Obesity:
Pathophysiology and Treatment

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Disclosures

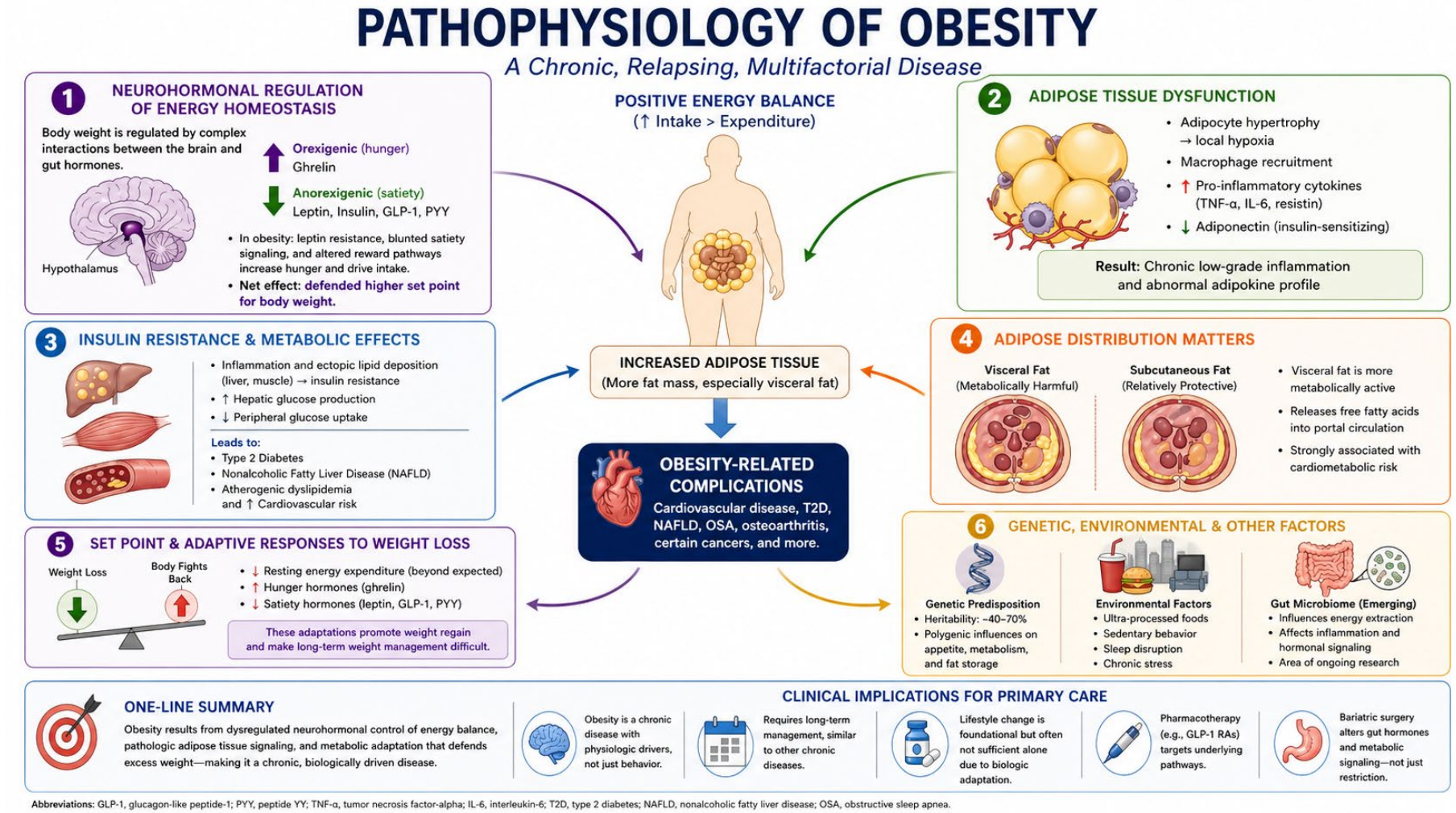
Intuitive - Robotic Surgery Training Proctor

Objectives

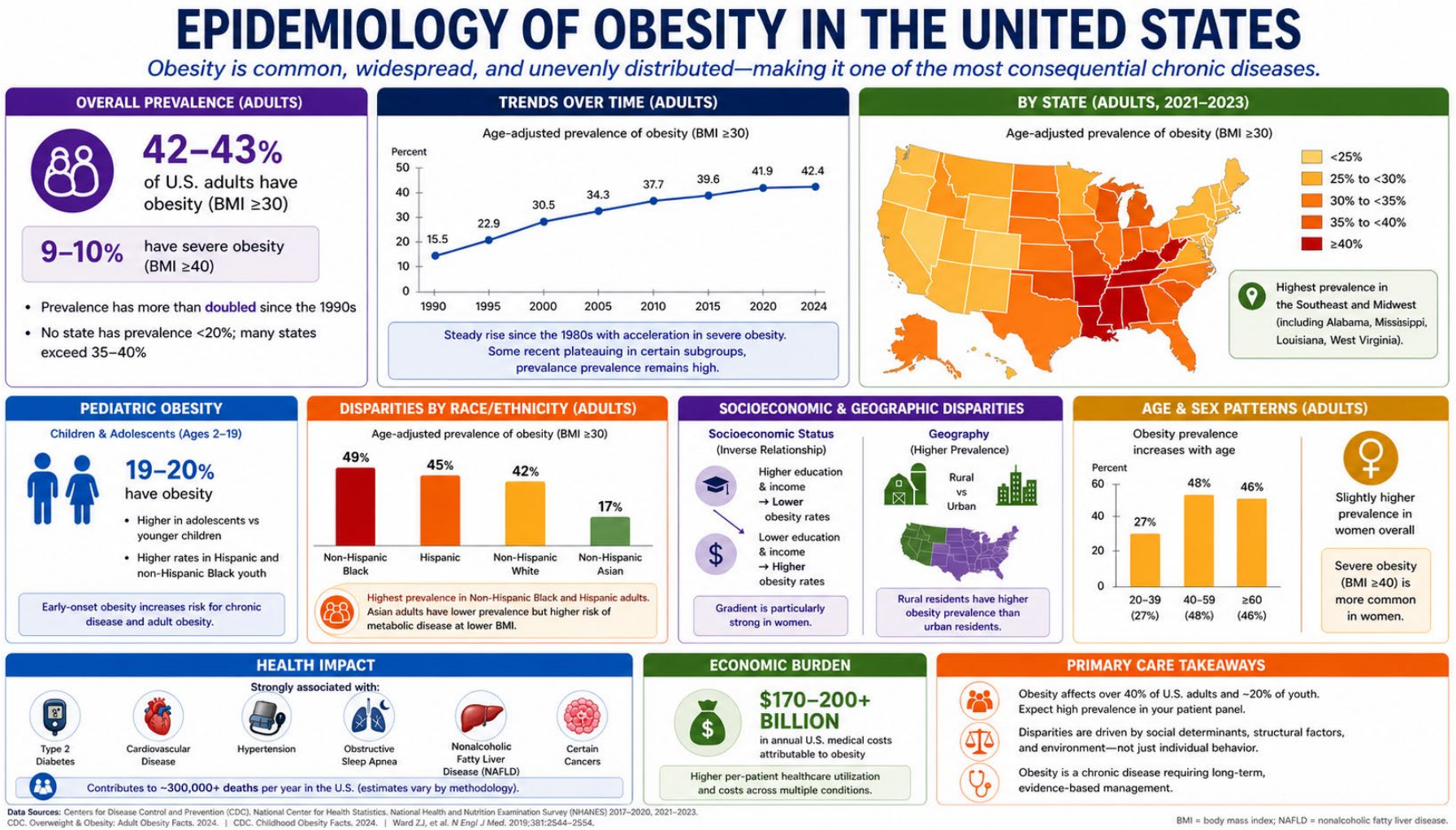
1. Overview of Obesity Pathophysiology
2. Epidemiology
3. Screening and Diagnosis
4. Treatment Options
5. Practice Patterns

Pathophysiology

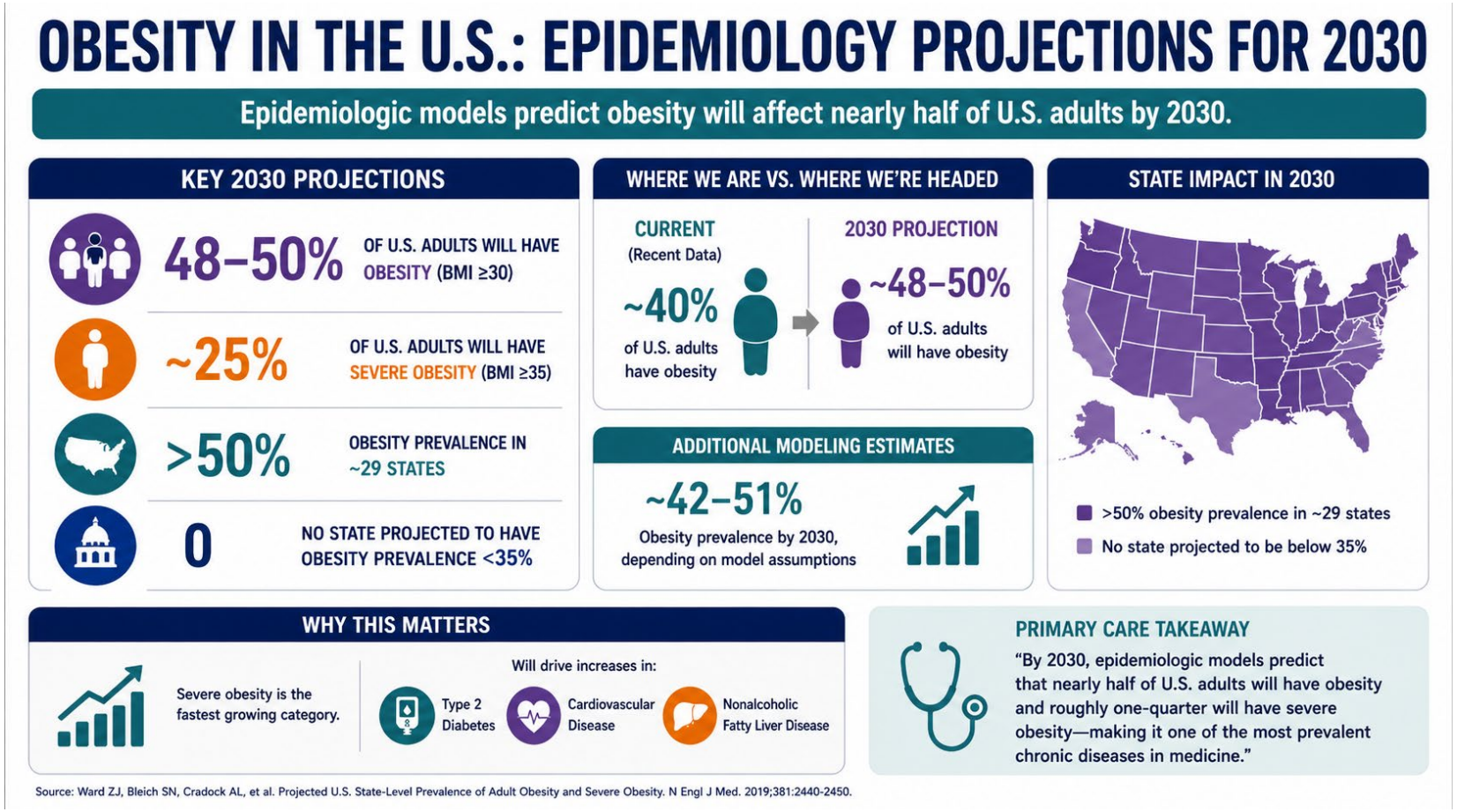
- **Neurohormonal Dysregulation**
  - Hypothalamus
    - Ghrelin, Leptin, Insulin, GLP-1, PYY
- **Dysfunction of Adipose Tissue**
  - Pro-inflammatory Cytokines, Adiponectin
  - Endocrine Organ
- **Insulin Resistance**
  - Ectopic Lipid Deposition
  - Decrease Glucose Uptake
- A**daptive Responses to Weight Loss**
  - Decrease Energy Expenditure (“Lower Metabolism”)
  - Increase Hunger Hormones
  - Decrease Satiety Hormones


PATHOPHYSIOLOGY OF OBESITY
A Chronic, Relapsing, Multifactorial Disease
1 NEUROHORMONAL REGULATION OF ENERGY HOMEOSTASIS
Body weight is regulated by complex interactions between the brain and gut hormones.
Orexigenic (hunger)
Ghrelin
Anorexigenic (satiety)
Leptin, Insulin, GLP-1, PYY
Hypothalamus
• In obesity: leptin resistance, blunted satiety signaling, and altered reward pathways increase hunger and drive intake.
• Net effect: defended higher set point for body weight.
POSITIVE ENERGY BALANCE
(↑ Intake > Expenditure)
2 ADIPOSE TISSUE DYSFUNCTION
• Adipocyte hypertrophy → local hypoxia
• Macrophage recruitment
• ↑ Pro-inflammatory cytokines (TNF-α, IL-6, resistin)
• ↓ Adiponectin (insulin-sensitizing)
Result: Chronic low-grade inflammation and abnormal adipokine profile
3 INSULIN RESISTANCE & METABOLIC EFFECTS
• Inflammation and ectopic lipid deposition (liver, muscle) → insulin resistance
• ↑ Hepatic glucose production
• ↓ Peripheral glucose uptake
Leads to:
• Type 2 Diabetes
• Nonalcoholic Fatty Liver Disease (NAFLD)
• Atherogenic dyslipidemia and ↑ Cardiovascular risk
INCREASED ADIPOSE TISSUE
(More fat mass, especially visceral fat)
4 ADIPOSE DISTRIBUTION MATTERS
Visceral Fat
(Metabolically Harmful)
Subcutaneous Fat
(Relatively Protective)
• Visceral fat is more metabolically active
• Releases free fatty acids into portal circulation
• Strongly associated with cardiometabolic risk
OBESITY-RELATED COMPLICATIONS
Cardiovascular disease, T2D, NAFLD, OSA, osteoarthritis, certain cancers, and more.
5 SET POINT & ADAPTIVE RESPONSES TO WEIGHT LOSS
Weight Loss
Body Fights Back
• ↓ Resting energy expenditure (beyond expected)
• ↑ Hunger hormones (ghrelin)
• ↓ Satiety hormones (leptin, GLP-1, PYY)
These adaptations promote weight regain and make long-term weight management difficult.
6 GENETIC, ENVIRONMENTAL & OTHER FACTORS
Genetic Predisposition
• Heritability: ~40–70%
• Polygenic influences on appetite, metabolism, and fat storage
Environmental Factors
• Ultra-processed foods
• Sedentary behavior
• Sleep disruption
• Chronic stress
Gut Microbiome (Emerging)
• Influences energy extraction
• Affects inflammation and hormonal signaling
• Area of ongoing research
ONE-LINE SUMMARY
Obesity results from dysregulated neurohormonal control of energy balance, pathologic adipose tissue signaling, and metabolic adaptation that defends excess weight—making it a chronic, biologically driven disease.
CLINICAL IMPLICATIONS FOR PRIMARY CARE
Obesity is a chronic disease with physiologic drivers, not just behavior.
Requires long-term management, similar to other chronic diseases.
Lifestyle change is foundational but often not sufficient alone due to biologic adaptation.
Pharmacotherapy (e.g., GLP-1 RAs) targets underlying pathways.
Bariatric surgery alters gut hormones and metabolic signaling—not just restriction.
Abbreviations: GLP-1, glucagon-like peptide-1; PYY, peptide YY; TNF-α, tumor necrosis factor-alpha; IL-6, interleukin-6; T2D, type 2 diabetes; NAFLD, nonalcoholic fatty liver disease; OSA, obstructive sleep apnea.

Caption


EPIDEMIOLOGY OF OBESITY IN THE UNITED STATES
Obesity is common, widespread, and unevenly distributed—making it one of the most consequential chronic diseases.
OVERALL PREVALENCE (ADULTS)
42–43%
of U.S. adults have obesity (BMI ≥30)
9–10% have severe obesity (BMI ≥40)
• Prevalence has more than doubled since the 1990s
• No state has prevalence <20%; many states exceed 35–40%
TRENDS OVER TIME (ADULTS)
Age-adjusted prevalence of obesity (BMI ≥30)
Percent
50
40
30
20
10
0
15.5
22.9
30.5
34.3
37.7
39.6
41.9
42.4
1990
1995
2000
2005
2010
2015
2020
2024
Steady rise since the 1980s with acceleration in severe obesity. Some recent plateauing in certain subgroups, prevalance prevalence remains high.
BY STATE (ADULTS, 2021–2023)
Age-adjusted prevalence of obesity (BMI ≥30)
<25%
25% to <30%
30% to <35%
35% to <40%
≥40%
Highest prevalence in the Southeast and Midwest (including Alabama, Mississippi, Louisiana, West Virginia).
PEDIATRIC OBESITY
Children & Adolescents (Ages 2–19)
19–20%
have obesity
• Higher in adolescents vs younger children
• Higher rates in Hispanic and non-Hispanic Black youth
Early-onset obesity increases risk for chronic disease and adult obesity.
DISPARITIES BY RACE/ETHNICITY (ADULTS)
Age-adjusted prevalence of obesity (BMI ≥30)
49%
45%
42%
17%
Non-Hispanic Black
Hispanic
Non-Hispanic White
Non-Hispanic Asian
Highest prevalence in Non-Hispanic Black and Hispanic adults. Asian adults have lower prevalence but higher risk of metabolic disease at lower BMI.
SOCIOECONOMIC & GEOGRAPHIC DISPARITIES
Socioeconomic Status
(Inverse Relationship)
Higher education & income → Lower obesity rates
Lower education & income → Higher obesity rates
Gradient is particularly strong in women.
Geography
(Higher Prevalence)
Rural vs Urban
Rural residents have higher obesity prevalence than urban residents.
AGE & SEX PATTERNS (ADULTS)
Obesity prevalence increases with age
Percent
60
40
20
0
27%
48%
46%
20–39 (27%)
40–59 (48%)
≥60 (46%)
Slightly higher prevalence in women overall
Severe obesity (BMI ≥40) is more common in women.
HEALTH IMPACT
Strongly associated with:
Type 2 Diabetes
Cardiovascular Disease
Hypertension
Obstructive Sleep Apnea
Nonalcoholic Fatty Liver Disease (NAFLD)
Certain Cancers
Contributes to ~300,000+ deaths per year in the U.S. (estimates vary by methodology).
ECONOMIC BURDEN
$170–200+ BILLION
in annual U.S. medical costs attributable to obesity
Higher per-patient healthcare utilization and costs across multiple conditions.
PRIMARY CARE TAKEAWAYS
Obesity affects over 40% of U.S. adults and ~20% of youth. Expect high prevalence in your patient panel.
Disparities are driven by social determinants, structural factors, and environment—not just individual behavior.
Obesity is a chronic disease requiring long-term, evidence-based management.
Data Sources: Centers for Disease Control and Prevention (CDC). National Center for Health Statistics. National Health and Nutrition Examination Survey (NHANES) 2017–2020, 2021–2023.
CDC. Overweight & Obesity: Adult Obesity Facts. 2024. | CDC. Childhood Obesity Facts. 2024. | Ward ZJ, et al. N Engl J Med. 2019;381:2544–2554.
BMI = body mass index; NAFLD = nonalcoholic fatty liver disease.

Caption


OBESITY IN THE U.S.: EPIDEMIOLOGY PROJECTIONS FOR 2030
Epidemiologic models predict obesity will affect nearly half of U.S. adults by 2030.
KEY 2030 PROJECTIONS
48–50%
OF U.S. ADULTS WILL HAVE OBESITY (BMI ≥30)
~25%
OF U.S. ADULTS WILL HAVE SEVERE OBESITY (BMI ≥35)
>50%
OBESITY PREVALENCE IN ~29 STATES
0
NO STATE PROJECTED TO HAVE OBESITY PREVALENCE <35%
WHERE WE ARE VS. WHERE WE'RE HEADED
CURRENT
(Recent Data)
~40%
of U.S. adults have obesity
2030 PROJECTION
~48–50%
of U.S. adults will have obesity
ADDITIONAL MODELING ESTIMATES
~42–51%
Obesity prevalence by 2030, depending on model assumptions
STATE IMPACT IN 2030
>50% obesity prevalence in ~29 states
No state projected to be below 35%
WHY THIS MATTERS
Severe obesity is the fastest growing category.
Will drive increases in:
Type 2 Diabetes
Cardiovascular Disease
Nonalcoholic Fatty Liver Disease
PRIMARY CARE TAKEAWAY
"By 2030, epidemiologic models predict that nearly half of U.S. adults will have obesity and roughly one-quarter will have severe obesity—making it one of the most prevalent chronic diseases in medicine."
Source: Ward ZJ, Bleich SN, Cradock AL, et al. Projected U.S. State-Level Prevalence of Adult Obesity and Severe Obesity. N Engl J Med. 2019;381:2440-2450.

Caption

SCREENING & DIAGNOSIS OF OBESITY IN PRIMARY CARE

Obesity is a chronic disease. Identify it, stage it, and treat it.

Screen every adult. Diagnose accurately, Assess severity. Address drivers. Initiate treatment.

1 SCREEN ROUTINELY: MAKE IT A VITAL SIGN

- Measure height and weight at every visit
- Automatically calculate BMI in the EHR
- Screen all adults (USPSTF Grade B)

Treat BMI like blood pressure—every patient, regularly.

2 DIAGNOSE USING BMI (ADULTS)

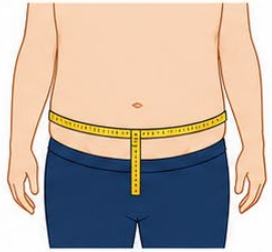
BMI = weight (kg) / height (m²)

Category	BMI (kg/m²)
Normal	18.5 – 24.9
Overweight	25.0 – 29.9
Obesity Class I	30.0 – 34.9
Obesity Class II	35.0 – 39.9
Obesity Class III (Severe)	≥ 40

Diagnosis of obesity = BMI ≥ 30 kg/m²

- BMI does not distinguish fat vs muscle.

3 ASSESS CENTRAL ADIPOSITY: MEASURE WAIST CIRCUMFERENCE



Measure at iliac crest after normal exhalation.

HIGH-RISK THRESHOLDS

Men
>102 cm (40 in)

Women
>88 cm (35 in)

Helps identify visceral adiposity and cardiometabolic risk, even at lower BMI.

4 STAGE DISEASE SEVERITY (BEYOND BMI)

A. COMORBIDITIES

Screen for:

- Type 2 Diabetes
- Hypertension
- Dyslipidemia
- Obstructive Sleep Apnea
- NAFLD (Fatty Liver Disease)
- And others

B. FUNCTIONAL IMPACT

- Mobility limitations
- Pain (e.g., osteoarthritis)
- Reduced physical function
- Quality of life
- Depression/anxiety

C. STAGING SYSTEMS

- AACE/ACE Staging
- Edmonton Obesity Staging System (EOSS)

Staging systems predict health risks and mortality better than BMI alone.

KEY TAKEAWAY: Screen all adults, diagnose using BMI, assess waist circumference and comorbidities, stage the severity, and treat obesity as a chronic disease from the time of diagnosis.

BMI = body mass index
EHR = electronic health record
NAFLD = nonalcoholic fatty liver disease

Sources: USPSTF. Screening for Obesity in Adults: Reccommendation Statement. JAMA. 2022;327(24):2414-2421.
Garvey WT, et al. AACE/ACE Comprehensive Clinical Practice Guidelines for Medical Care of Patients With Obesity. *Endocr Pract*. 2016;22(Suppl 3):1-203.
Apovian CM, et al. Endocrine Society Clinical Practice Guideline: Pharmacological Management of Obesity. *J Clin Endocrinol Metab*. 2015;100(2):342-362.

Caption

Treatment Options

You've made the diagnosis… now what?

- Lifestyle Modifications
- Obesity Management Medications (OMM)
- Metabolic Bariatric Surgery (MBS)

Lifestyle Modification (Diet & Exercise)

- Typically 12 or more intensive sessions per year (physician, dietician, etc.)

At 5 years, weight regain is the norm.

On average, more than half of lost weight is regained by 2 years, and **>80% is regained by 5 years** after lifestyle-based weight loss.

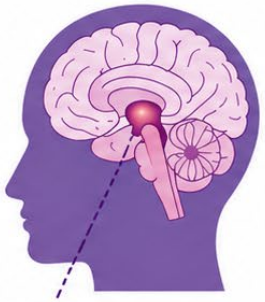
- Initial loss: ~5–10%
- Maintained at 5 years: often ~2–5%

WHY DIET & EXERCISE ALONE ARE OFTEN INEFFECTIVE FOR OBESITY

Two powerful biological responses make weight loss difficult and hard to sustain.

1 THE BODY DEFENDS HIGHER WEIGHT

After weight loss, the brain activates powerful responses to restore your prior weight.



The hypothalamus controls hunger, satiety, and energy balance.

- ↑ **INCREASED HUNGER** (ghrelin)
- ↓ **DECREASED SATIETY** (leptin, PYY, GLP-1)
- ↑ **STRONGER FOOD REWARD SIGNALS**
- ↑ **INCREASED CRAVINGS** for high-calorie foods

These powerful brain responses work to restore your prior weight.

2 METABOLISM SLOWS

After weight loss, your body burns fewer calories than expected.

- ↓ **FEWER CALORIES BURNED AT REST** (lower resting metabolism)
- ↓ **LESS ENERGY FROM ACTIVITY** (non-exercise activity and movement)
- ↓ **THERMIC EFFECT OF FOOD** (fewer calories used to digest food)
- → **MORE EFFICIENT MOVEMENT** (body uses less energy to do the same tasks)

Your body conserves energy and resists further weight loss.

BOTTOM LINE: These biological adaptations make weight loss difficult and promote weight regain. That's why diet and exercise alone usually lead to modest, temporary results.

Caption

THE HARM OF BLAMING PATIENTS FOR "FAILURE" OF DIET & EXERCISE ALONE

Obesity is a chronic, biologically driven disease. Diet and exercise alone is often not enough.

Blaming patients when diet and exercise don't lead to weight loss causes real harm and undermines care.

1 REINFORCES WEIGHT STIGMA

- Patients feel judged, ashamed, or dismissed
- Avoid care and screening
- Lower trust in clinicians
- Poorer health outcomes

2 MISREPRESENTS THE DISEASE

- Obesity is a chronic, biologically regulated disease—not a failure of willpower
- Blame oversimplifies complex neurohormonal and metabolic drivers

3 DELAYS EFFECTIVE TREATMENT

Clinicians may delay:

- Intensive behavioral programs
- Anti-obesity medications
- Bariatric/metabolic surgery
- Long-term follow-up

4 REDUCES MOTIVATION AND ENGAGEMENT

- Shame rarely helps
- Patients who feel blamed are more likely to:
  - Disengage from care
  - Miss visits
  - Stop trying

BOTTOM LINE: When lifestyle therapy alone is insuficient, the appropriate conclusion is not that the patient failed—it is that the treatment plan needs to change.

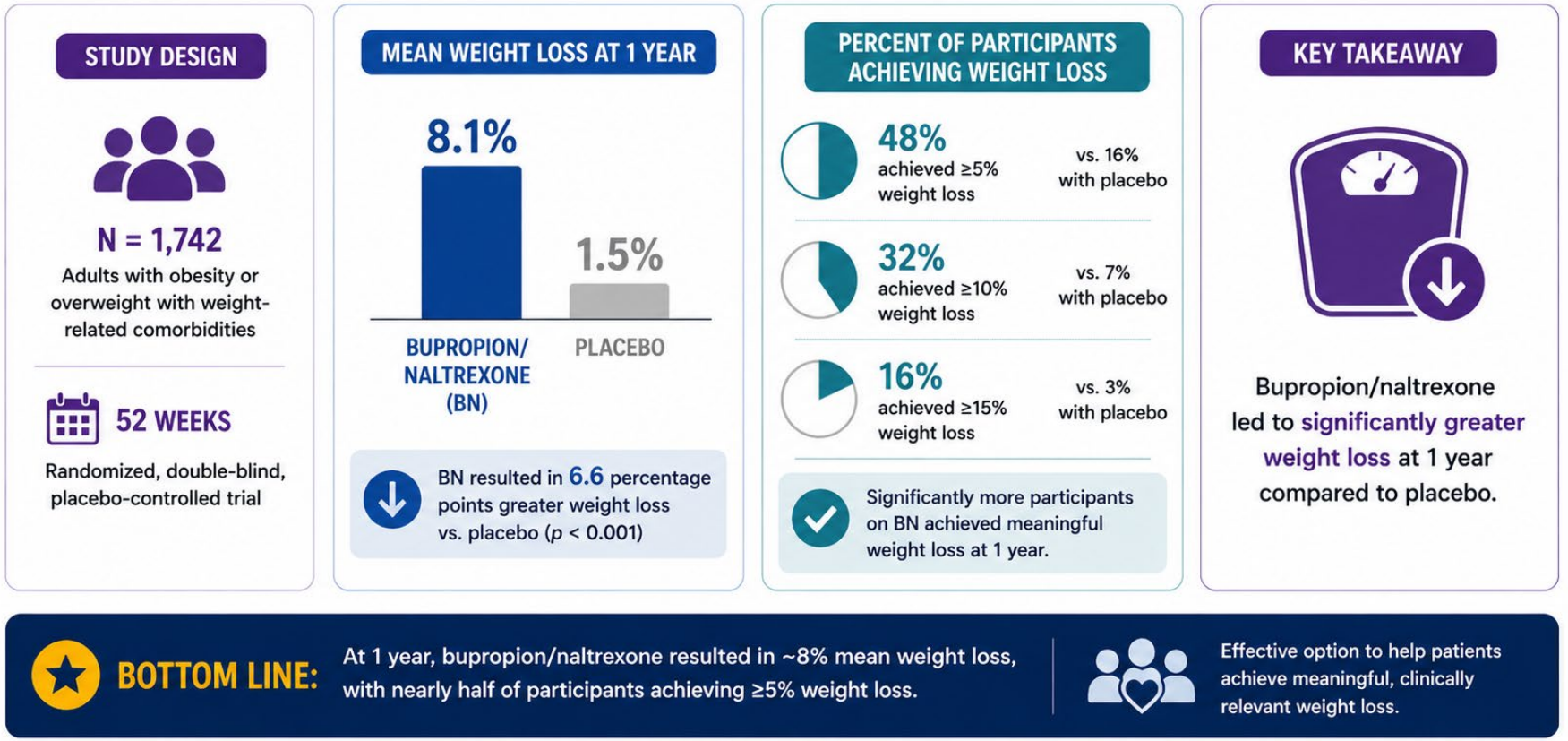
Caption

Obesity Management Medications

- Bupropion/Naltrexone
- Phentermine/Topiramate
- Semaglutide
- Tirzepatide

ONE YEAR WEIGHT LOSS OUTCOMES WITH BUPROPION/NALTREXONE

The COR-BMOD trial evaluated bupropion/naltrexone (BN) in adults with obesity or overweight with weight-related comorbidities.



Caption

BUPROPION/NALTREXONE: DOSING

Titrate weekly to target dose to improve tolerability.

WEEKLY TITRATION SCHEDULE

WEEK	MORNING DOSE	EVENING DOSE
1	1 tablet (8 mg/90 mg)	0 tablets
2	1 tablet (8 mg/90 mg)	1 tablet (8 mg/90 mg)
3	2 tablets (16 mg/180 mg)	1 tablet (8 mg/90 mg)
4+	2 tablets (16 mg/180 mg)	2 tablets (16 mg/180 mg)

Swallow tablets whole. Do not cut, crush, or chew.
Take with or without food.

TARGET DOSE

2 tablets twice daily

(32 mg/360 mg total daily dose)

Take in the morning and evening (about 12 hours apart)

BOTTOM LINE: Titrate weekly to a target dose of 2 tablets twice daily for best tolerability and treatment success.

Caption

PHENTERMINE 37.5 mg + TOPIRAMATE: 1-YEAR WEIGHT LOSS OUTCOMES

Real-world and clinical practice data suggest substantial and durable weight loss at 1 year.

MEAN WEIGHT LOSS AT 1 YEAR

~10–15%

total body weight loss in many patients

Some high responders may exceed this.

WEIGHT LOSS RESPONSE RATES (APPROXIMATE)

Proportion of patients achieving:

≥5% weight loss	≥10% weight loss	≥15% weight loss
70–85%	50–65%	25–40%

Results vary based on topiramate dose, titration, formulation (IR vs ER), and tolerability.

HOW THESE DRUGS WORK

Phentermine

- Stimulates release of norepinephrine in the brain to reduce appetite.

Topiramate

- Modulates neurotransmitters (GABA, glutamate) and enhances satiety to reduce appetite and food intake.

Together, they reduce appetite and help you feel full longer, leading to lower calorie intake and weight loss.

IMPORTANT CONSIDERATIONS

MONITOR FOR:

- Insomnia / tachycardia
- Paresthesias
- Cognitive slowing / word-finding difficulty
- Mood changes
- Dry mouth
- Constipation

SAFETY:

- Avoid in pregnancy (topiramate teratogenicity)
- Use caution in cardiovascular disease
- Slow titration improves tolerability

KEY TAKEAWAY:

At 1 year, phentermine 37.5 mg plus topiramate often produces ~10–15% weight loss, with many patients achieving double-digit percentage loss.

Note: Outcomes are estimates from clinical practice and observational data. Individual results vary.

Caption

SEMAGLUTIDE (2.4 mg weekly): WEIGHT LOSS OUTCOMES IN ADULTS WITHOUT DIABETES

Summary of Non-Diabetic Clinical Trials (STEP Program) with Lifestyle Intervention

KEY TRIAL: STEP 1 (68 WEEKS)

Adults with obesity or overweight without diabetes

SEMAGLUTIDE 2.4 mg	PLACEBO
~14.9%	~2.4%
mean weight loss from baseline	mean weight loss from baseline

Participants also received lifestyle intervention (reduced-calorie diet and increased physical activity)

STEP 3 (68 WEEKS)

Semaglutide 2.4 mg + intensive behavioral therapy

~16%

mean weight loss from baseline

STEP 4 (WITHDRAWAL TRIAL)

After 20 weeks of open-label semaglutide run-in

Continued semaglutide
Continued to lose more weight

Switched to placebo
Regained a significant amount of weight

Demonstrates obesity is a chronic condition requiring ongoing treatment.

STEP 5 (2-YEAR TRIAL)

Results at 104 weeks

~15%

mean weight loss maintained

Long-term weight loss maintained with continued semaglutide treatment.

COMMON SIDE EFFECTS

- Nausea
- Vomiting
- Constipation
- Diarrhea

Mostly mild to moderate and tend to lessen over time.

Slow dose escalation improves tolerability.

ONE-LINE SUMMARY

In adults without diabetes, semaglutide 2.4 mg weekly produces ~15% mean weight loss, with about half of patients achieving ≥15% weight loss and durable results when continued.

Note: STEP = Semaglutide Treatment Effect in People with obesity.

Caption

SELECT TRIAL: WEIGHT LOSS OUTCOMES WITH SEMAGLUTIDE 2.4 mg

Semaglutide Effects on Cardiovascular Outcomes in People With Overweight or Obesity

ABOUT THE SELECT TRIAL

Population
Adults ≥45 years with overweight or obesity, established cardiovascular disease, and without diabetes

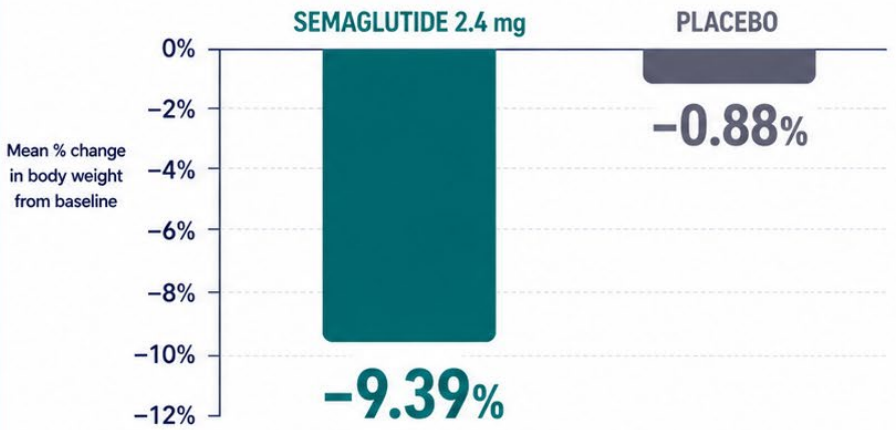
Design
Randomized, double-blind, placebo-controlled cardiovascular outcomes trial

Intervention
Semaglutide 2.4 mg once weekly vs placebo + standard care

Follow-up
Mean follow-up ~3.3 years (~40 months)

MEAN PERCENT CHANGE IN BODY WEIGHT

Estimated mean percent change from baseline at 104 weeks



Estimated treatment difference
−8.51
percentage points

Semaglutide 2.4 mg resulted in ~8.5 percentage points greater weight loss than placebo at 104 weeks.

KEY TAKEAWAY

In adults with overweight or obesity and established cardiovascular disease without diabetes, semaglutide 2.4 mg led to a **9.39%** mean weight loss at 104 weeks, compared with **0.88%** with placebo (difference: **−8.51 percentage points**).

In the SELECT trial, semaglutide 2.4 mg also reduced major adverse cardiovascular events (CV death, nonfatal MI, nonfatal stroke) by **20%** vs placebo (HR 0.80; 95% CI 0.72–0.90).

Note: Results are from the SELECT trial. Weight loss was a secondary outcome.

Source: Lincoff AM et al. N Engl J Med. 2023;389:2221-2232.

Caption

SEMAGLUTIDE 7.2 mg WEEKLY: KEY TRIAL & MEAN WEIGHT LOSS

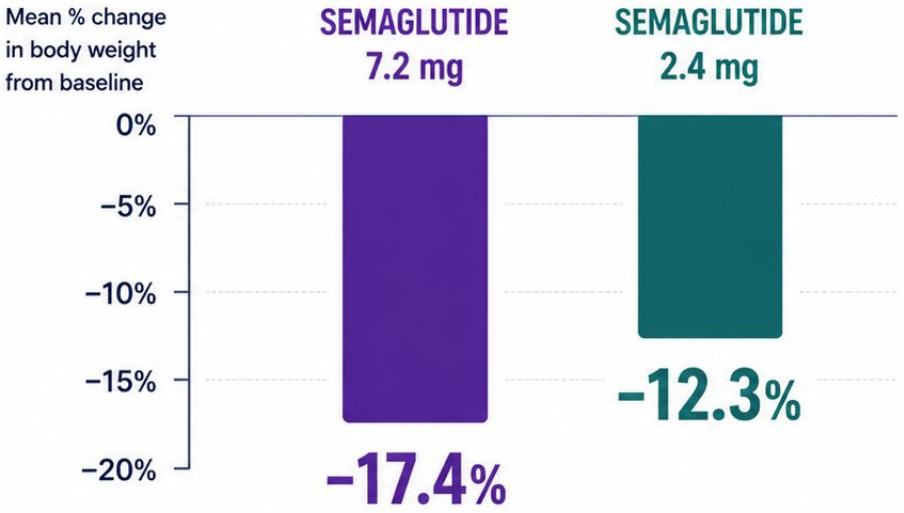
Higher-dose semaglutide (7.2 mg weekly) produces greater weight loss than 2.4 mg weekly in non-diabetic adults.

KEY TRIAL: STEP UP (72 WEEKS)

Adults with obesity or overweight without diabetes

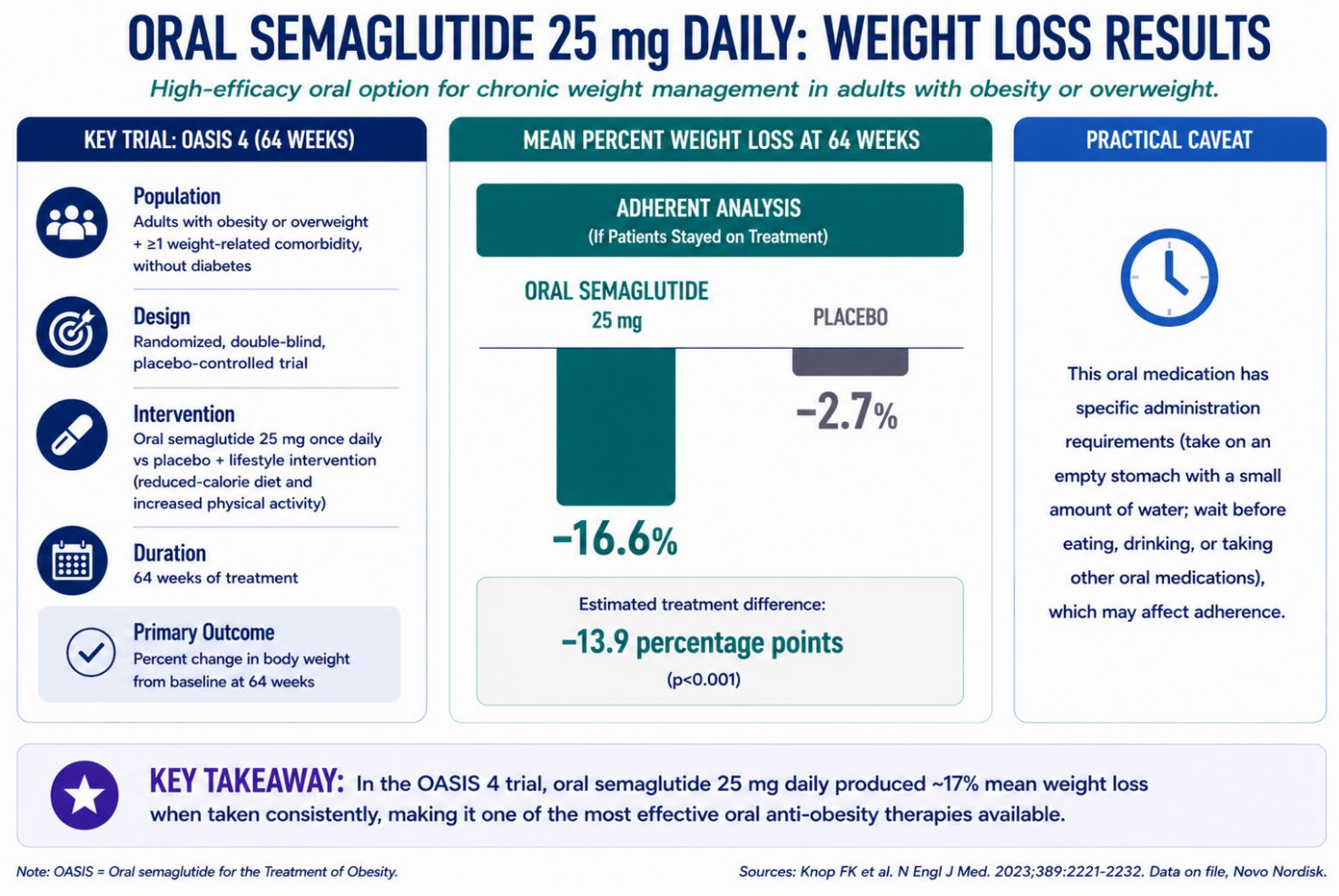
Randomized, double-blind trial comparing semaglutide 7.2 mg vs 2.4 mg weekly, both with lifestyle intervention.

MEAN WEIGHT LOSS AT 72 WEEKS (PRIMARY OUTCOME)



7.2 mg resulted in ~5.1 percentage points more weight loss than 2.4 mg (mean difference; p<0.001).

Caption


ORAL SEMAGLUTIDE 25 mg DAILY: WEIGHT LOSS RESULTS
High-efficacy oral option for chronic weight management in adults with obesity or overweight.
KEY TRIAL: OASIS 4 (64 WEEKS)
Population
Adults with obesity or overweight + ≥1 weight-related comorbidity, without diabetes
Design
Randomized, double-blind, placebo-controlled trial
Intervention
Oral semaglutide 25 mg once daily vs placebo + lifestyle intervention (reduced-calorie diet and increased physical activity)
Duration
64 weeks of treatment
Primary Outcome
Percent change in body weight from baseline at 64 weeks
MEAN PERCENT WEIGHT LOSS AT 64 WEEKS
ADHERENT ANALYSIS
(If Patients Stayed on Treatment)
ORAL SEMAGLUTIDE 25 mg
PLACEBO
-16.6%
-2.7%
Estimated treatment difference:
-13.9 percentage points
(p<0.001)
PRACTICAL CAVEAT
This oral medication has specific administration requirements (take on an empty stomach with a small amount of water; wait before eating, drinking, or taking other oral medications), which may affect adherence.
KEY TAKEAWAY: In the OASIS 4 trial, oral semaglutide 25 mg daily produced ~17% mean weight loss when taken consistently, making it one of the most effective oral anti-obesity therapies available.
Note: OASIS = Oral semaglutide for the Treatment of Obesity.
Sources: Knop FK et al. N Engl J Med. 2023;389:2221-2232. Data on file, Novo Nordisk.

Caption

SURMOUNT-1 & SURMOUNT-4: TIRZEPATIDE IN NON-DIABETIC ADULTS

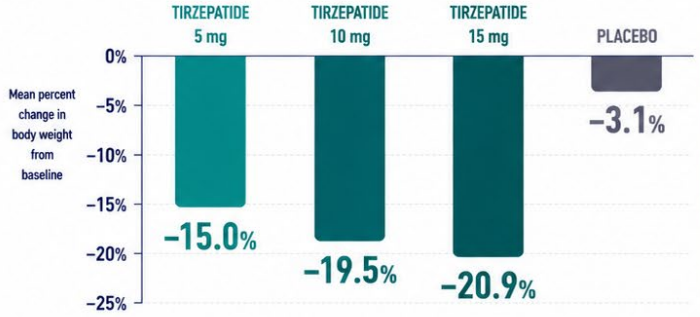
Efficacy of tirzepatide and the importance of continued treatment for long-term weight management.

SURMOUNT-1: HOW MUCH WEIGHT LOSS IS POSSIBLE?

Population: Adults with obesity or overweight, without diabetes

Design: Randomized, double-blind, placebo-controlled trial

MEAN PERCENT WEIGHT LOSS AT 72 WEEKS



KEY TAKEAWAY: Tirzepatide produced very large average weight loss, with many patients achieving ≥20%.

Approximate proportion achieving ≥20% weight loss at 72 weeks

5 mg	10 mg	15 mg	Placebo
~30%	~50%	~57%	~3%

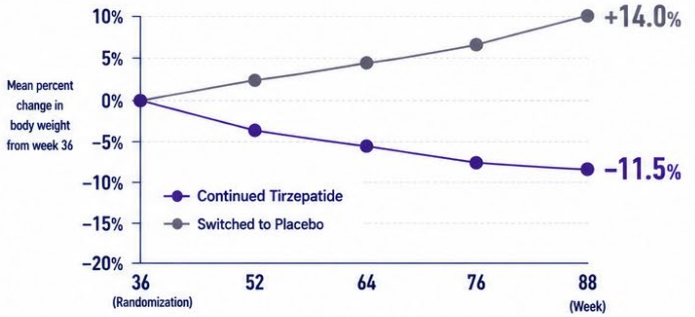
SURMOUNT-4: DOES WEIGHT RETURN IF TREATMENT STOPS?

Population: Adults with obesity or overweight, without diabetes

Design: All participants received open-label tirzepatide for 36 weeks, then responders randomized to continue tirzepatide or switch to placebo for 52 additional weeks (week 88 total)

MEAN PERCENT CHANGE IN BODY WEIGHT

From end of lead-in (week 36) to week 88



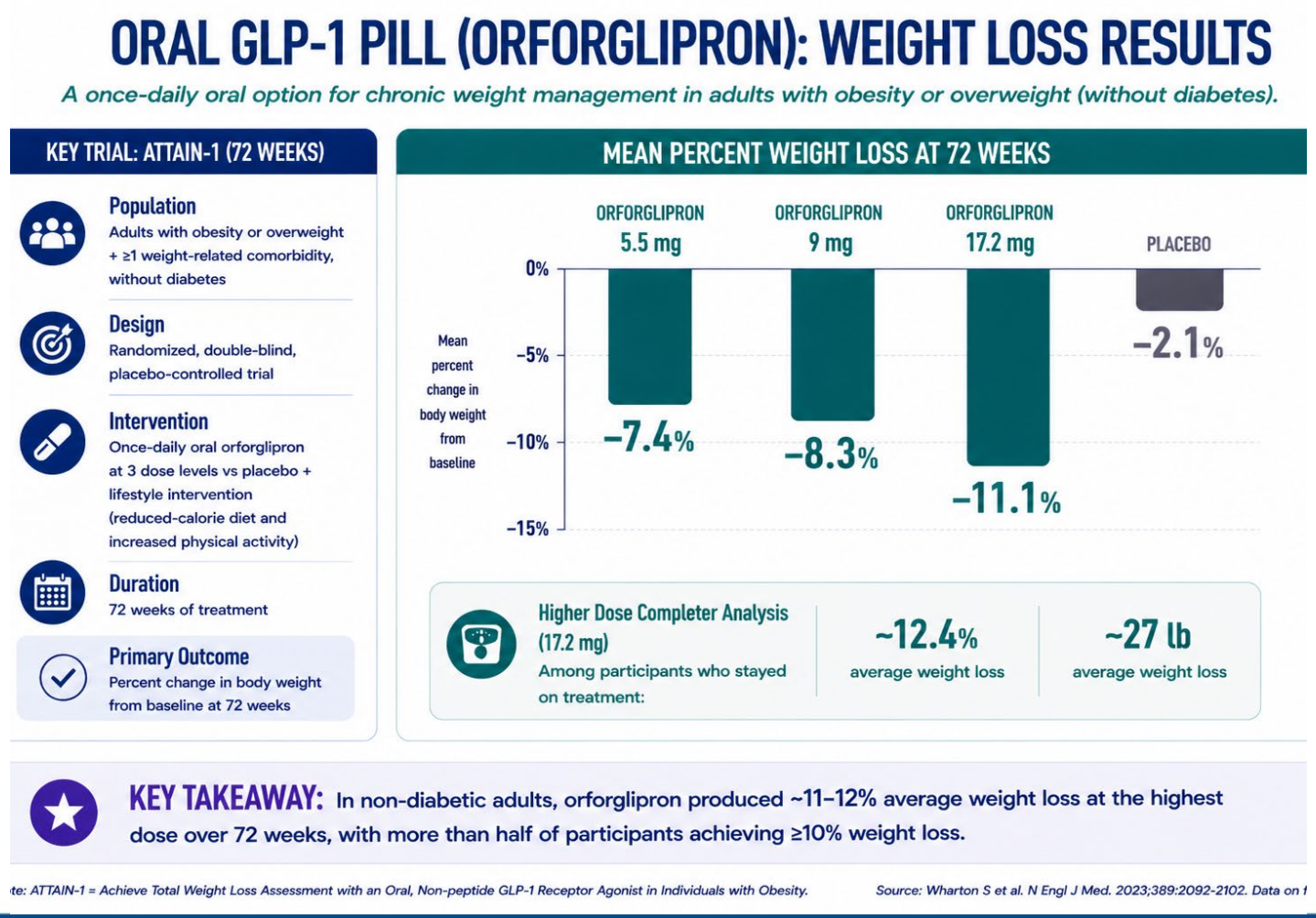
KEY TAKEAWAY: Continuing tirzepatide maintained and continued weight loss, while stopping treatment led to substantial weight regain.

BOTTOM LINE: SURMOUNT-1 showed the potential for ~15–21% average weight loss at 72 weeks. SURMOUNT-4 demonstrated that ongoing treatment is necessary to maintain that benefit.

Note: SURMOUNT-1 duration was 72 weeks. SURMOUNT-4 total duration was 88 weeks (36-week lead-in + 52-week randomized period).

Sources: Jastreboff AM et al. N Engl J Med. 2022;387:205-216. Aronne LJ et al. JAMA. 2024;331:38-48

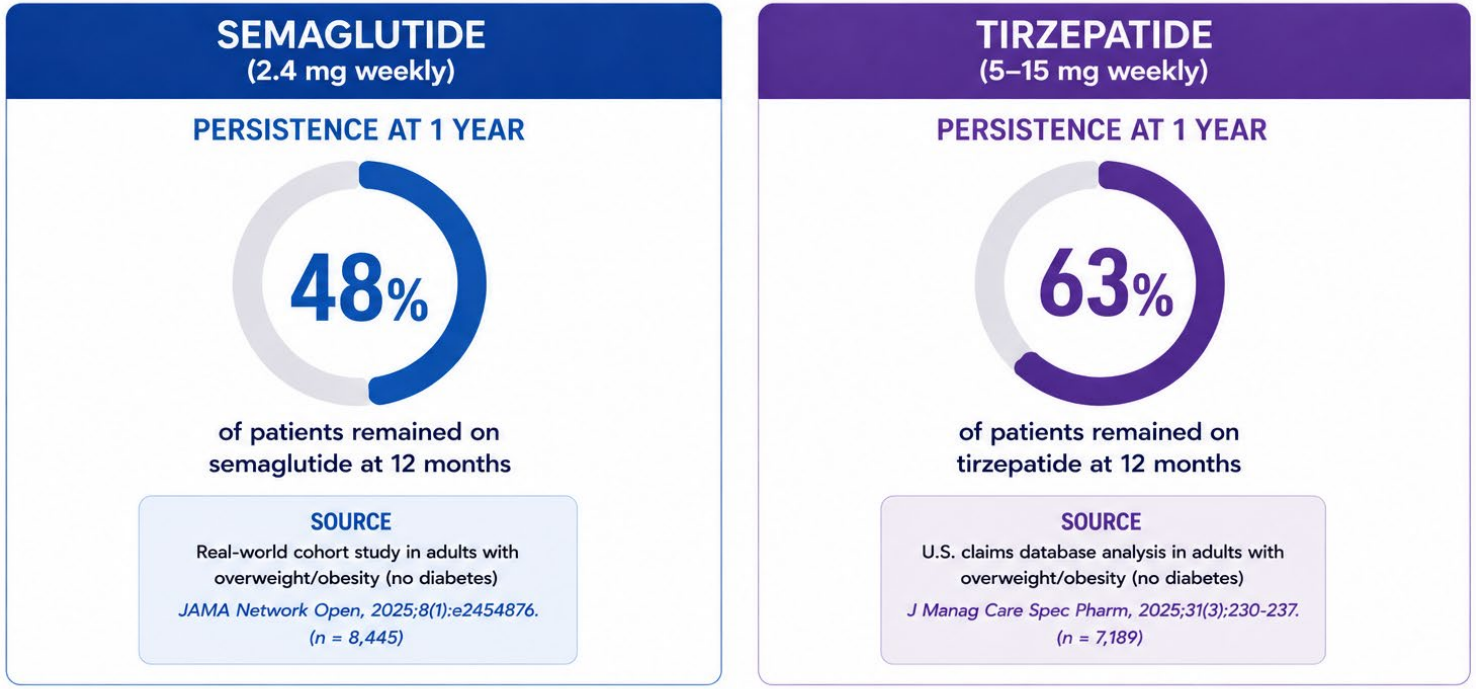
Caption


ORAL GLP-1 PILL (ORFORGLIPRON): WEIGHT LOSS RESULTS
A once-daily oral option for chronic weight management in adults with obesity or overweight (without diabetes).
KEY TRIAL: ATTAIN-1 (72 WEEKS)
Population
Adults with obesity or overweight + ≥1 weight-related comorbidity, without diabetes
Design
Randomized, double-blind, placebo-controlled trial
Intervention
Once-daily oral orforglipron at 3 dose levels vs placebo + lifestyle intervention (reduced-calorie diet and increased physical activity)
Duration
72 weeks of treatment
Primary Outcome
Percent change in body weight from baseline at 72 weeks
MEAN PERCENT WEIGHT LOSS AT 72 WEEKS
ORFORGLIPRON 5.5 mg
ORFORGLIPRON 9 mg
ORFORGLIPRON 17.2 mg
PLACEBO
Mean percent change in body weight from baseline
0%
-5%
-10%
-15%
-7.4%
-8.3%
-11.1%
-2.1%
Higher Dose Completer Analysis (17.2 mg)
Among participants who stayed on treatment:
~12.4%
average weight loss
~27 lb
average weight loss
KEY TAKEAWAY: In non-diabetic adults, orforglipron produced ~11–12% average weight loss at the highest dose over 72 weeks, with more than half of participants achieving ≥10% weight loss.
te: ATTAIN-1 = Achieve Total Weight Loss Assessment with an Oral, Non-peptide GLP-1 Receptor Agonist in Individuals with Obesity.
Source: Wharton S et al. N Engl J Med. 2023;389:2092-2102. Data on f

Caption

REAL-WORLD PERSISTENCE AT 1 YEAR

Among adults using GLP-1/GIP receptor agonists for weight management (without diabetes)



KEY TAKEAWAY In real-world practice, about half of patients using semaglutide remain on therapy therapy at 1 year, while nearly two-thirds of patients using tirzepatide remain on therapy at 1 year.

Note: Studies include adults using these medications for weight management without type 2 diabetes.
Persistence = proportion of patients who remained on therapy at 12 months.

Sources: 1. JAMA Network Open. 2025;8(1):e2454876.
2. J Manag Care Spec Pharm. 2025;31(3):230-237.

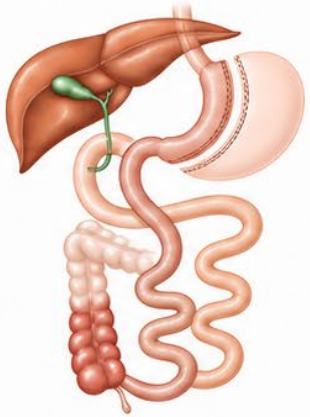
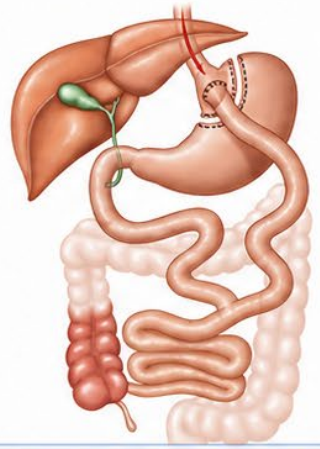
Caption

Metabolic Bariatric Surgery

- Sleeve Gastrectomy
- Gastric Bypass
- Duodenal Switch

AFTER BARIATRIC SURGERY

Percent of total body weight loss (%TWL) at 1 year post-surgery in adults with obesity

BILIOPANCREATIC DIVERSION WITH DUODENAL SWITCH (BPD/DS)	ROUX-EN-Y GASTRIC BYPASS (RYGB)	SLEEVE GASTRECTOMY (SG)
		
AVERAGE %TWL AT 1 YEAR **30–45%**	AVERAGE %TWL AT 1 YEAR **25–35%**	AVERAGE %TWL AT 1 YEAR **20–30%**

KEY TAKEAWAY: At 1 year after surgery, patients can expect to lose about 20–45% of their total body weight, depending on the procedure. **BPD/DS typically results in the greatest weight loss,** followed by RYGB, then SG.

%TWL = Percent of Total Body Weight Loss

Caption

TEEN-LABS STUDY: ADOLESCENT BARIATRIC SURGERY SUMMARY

Teen–Longitudinal Assessment of Bariatric Surgery (Teen-LABS) — the largest prospective U.S. study of metabolic/bariatric surgery in adolescents with severe obesity.

STUDY POPULATION

- ~240 adolescents aged 13–19
- Severe obesity
- Mostly Roux-en-Y gastric bypass (RYGB) or sleeve gastrectomy (SG)

WEIGHT LOSS OUTCOMES

3 YEARS	~27% mean total body weight loss
5 YEARS	26–28% mean total body weight loss (RYGB cohorts)
10 YEARS	~20% mean BMI reduction maintained a decade later

CARDIOMETABOLIC OUTCOMES

Major improvement and high remission rates

TYPE 2 DIABETES	Very high remission rates. At 5 years, teens had higher remission than adults in comparison studies.
HYPERTENSION	Marked remission/ improvement. Better outcomes than adults at 5 years.
DYSLIPIDEMIA	Significant improvement in abnormal lipids over time.

PRIMARY CARE TAKEAWAY:

For adolescents with severe obesity, bariatric surgery is an evidence-based, disease-modifying treatment associated with durable weight loss and major reduction in future metabolic risk when paired with long-term follow-up.

Note: Results reflect findings from the Teen–LABS study. Results may vary based on patient factors and center experience.

Sources: Inge TH, Zeller MH, Jenkins TM, et al. N Engl J Med. 2016;374:113–123.
Nadglowski J, O'Brien PE, Foreyt JP, et al. N Engl J Med. 2019;380:2134–2145.

Caption

ADULT BARIATRIC SURGERY: 30-DAY COMPLICATIONS

MBSAQIP REGISTRY DATA – AVERAGE RISK PATIENTS

DATA SOURCE: Metabolic and Bariatric Surgery Accreditation and Quality Improvement Program (MBSAQIP®)

PARTICIPANTS: 177 Accredited Centers

TIME FRAME: 2022

DEFINITION – AVERAGE RISK

Patients with no high-risk factors:
age <65, BMI <60 kg/m², non-smoker,
and no significant comorbidities
(no dyspnea at rest, steroid use, dialysis,
or bleeding disorders)

30-DAY POSTOPERATIVE OUTCOMES	AVERAGE RISK PATIENTS (N = 47,542) % (95% CI)
Bleeding requiring transfusion	0.72% (0.60 – 0.85)
Reoperation	1.33% (1.14 – 1.53)
Anastomotic leak	0.56% (0.43 – 0.70)
Surgical site infection (superficial, deep, or organ/space)	1.86% (1.64 – 2.10)
Pulmonary complication (e.g., pneumonia, failure to wean, reintubation)	0.89% (0.73 – 1.07)
Venous thromboembolism (DVT or PE)	0.48% (0.37 – 0.61)
Cardiac complication* (e.g., MI, cardiac arrest)	0.24% (0.16 – 0.34)
30-Day Readmission	5.01% (4.68 – 5.36)
30-Day Mortality	0.07% (0.04 – 0.11)

KEY TAKEAWAY

In average risk patients undergoing bariatric surgery at MBSAQIP-accredited centers, the overall 30-day mortality is

0.07%

ABOUT THE MBSAQIP® DATA

- Clinical data from a prospective, audited registry
- Risk-adjusted and statistically validated
- Includes patients undergoing primary bariatric procedures (RYGB, sleeve gastrectomy, and biliopancreatic diversion/duodenal switch)
- Results may not be generalizable to all settings

CITATION: Metabolic and Bariatric Surgery Accreditation and Quality Improvement Program (MBSAQIP®). MBSAQIP 2022 Annual Report. Chicago, IL: American College of Surgeons; 2023.
Available at: https://www.facs.org/quality-programs/mbsaqip/annual-reports

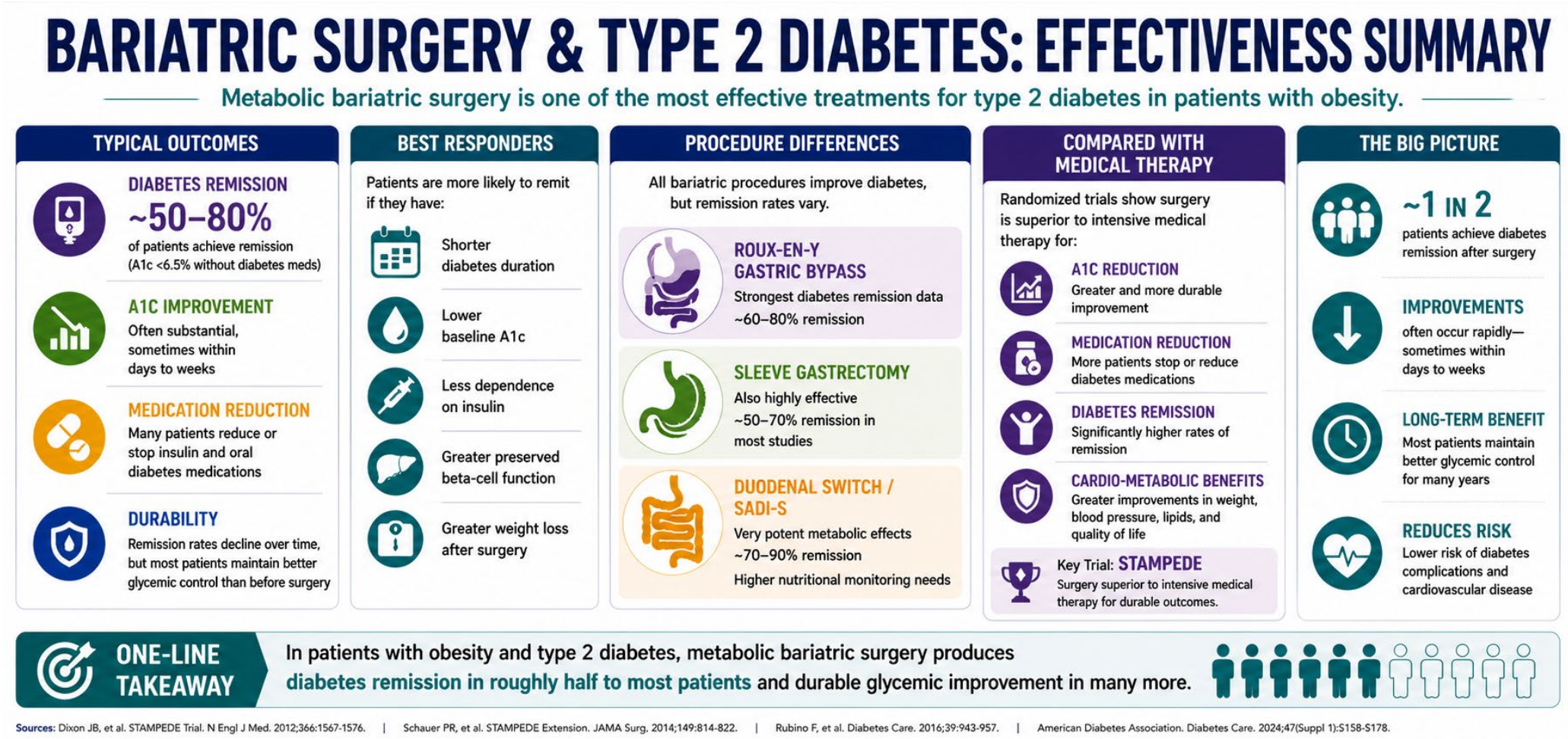
*Cardiac complication includes myocardial infarction or cardiac arrest requiring intervention.

Abbreviations: CI, confidence interval; DVT, deep vein thrombosis; MI, myocardial infarction; PE, pulmonary embolism; RYGB, Roux-en-Y gastric bypass.

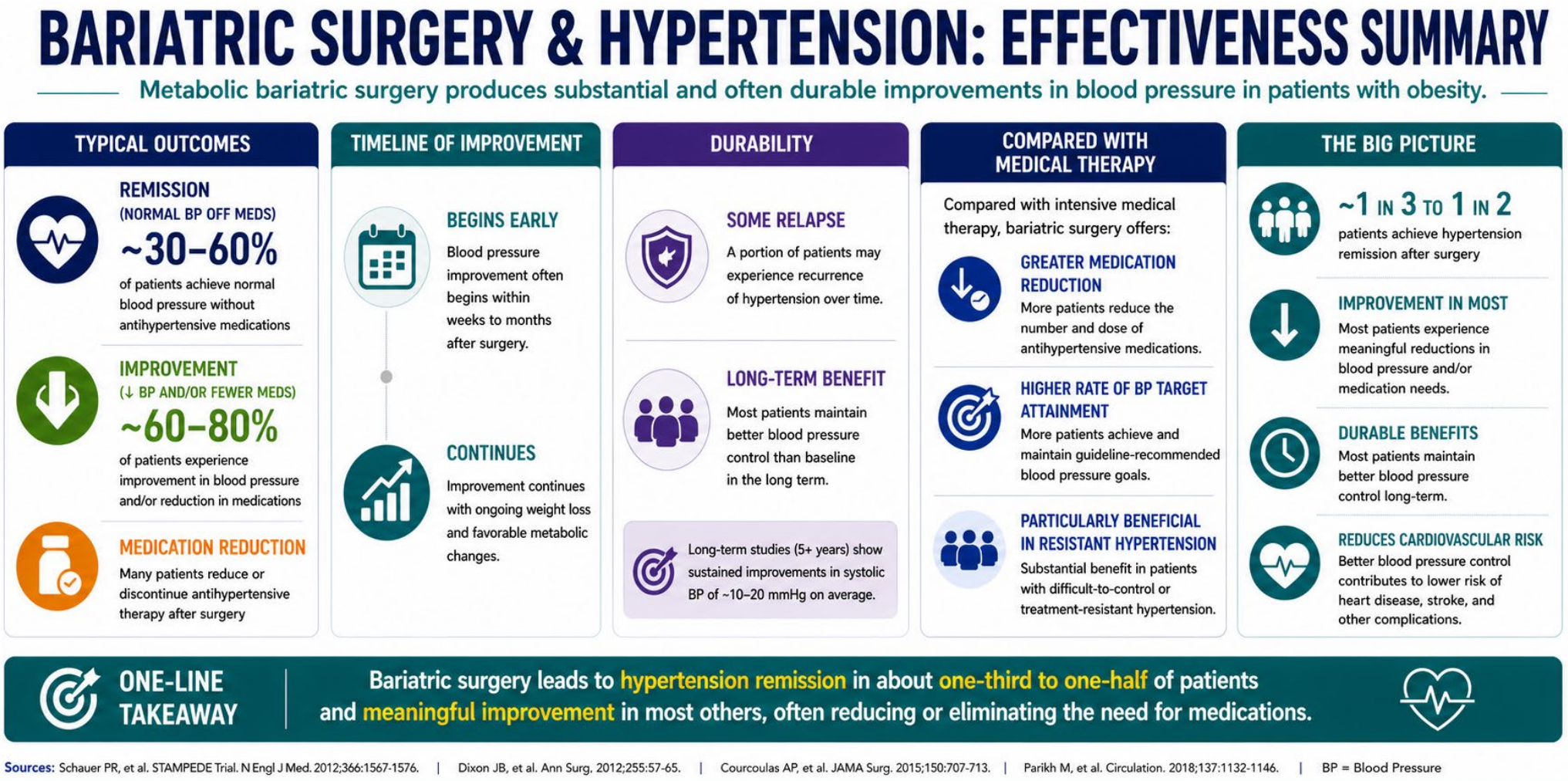
Caption


HOW MUCH DOES SEVERE OBESITY SHORTEN LIFE?
LIFE EXPECTANCY AND BMI ≥40 kg/m² (CLASS III OBESITY)
Adults with BMI ≥40 kg/m² have a significantly shorter life expectancy compared with normal-weight individuals.
ESTIMATED REDUCTION IN LIFE EXPECTANCY
~6 TO 14 YEARS
depending on age, sex, and health status.
WHY SEVERE OBESITY SHORTENS LIFE
Cardiovascular disease
Type 2 diabetes
Sleep apnea & respiratory disease
Liver & kidney disease
Certain cancers
Obesity increases the risk of many chronic diseases that can reduce lifespan.
DECREASED LIFE EXPECTANCY BY BMI CATEGORY
BMI (kg/m²)
ESTIMATED REDUCTION IN LIFE EXPECTANCY (compared with normal BMI 18.5–24.9)
AVERAGE REDUCTION (YEARS)
25.0 – 29.9 (Overweight)
~2 – 4 years
30.0 – 34.9 (Obesity Class I)
~3 – 6 years
35.0 – 39.9 (Obesity Class II)
~4 – 8 years
40.0 – 44.9 (Obesity Class III)
~8 – 10 years
≥45.0 (Severe Obesity)
~10 – 14 years
0
5
10
15
YEARS OF LIFE LOST
WHAT RESEARCH SHOWS
Large Prospective Cohort Studies (Pooled Analysis)
A pooled analysis of 239 prospective studies with >4 million participants found that individuals with BMI ≥40 had 6 to 14 years of life expectancy lost compared with normal weight.
UK Modeling Study (PHE, 2019)
Life expectancy losses at age 40 for individuals with severe obesity:
BMI 40–44.9: ~8 – 10 years
BMI ≥45: ~10 – 14 years
Greater reductions observed with smoking, diabetes, and other comorbid conditions.
IMPORTANT: These are population averages. Individual life expectancy depends on many factors, including age, genetics, smoking status, physical fitness, and the presence and control of other medical conditions.
Weight loss and treatment of obesity-related conditions can improve both quality and length of life.
SOURCES: 1. Global BMI Mortality Collaboration. Lancet Diabetes Endocrinol. 2016;4(6):437-445. | 2. Public Health England (PHE) Obesity and Life Expectancy Tool. 2019. | 3. Collaboration Di Angelantonio E, et al. Body-mass index and all-cause mortality: individual-participant-data meta-analysis of 239 prospective studies in four continents. Lan. Lancet. 2016;388(10046):776-786.

Caption


BARIATRIC SURGERY & TYPE 2 DIABETES: EFFECTIVENESS SUMMARY
Metabolic bariatric surgery is one of the most effective treatments for type 2 diabetes in patients with obesity.
TYPICAL OUTCOMES
DIABETES REMISSION
~50–80%
of patients achieve remission (A1c <6.5% without diabetes meds)
A1C IMPROVEMENT
Often substantial, sometimes within days to weeks
MEDICATION REDUCTION
Many patients reduce or stop insulin and oral diabetes medications
DURABILITY
Remission rates decline over time, but most patients maintain better glycemic control than before surgery
BEST RESPONDERS
Patients are more likely to remit if they have:
Shorter diabetes duration
Lower baseline A1c
Less dependence on insulin
Greater preserved beta-cell function
Greater weight loss after surgery
PROCEDURE DIFFERENCES
All bariatric procedures improve diabetes, but remission rates vary.
ROUX-EN-Y GASTRIC BYPASS
Strongest diabetes remission data
~60–80% remission
SLEEVE GASTRECTOMY
Also highly effective
~50–70% remission in most studies
DUODENAL SWITCH / SADI-S
Very potent metabolic effects
~70–90% remission
Higher nutritional monitoring needs
COMPARED WITH MEDICAL THERAPY
Randomized trials show surgery is superior to intensive medical therapy for:
A1C REDUCTION
Greater and more durable improvement
MEDICATION REDUCTION
More patients stop or reduce diabetes medications
DIABETES REMISSION
Significantly higher rates of remission
CARDIO-METABOLIC BENEFITS
Greater improvements in weight, blood pressure, lipids, and quality of life
Key Trial: STAMPEDE
Surgery superior to intensive medical therapy for durable outcomes.
THE BIG PICTURE
~1 IN 2
patients achieve diabetes remission after surgery
IMPROVEMENTS
often occur rapidly—sometimes within days to weeks
LONG-TERM BENEFIT
Most patients maintain better glycemic control for many years
REDUCES RISK
Lower risk of diabetes complications and cardiovascular disease
ONE-LINE TAKEAWAY
In patients with obesity and type 2 diabetes, metabolic bariatric surgery produces diabetes remission in roughly half to most patients and durable glycemic improvement in many more.
Sources: Dixon JB, et al. STAMPEDE Trial. N Engl J Med. 2012;366:1567-1576. | Schauer PR, et al. STAMPEDE Extension. JAMA Surg. 2014;149:814-822. | Rubino F, et al. Diabetes Care. 2016;39:943-957. | American Diabetes Association. Diabetes Care. 2024;47(Suppl 1):S158-S178.

Caption


BARIATRIC SURGERY & HYPERTENSION: EFFECTIVENESS SUMMARY
Metabolic bariatric surgery produces substantial and often durable improvements in blood pressure in patients with obesity.
TYPICAL OUTCOMES
REMISSION
(NORMAL BP OFF MEDS)
~30–60%
of patients achieve normal blood pressure without antihypertensive medications
IMPROVEMENT
(↓ BP AND/OR FEWER MEDS)
~60–80%
of patients experience improvement in blood pressure and/or reduction in medications
MEDICATION REDUCTION
Many patients reduce or discontinue antihypertensive therapy after surgery
TIMELINE OF IMPROVEMENT
BEGINS EARLY
Blood pressure improvement often begins within weeks to months after surgery.
CONTINUES
Improvement continues with ongoing weight loss and favorable metabolic changes.
DURABILITY
SOME RELAPSE
A portion of patients may experience recurrence of hypertension over time.
LONG-TERM BENEFIT
Most patients maintain better blood pressure control than baseline in the long term.
Long-term studies (5+ years) show sustained improvements in systolic BP of ~10–20 mmHg on average.
COMPARED WITH MEDICAL THERAPY
Compared with intensive medical therapy, bariatric surgery offers:
GREATER MEDICATION REDUCTION
More patients reduce the number and dose of antihypertensive medications.
HIGHER RATE OF BP TARGET ATTAINMENT
More patients achieve and maintain guideline-recommended blood pressure goals.
PARTICULARLY BENEFICIAL IN RESISTANT HYPERTENSION
Substantial benefit in patients with difficult-to-control or treatment-resistant hypertension.
THE BIG PICTURE
~1 IN 3 TO 1 IN 2
patients achieve hypertension remission after surgery
IMPROVEMENT IN MOST
Most patients experience meaningful reductions in blood pressure and/or medication needs.
DURABLE BENEFITS
Most patients maintain better blood pressure control long-term.
REDUCES CARDIOVASCULAR RISK
Better blood pressure control contributes to lower risk of heart disease, stroke, and other complications.
ONE-LINE TAKEAWAY
Bariatric surgery leads to hypertension remission in about one-third to one-half of patients and meaningful improvement in most others, often reducing or eliminating the need for medications.
Sources: Schauer PR, et al. STAMPEDE Trial. N Engl J Med. 2012;366:1567-1576. | Dixon JB, et al. Ann Surg. 2012;255:57-65. | Courcoulas AP, et al. JAMA Surg. 2015;150:707-713. | Parikh M, et al. Circulation. 2018;137:1132-1146. | BP = Blood Pressure

Caption

BARIATRIC SURGERY & DYSLIPIDEMIA: EFFECTIVENESS SUMMARY

Metabolic bariatric surgery produces significant and durable improvements in lipid profiles and reduces cardiovascular risk.

TYPICAL OUTCOMES

SUBSTANTIAL IMPROVEMENTS IN LIPID PROFILE

- **LDL CHOLESTEROL** ↓ 20–35% average reduction
- **HDL CHOLESTEROL** ↑ 15–30% average increase
- **TRIGLYCERIDES** ↓ 30–50% average reduction
- **TOTAL CHOLESTEROL** ↓ 15–25% average reduction

Many patients achieve normalization of lipid levels and can reduce or discontinue lipid-lowering medications.

TIMELINE OF IMPROVEMENT

EARLY CHANGES
Improvement in triglycerides and HDL can occur within weeks.

CONTINUES OVER TIME
Lipid profile continues to improve with ongoing weight loss and metabolic changes.

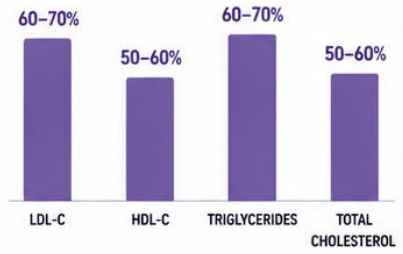
PEAK & STABILIZATION
Greatest improvements usually seen at 6–12 months and sustained long-term in most patients.

Long-term studies (5+ years) show sustained lipid improvements in the majority of patients.

DURABILITY

IMPROVEMENTS ARE DURABLE FOR MOST PATIENTS
Some regression may occur with weight regain, but most patients maintain significantly better lipid levels than before surgery.

% OF PATIENTS ACHIEVING NORMAL LIPID LEVELS (Off or reduced medication)



Ranges vary by study, procedure, and baseline lipid levels.

COMPARED WITH MEDICAL THERAPY

Compared with intensive medical therapy alone, bariatric surgery results in:

GREATER LIPID IMPROVEMENT
Larger reductions in LDL, TG and total cholesterol; greater increase in HDL.

MORE MEDICATION REDUCTION
Higher likelihood of reducing or discontinuing statins, fibrates, and other agents.

LOWER CARDIOVASCULAR RISK
Improvements in lipids contribute to reduced risk of heart disease, stroke, and cardiovascular events.

Randomized trials (e.g., STAMPEDE) show surgery is superior to intensive medical therapy for improving lipid profiles.

THE BIG PICTURE

IMPROVES ACROSS PATIENTS
Effective in patients with mixed dyslipidemia and metabolic syndrome.

PART OF RISK REDUCTION
Lipid improvements occur alongside weight loss, better glycemic control, and blood pressure reduction.

DURABLE BENEFITS
Most patients maintain better lipid levels long-term with lifestyle adherence.

CLINICALLY MEANINGFUL
Reductions in atherogenic lipids and increases in HDL translate into meaningful cardiovascular benefit.

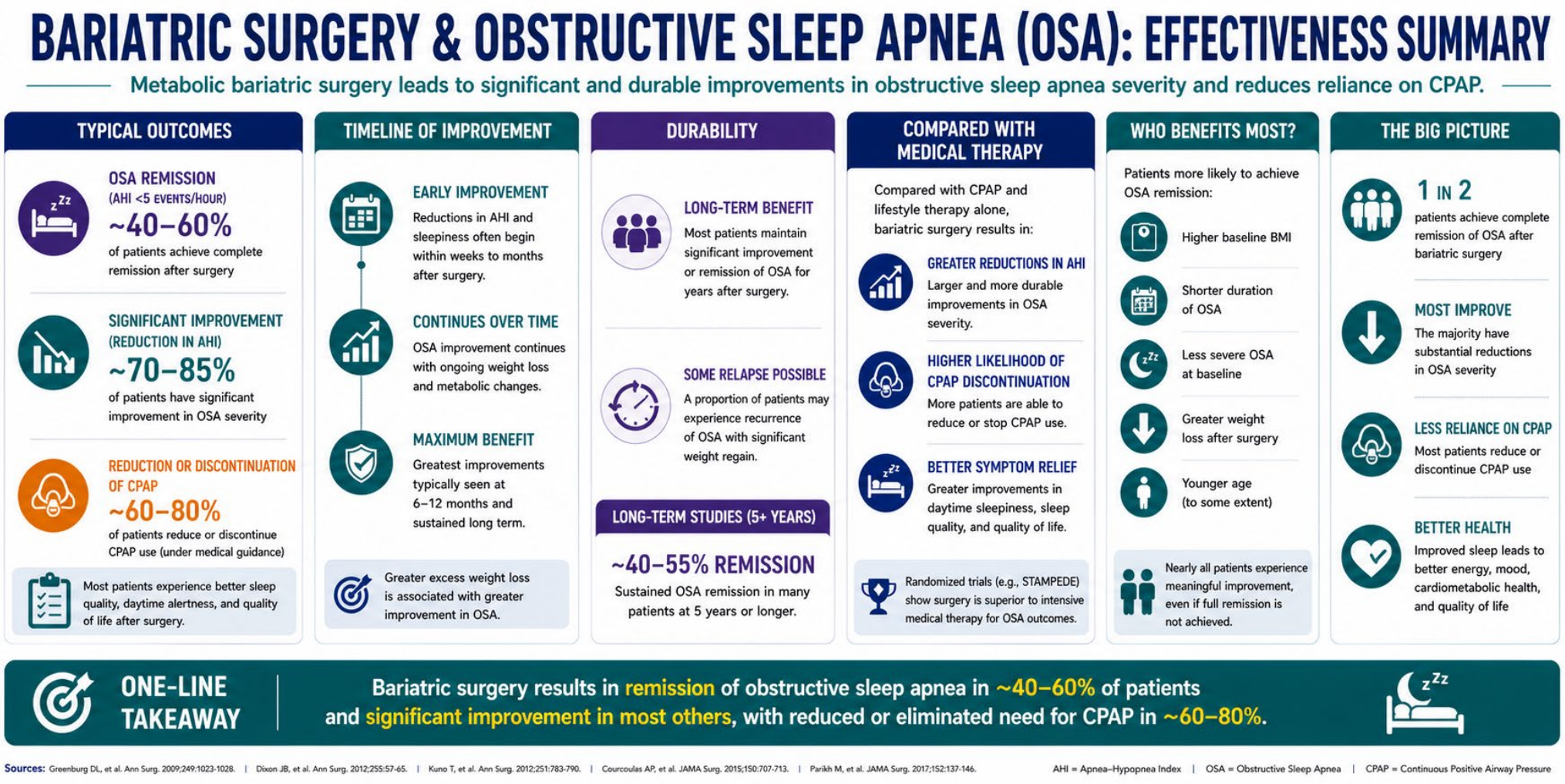
ONE-LINE TAKEAWAY

Bariatric surgery leads to significant reductions in LDL cholesterol and triglycerides, increases in HDL cholesterol, and normalization of lipid levels in many patients—improving long-term cardiovascular health.

Sources: Schauer PR, et al. STAMPEDE Trial. N Engl J Med. 2012;366:1567-1576. | Ikramuddin S, et al. JAMA. 2013;309(21):2240-2249. | Courcoulas AP, et al. JAMA Surg. 2015;150:707-713. | Sjöström L, et al. N Engl J Med. 2007;357:741-752.

LDL = Low-Density Lipoprotein HDL = High-Density Lipoprotein TG = Triglycerides TC = Total Cholesterol

Caption


BARIATRIC SURGERY & OBSTRUCTIVE SLEEP APNEA (OSA): EFFECTIVENESS SUMMARY
Metabolic bariatric surgery leads to significant and durable improvements in obstructive sleep apnea severity and reduces reliance on CPAP.
TYPICAL OUTCOMES
OSA REMISSION
(AHI <5 EVENTS/HOUR)
~40–60%
of patients achieve complete remission after surgery
SIGNIFICANT IMPROVEMENT
(REDUCTION IN AHI)
~70–85%
of patients have significant improvement in OSA severity
REDUCTION OR DISCONTINUATION OF CPAP
~60–80%
of patients reduce or discontinue CPAP use (under medical guidance)
Most patients experience better sleep quality, daytime alertness, and quality of life after surgery.
TIMELINE OF IMPROVEMENT
EARLY IMPROVEMENT
Reductions in AHI and sleepiness often begin within weeks to months after surgery.
CONTINUES OVER TIME
OSA improvement continues with ongoing weight loss and metabolic changes.
MAXIMUM BENEFIT
Greatest improvements typically seen at 6–12 months and sustained long term.
Greater excess weight loss is associated with greater improvement in OSA.
DURABILITY
LONG-TERM BENEFIT
Most patients maintain significant improvement or remission of OSA for years after surgery.
SOME RELAPSE POSSIBLE
A proportion of patients may experience recurrence of OSA with significant weight regain.
LONG-TERM STUDIES (5+ YEARS)
~40–55% REMISSION
Sustained OSA remission in many patients at 5 years or longer.
COMPARED WITH MEDICAL THERAPY
Compared with CPAP and lifestyle therapy alone, bariatric surgery results in:
GREATER REDUCTIONS IN AHI
Larger and more durable improvements in OSA severity.
HIGHER LIKELIHOOD OF CPAP DISCONTINUATION
More patients are able to reduce or stop CPAP use.
BETTER SYMPTOM RELIEF
Greater improvements in daytime sleepiness, sleep quality, and quality of life.
Randomized trials (e.g., STAMPEDE) show surgery is superior to intensive medical therapy for OSA outcomes.
WHO BENEFITS MOST?
Patients more likely to achieve OSA remission:
Higher baseline BMI
Shorter duration of OSA
Less severe OSA at baseline
Greater weight loss after surgery
Younger age (to some extent)
Nearly all patients experience meaningful improvement, even if full remission is not achieved.
THE BIG PICTURE
1 IN 2
patients achieve complete remission of OSA after bariatric surgery
MOST IMPROVE
The majority have substantial reductions in OSA severity
LESS RELIANCE ON CPAP
Most patients reduce or discontinue CPAP use
BETTER HEALTH
Improved sleep leads to better energy, mood, cardiometabolic health, and quality of life
ONE-LINE TAKEAWAY
Bariatric surgery results in remission of obstructive sleep apnea in ~40–60% of patients and significant improvement in most others, with reduced or eliminated need for CPAP in ~60–80%.
Sources: Greenburg DL, et al. Ann Surg. 2009;249:1023-1028. | Dixon JB, et al. Ann Surg. 2012;255:57-65. | Kuno T, et al. Ann Surg. 2012;251:783-790. | Courcoulas AP, et al. JAMA Surg. 2015;150:707-713. | Parikh M, et al. JAMA Surg. 2017;152:137-146.
AHI = Apnea–Hypopnea Index | OSA = Obstructive Sleep Apnea | CPAP = Continuous Positive Airway Pressure

Caption

BARIATRIC SURGERY & POLYCYSTIC OVARIAN SYNDROME (PCOS): EFFECTIVENESS SUMMARY

Metabolic bariatric surgery leads to significant and durable improvements in PCOS symptoms, hormonal imbalance, metabolic health, and quality of life.

TYPICAL OUTCOMES

IMPROVEMENT IN PCOS SYMPTOMS
~60–80%
of patients experience significant improvement or resolution of PCOS symptoms

RESTORATION OF MENSTRUAL REGULARITY
~60–80%
of premenopausal women experience return of regular menstrual cycles

REDUCTION IN HYPERANDROGENISM (SIGNS & SYMPTOMS)
~50–70%
of patients show improvement in hirsutism and acne

IMPROVED FERTILITY
~2–4x
higher odds of conception compared with lifestyle measures alone (observational studies)

Benefits are greatest with greater weight loss and metabolic improvement.

TIMELINE OF IMPROVEMENT

EARLY (WEEKS TO MONTHS)
Improvements in insulin resistance and androgen levels can occur within weeks to months after surgery.

3–6 MONTHS
Menstrual regularity and reduction in acne/hirsutism commonly begin during this period.

6–12 MONTHS
Maximal improvements in hormonal profile, ovulation, and metabolic parameters usually seen.

CONTINUES LONG TERM
Sustained weight loss and metabolic health support long-term PCOS remission or improvement.

Durable benefits are linked to sustained weight loss and resolution of insulin resistance.

EFFECTS ON KEY PCOS FEATURES

↓ INSULIN RESISTANCE
Marked improvement in insulin sensitivity and glucose metabolism (HOMA-IR often ↓ 50–80%).

↓ ANDROGEN LEVELS
Total testosterone and free androgen index typically decrease significantly.

OVULATION & MENSTRUAL FUNCTION
Increased ovulation rates and restoration of regular cycles in the majority of women.

HIRSUTISM & ACNE
Gradual improvement in hirsutism (Ferriman–Gallwey score) and acne severity.

METABOLIC HEALTH
Improved lipid profile, blood pressure, inflammation, and reduced risk of type 2 diabetes.

Improvements occur across both obese and non-obese women with PCOS, but are greater in those with obesity.

DURABILITY

LONG-TERM BENEFITS
Most studies with 3–10+ years follow-up show maintenance of:

- Weight loss
- Improved insulin sensitivity
- Lower androgen levels
- Menstrual regularity
- Reduced PCOS symptom burden

SOME RELAPSE POSSIBLE
Partial return of symptoms can occur with significant weight regain.

Sustained lifestyle and follow-up care are important to maintain long-term improvement.

COMPARED WITH MEDICAL & LIFESTYLE THERAPY

Compared with lifestyle modification and medications alone, bariatric surgery results in:

GREATER IMPROVEMENT
Larger reductions in insulin resistance, androgens, and PCOS symptoms.

REDUCED NEED FOR MEDICATIONS
Many women reduce or stop metformin, anti-androgens, and hormonal therapies.

HIGHER FERTILITY RATES
Greater likelihood of spontaneous ovulation and pregnancy.

BETTER OVERALL HEALTH
Greater improvements in weight, cardiometabolic risk factors, and quality of life.

Evidence from observational studies and meta-analyses consistently favors surgery for durable PCOS improvement in women with obesity.

THE BIG PICTURE

SUBSTANTIAL IMPACT
~60–80% of women experience major improvement or remission of PCOS features.

MULTIPLE BENEFITS
Improves reproductive, hormonal, metabolic, and psychological outcomes.

DURABLE RESULTS
Most women maintain improvements for many years with sustained weight loss.

IMPROVED QUALITY OF LIFE
Reduces symptom burden and enhances physical and emotional well-being.

SUPPORTS FERTILITY & FUTURE PREGNANCY
Especially beneficial for women desiring pregnancy.

Bariatric surgery can be a transformative treatment for women with PCOS and obesity.

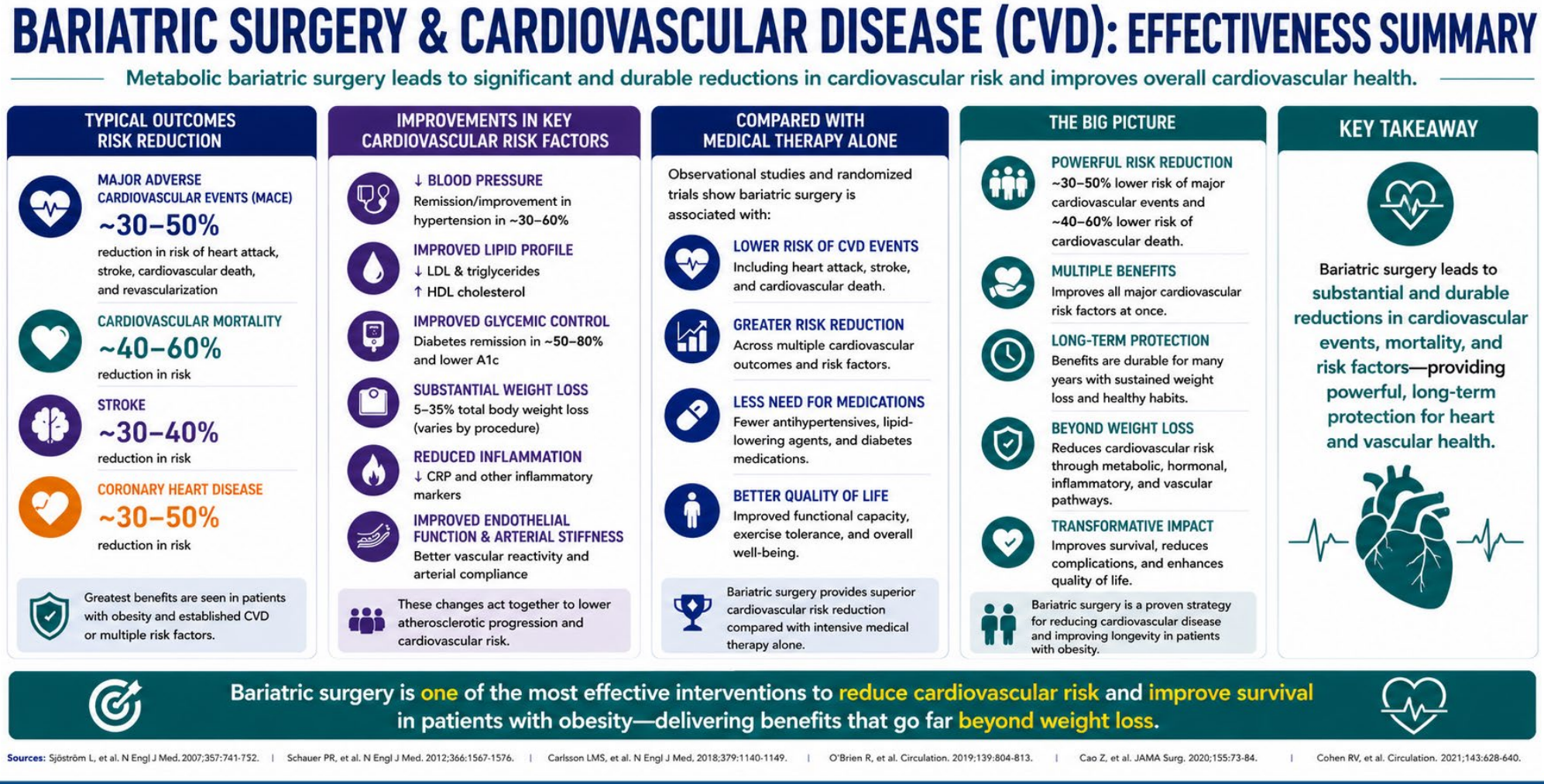
ONE-LINE TAKEAWAY

Bariatric surgery leads to significant and durable improvement or remission of PCOS symptoms in ~60–80% of women, with restoration of menstrual regularity, reduced androgen levels, improved fertility, and better metabolic health.

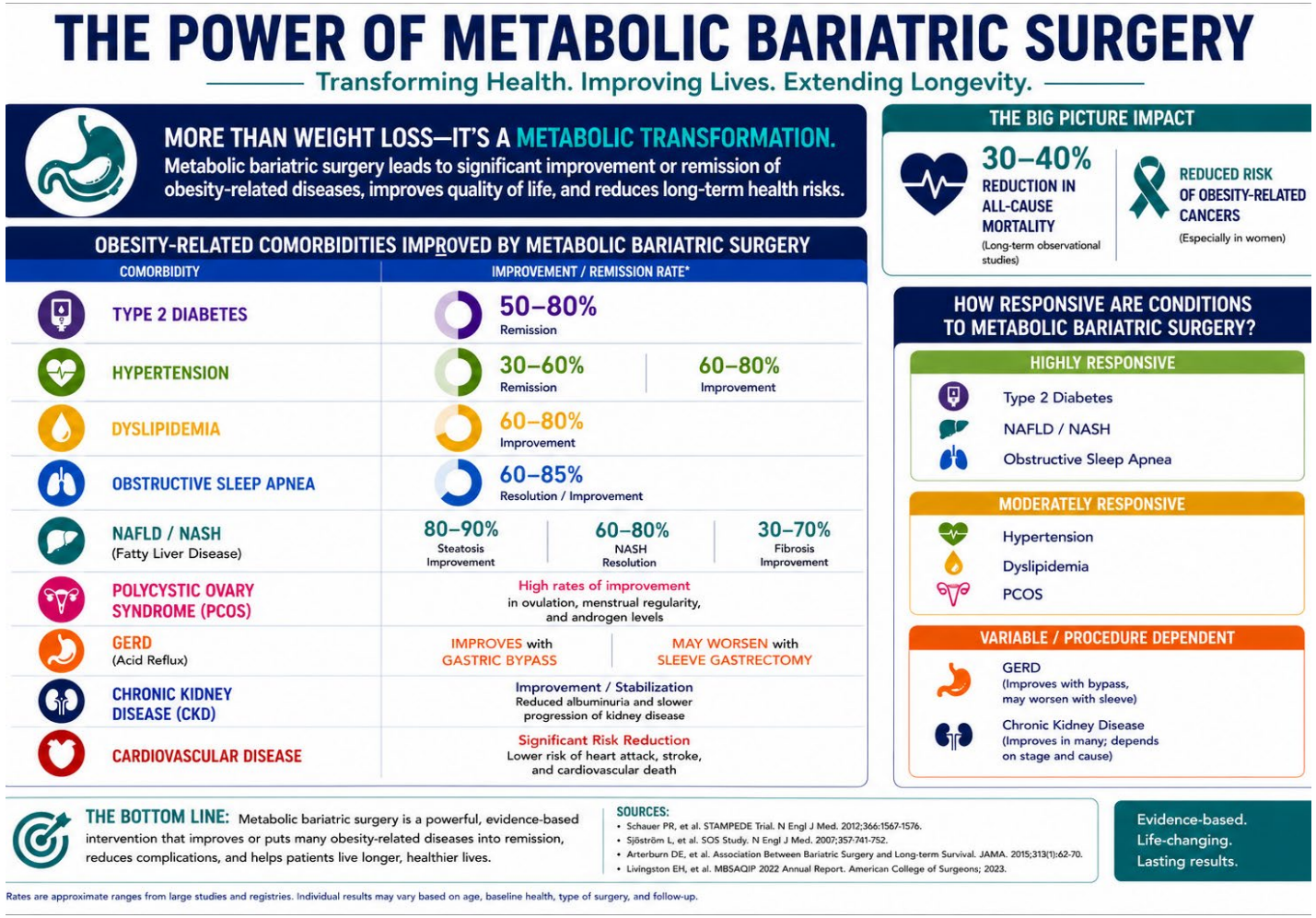
Sources: Ding T, et al. Obes Surg. 2016;26:1696-1702. | Tang T, et al. Hum Reprod Update. 2012;18:618-637. | Escobar-Morreale HF, et al. Nat Rev Endocrinol. 2018;14:270-284. | Morin-Papunen L, et al. Hum Reprod Update. 2022;28:725-750. | Roehlen N, et al. Obes Surg. 2021;31:3448-3460.

PCOS = Polycystic Ovary Syndrome

Caption


BARIATRIC SURGERY & CARDIOVASCULAR DISEASE (CVD): EFFECTIVENESS SUMMARY
Metabolic bariatric surgery leads to significant and durable reductions in cardiovascular risk and improves overall cardiovascular health.
TYPICAL OUTCOMES RISK REDUCTION
MAJOR ADVERSE CARDIOVASCULAR EVENTS (MACE)
~30–50%
reduction in risk of heart attack, stroke, cardiovascular death, and revascularization
CARDIOVASCULAR MORTALITY
~40–60%
reduction in risk
STROKE
~30–40%
reduction in risk
CORONARY HEART DISEASE
~30–50%
reduction in risk
Greatest benefits are seen in patients with obesity and established CVD or multiple risk factors.
IMPROVEMENTS IN KEY CARDIOVASCULAR RISK FACTORS
↓ BLOOD PRESSURE
Remission/improvement in hypertension in ~30–60%
IMPROVED LIPID PROFILE
↓ LDL & triglycerides
↑ HDL cholesterol
IMPROVED GLYCEMIC CONTROL
Diabetes remission in ~50–80% and lower A1c
SUBSTANTIAL WEIGHT LOSS
5–35% total body weight loss (varies by procedure)
REDUCED INFLAMMATION
↓ CRP and other inflammatory markers
IMPROVED ENDOTHELIAL FUNCTION & ARTERIAL STIFFNESS
Better vascular reactivity and arterial compliance
These changes act together to lower atherosclerotic progression and cardiovascular risk.
COMPARED WITH MEDICAL THERAPY ALONE
Observational studies and randomized trials show bariatric surgery is associated with:
LOWER RISK OF CVD EVENTS
Including heart attack, stroke, and cardiovascular death.
GREATER RISK REDUCTION
Across multiple cardiovascular outcomes and risk factors.
LESS NEED FOR MEDICATIONS
Fewer antihypertensives, lipid-lowering agents, and diabetes medications.
BETTER QUALITY OF LIFE
Improved functional capacity, exercise tolerance, and overall well-being.
Bariatric surgery provides superior cardiovascular risk reduction compared with intensive medical therapy alone.
THE BIG PICTURE
POWERFUL RISK REDUCTION
~30–50% lower risk of major cardiovascular events and ~40–60% lower risk of cardiovascular death.
MULTIPLE BENEFITS
Improves all major cardiovascular risk factors at once.
LONG-TERM PROTECTION
Benefits are durable for many years with sustained weight loss and healthy habits.
BEYOND WEIGHT LOSS
Reduces cardiovascular risk through metabolic, hormonal, inflammatory, and vascular pathways.
TRANSFORMATIVE IMPACT
Improves survival, reduces complications, and enhances quality of life.
Bariatric surgery is a proven strategy for reducing cardiovascular disease and improving longevity in patients with obesity.
KEY TAKEAWAY
Bariatric surgery leads to substantial and durable reductions in cardiovascular events, mortality, and risk factors—providing powerful, long-term protection for heart and vascular health.
Bariatric surgery is one of the most effective interventions to reduce cardiovascular risk and improve survival in patients with obesity—delivering benefits that go far beyond weight loss.
Sources: Sjöström L, et al. N Engl J Med. 2007;357:741-752. | Schauer PR, et al. N Engl J Med. 2012;366:1567-1576. | Carlsson LMS, et al. N Engl J Med. 2018;379:1140-1149. | O'Brien R, et al. Circulation. 2019;139:804-813. | Cao Z, et al. JAMA Surg. 2020;155:73-84. | Cohen RV, et al. Circulation. 2021;143:628-640.

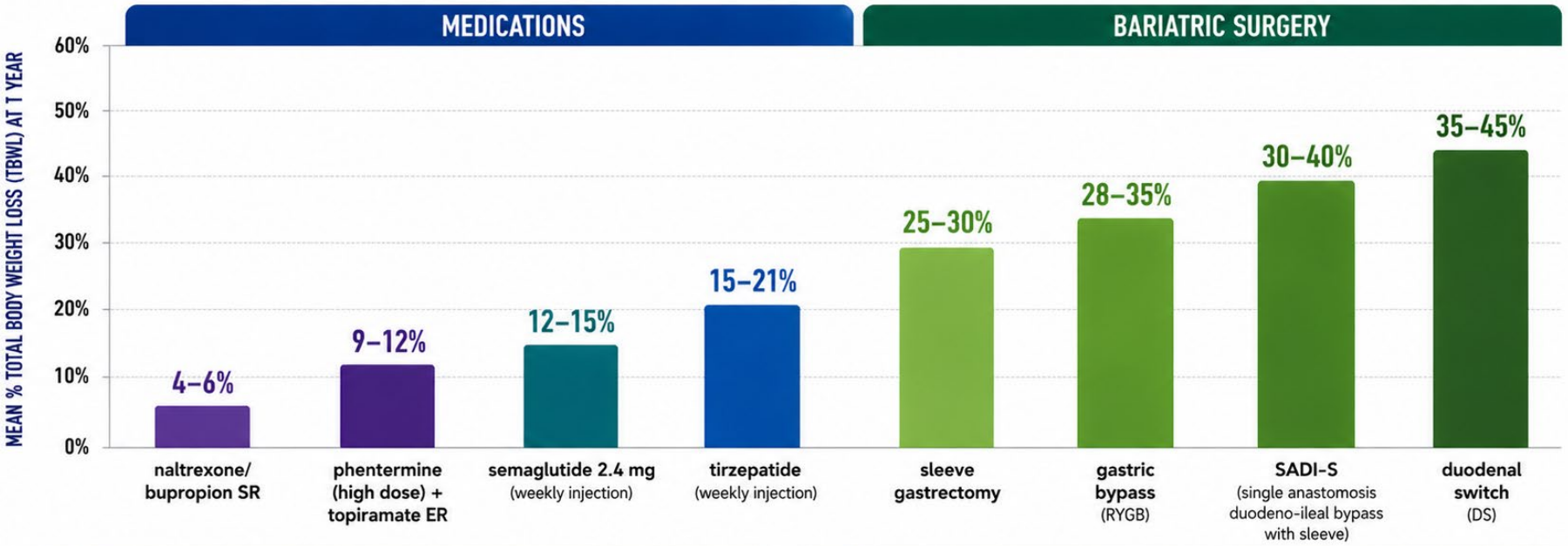
Caption


THE POWER OF METABOLIC BARIATRIC SURGERY
Transforming Health. Improving Lives. Extending Longevity.
MORE THAN WEIGHT LOSS—IT'S A METABOLIC TRANSFORMATION.
Metabolic bariatric surgery leads to significant improvement or remission of obesity-related diseases, improves quality of life, and reduces long-term health risks.
THE BIG PICTURE IMPACT
30–40%
REDUCTION IN ALL-CAUSE MORTALITY
(Long-term observational studies)
REDUCED RISK OF OBESITY-RELATED CANCERS
(Especially in women)
OBESITY-RELATED COMORBIDITIES IMPROVED BY METABOLIC BARIATRIC SURGERY
COMORBIDITY
IMPROVEMENT / REMISSION RATE*
TYPE 2 DIABETES
50–80% Remission
HYPERTENSION
30–60% Remission
60–80% Improvement
DYSLIPIDEMIA
60–80% Improvement
OBSTRUCTIVE SLEEP APNEA
60–85% Resolution / Improvement
NAFLD / NASH (Fatty Liver Disease)
80–90% Steatosis Improvement
60–80% NASH Resolution
30–70% Fibrosis Improvement
POLYCYSTIC OVARY SYNDROME (PCOS)
High rates of improvement in ovulation, menstrual regularity, and androgen levels
GERD (Acid Reflux)
IMPROVES with GASTRIC BYPASS
MAY WORSEN with SLEEVE GASTRECTOMY
CHRONIC KIDNEY DISEASE (CKD)
Improvement / Stabilization
Reduced albuminuria and slower progression of kidney disease
CARDIOVASCULAR DISEASE
Significant Risk Reduction
Lower risk of heart attack, stroke, and cardiovascular death
HOW RESPONSIVE ARE CONDITIONS TO METABOLIC BARIATRIC SURGERY?
HIGHLY RESPONSIVE
Type 2 Diabetes
NAFLD / NASH
Obstructive Sleep Apnea
MODERATELY RESPONSIVE
Hypertension
Dyslipidemia
PCOS
VARIABLE / PROCEDURE DEPENDENT
GERD
(Improves with bypass, may worsen with sleeve)
Chronic Kidney Disease
(Improves in many; depends on stage and cause)
THE BOTTOM LINE: Metabolic bariatric surgery is a powerful, evidence-based intervention that improves or puts many obesity-related diseases into remission, reduces complications, and helps patients live longer, healthier lives.
SOURCES:
• Schauer PR, et al. STAMPEDE Trial. N Engl J Med. 2012;366:1567-1576.
• Sjöström L, et al. SOS Study. N Engl J Med. 2007;357-741-752.
• Arterburn DE, et al. Association Between Bariatric Surgery and Long-term Survival. JAMA. 2015;313(1):62-70.
• Livingston EH, et al. MBSAQIP 2022 Annual Report. American College of Surgeons; 2023.
Evidence-based.
Life-changing.
Lasting results.
Rates are approximate ranges from large studies and registries. Individual results may vary based on age, baseline health, type of surgery, and follow-up.

Caption

WEIGHT LOSS OUTCOMES AT 1 YEAR: MEDICATIONS vs. BARIATRIC SURGERY

Percent total body weight loss (TBWL) at 1 year in adults with obesity*



Medication results vary by dose and individual response. Surgery typically delivers greater and more durable weight loss than medications.

Bariatric surgery consistently achieves ~25–45% TBWL at 1 year, substantially more than available medications.

*Adults with BMI ≥30 kg/m² or ≥27 kg/m² with obesity-related conditions. **High dose phentermine = 15 mg/day (or 37.5 mg/day) when used off-label.

Note: Ranges reflect mean % TBWL at 1 year from randomized controlled trials and high-quality observational studies.

Sources: Wadden TA, et al. Obesity (Silver Spring). 2011;19:110-120. | Garvey WT, et al. Obesity (Silver Spring). 2012;20:330-342. | Wilding JPH, et al. N Engl J Med. 2021;384:989-1002. Jastreboff AM, et al. N Engl J Med. 2022;387:205-216. | Peterli R, et al. Ann Surg. 2018;268:740-746. | Adams TD, et al. N Engl J Med. 2017;377:1143-1155. Sanchez-Pernaute A, et al. Obes Surg. 2018;28:3177-3186. | Arterburn DE, et al. Ann Intern Med. 2020;172:877-887.

Caption


TREAT OBESITY EFFECTIVELY—NOT STEP WISE
Obesity is a chronic, progressive, relapsing disease—treat it with the right tool for the right patient, right away.
THE STEPWISE (HIERARCHICAL) APPROACH DELAYS RESULTS
Traditional stepwise model:
Start with least intensive options and "step up" only if needed
1 Lifestyle Modification
~3–5% average weight loss
2 Oral Medications
~5–12% average weight loss
3 Injectable Medications
~12–21% average weight loss
4 Surgery
~25–45% average weight loss
Months to Years of Delay
Why this approach falls short:
Prolonged exposure to obesity-related risks and comorbidities
Many patients drop out or lose motivation during the wait
Weight regain is common at each step
Delays the best chance for long-term success
CHOOSE THE MOST EFFECTIVE TREATMENT FIRST
Personalized, effectiveness-first approach:
Match the treatment to the patient and their goals from the start
Severity of obesity
Health conditions and urgency
Weight loss goals
Patient preferences
Access and resources
Previous treatment experience
Select the option most likely to deliver the greatest, most durable results
Lifestyle Modification
~3–5%
Oral Medications
~5–12%
Injectable Medications
~12–21%
Metabolic Surgery
~25–45%
Start with the treatment most likely to achieve meaningful, durable weight loss and improvement (or remission) of obesity-related conditions.
THE GOAL IS NOT TO "TRY EVERYTHING." THE GOAL IS TO GET THE RIGHT TREATMENT TO THE RIGHT PATIENT AT THE RIGHT TIME.
Earlier, more effective treatment leads to better health, fewer complications, and lower long-term costs.
Choosing the most effective treatment first can lead to:
Greater weight loss and better health outcomes
Higher likelihood of achieving and maintaining goals
Reduction or remission of obesity-related conditions
Less time living with disease burden
Lower overall healthcare utilization and costs
Obesity treatment should be personalized, not procedural.
EFFECTIVENESS FIRST. ALWAYS.
THERE IS NO ONE-SIZE-FITS-ALL PATH. THERE IS THE RIGHT PATH FOR EACH PERSON.
Lead with effectiveness. Treat obesity like the chronic disease it is.

Caption

TREAT OBESITY TO TARGET: THE LATEST EVIDENCE

Define the target. Choose the therapy most likely to reach it. Reassess and adjust until the target is achieved.

WHY NOT STEPWISE?

The traditional stepwise approach delays effective treatment, increases risk of complications, and leads to more drop-out.

Start with the treatment most likely to achieve the patient's target.

EVIDENCE-BASED WEIGHT LOSS TARGETS & BENEFITS

≥5%	Improves glycemia, triglycerides, blood pressure, and liver fat	• Improved insulin sensitivity • Improved lipid profile • Lower blood pressure
≥10%	Improves many obesity-related complications	• Better glycemic control • Improved sleep apnea • Improved mobility & quality of life
≥15%	Greater cardiometabolic benefit and reduction in liver fat	• Significant CV risk reduction • NAFLD improvement • Reduced inflammation
≥20%+	Often needed for remission of comorbidities and maximum benefit	• Type 2 diabetes remission more likely • Severe OSA improvement • NASH resolution more likely

MATCH TREATMENT INTENSITY TO GOAL

Prevent progression / modest improvement	Lifestyle + behavioral care
≥10% weight loss	Anti-obesity medications
≥15–20% weight loss or major comorbidity improvement	High-efficacy medications and/or surgery
Diabetes remission, severe OSA, advanced obesity	Consider bariatric surgery early

THE TREAT-TO-TARGET CYCLE: CONTINUOUS & DYNAMIC

1. ASSESS & SET TARGET
- Evaluate health, comorbidities and patient priorities
- Set a specific % weight loss target and health goals

→

2. CHOOSE BEST OPTION TO REACH TARGET

Select the therapy most likely to achieve the target for this individual

→

3. REASSESS REGULARLY
- Monitor progress, health metrics, side effects, and patient experience
- Reassess every 8–12 weeks

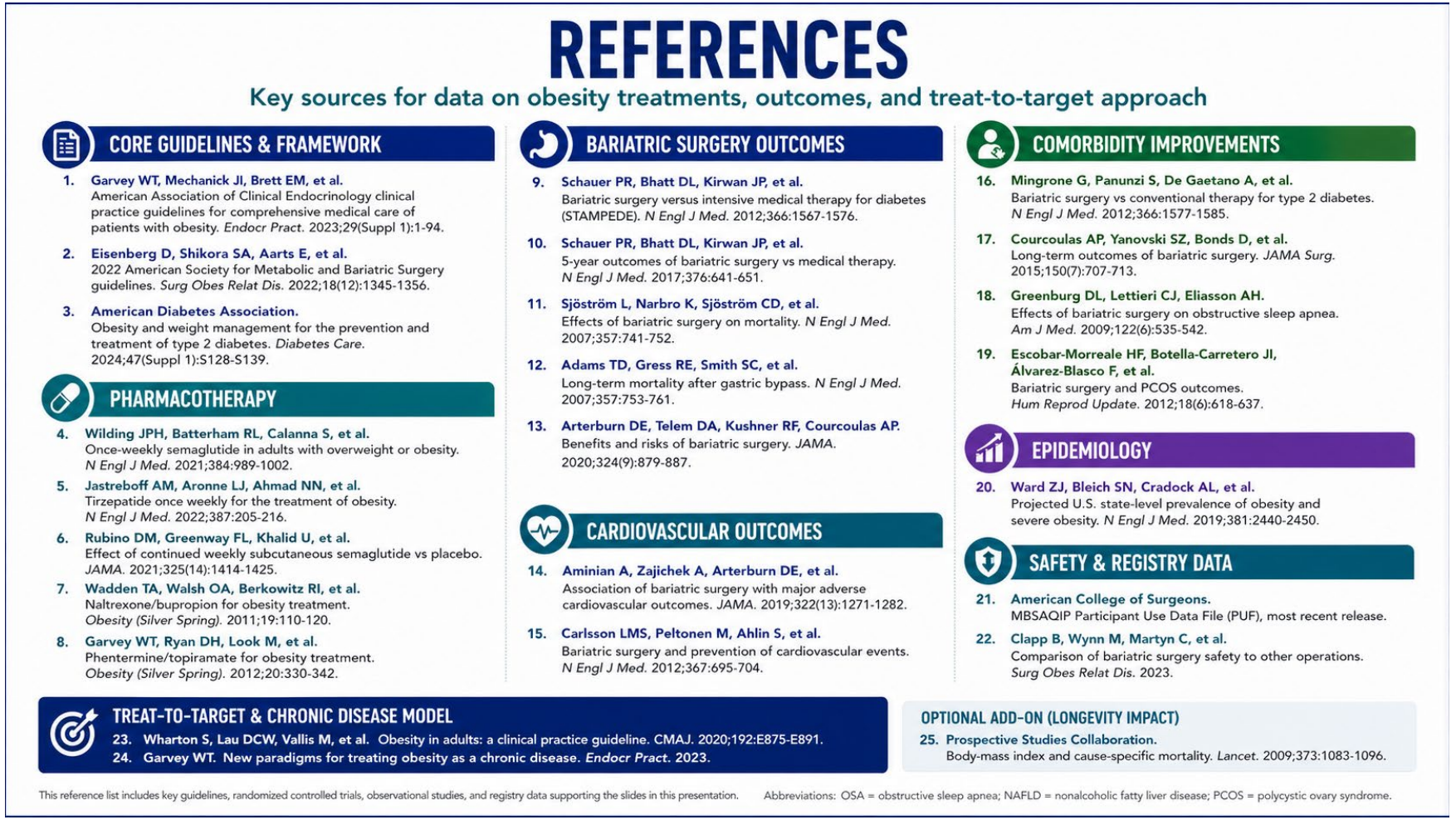
→

4. ADJUST TO STAY AT TARGET
- Intensify, switch, or add therapy if target not met
- Reassess and support to sustain results

Goal: Use the right treatment, for the right patient, at the right time.

Earlier use of effective therapy leads to greater weight loss, better health outcomes, fewer complications, and lower long-term costs.

Caption



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Key sources for data on obesity treatments, outcomes, and treat-to-target approach

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8. **Garvey WT, Ryan DH, Look M, et al.** Phentermine/topiramate for obesity treatment. *Obesity (Silver Spring).* 2012;20:330-342.

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TREAT-TO-TARGET & CHRONIC DISEASE MODEL

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OPTIONAL ADD-ON (LONGEVITY IMPACT)

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This reference list includes key guidelines, randomized controlled trials, observational studies, and registry data supporting the slides in this presentation.

Abbreviations: OSA = obstructive sleep apnea; NAFLD = nonalcoholic fatty liver disease; PCOS = polycystic ovary syndrome.

Caption