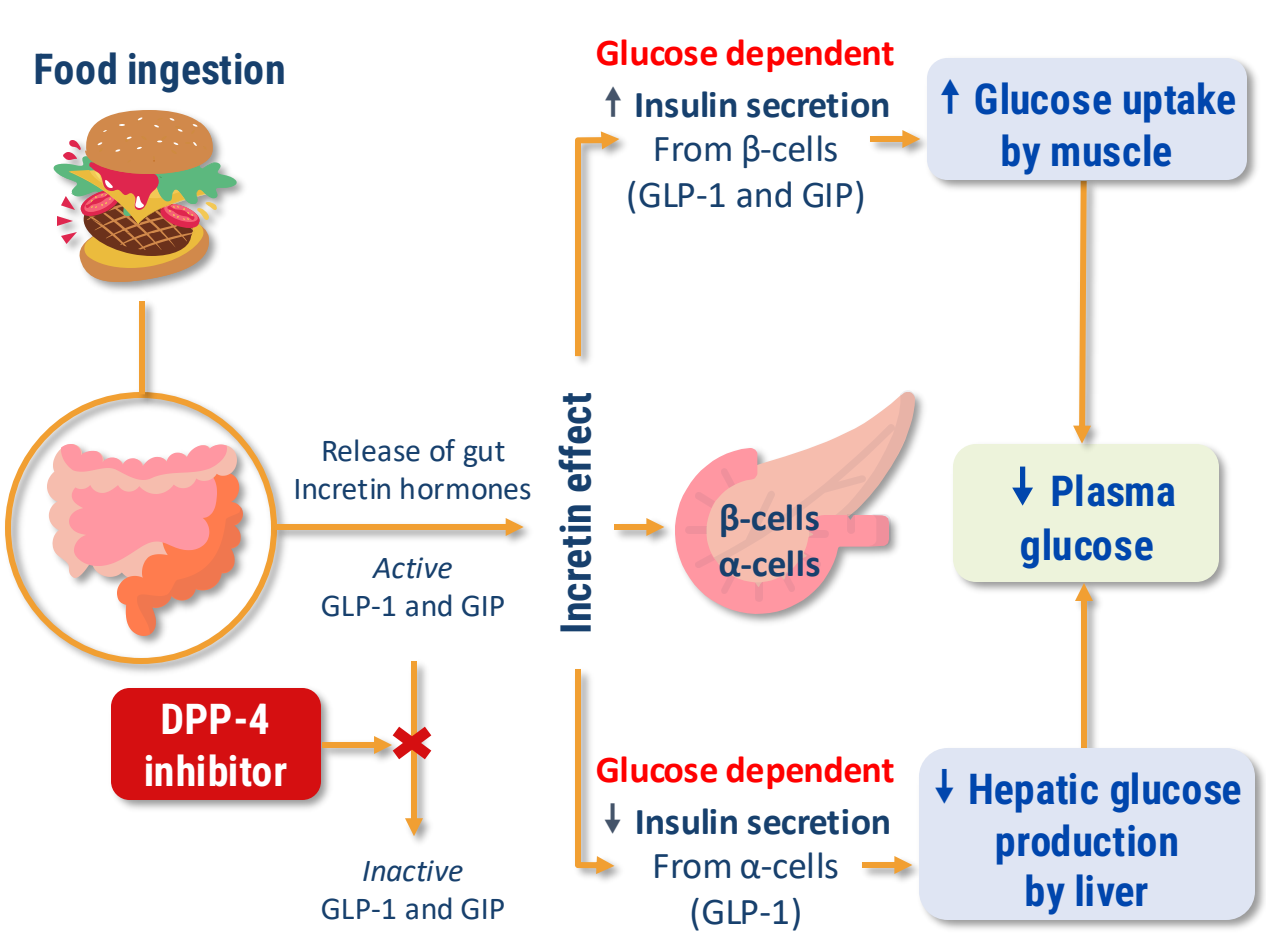


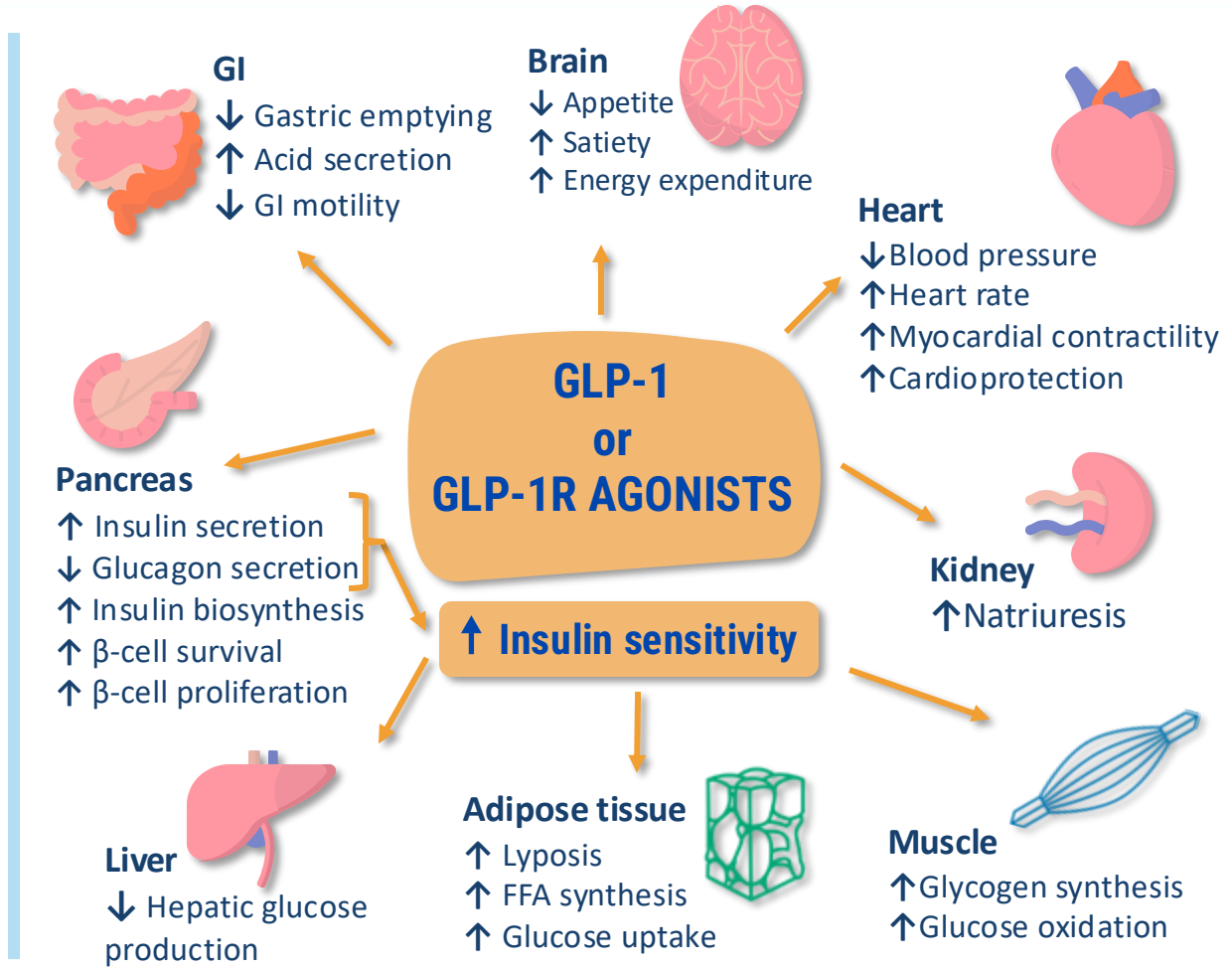


6 mo placebo
6 mo metformin

J Clin Endocrinol Metab, June 2006, 91(6):2074–2080

GLP-1R Agonists – Mechanism of Action





GLP-1 Receptor Agonists: Novo Nordisk

Liraglutide

Victoza

- Frequency = **daily**
- Dosing:
  - 0.6 mg daily x 1 week
  - 1.2 mg daily x 1 week
  - **1.8 mg daily x 1 week**

Saxenda

- Frequency = **daily**
- Dosing:
  - 0.6 mg daily x 1 week
  - 1.2 mg daily x 1 week
  - 1.8 mg daily x 1 week
  - 2.4 mg daily x 1 week
  - 3.0 mg daily x 1 week

Semaglutide

Ozempic

Covered by OHIP+

- Frequency = **weekly**
- Dosing:
  - 0.25 mg weekly x 4 weeks
  - 0.5 mg weekly x 4 weeks
  - **1.0 mg weekly** (maintenance)
  - Can be increased to 2.0 mg weekly if needed

Wegovy

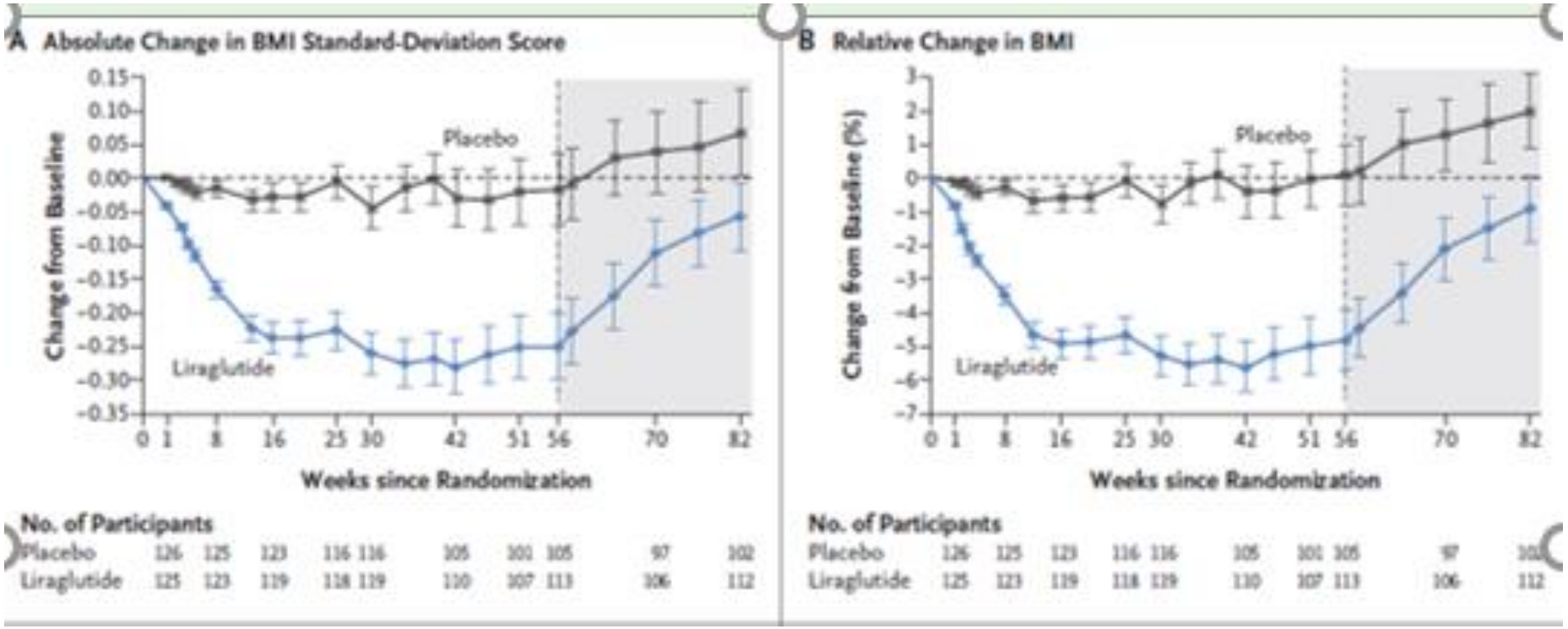
- Frequency = **weekly**
- Dosing:
  - 0.25 mg weekly x 4 weeks
  - 0.5 mg weekly x 4 weeks
  - 1.0 mg weekly x 4 weeks
  - 1.7 mg weekly x 4 weeks
  - 2.4 mg weekly (maintenance)

Side effects: nausea, diarrhea/constipation MC; rare: pancreatitis, gastroparesis

SickKids

A Randomized, Controlled Trial of Liraglutide for Adolescents with Obesity

Aaron S. Kelly, Ph.D., Pernille Auerbach, M.D., Ph.D., Margarita Barrientos-Perez, M.D., Inge Gies, M.D., Ph.D., Paula M. Hale, M.D., Claude Marcus, M.D., Ph.D., Lucy D. Mastrandrea, M.D., Ph.D., Nandana Prabhu, M.Sc., and Silva Arslanian, M.D. for the NN8022-4180 Trial Investigators*



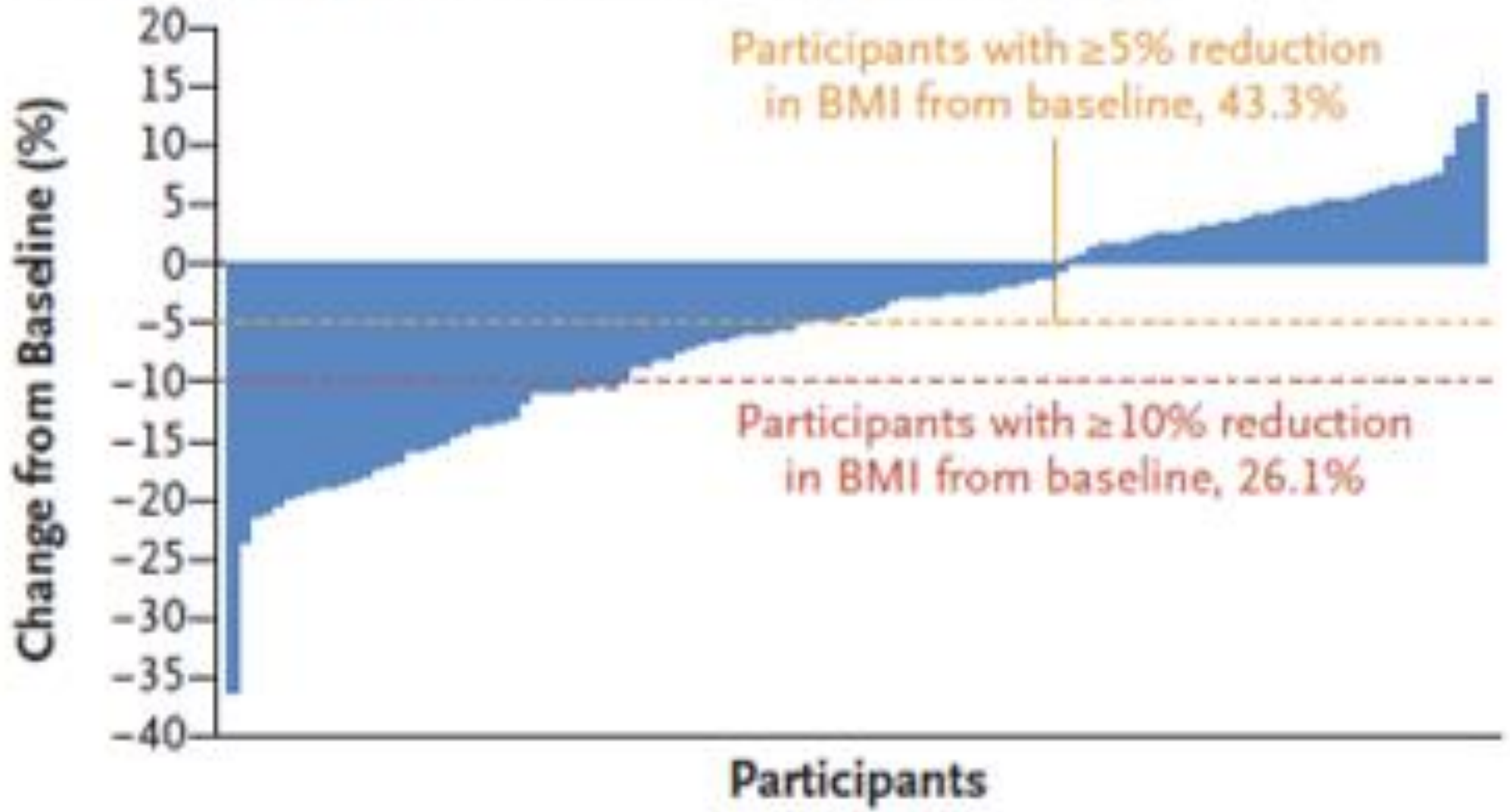
BMI z-score ETD –0.22
in favour of liraglutide

% BMI change ETD –4.64%
in favour of liraglutide

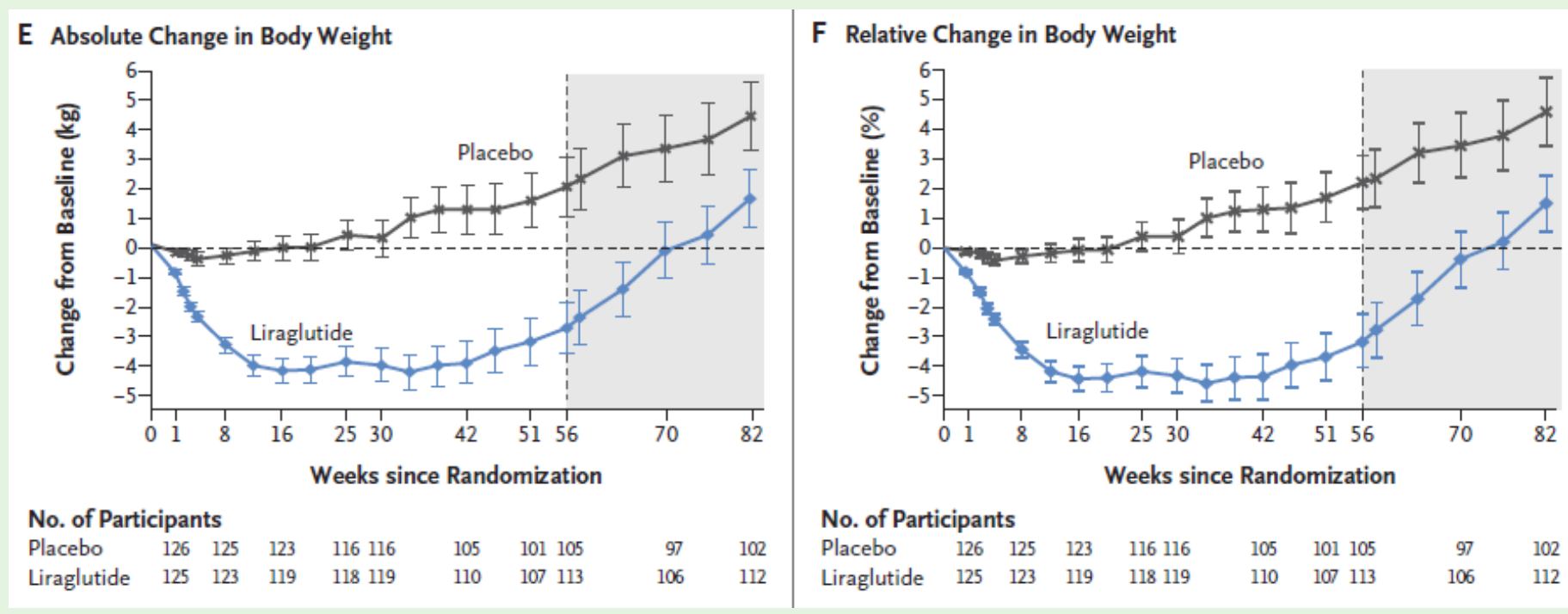
N=250; 80% retention
Mean age 14.9y; BMI 35 kg/m2

BMI, body mass index; ETD, estimated treatment difference. Kelly AS et al. N Engl J Med 2020; 382:2117–28.

C Relative Change in BMI at Wk 56 in Liraglutide Group



Change in body weight: Pediatric vs Adult



	Weight change		
	ETD	Liraglutide	Placebo
Pediatric[1]	-4.5 kg	–2.7 kg	+2.1 kg
Adult[2]	–5.6 kg	–8.4 kg	–2.8 kg

	Percent body weight change		
	ETD	Liraglutide	Placebo
Pediatric[1]	-5.0%	–3.2%	+2.2%
Adult[2]	-5.4%	–8.0%	–2.6%

Direct comparisons should not be made between trials. ETD, estimated treatment difference.

1. Kelly AS et al. N Engl J Med 2020; 382:2117–28; 2. Pi-Sunyer X et al. N Engl J Med 2015; 272:11–22.

The NEW ENGLAND JOURNAL of MEDICINE

ORIGINAL ARTICLE

This article was published on September 10, 2024, at NEJM.org.

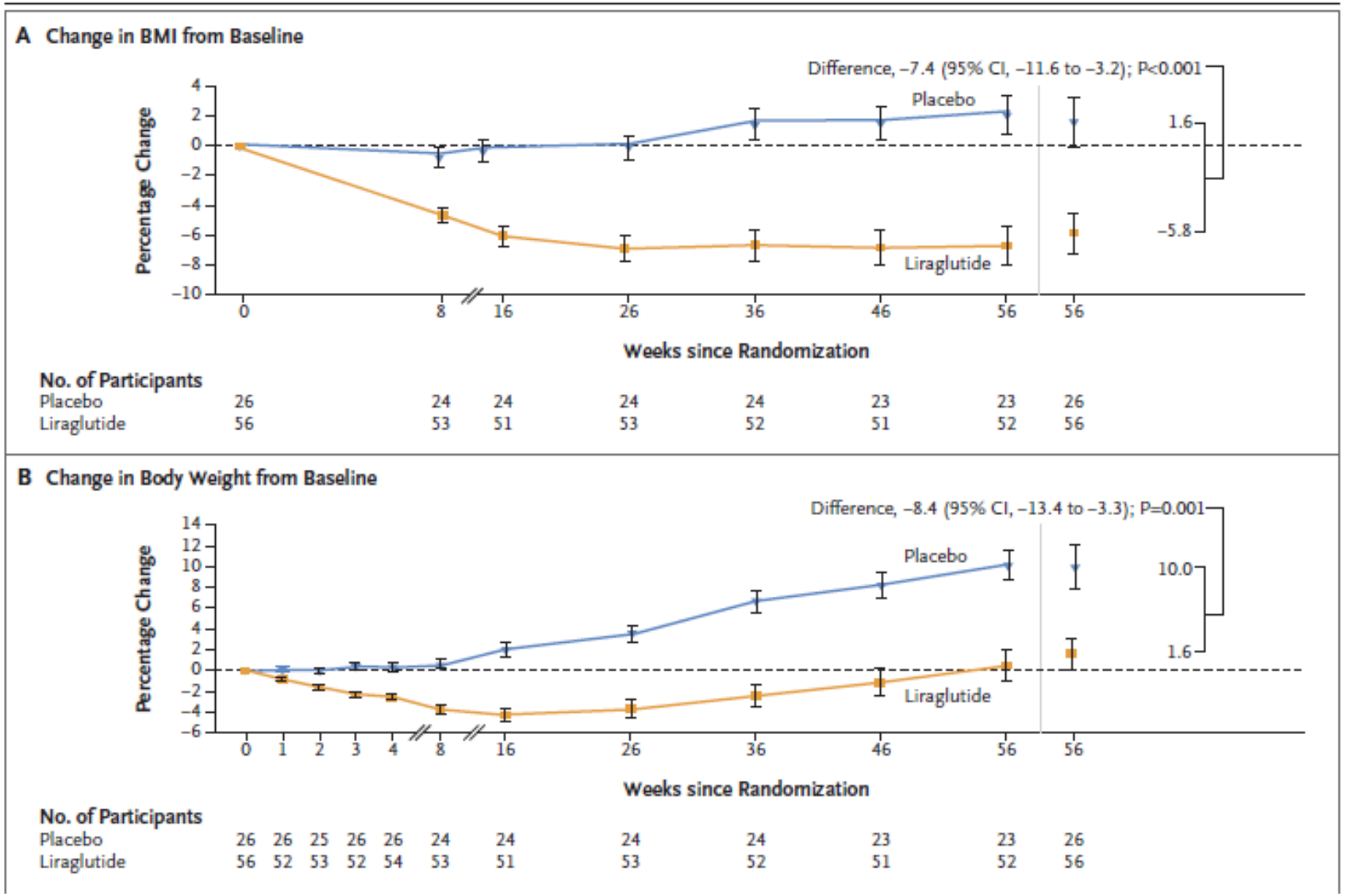
Liraglutide for Children 6 to <12 Years of Age with Obesity — A Randomized Trial

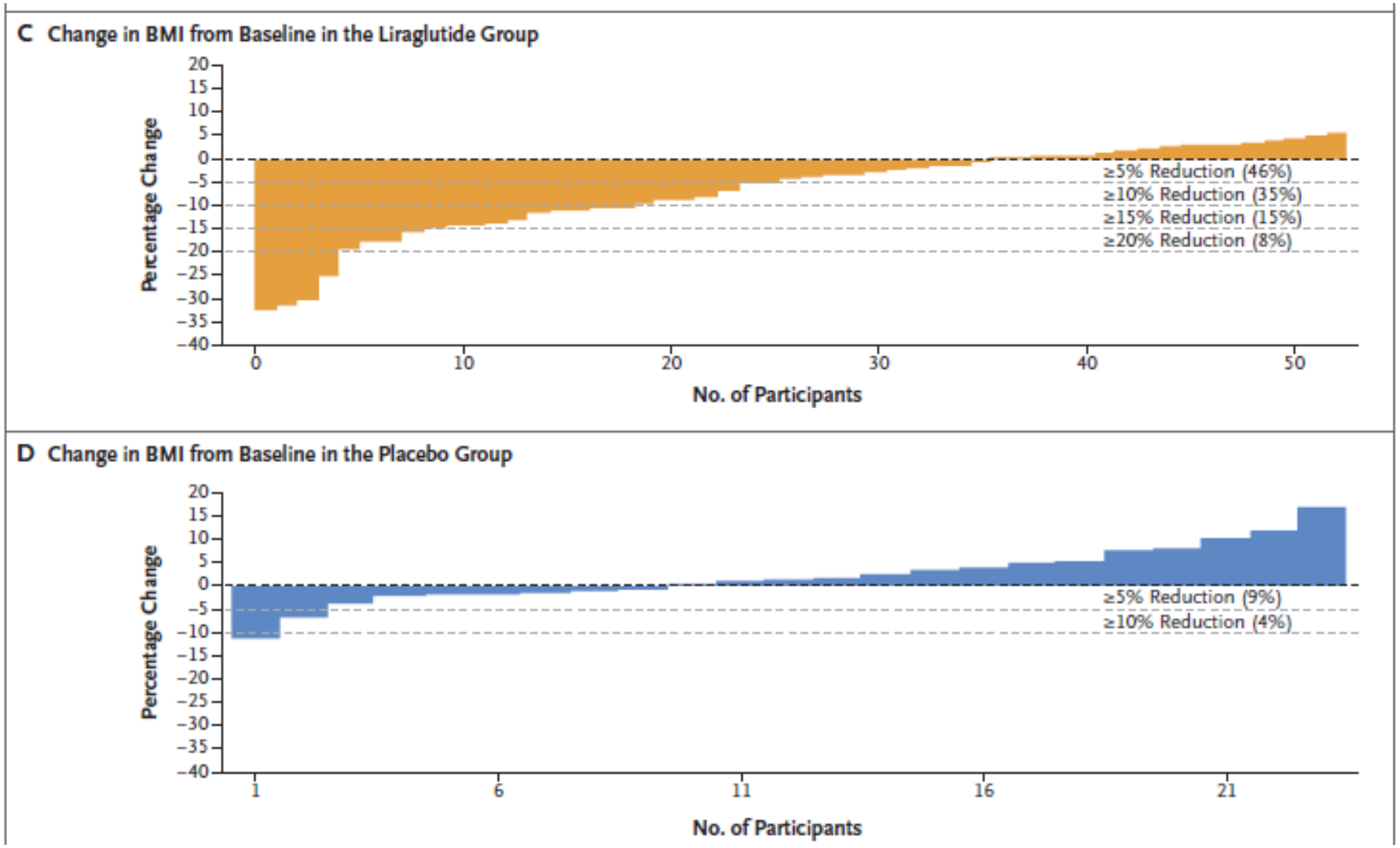
Claudia K. Fox, M.D., Margarita Barrientos-Pérez, M.D., Eric M. Bomberg, M.D., John Dcruz, M.D., Inge Gies, Ph.D., Nina M. Harder-Lauridsen, Ph.D., Muhammad Yazid Jalaludin, M.D., Kushal Sahu, M.Sc., Petra Weimers, Ph.D., Thomas Zueger, M.D., and Silva Arslanian, M.D., for the SCALE Kids Trial Group*

82 participants randomized 2:1 Liraglutide vs Placebo
Liraglutide titrated 0.6 mg to 3 mg daily over 4 weeks
56 week study with extension study ongoing
90% completed study

Table 1. Characteristics of the Participants at Baseline.*

Characteristic	Liraglutide (N=56)	Placebo (N=26)	Total (N=82)
Sex — no. (%)			
Male	30 (54)	14 (54)	44 (54)
Female	26 (46)	12 (46)	38 (46)
Age — yr	10±2	10±2	10±2
Race or ethnic group — no. (%)†			
American Indian or Alaska Native	1 (2)	0	1 (1)
Asian	6 (11)	2 (8)	8 (10)
Black	4 (7)	2 (8)	6 (7)
White	37 (66)	22 (85)	59 (72)
Other	8 (14)	0	8 (10)
Tanner stage — no. (%)‡			
1	24 (43)	10 (38)	34 (41)
2 or 3	22 (39)	13 (50)	35 (43)
4 or 5	10 (18)	3 (12)	13 (16)
Obesity class — no. (%)§			
1	10 (18)	10 (38)	20 (24)
2	26 (46)	4 (15)	30 (37)
3	20 (36)	12 (46)	32 (39)
BMI			
Mean	30.9±4.7	31.3±7.0	31.0±5.5
Standard-deviation score	3.65±0.81	3.87±1.35	3.72±1.01
Percentage of the 95th percentile	135.5±17.9	138.7±28.5	136.5±21.7


A Change in BMI from Baseline
Difference, −7.4 (95% CI, −11.6 to −3.2); P<0.001
Placebo
Liraglutide
1.6
−5.8
Percentage Change
4
2
0
−2
−4
−6
−8
−10
0
8
16
26
36
46
56
56
Weeks since Randomization
No. of Participants
Placebo 26 24 24 24 24 23 23 26
Liraglutide 56 53 51 53 52 51 52 56
B Change in Body Weight from Baseline
Difference, −8.4 (95% CI, −13.4 to −3.3); P=0.001
Placebo
Liraglutide
10.0
1.6
Percentage Change
14
12
10
8
6
4
2
0
−2
−4
−6
0 1 2 3 4 8 16 26 36 46 56 56
Weeks since Randomization
No. of Participants
Placebo 26 26 25 26 26 24 24 24 24 23 23 26
Liraglutide 56 52 53 52 54 53 51 53 52 51 52 56



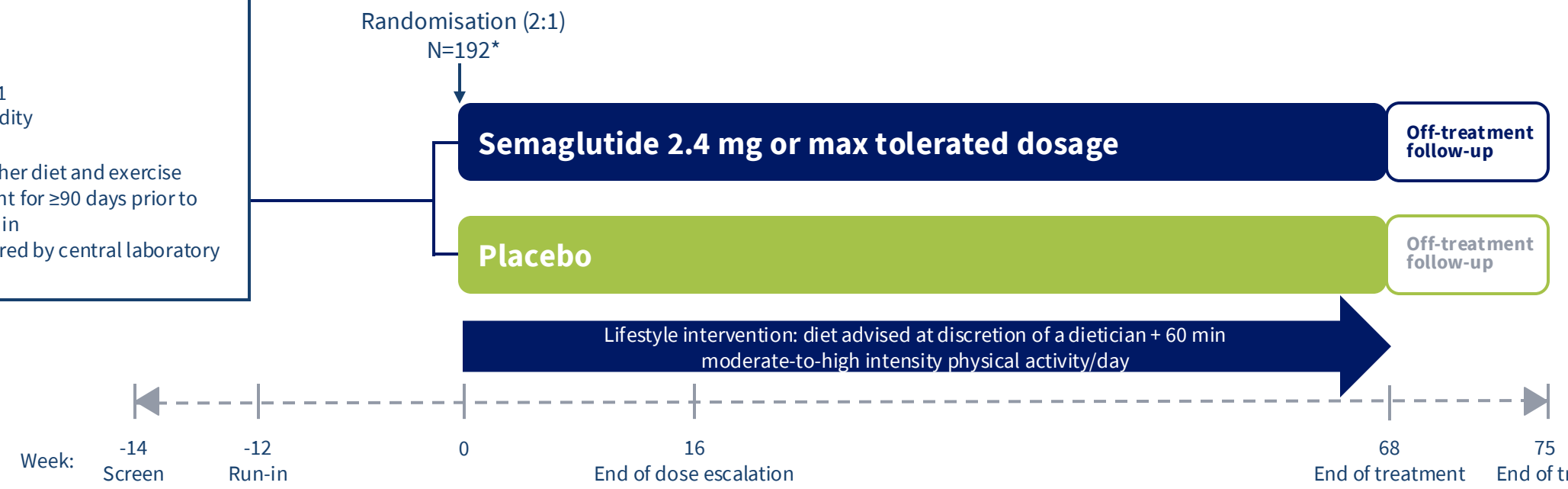
Adverse events:
Primarily GI

Long term effects on growth unknown

Once-Weekly Semaglutide in Adolescents with Obesity

Daniel Weghuber, M.D., Timothy Barrett, Ph.D., Margarita Barrientos-Pérez, M.D., Inge Gies, Ph.D., Dan Hesse, Ph.D., Ole K. Jeppesen, M.Sc., Aaron S. Kelly, Ph.D., Lucy D. Mastrandrea, M.D., Rasmus Sørrig, Ph.D., and Silva Arslanian, M.D., for the STEP TEENS Investigators*

- Male or female
- Age 12 to <18 years
- BMI:
  - ≥95th percentile†, or
  - ≥85th percentile† with ≥1 weight-related comorbidity
- For subjects with T2D:
  - Subject treated with either diet and exercise alone or stable treatment for ≥90 days prior to screening with metformin
  - HbA_{1c} ≤10.0% as measured by central laboratory at screening



Trial information

Double-blind, multicentre, multinational, placebo-controlled trial

N=201, 62% F, 75% White
Age: 15.4 ± 1.6y
Weight 107.5 ± 24.5
BMI 37.0 ± 6.4 kg/m2

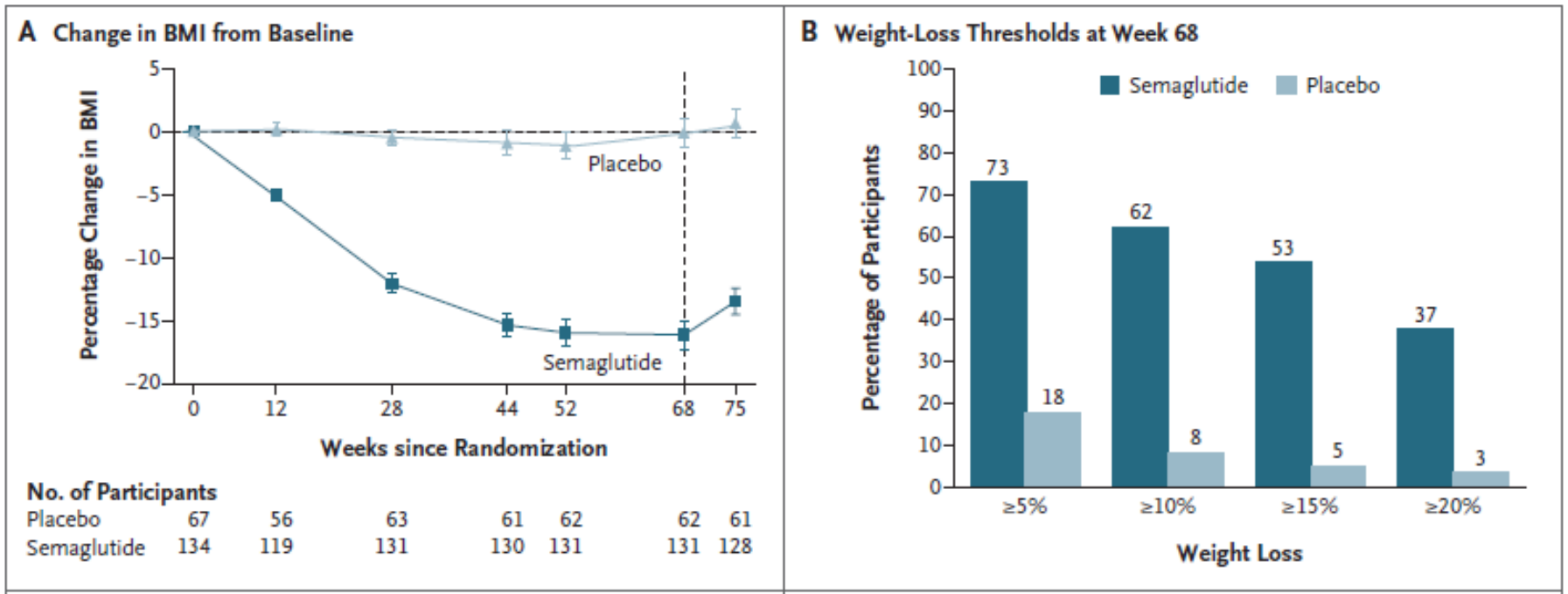
Key endpoints

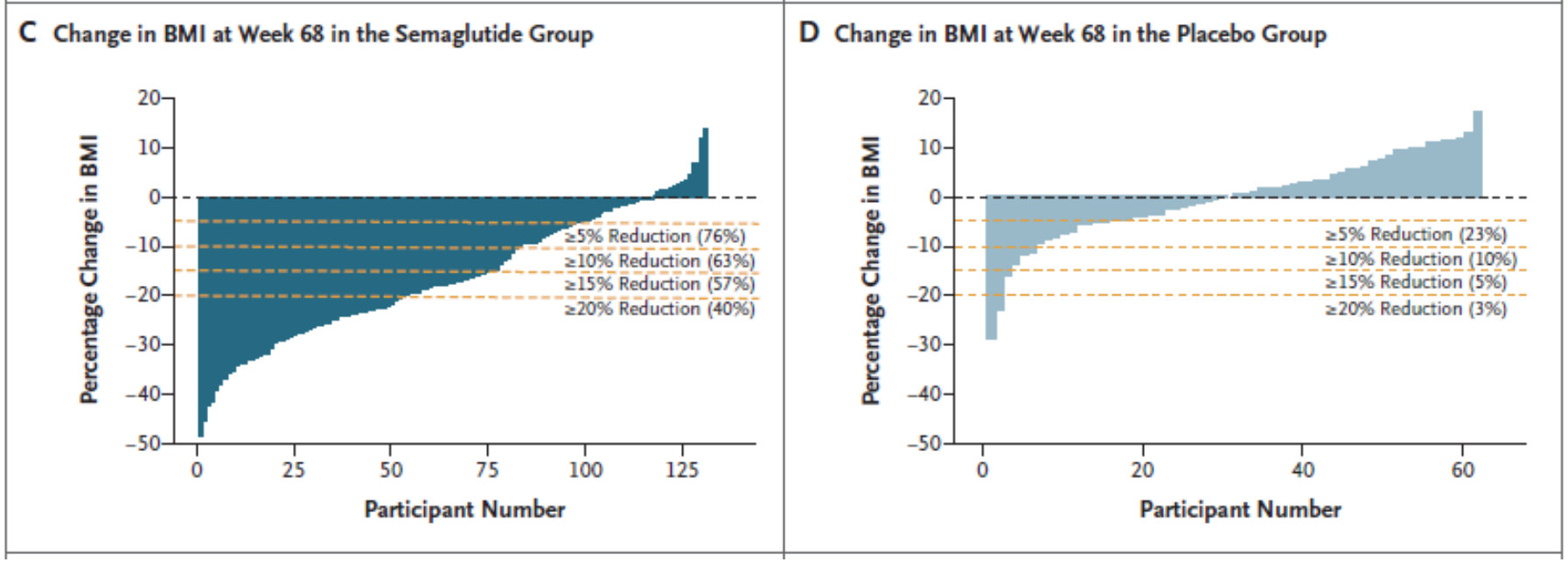
Primary: Change in BMI

Secondary: 5% body weight and BMI responders, change in body weight, change in BMI score, waist circumference, blood pressure

% BMI change ETD −16.7 % (−20.3 to −13.2) in favour of semaglutide

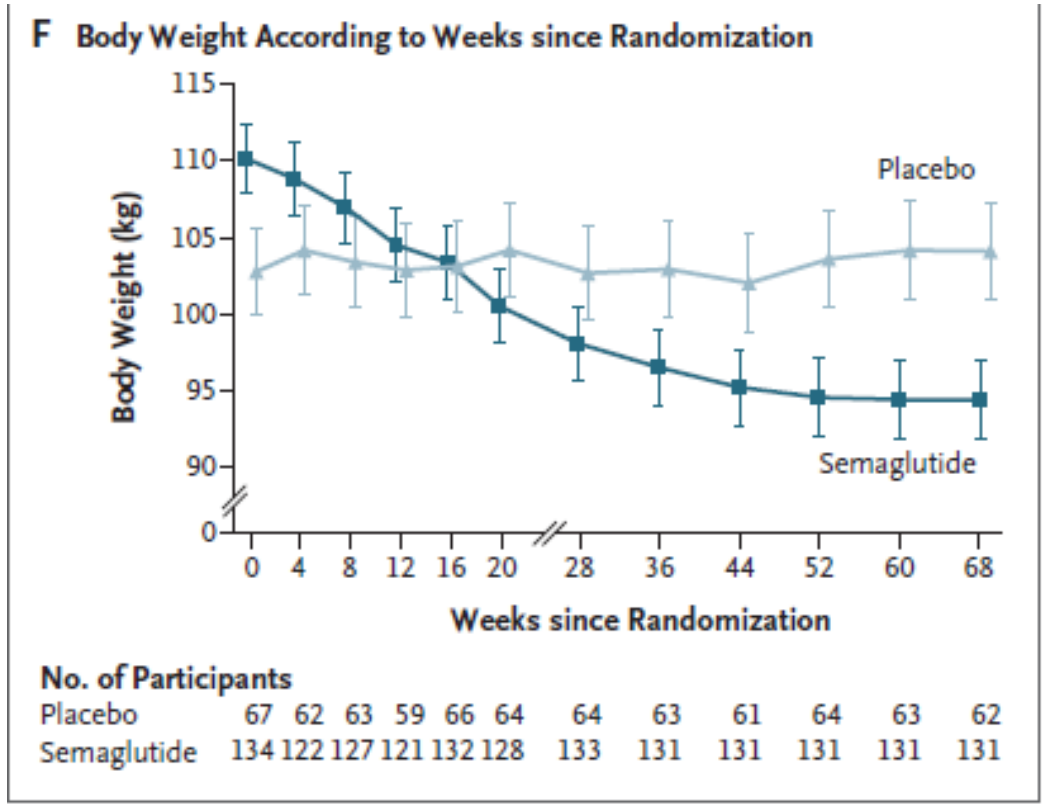
Improvements in all lipid parameters (except HDL), systolic BP, HbA1c, ALT in semaglutide group





Safety Profile: GI side effects in 62% S vs 42% P
5 episodes of cholelithiasis

Change in body weight: Pediatric vs Adult



	Weight change		
	ETD	Semaglutide	Placebo
Pediatric[1]	-17.7 kg	–15.3 kg	+2.4 kg
Adult[2]	–12.7 kg	–15.3 kg	–2.6 kg

	Percent body weight change		
	ETD	Semaglutide	Placebo
Pediatric[1]	+17.7%	-14.7%	2.7%
Adult[2]	-12.4%	–14.9%	–2.4%

Direct comparisons should not be made between trials. ETD, estimated treatment difference.
1. Weghuber et al. N Engl J Med 2022 2. Wilding et al. N Engl J Med 2021

GLP-1 Receptor Agonists: Oral

Semaglutide

Rybelsus (T2D)

- Frequency = **daily**
- Dosing:
  - 3 mg daily x 30 days
  - 7 mg daily
  - 14 mg daily

Adult studies show dose dependent weight loss 2-4 kg

Semaglutide

Obesity

- Frequency = **daily**
- Dosing:
- 50 mg daily

Adult study results published June 25, 2023, The Lancet
ETD -12.7% weight loss, average 8 kg over 68 weeks

GLP-1 Receptor Agonists: Eli Lilly

Tirzepatide
Dual GLP-1/GIP co-agonist

Mounjaro (T2D) and Obesity

- Frequency = **weekly**
- Dosing: T2D: 5-15 mg
- Obesity: 15 mg SC

Adult study results published July 21, 2022, The NEJM
ETD -20.9% weight loss, average 23.6 kg over 78 weeks

Orforglipron

Obesity

- Frequency = **daily**
- Dosing:
- 50 mg daily

Adult study results published Sept 7, 2023, The NEJM
ETD -12.6% weight loss, average 13.3 kg over 26 weeks

Phentermine/Topiramate for the Treatment of Adolescent Obesity

Aaron S. Kelly, Ph.D.,[1] Megan O. Bensignor, M.D.,[1] Daniel S. Hsia, M.D.,[2] Ashley H. Shoemaker, M.D.,[3] Winnie Shih,[4] Craig Peterson, M.S.,[4] and Santosh T. Varghese, M.D.,[4] for the Trial Investigators*

NEJM Evid 2022; 1 (6)
DOI: 10.1056/EVIDoa2200014
April 30, 2022

Table 1. Demographics and Baseline Characteristics.*

Characteristic	Placebo (n=56)	Mid-Dose PHEN/TPM (n=54)	Top-Dose PHEN/TPM (n=113)	Overall (N=223)
Age at screening — yr	14.0±1.41	14.1±1.28	13.9±1.36	14.0±1.35
Sex — no. (%)				
Female	30 (53.6)	28 (51.9)	63 (55.8)	121 (54.3)
Male	26 (46.4)	26 (48.1)	50 (44.2)	102 (45.7)
White	42 (75.0)	36 (66.7)	71 (62.8)	149 (66.8)
Black or African American	10 (17.9)	14 (25.9)	36 (31.9)	60 (26.9)
Other	4 (7.1)	4 (7.4)	4 (3.5)	12 (5.4)
American Indian or Alaska Native	0	0	1 (0.9)	1 (0.4)
Asian	0	0	1 (0.9)	1 (0.4)
Native Hawaiian or Other Pacific Islander	0	0	0	0
Ethnicity — no. (%)				
Hispanic or Latino	13 (23.2)	25 (46.3)	34 (30.1)	72 (32.3)
Not Hispanic or Latino	42 (75.0)	28 (51.9)	79 (69.9)	149 (66.8)
Not stated	1 (1.8)	1 (1.9)	0	2 (0.9)
Weight — kg	102.2±21.8	105.2±22.4	108.5±25.0	106.1±23.7
Height — cm	167.2±7.6	168.6±8.0	166.3±7.8	167.1±7.8
BMI‡	36.4±6.4	36.9±6.8	39.0±7.4	37.8±7.1

56-week RCT
adolescents 12-17 yrs of age with obesity
randomly assigned 1:1:2 to receive
either placebo,
mid-dose PHEN/TPM (7.5 mg/46 mg), or
top-dose PHEN/TPM (15mg/92 mg)

Mechanism of action unclear
Side effects: paresthesia, dry mouth, constipation

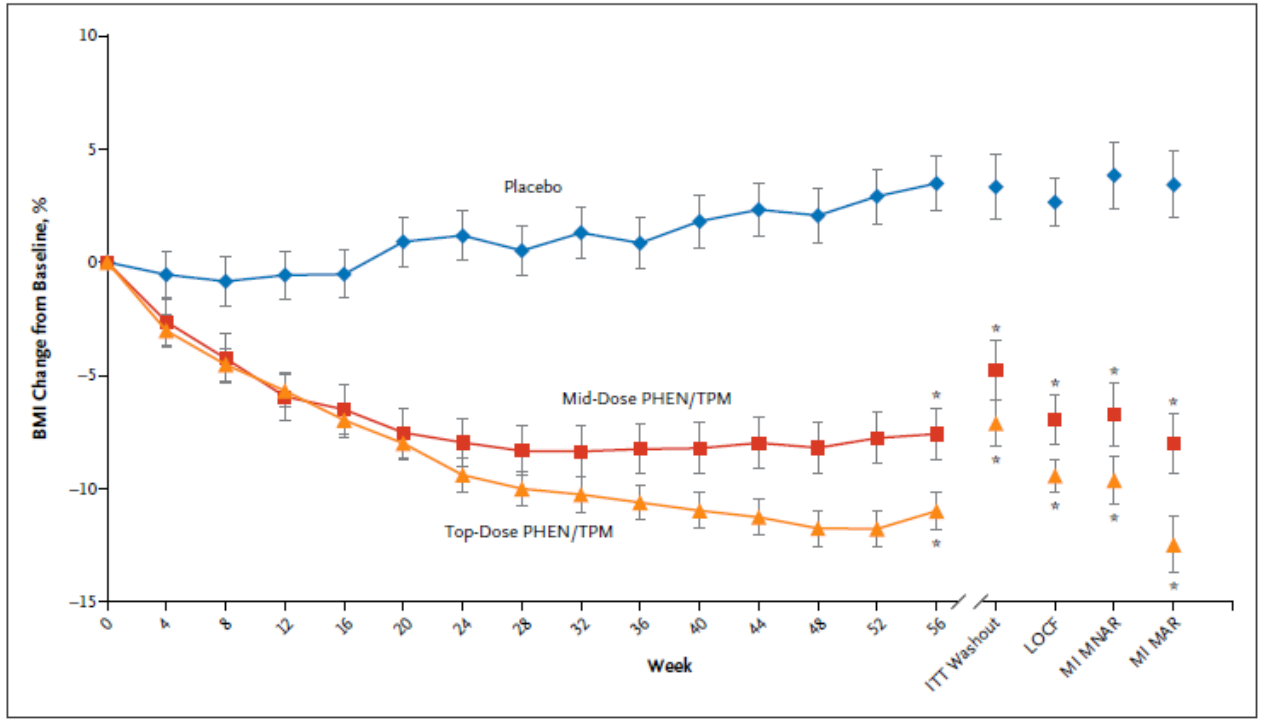


Figure 2 Percent Body-Mass Index Change Over Time.

Plot of least square means (±SE) of percentage change in body-mass index (BMI) using observed data from baseline to week 56 by treatment group (with the primary analysis, modified intent-to-treat [ITT], and other imputation models). The mid and top doses are 7.5 mg/46 mg and 15 mg/92 mg of phentermine/topiramate (PHEN/TPM), respectively. LOCF denotes last observation carried forward, MAR missing at random, MI multiple imputation, and MNAR, missing not at random. *P<0.001 versus placebo.

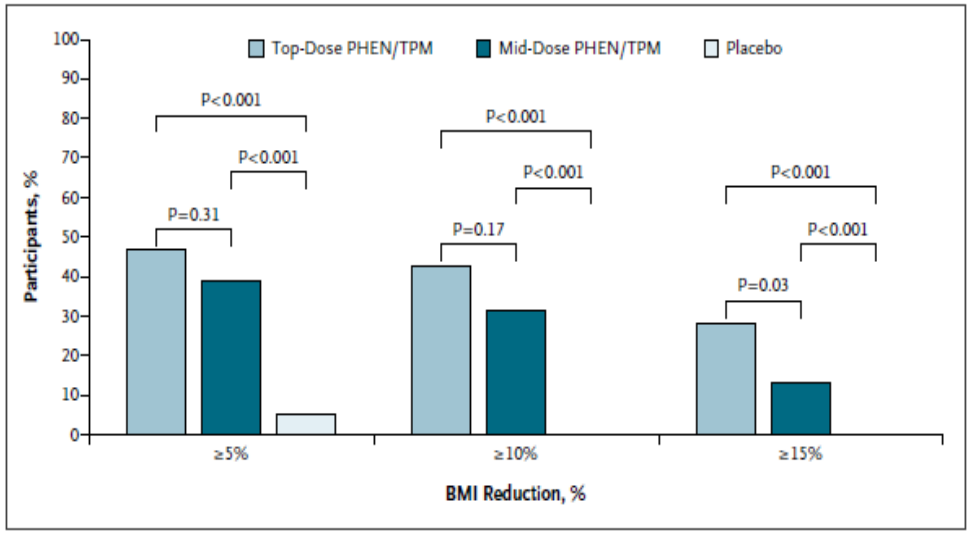


Figure 3 Percentage of Participants Achieving Various Body-Mass Index Reduction Benchmarks.

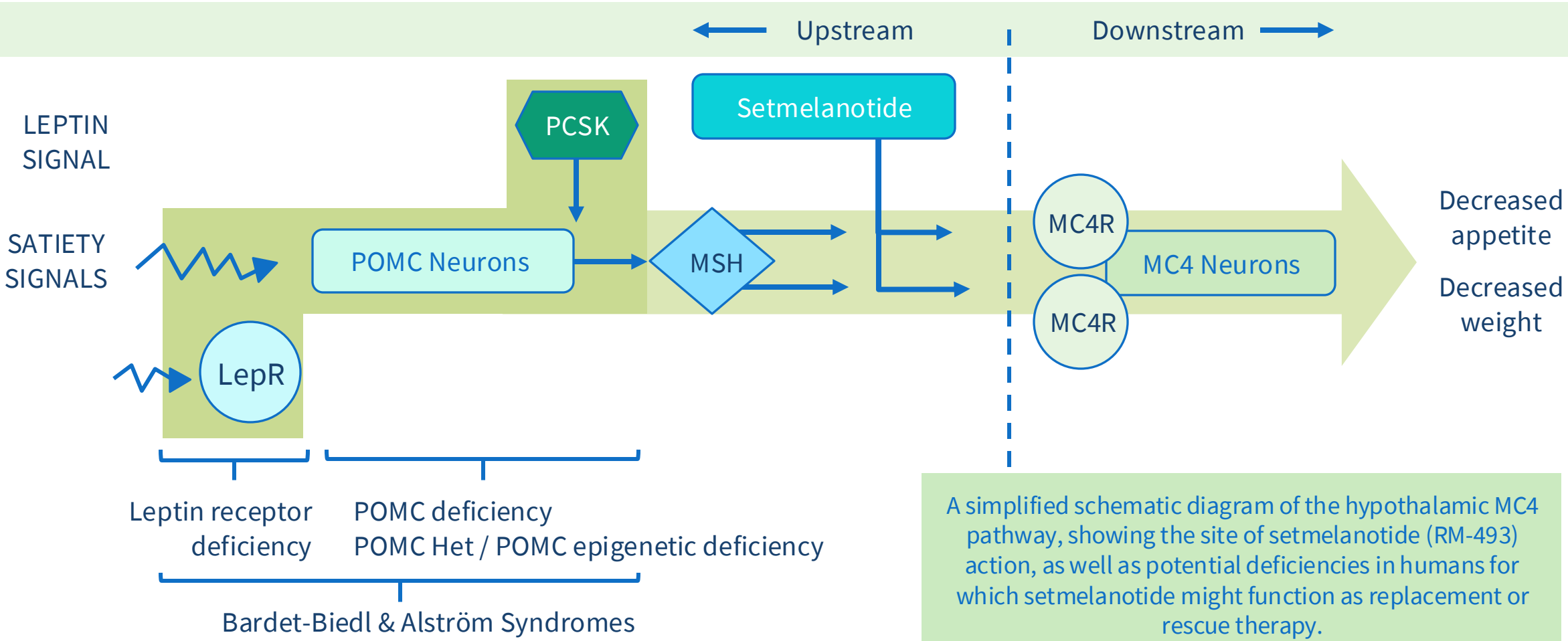
NEJM Evid 2022; 1 (6)
DOI: 10.1056/EVIDoa2200014

Table 2. Estimated Mean Change from Baseline in Primary and Secondary End Points at Week 56.*

End Point	Placebo (n=56)	Mid-Dose PHEN/TPM (n=54)	Top-Dose PHEN/TPM (n=113)	Mid Dose vs. Placebo (95% CI)	Top Dose vs. Placebo (95% CI)
Percent BMI, percentage point difference†	3.34±1.44	−4.78±1.30	−7.11±1.01	−8.11 (−11.92 to −4.31)	−10.44 (−13.89 to −6.99)
BMI	1.20±0.46	−2.53±0.44	−4.15±0.31	−3.73 (−4.97 to −2.50)	−5.35 (−6.44 to −4.27)
BMI % of the 95th percentile	4.97±1.74	−9.41±1.65	−15.28±1.16	−14.38 (−19.07 to −9.69)	−20.25 (−24.37 to −16.13)
Weight, kg	6.57±1.28	−5.49±1.23	−9.23±0.86	−12.06 (−15.55 to −8.58)	−15.80 (−18.82 to −12.77)
Waist circumference, cm	0.31±1.39	−7.42±1.29	−9.27±0.91	−7.72 (−11.43 to −4.02)	−9.58 (−12.83 to −6.33)
WBISI (Matsuda), mmol/l‡	1.06±0.62	1.25±0.54	1.85±0.38	0.19 (−1.45 to 1.82)	0.80 (−0.64 to 2.24)
HDL-C, percentage point difference	−3.65±2.85	6.65±2.45	5.10±1.76	10.30 (2.91 to 17.70)	8.75 (2.15 to 15.35)
Triglycerides, percentage point difference	8.35±7.37	−12.79±6.30	−12.37±4.49	−21.14 (−40.24 to −2.05)	−20.72 (−37.71 to −3.72)
Systolic blood pressure, mm Hg	2.80±1.62	−0.97±1.50	1.00±1.04	−3.76 (−8.09 to 0.56)	−1.80 (−5.58 to 1.97)
Diastolic blood pressure, mm Hg	3.11±1.33	−0.87±1.22	0.14±0.85	−3.99 (−7.53 to −0.45)	−2.97 (−6.07 to 0.12)
IWQOL total score§	2.94±1.89	4.31±1.70	3.11±1.20	1.37 (−3.64 to 6.39)	0.17 (−4.25 to 4.60)
Heart rate, beats per min	1.46±1.72	−1.31±1.57	5.27±1.10	−2.77 (−7.32 to 1.79)	3.82 (−0.17 to 7.81)

NEJM Evid 2022; 1 (6)
DOI: 10.1056/EVIDoa2200014

Proopiomelanocortin Deficiency Treated with a Melanocortin-4 Receptor Agonist



A simplified schematic diagram of the hypothalamic MC4 pathway, showing the site of setmelanotide (RM-493) action, as well as potential deficiencies in humans for which setmelanotide might function as replacement or rescue therapy.

Het, heterozygous; LepR, leptin receptor; PCSK, gene symbol for prohormone convertase 1/3; POMC, proopiomelanocortin; MSH, melanocyte stimulating hormone; MC4R, melanocortin-4 receptor. Kühnen P et al. N Engl J Med 2016; 375:240–6.

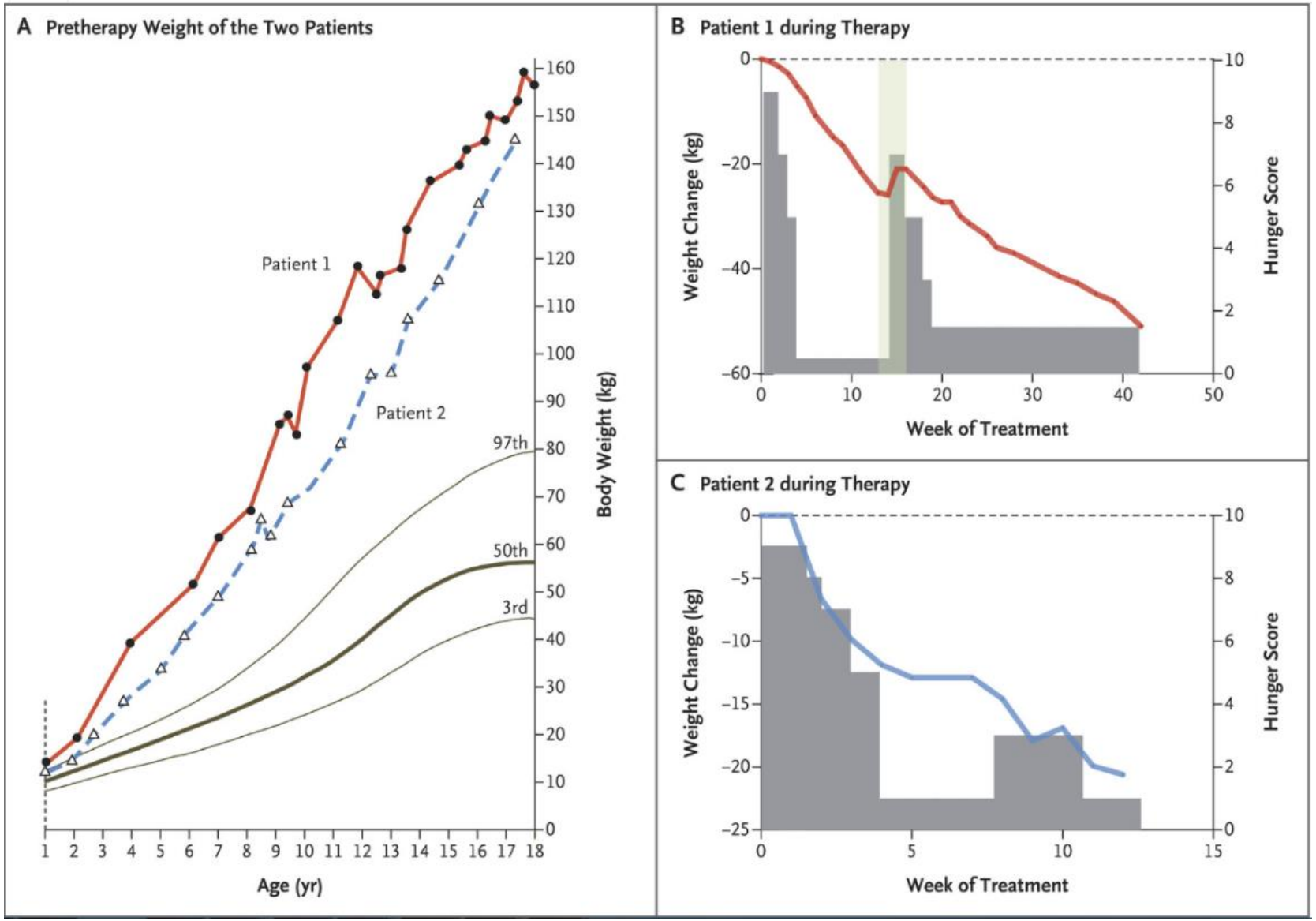
POMC

Trial information:

- Phase 2, nonrandomized, open-label pilot study
- N=2 adult patients with proopiomelanocortin deficiency

Off-treatment phase

Hunger score



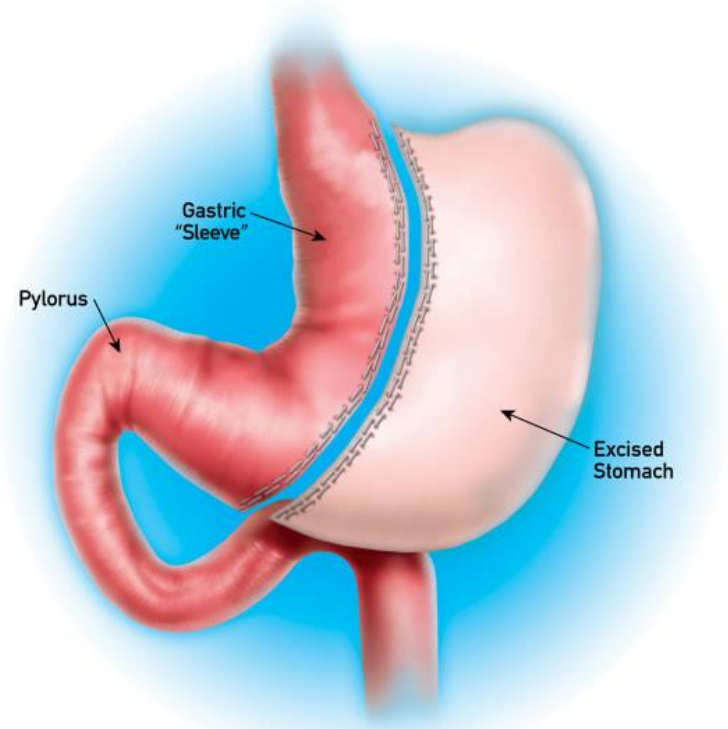
Kühnen P et al. N Engl J Med 2016; 375:240–6.

Practical Considerations

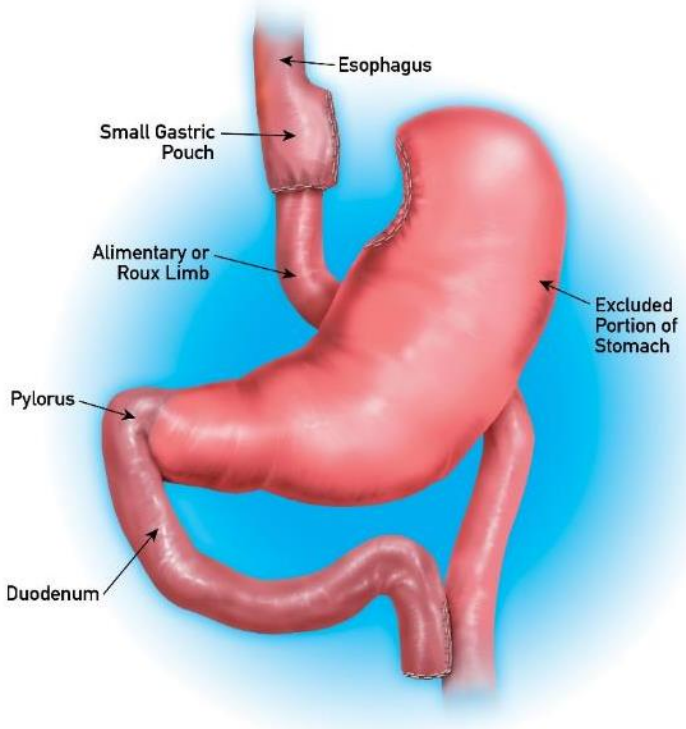
- Combined with lifestyle management
- Age – lower limit?
- Co-morbid conditions
- Degree of obesity
- Special populations
- Duration of therapy
- Response to therapy
- Cost and Coverage
- Concern for ED

Bariatric Surgery

Vertical Sleeve Gastrectomy



Roux-en-y Gastric Bypass

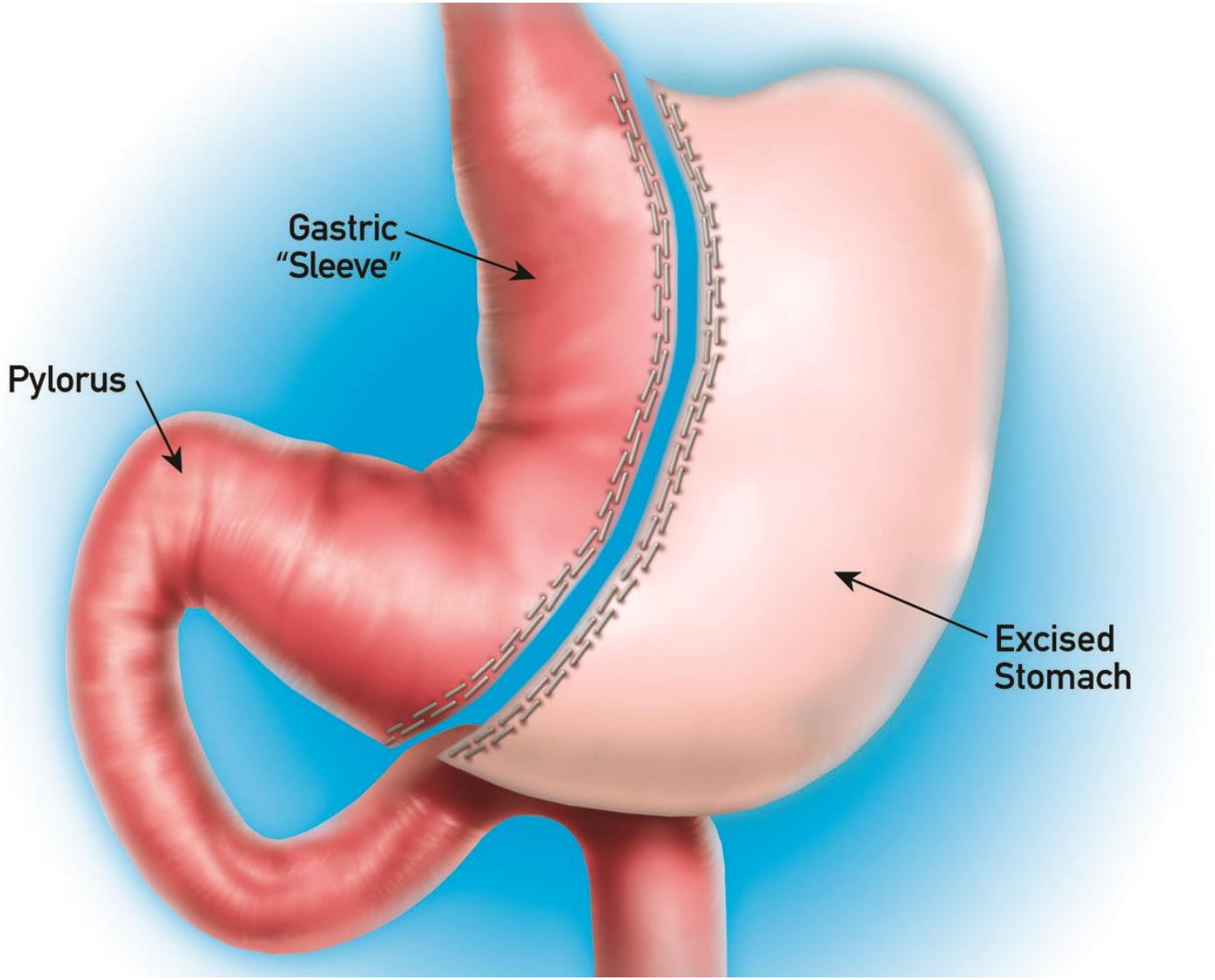


Bariatric Surgery

Eligibility:

- teens who have reached full physical maturity
- engaged in ≥6 months of an interdisciplinary weight-management program
- severe obesity with weight-related health complications

Disrupts some biologic mechanisms that contribute to weight regain in those who achieve weight loss through a lifestyle change alone.



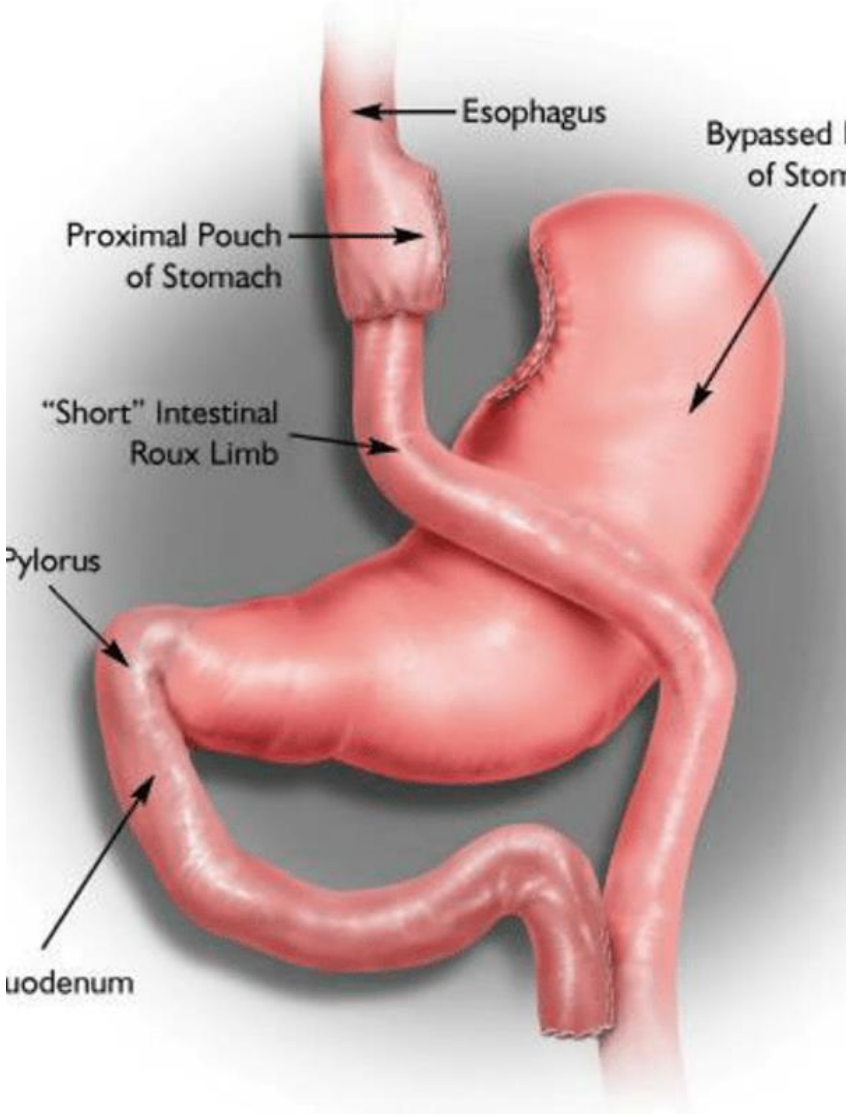
Sleeve Gastroectomy

Pros:

- Lower surgical complication rate
- Lower risk of vitamin deficiency
- No dumping or malabsorption
- Potential for conversion to RYGB

Cons:

- Potential for less weight loss



Roux-en-Y Gastric Bypass

Pros:

- Greater weight loss
- Weight loss more sustained
- Reduced appetite
- Improved resolution of diabetes and metabolic complications

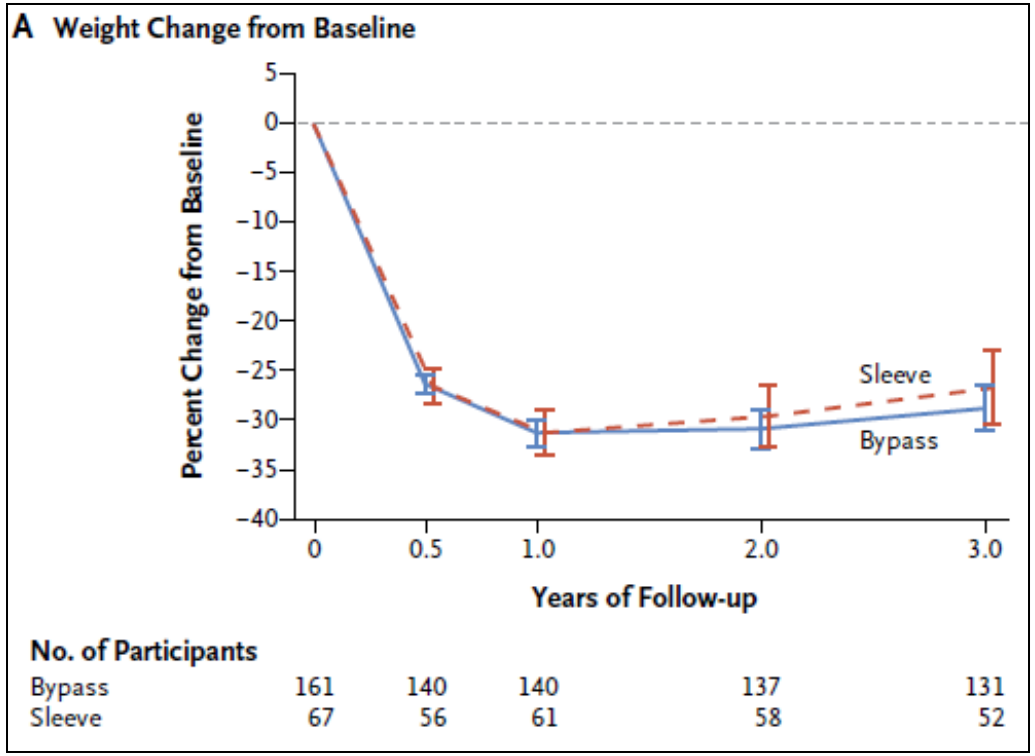
Cons:

- Higher surgical (acute and long term) complication rates
- Malabsorption: vitamin deficiencies
- Dumping syndrome

Weight Loss and Health Status 3 Years after Bariatric Surgery in Adolescents

Thomas H. Inge, M.D., Ph.D., Anita P. Courcoulas, M.D., Todd M. Jenkins, Ph.D., Marc P. Michalsky, M.D., Michael A. Helmrath, M.D., Mary L. Brandt, M.D., Carroll M. Harmon, M.D., Ph.D., Meg H. Zeller, Ph.D., Mike K. Chen, M.D., Stavra A. Xanthakos, M.D., Mary Horlick, M.D., and C. Ralph Buncher, Sc.D., for the Teen-LABS Consortium*

N ENGL J MED 374;2 NEJM.ORG JANUARY 14, 2016



Loss of 25-30% of starting weight (or BMI)

Characteristic	All Participants (N=228)	Gastric Bypass (N=161)	Sleeve Gastrectomy (N=67)
Age — yr	17±1.6	17±1.5	17±1.7
Mean BMI (95% CI)			
Baseline	53 (51 to 54)	54 (52 to 55)	50 (48 to 52)
3 Yr¶	38 (37 to 40)	39 (37 to 41)	37 (34 to 39)

Evolution and Outcomes of a Canadian Pediatric Bariatric Surgery Program☆

Median age 17.4 y [13.6-18.2 y]
BMI at surgery 47.5 ± 5.2

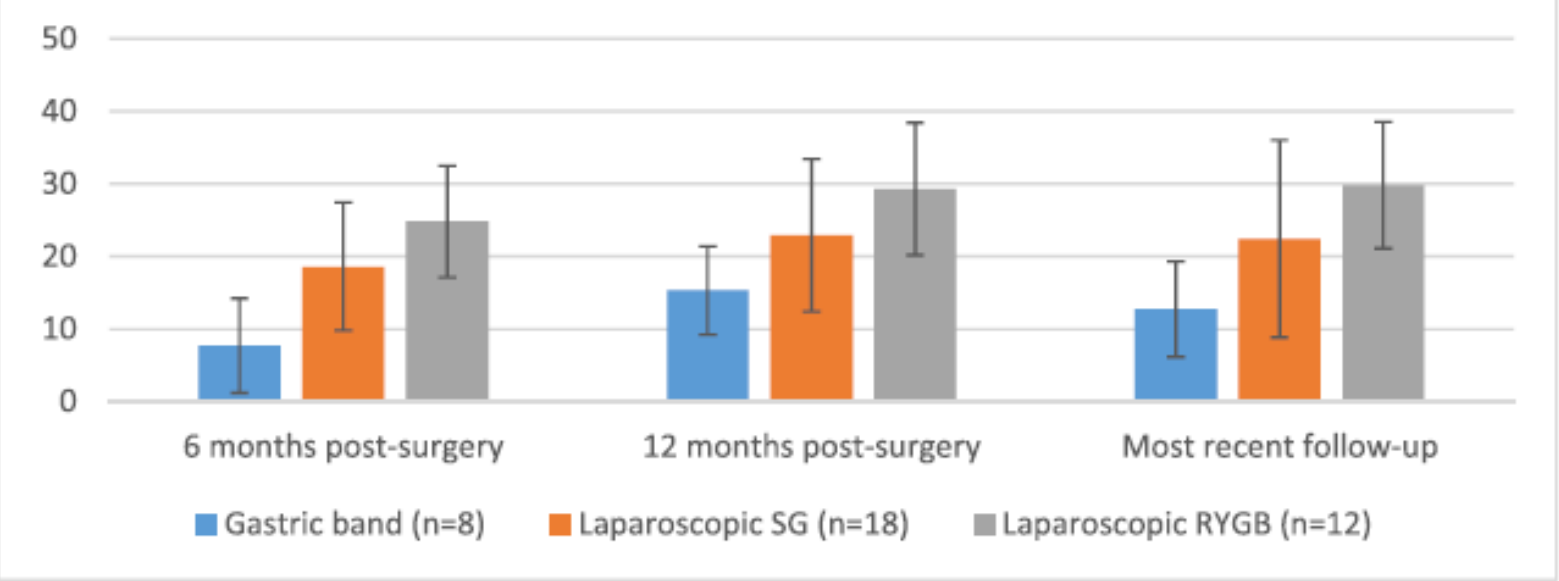


Fig. 2. Percentage weight loss over time among adolescents undergoing weight loss surgery between 2007 and 2017.

Pediatric Obesity. 2024;e13119.
https://doi.org/10.1111/ijpo.13119

Effectiveness of surgical interventions for managing obesity in children and adolescents: A systematic review and meta-analysis framed using minimal important difference estimates based on GRADE guidance to inform a clinical practice guideline

Krista Oei[1,2] | Bradley C. Johnston[3] | Geoff D. C. Ball[4] | Donna Fitzpatrick-Lewis[5] | Ali Usman[5] | Diana Sherifali[5] | Zahra Esmaeilinezhad[3] | Roah Merdad[6] | Elizabeth Dettmer[1] | Julius Erdstein[7] | Jacob C. Langer[1,2] | Catherine Birken[1,2] | Mélanie Henderson[8,9] | Sarah A. Moore[10] | Katherine M. Morrison[5,11] | Jill Hamilton[1,2] | the Steering Committee for Updating the Canadian Clinical Practice Guideline for Managing Pediatric Obesity

- Studies limited to 1 RCT and observational studies

- 5 surgical techniques:
  - Roux-en-Y Gastric Bypass (RYGB)
  - Laparoscopic Adjustable Gastric Banding (LAGB)
  - Laparoscopic Sleeve Gastrectomy (LSG)
- Duodenojejunal Bypass Liner (DJBL)
- Intra-Gastric Weight Loss Device (IGWLD)

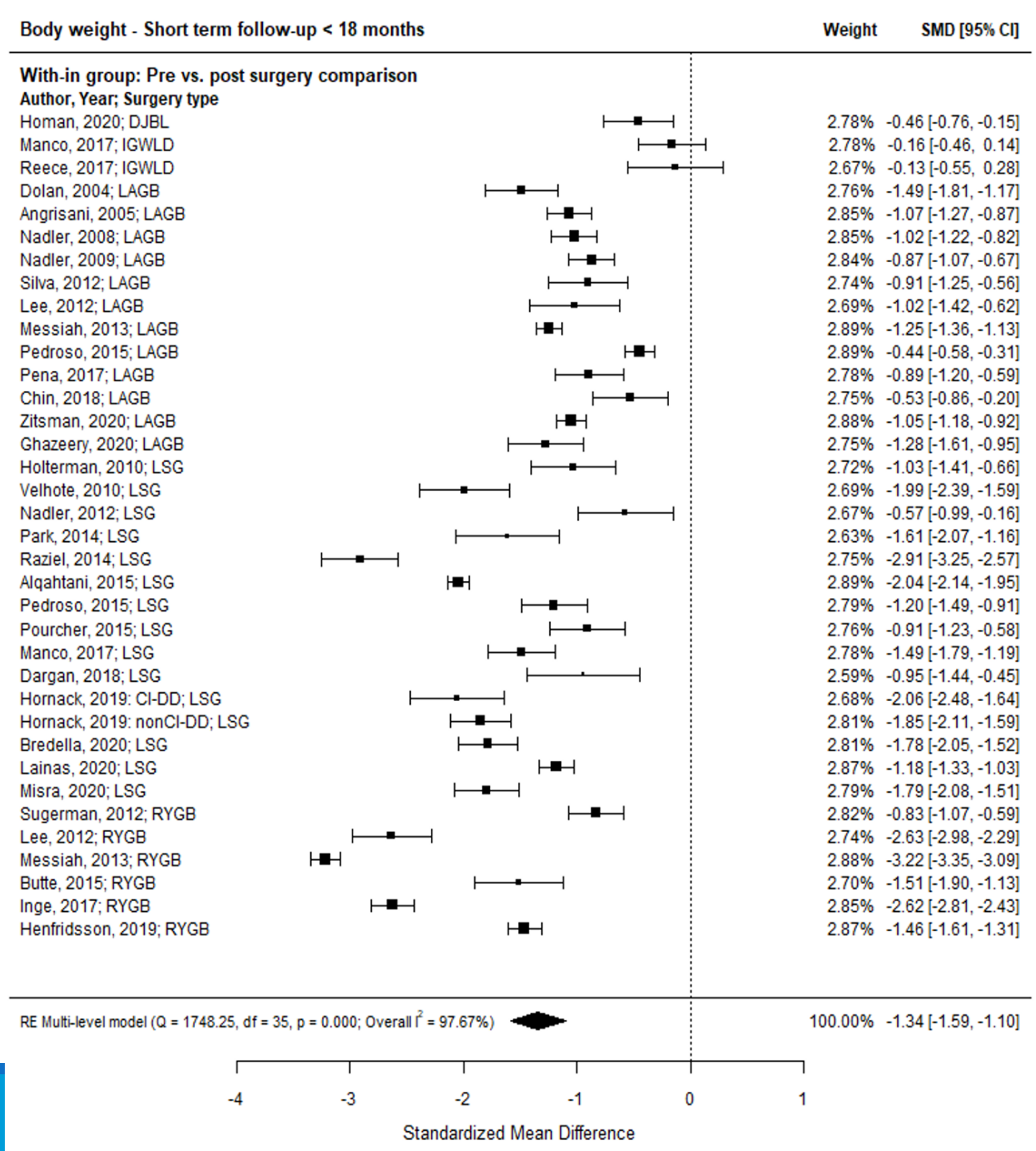
- Outcomes:
  - PROMs – HRQL, Anxiety, Depression
  - Blood Pressure
  - Insulin Resistance – Fasting Insulin, HOMA-IR
  - Lipid profile
- ALT
- BMI, BMI z-score
- Weight
- Adverse Events

- Follow-up periods:

Short (<18 mths), Intermediate (18-24 mths), long-term (>24 mths)

Study Designs

- 63 publications (43 original studies)
  - Total number of participants = 6,128 (66% female)
  - Studies included:
    - 1 RCT
    - 13 controlled observational studies
    - 49 uncontrolled single-arm observational studies



Body Weight

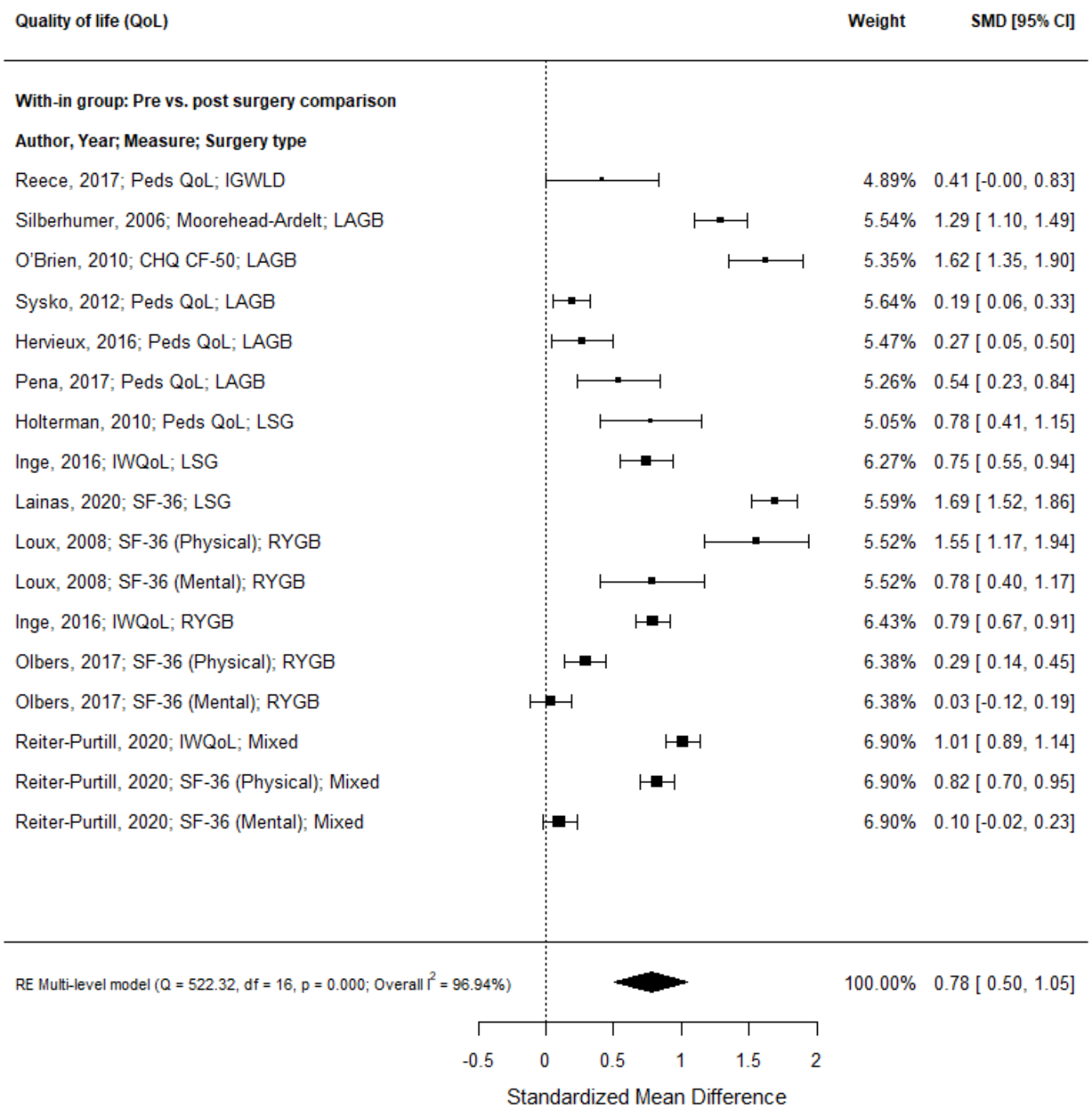
31 studies

Pooled SMD = -1.34

(95% CI -1.59,-1.10)

Mean difference

-25.2kg (-29.9, -20.7)



QOL

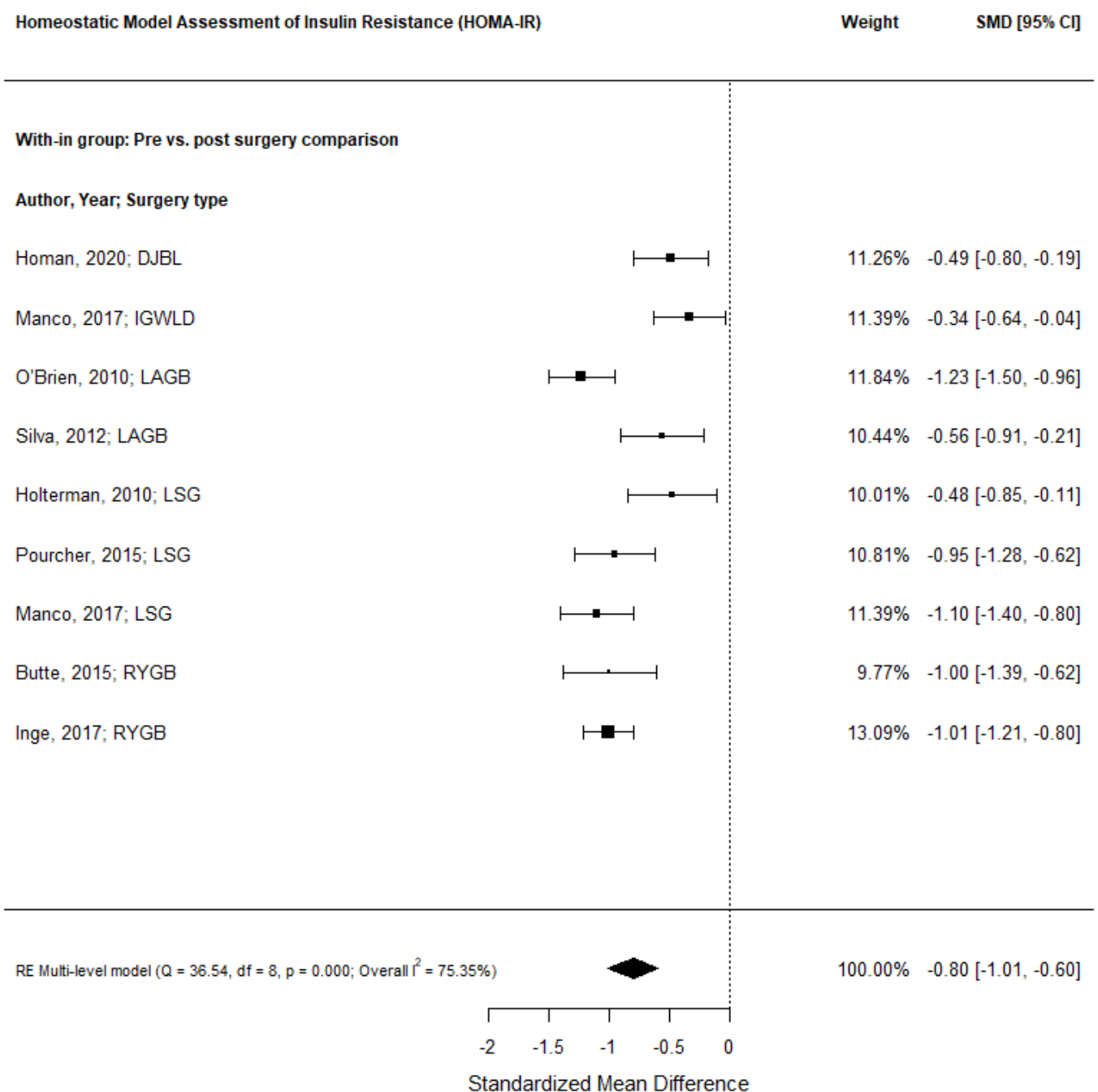
12 studies

Pooled SMD = 0.78

(95% CI 0.50,1.05)

Equates to an increase of 12 points on peds HRQOL

Insulin Resistance



8 studies

Pooled SMD = -0.80

(95% CI -1.01,-0.60)

Mean difference

-2.7 HOMA-IR

Surgical Complications

Table 4. Intraabdominal Operations and Other Related Procedures from 31 Days to 3 Years after the Bariatric Procedure.*

Procedure	All Participants (N=228)			Gastric Bypass (N=161)			Sleeve Gastrectomy (N=67)		
	Patients	Events	Rate (95% CI)	Patients	Events	Rate (95% CI)	Patients	Events	Rate (95% CI)
	no. (%)	*no.*	*events per 300 person-years*	*no. (%)*	*no.*	*events per 300 person-years*	*no. (%)*	*no.*	*events per 300 person-years*
Intraabdominal operations	30 (13)	47	22.3 (16.8–29.7)	23 (14)	38	25.0 (18.2–34.4)	7 (10)	9	15.4 (8.0–29.5)
Ventral hernia repair	1 (<1)	1	0.5 (0.1–3.4)	0	0	0	1 (1)	1	1.7 (0.2–12.1)
Exploratory laparotomy	3 (1)	3	1.4 (0.5–4.4)	3 (2)	3	2.0 (0.6–6.1)	0	0	0
Wound drainage	2 (1)	2	1.0 (0.2–3.8)	1 (1)	1	0.7 (0.1–4.7)	1 (1)	1	1.7 (0.2–12.1)
Lysis of adhesions	4 (2)	6	2.9 (1.3–6.3)	4 (2)	6	3.9 (1.8–8.8)	0	0	0
Gastrostomy	4 (2)	5	2.4 (1.0–5.7)	4 (2)	5	3.3 (1.4–7.9)	0	0	0
Sleeve gastrectomy converted to gastric bypass	1 (1)	1	1.7 (0.2–12.1)	NA	NA	NA	1 (1)	1	1.7 (0.2–12.1)
Appendicostomy for antegrade enemas	1 (<1)	1	0.5 (0.1–3.4)	0	0	0	1 (1)	1	1.7 (0.2–12.1)
Repair of internal hernia	3 (1)	5	2.4 (1.0–5.7)	3 (2)	5	3.3 (1.4–7.9)	0	0	0
Bowel resection or diverting stoma	2 (1)	2	1.0 (0.2–3.8)	2 (1)	2	1.3 (0.3–5.3)	0	0	0
Luminal stent placement for leak	1 (<1)	1	0.5 (0.1–3.4)	0	0	0	1 (1)	1	1.7 (0.2–12.1)
Cholecystectomy	18 (8)	18	8.6 (5.4–13.6)	15 (9)	15	9.9 (6.0–16.4)	3 (4)	3	5.1 (1.7–15.9)
Appendectomy	2 (1)	2	1.0 (0.2–3.8)	1 (1)	1	0.7 (0.1–4.7)	1 (1)	1	1.7 (0.2–12.1)
Endoscopic procedures	29 (13)	48	22.8 (17.2–30.3)	24 (15)	41	27.0 (19.9–36.6)	5 (7)	7	12.0 (5.7–25.1)
Upper gastrointestinal tract endoscopy	21 (9)	37	17.6 (12.7–24.3)	16 (10)	31	20.4 (14.3–29.0)	5 (7)	6	10.2 (4.6–22.8)
Stricture dilation	9 (4)	11	5.2 (2.9–9.4)	8 (5)	10	6.6 (3.5–12.2)	1 (1)	1	1.7 (0.2–12.1)

* Data are for events that occurred through the 3-year follow-up visit (visit window, 2.5 to 3.5 years). NA denotes not applicable.

13% overall

Nutritional Deficiencies

RYGB

Prevalence (%)	Baseline	3 years
Low Vitamin B12	<1	8
Low 25OH Vit D	45	48*
Low Ferritin	2	66
Low Vit A	6	16

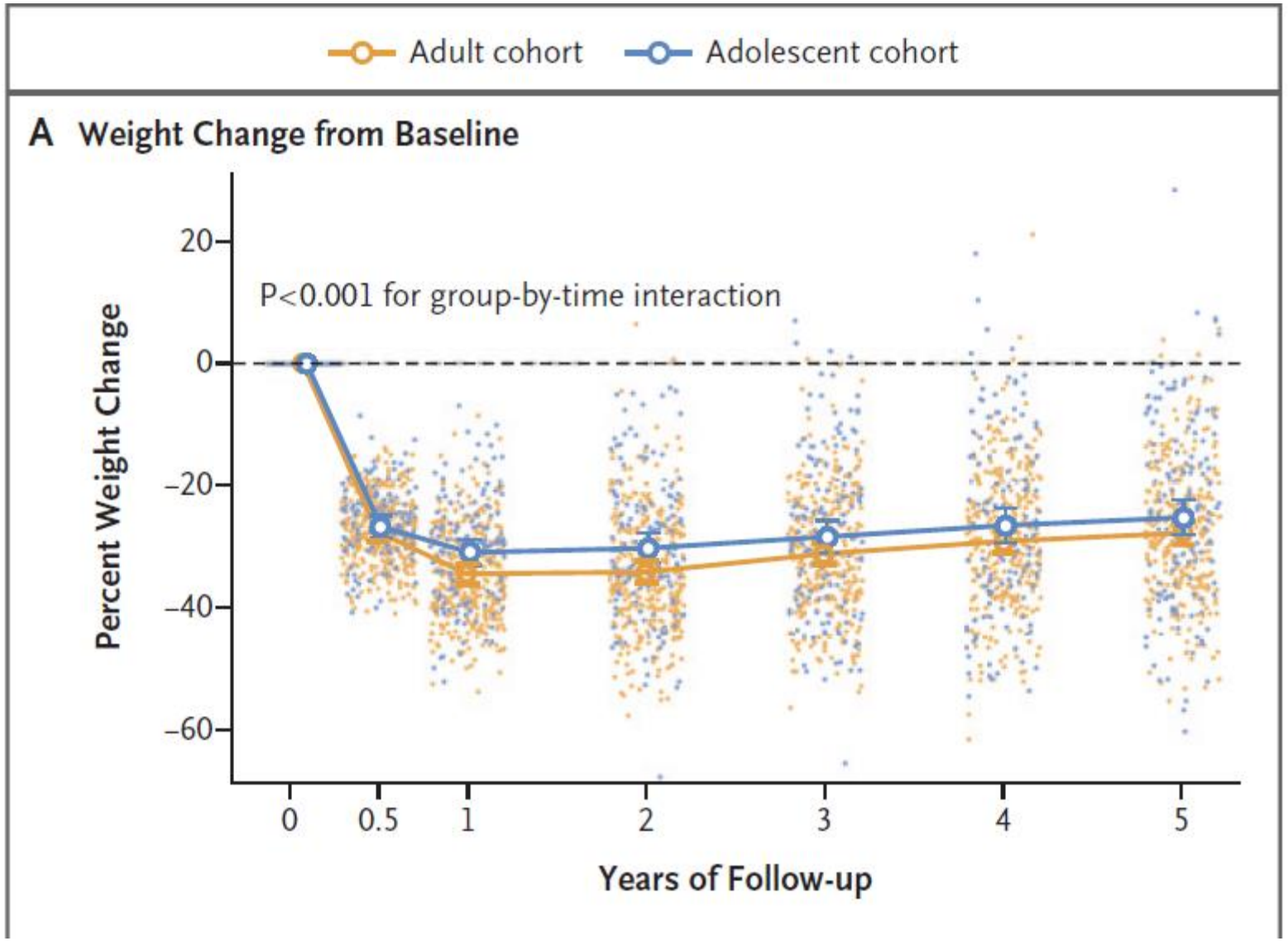
Sleeve

Prevalence (%)	Baseline	3 years
Low 25OH Vit D	19	30*
Low Ferritin	11	34

*** P = NS**

Cardiometabolic Outcomes

	Prevalence %	Remission %
Type 2 DM	**13**	**95**
Pre-diabetes	**10**	**76**
Dyslipidemia	**76**	**66**
HTN	**43**	**74**
Renal	**17**	**86**



5 years after surgery:

% weight change

Adolescents: −26%; [−29 to −23]

Adults −29%; [−31 to −27] (P = 0.08)

Remission T2D

Adolescents: 86%

Adults: 53%

Surgical complications slightly higher
In teens (approx. 13%)
Higher rates of B12, ferritin, vitamin D
Deficiencies in teens

ELSEVIER

CrossMark

Surgery for Obesity and Related Diseases 14 (2018) 882–901

SURGERY FOR OBESITY AND RELATED DISEASES

Review article

ASMBS pediatric metabolic and bariatric surgery guidelines, 2018

Table 1
Indications and contraindications for adolescent metabolic and bariatric surgery (MBS)

Indications for adolescent MBS include
• BMI ≥35 kg/m^2 or 120% of the 95th percentile with clinically significant co-morbid conditions such as obstructive sleep apnea (AHI > 5), T2D, IIH, NASH, Blount's disease, SCFE, GERD, or hypertension; or BMI ≥40 kg/m^2 or 140% of the 95th percentile (whichever is lower).
• A multidisciplinary team must also consider whether the patient and family have the ability and motivation to adhere to recommended treatments pre- and postoperatively, including consistent use of micronutrient supplements.
Contraindications for adolescent MBS include
• A medically correctable cause of obesity
• An ongoing substance abuse problem (within the preceding yr)
• A medical, psychiatric, psychosocial, or cognitive condition that prevents adherence to postoperative dietary and medication regimens.
• Current or planned pregnancy within 12 to 18 mo of the procedure

BMI = body mass index; AHI = apnea-hypopnia index; T2D = type 2 diabetes; IIH = idiopathic intracranial hypertension; NASH = nonalcoholic steatohepatitis; SCFE = slipped capital femoral epiphysis; GERD = gastroesophageal reflux disease.

Considerations in Adolescents

- Does the rapid weight loss of surgery increase the development of eating disorders in this age group?
- Psychological and Emotional Maturity level
- Cognitive ability to consent
- Physical Maturity (Tanner IV)
- Efficacy in those with Hypothalamic Obesity and individuals with developmental delay

STOMP
SickKids Team Obesity Management Program

War on obesity: Hospital now offers drastic option for obese 12-year-olds

NP Postmedia News | June 11, 2011 7:30 AM ET
More from Postmedia News

SickKids first to offer teens surgery for obesity

CARLY WEEKS
The Globe and Mail
Published Friday, Feb. 05 2010, 12:48 AM EST
Last updated Thursday, Aug. 23 2012, 1:41 PM EDT

Should Adolescents Have Bariatric Surgery?

http://drsuetalks.blogspot.ca/2011/05/should-adolescents-have-bariatric.html

New SickKids program helps teens STOMP out obesity

First program in Canada to offer weight-loss surgery to paediatric patients

SickKids: Weight-loss teen gets his life back

Video for Hospital for Sick Children special section. Nicholas Menecola 17 has taken part in the STOMP program at Sick Kids. He lost 120 pounds on the program. STOMP stands for Sick kids Team Obesity Management Program.

Tweet 0 | 8+1 0 | reddit this!

Adolescent Bariatric Surgery: The Canadian Perspective

CBC News

Obese teens offered surgery option

http://www.cbc.ca/news/health/story/2010/02/05

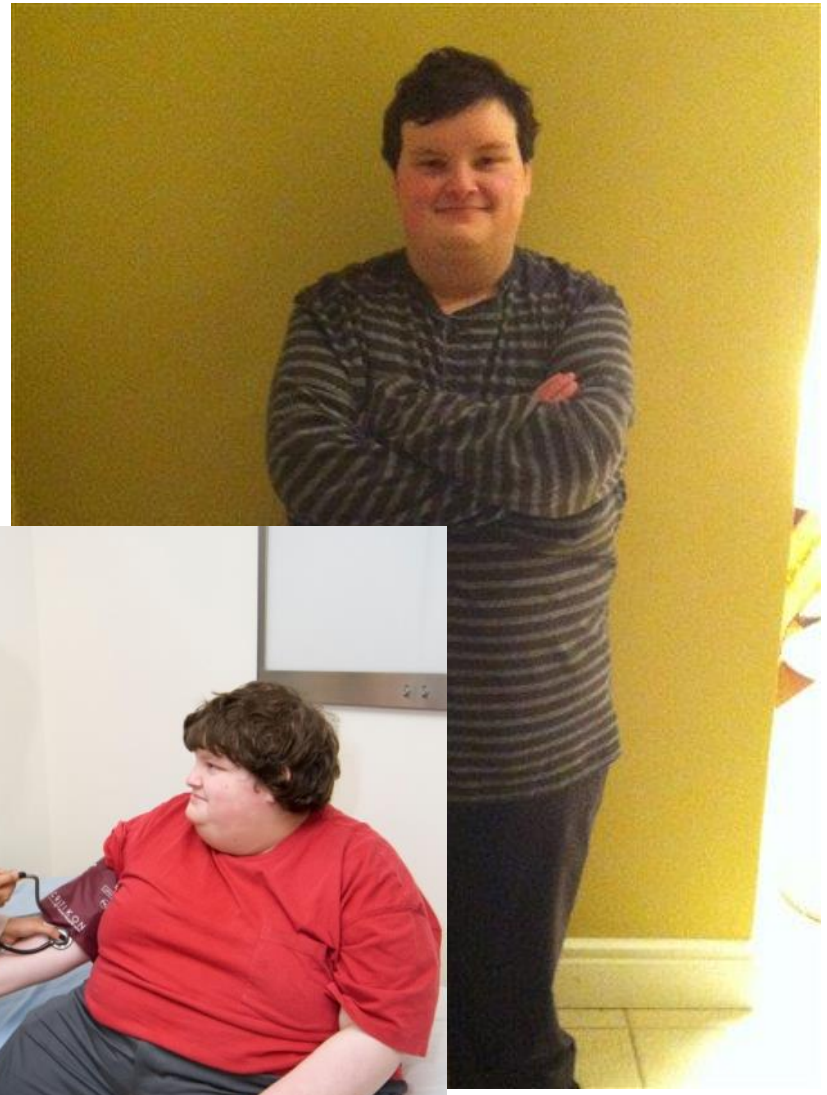
Last Updated: Friday, February 5, 2010

Sick Kids gives overweight teen 'new life'

HTTP://WWW.TORONTOSUN.COM/NEWS/TORO

JENNY YUEN, TORONTO SUN
FEBRUARY 05, 2010

Changing Life Trajectories



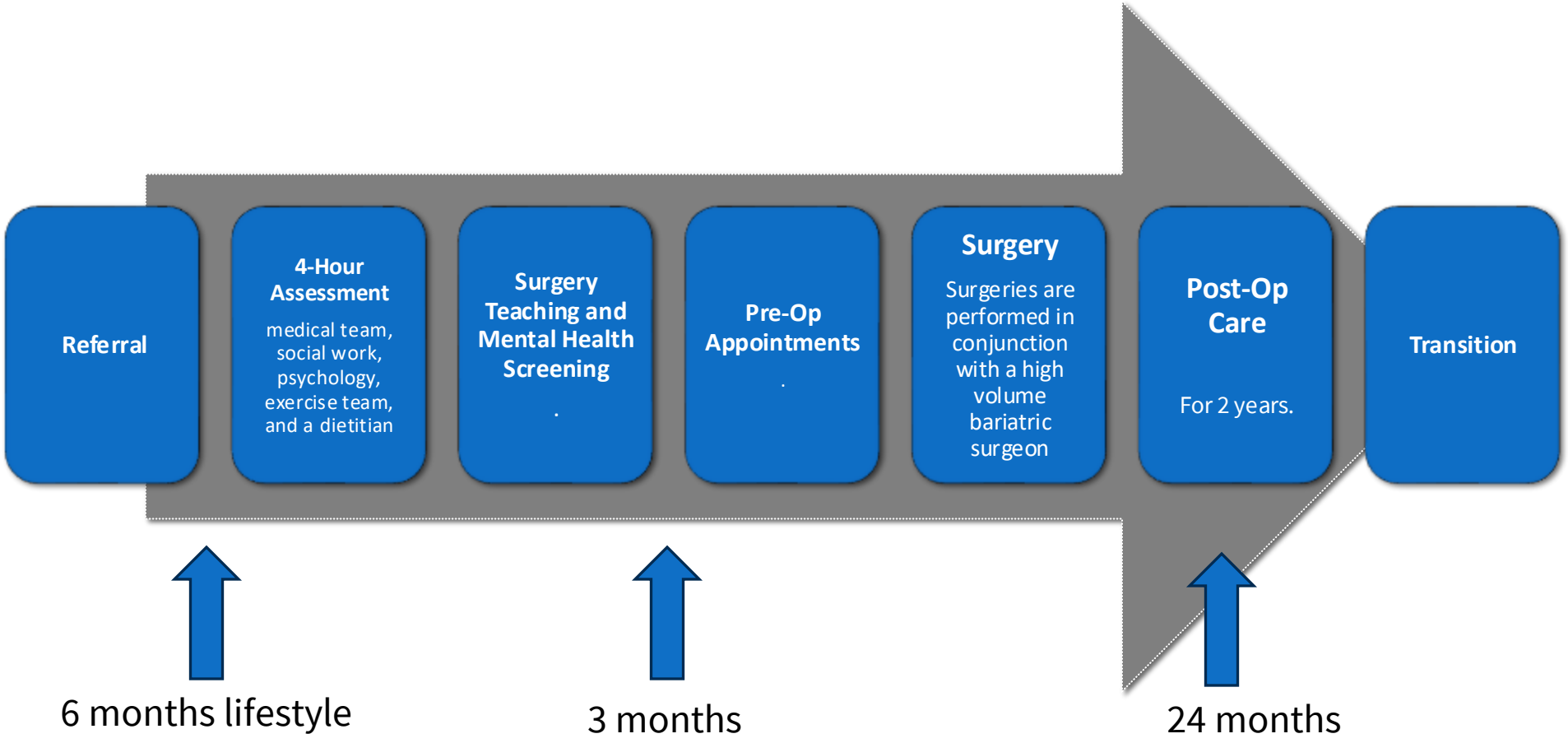
"It's been 2 years since surgery. I've lost 120 lb and my life is good. I never really knew a life without being overweight and it's so much easier now.

I'm in University and don't have to worry about being too slow to get to the next class in time because I can move better.

I am going out with friends more; things are opening up for me – it's fun.

I have some challenges with eating due to the surgery but overall the positives far outweigh the negatives."

SickKids Bariatric Surgery Referrals



Summary

Childhood obesity carries significant comorbidity, prevention is key

Tools to assist in lifestyle modification include medication and bariatric surgery

Further research into factors related to ‘responders’ and ‘nonresponders’ may aid in treatment decision making

Resources For
HEALTH PROFESSIONALS

Resources For
FAMILIES

MEANT PREVENT 2 Kitchen

www.Meant2prevent.ca

STOMP
SickKids Team Obesity Management Program

SickKids®

CIHR IRSC

team abc 3
Team to Address Bariatric Care in Canadian Children

CANADA'S CHILDREN'S HOSPITAL FOUNDATIONS