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Cardiometabolic Health Congress

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Foundations of Cardiometabolic Health Certification Course

Certified Cardiometabolic Health Professional (CCHP)

Metabolic Surgery

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Disclosures

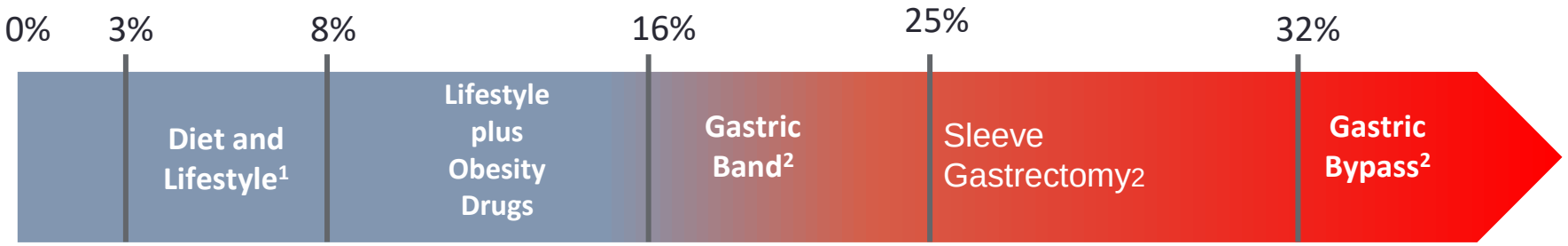
- **Consulting Fee:** Ethicon Endo-Surgery, Medtronic, Novo Nordisk
- **Speakers Bureau:** Novo Nordisk
- **Contracted Research:** Ethicon Endo-Surgery, Novo Nordisk, Regeneron

Components of an Effective Obesity Management Program

Wadden TA, et al. *Med Clin North Am*. 2000;84(2):441-461; Stumbo P, et al. *Surg Clin North Am.* 2005;85(4):703-723.

Weight Management Intensification Options

- Patients with low risk should have lower intensity, less risk approaches.
- Higher risk approaches are justified when patients have more complicated obesity.

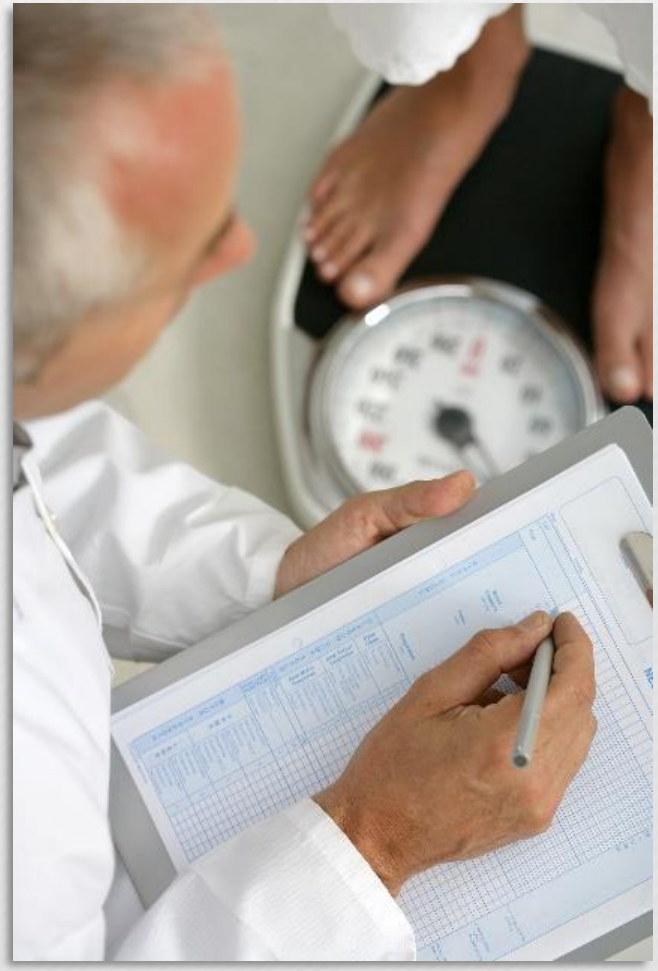


From LABS[3]: Perioperative deep vein thrombosis, thromboembolism, or death
1% for gastric band 5% for bypass

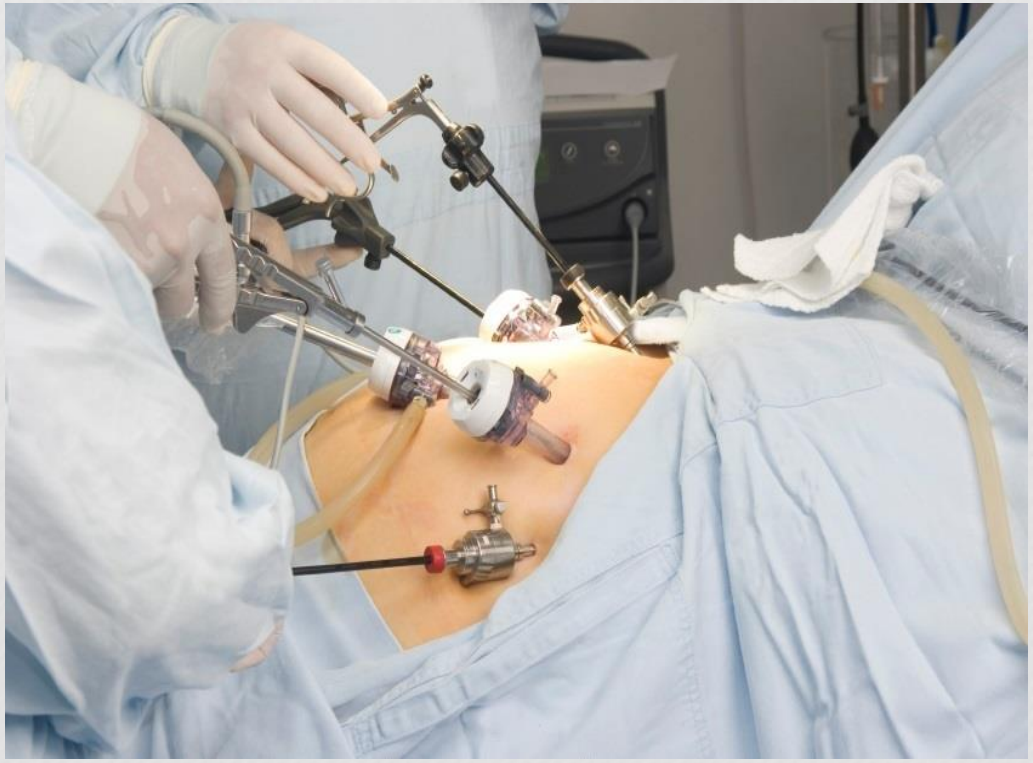
1. Jensen MD, et al. *Circulation.* 2014;129(25 Suppl 2):S102-S138.
2. Courcoulas AP, et al. *JAMA.* 2013;310(22):2416-2425.
3. Longitudinal Assessment of Bariatric Surgery (LABS) Consortium, et al. *N Engl J Med.* 2009;361(5):445-454.

Medical and Surgical Treatment of Obesity:

Implementing Practical Therapies into Clinical Practice



Bariatric Surgery



Images courtesy of Christopher Still, DO, FACP, FTOS

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Bariatric Surgery: Criteria & Overview of Common Procedures

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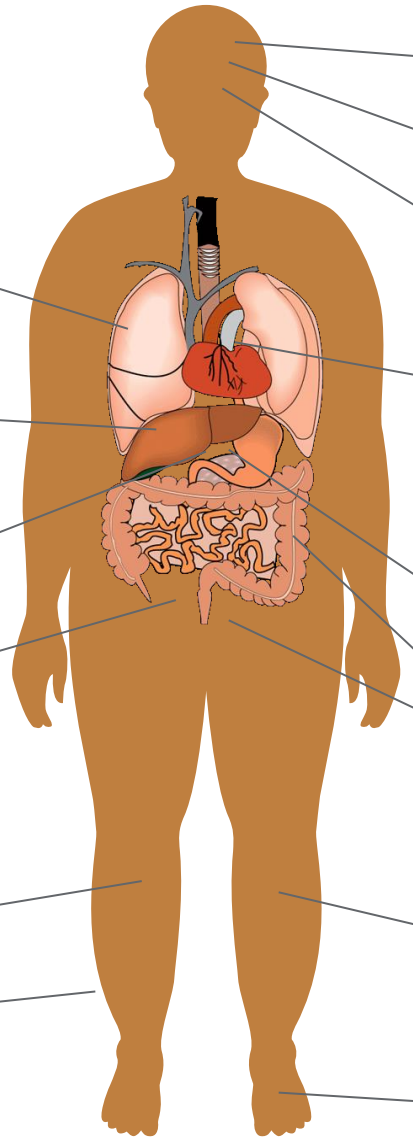
Bariatric Surgery Criteria

BMI = body mass index; OSA = obstructive sleep apnea.

US Centers for Disease Control and Prevention. Accessed June 25, 2021. http://www.cdc.gov/healthyweight/assessing/bmi/adult_bmi
Mechanick JI, et al. Endocr Pract. 2019;25(12):1346-1359.

Resolution of Comorbidities



Idiopathic intracranial hypertension

Stroke

Cataracts

Coronary heart disease

- Diabetes
- Dyslipidemia
- Hypertension **69% resolved**

Severe pancreatitis

Cancer
Breast, uterus, cervix, colon, esophagus, pancreas, kidney, prostate

Phlebitis 95% resolved
Venous stasis

Gout 72% resolved

74%-98% resolved

Pulmonary disease
Abnormal function
Obstructive sleep apnea
Hypoventilation syndrome

90% reduced

Nonalcoholic fatty liver disease
Steatosis
Steatohepatitis
Cirrhosis

Gall bladder disease

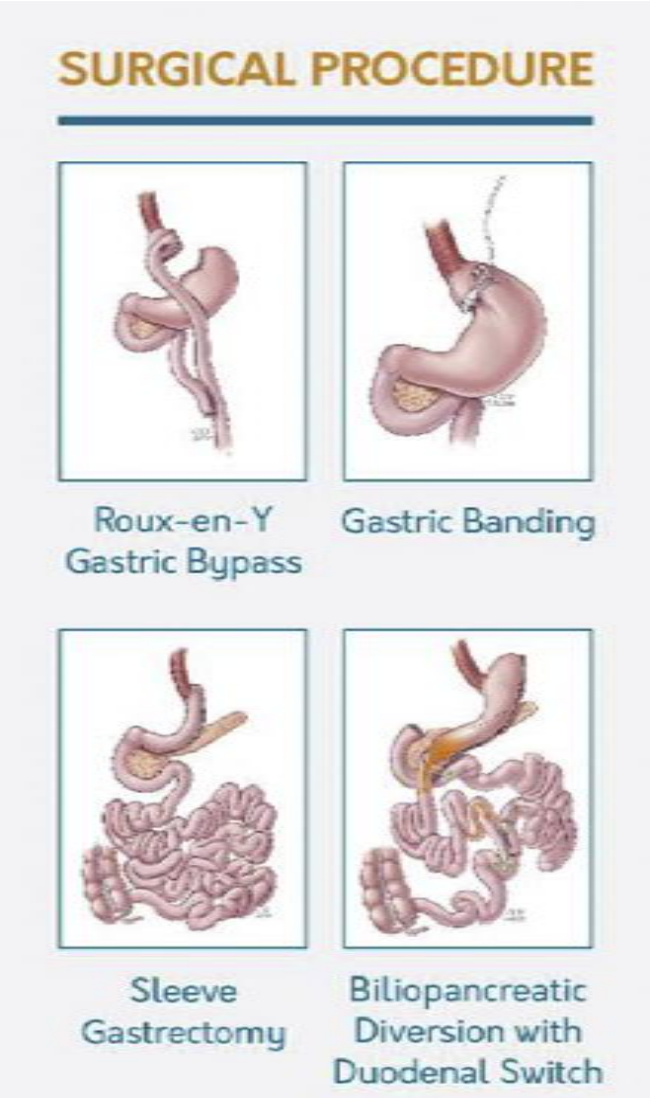
Gynecologic abnormalities
Abnormal menses
Infertility
Polycystic ovarian syndrome

41% resolved **Osteoarthritis**

Skin

Slide courtesy of Christopher Still, DO, FACP, FTOS.
Adapted from the Endocrine Society Weight First. ENDO 2016.

Current Surgical Bariatric Procedures



4 surgical procedures shown are endorsed by American Society of Metabolic and Bariatric Surgery

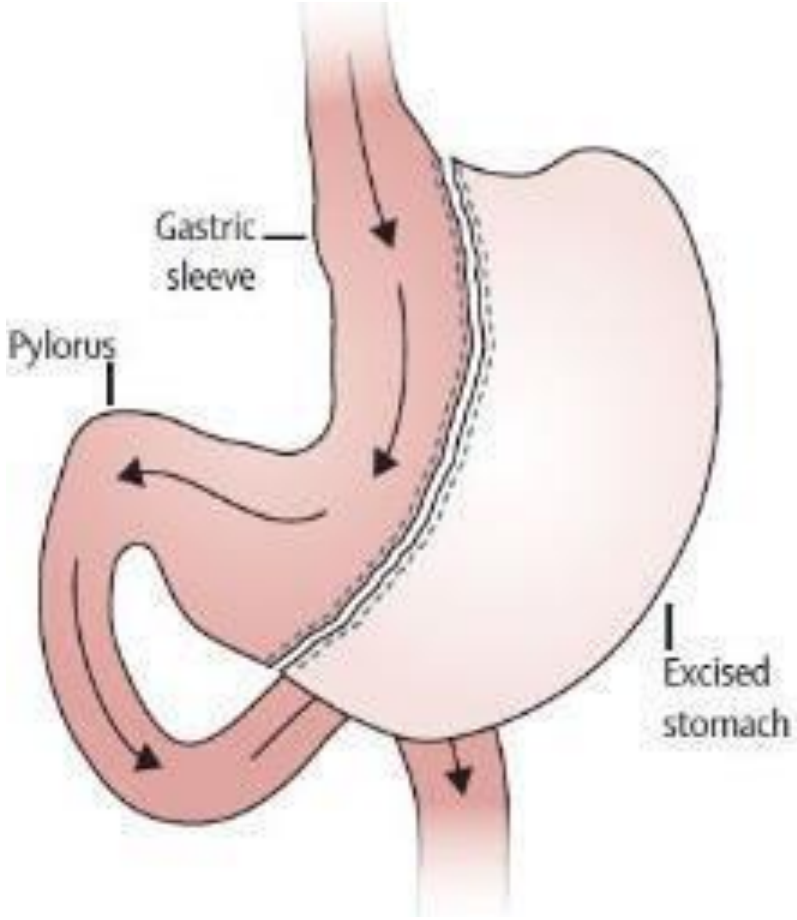
Currently performed procedures:

- Laparoscopic sleeve gastrectomy (70%)
- Laparoscopic gastric bypass (25%)
- Adjustable gastric banding (3%)
- Duodenal switch (2%)

Mechanick JI, … Still CD, et al. *Surg Obes Relat Dis.* 2020;16(2):175-247

Sleeve Gastrectomy

- Bariatric procedure originally part of BPD/DS, now used as a first stage or stand alone if patient loses enough weight
- Remove part of stomach, creating a sleeve from esophagus to antrum
- A 36Fr bougie is used to size the sleeve

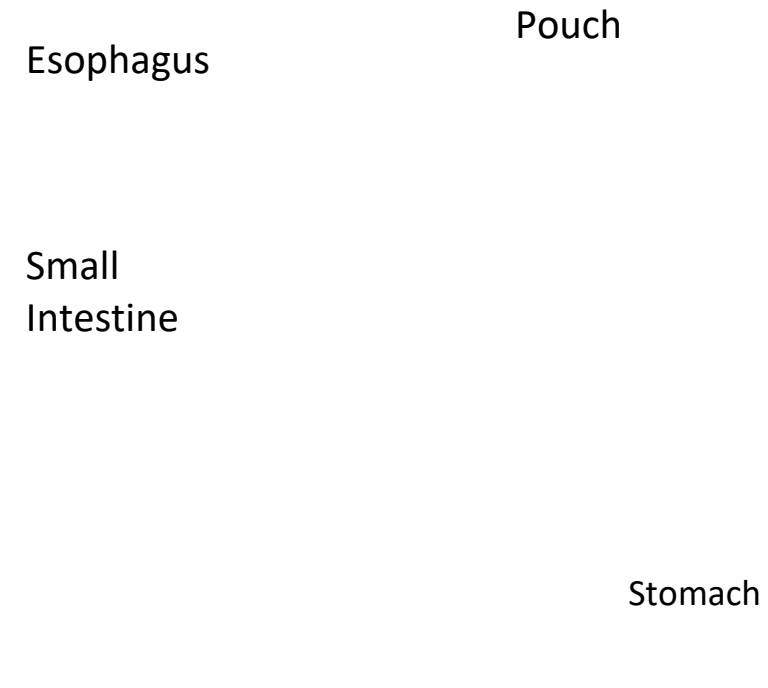


BPD/DS = biliopancreatic diversion with duodenal switch; Fr = French.

Madsbad S, et al. *Lancet Diabetes Endocrinol*. 2014;2(2):152-164.
Wang Y, et al. *Int J Surg.* 2018;49:32-38.

Roux-en-Y Gastric Bypass (RYGB)

- ↓ **Ghrelin**
- ↑ **GLP-1**
- ↑ **Peptide YY**
- ↑ **Insulin**

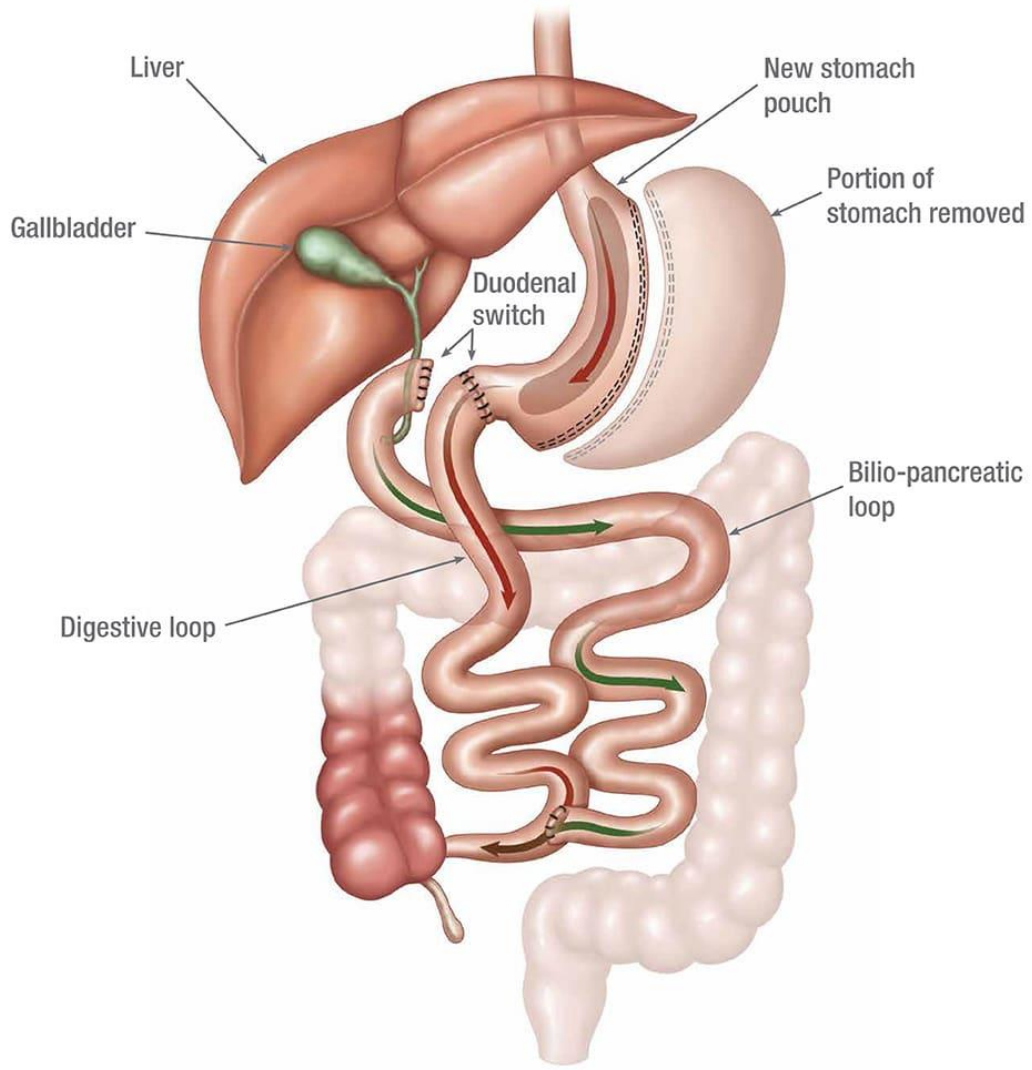


GLP-1 = glucagon-like peptide 1.

Madsbad S, et al. *Lancet Diabetes Endocrinol*. 2014;2(2):152-164.

Duodenal Switch

- Combination operation
  - *Sleeve*
  - *Biliopancreatic Diversion*
  - *Neurohormonal – decreased Ghrelin and increased GLP-1*
- Highest remission rate for type 2 diabetes
- ~85% Excess Weight Loss
- Significant risk of malabsorption of nutrients
- Usually performed on patients with a BMI >60 kg/m^2



Madsbad S, et al. *Lancet Diabetes Endocrinol*. 2014;2(2):152-164.

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Efficacy of Metabolic Surgery

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Why does bariatric surgery work so well?

Food Intake

- Changes in hunger and fullness via enhanced satiety leading to decrease in calorie intake
- Mean caloric intake 600-700 one month postop to 1000-1800 after first year
- Average reduction of 1800 kcal per day from pre-op intake sustained for several years

Potential Mediators of Decreased Food Intake

- Increased transit of food into mid-gut through gastric pouch

Mediators for Food Preferences

- Taste function domains
- Sensory-discriminative *(stimulus identification)*
- Hedonic *(ingestive motivation) altered brain responsivity to high calorie food cues*
- Physiological *(digestive preparation)*

Hormonal

- GLP-1 and PYY increase
- Ghrelin decreases

Change in Gut Microbiota

- Short chain fatty acids – calorie extraction/signals

Energy Expenditure

- Increase/Decreased basal metabolic rate after bariatric surgery – in gut?

Food Preferences Change

- Dumping syndrome?
- Conditioned food avoidance?

Calorie Malabsorption

- Exclusion of 10% of the bowel after RYGB unlikely to result in malabsorption

Neural

- Vagal and partial vagal transection

Change in Bile Acids

- Partly responsible for intestinal hypertrophy, anorexigenic hormone secretion and alterations in gut microbiota; activation of FXR signaling

Madsbad S, et al. *Lancet Diabetes Endocrinol*. 2014:2:152-164.

The NEW ENGLAND JOURNAL of MEDICINE

ORIGINAL ARTICLE

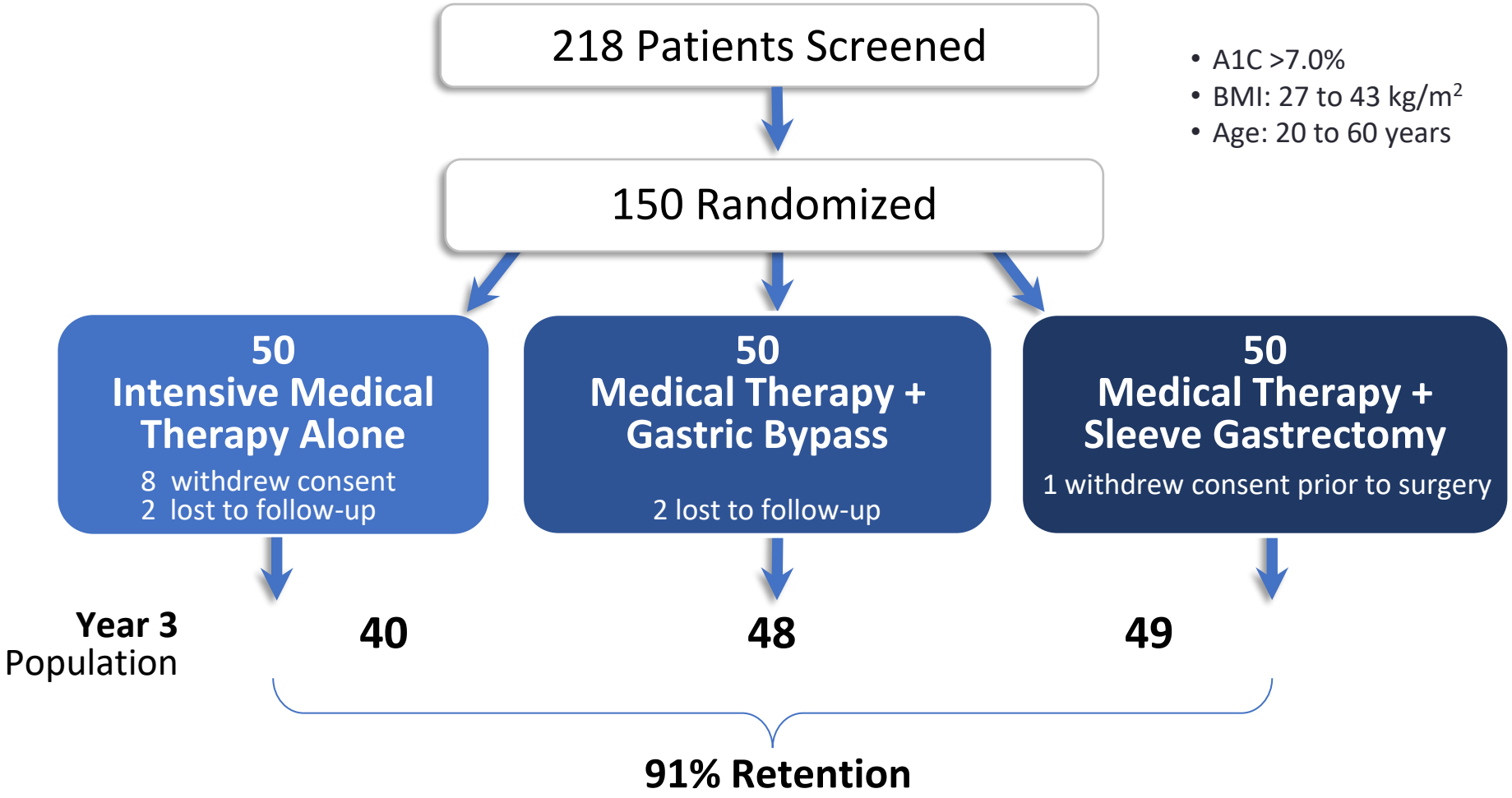
Bariatric Surgery versus Intensive Medical Therapy in Obese Patients with Diabetes

Philip R. Schauer, M.D., Sangeeta R. Kashyap, M.D., Kathy Wolski, M.P.H., Stacy A. Brethauer, M.D., John P. Kirwan, Ph.D., Claire E. Pothier, M.P.H., Susan Thomas, R.N., Beth Abood, R.N., Steven E. Nissen, M.D., and Deepak L. Bhatt, M.D., M.P.H.

Schauer PR, et al. *N Engl J Med*. 2012;366(17):1567-1576.

STAMPEDE Trial

STAMPEDE = Surgical Therapy and Medications Potentially Eradicate Diabetes Efficiently

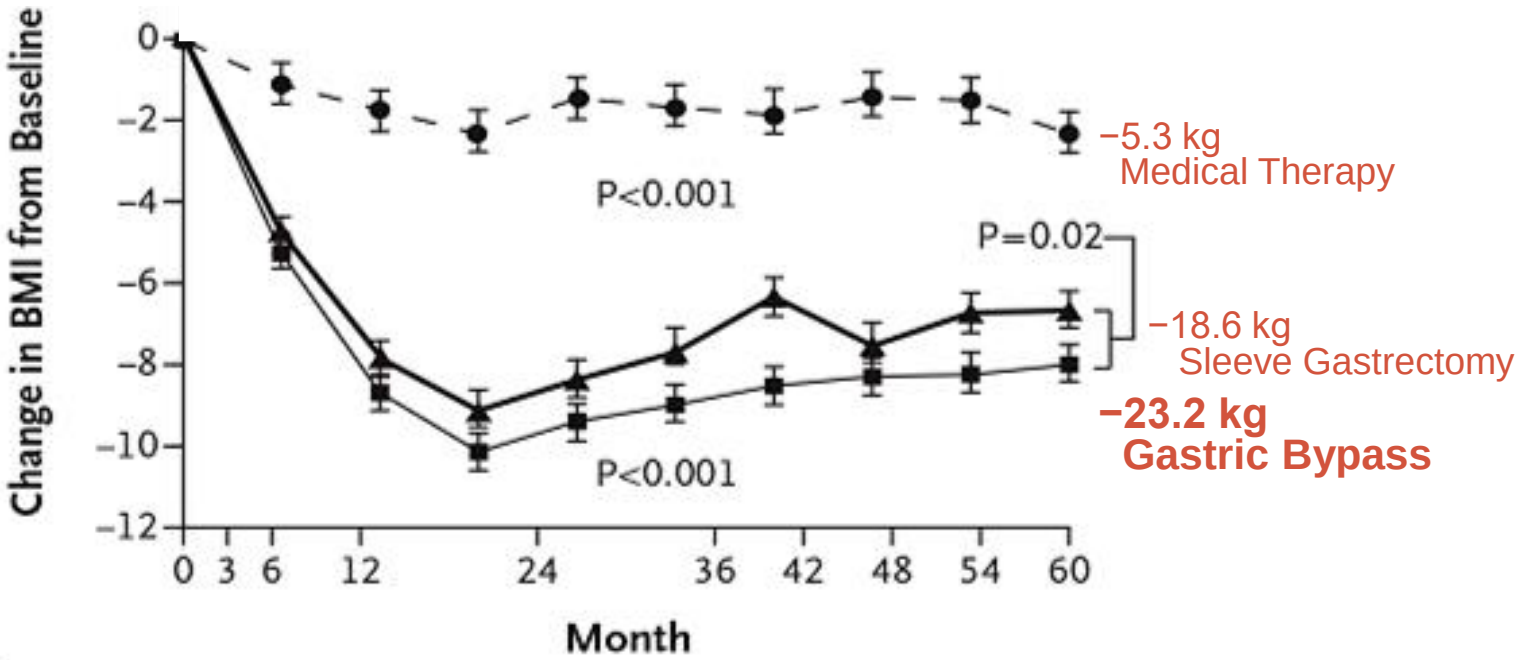


A1C = glycated hemoglobin.

Kashyap SR, et al. *Diabetes Obes Metab*. 2010;12(5):452-454.

Weight Change After Bypass and Sleeve vs Medical Tx in Patients with T2DM

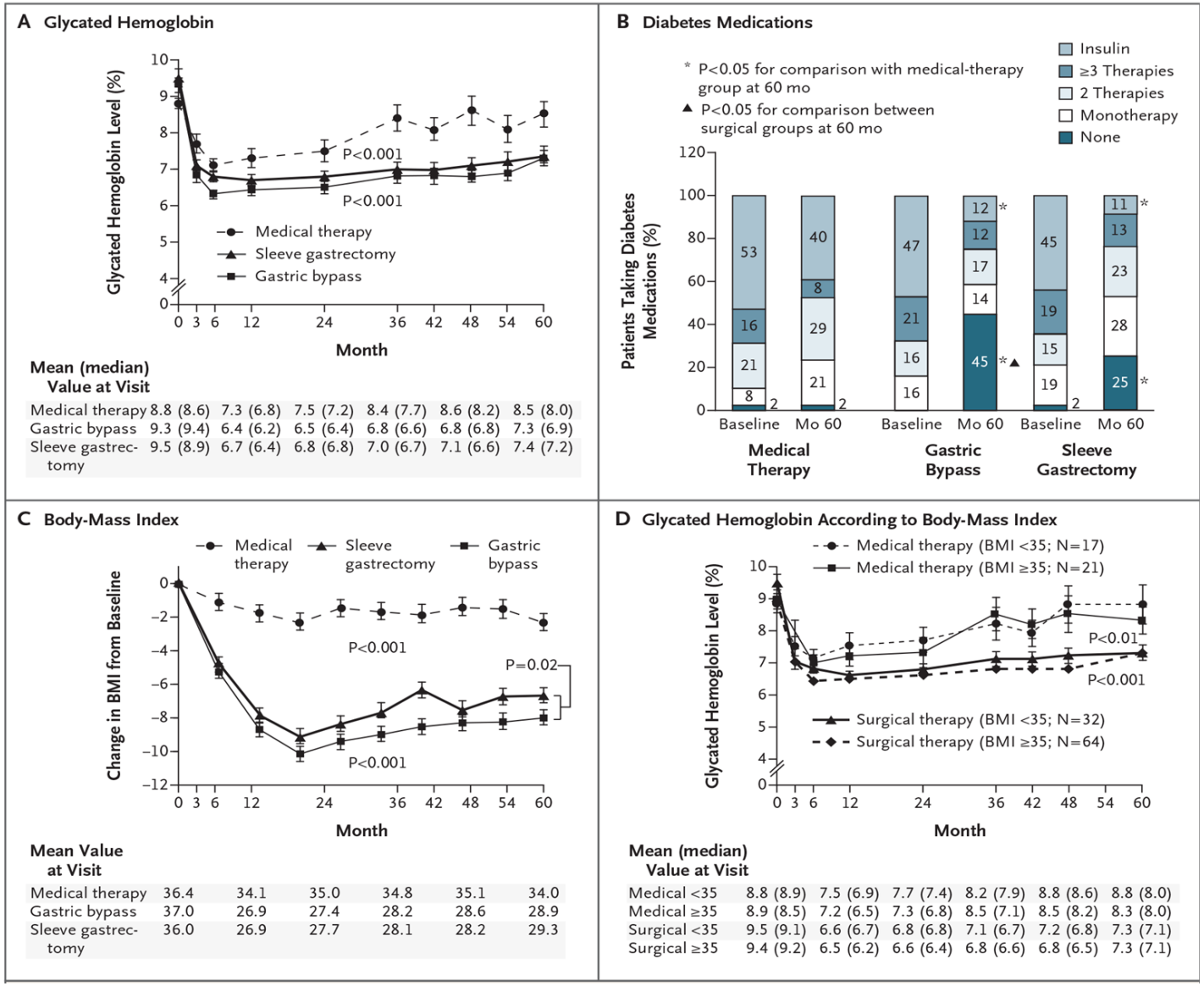
Five-year Data of patients with T2DM and BMI of 27 to 43



Mean Value at Visit						
Medical therapy	36.4	34.1	35.0	34.8	35.1	34.0
Gastric bypass	37.0	26.9	27.4	28.2	28.6	28.9
Sleeve gastrectomy	36.0	26.9	27.7	28.1	28.2	29.3

Schauer PR, et al. *N Engl J Med*. 2017;376(7):641-651.

Five-year Outcomes for Bariatric Surgery vs Intensive Medical Therapy for Diabetes



Mean (median) Value at Visit

Medical therapy	8.8 (8.6)	7.3 (6.8)	7.5 (7.2)	8.4 (7.7)	8.6 (8.2)	8.5 (8.0)
Gastric bypass	9.3 (9.4)	6.4 (6.2)	6.5 (6.4)	6.8 (6.6)	6.8 (6.8)	7.3 (6.9)
Sleeve gastrectomy	9.5 (8.9)	6.7 (6.4)	6.8 (6.8)	7.0 (6.7)	7.1 (6.6)	7.4 (7.2)

Mean Value at Visit

Medical therapy	36.4	34.1	35.0	34.8	35.1	34.0
Gastric bypass	37.0	26.9	27.4	28.2	28.6	28.9
Sleeve gastrectomy	36.0	26.9	27.7	28.1	28.2	29.3

Mean (median) Value at Visit

Medical <35	8.8 (8.9)	7.5 (6.9)	7.7 (7.4)	8.2 (7.9)	8.8 (8.6)	8.8 (8.0)
Medical ≥35	8.9 (8.5)	7.2 (6.5)	7.3 (6.8)	8.5 (7.1)	8.5 (8.2)	8.3 (8.0)
Surgical <35	9.5 (9.1)	6.6 (6.7)	6.8 (6.8)	7.1 (6.7)	7.2 (6.8)	7.3 (7.1)
Surgical ≥35	9.4 (9.2)	6.5 (6.2)	6.6 (6.4)	6.8 (6.6)	6.8 (6.5)	7.3 (7.1)

Schauer PR, et al. *N Engl J Med*. 2017;376(7):641-651.

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Safety of Metabolic Surgery

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2019 Guidelines for Perioperative Nutrition, Metabolic, and Nonsurgical Support of Patients Undergoing Bariatric Procedures

Update

Clinical practice guidelines for the perioperative nutrition, metabolic, and nonsurgical support of patients undergoing bariatric procedures – 2019 update: cosponsored by American Association of Clinical Endocrinologists/American College of Endocrinology, The Obesity Society, American Society for Metabolic & Bariatric Surgery, Obesity Medicine Association, and American Society of Anesthesiologists

Jeffrey I. Mechanick, M.D., F.A.C.P., F.A.C.N., M.A.C.E.[a,b,*], Caroline Apovian, M.D.[c], Stacy Brethauer, M.D.[d], W. Timothy Garvey, M.D., F.A.C.E.[e,f], Aaron M. Joffe, D.O., F.C.C.M.[g], Julie Kim, M.D.[h], Robert F. Kushner, M.D.[i], Richard Lindquist, M.D., F.A.A.S.P.[j], Rachel Pessah-Pollack, M.D., F.A.C.E.[k], Jennifer Seger, M.D.[l], Richard D. Urman, M.B.A., M.D., C.P.E.[m], Stephanie Adams, Ph.D.[n], John B. Cleek, M.D.[e], Riccardo Correa, M.D., F.A.C.E.[o], M. Kathleen Figaro, M.S., M.D., F.A.C.E.[p], Karen Flanders, M.S.N., C.N.P., C.B.N.[q], Jayleen Grams, M.D., Ph.D.[r,s], Daniel L. Hurley, M.D., F.A.C.E.[t], Shanu Kothari, M.D., F.A.C.S., F.A.S.M.B.S.[u], Michael V. Seger, M.D., F.A.C.S., F.A.S.M.B.S.[v], Christopher D. Still, D.O., F.A.C.N., F.A.C.P.[w,x]

Mechanick JI, … Still CD, et al. *Surg Obes Relat Dis.* 2020;16(2):175-247

Nutritional and Metabolic Deficiencies After Bariatric Surgery

- **Gastric restrictive procedures**
  - *Iron deficiency 32%*
  - *Thiamine deficiency*
- **Roux-en-Y gastric bypass**
  - *Calcium (50% to 60%) and vitamin D (20% to 60%)*
  - *Iron deficiency 15% to 50% (49% to 52% with BMI >50)*
    - Decreased acidification and proximal small bowel absorption
  - *B_{12} deficiency 10% to 70% 1 to 9 years after[a] (half-life 400 days)*
    - Decreased liberation of B_{12} from protein foods
    - Decreased intrinsic factor production
    - Decreased ileal absorption
    - Requirement = 2 mcg/day; stores = 3000 to 5000 mcg
  - *Thiamin deficiency*
  - *Folic acid deficiency 10% to 35% due to low intake and ↓ gastric acid*
  - *Protein deficiency (<1% to 4.7%)[1]*

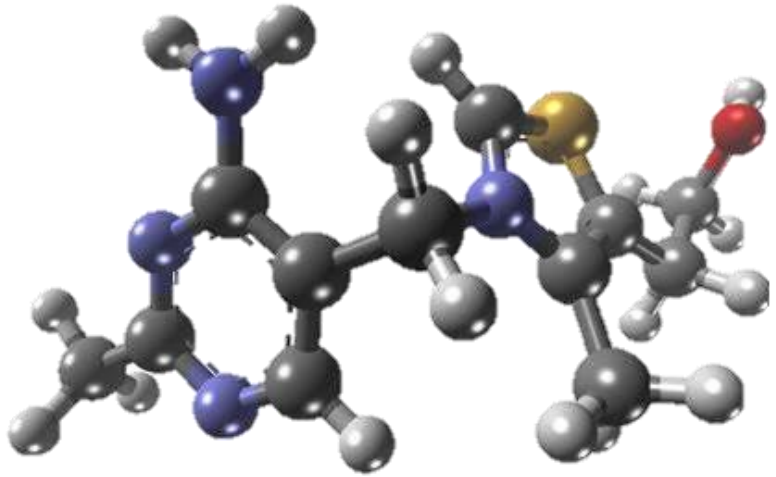
[a]Earlier if B_{12} deficiency occurs preoperatively.

1. Faintuch J, et al. *Obes Surg.* 2004;14(2):175-181.

Kushner R, Still C. *Nutrition and Bariatric Surgery*. 2014; CRC Press. Boca Raton, FL.

Thiamine Deficiency

- Stores last 3 to 6 weeks
- Decreased gastric acid production
- Altered gastrointestinal anatomy
- Decreased food intake
- Frequent vomiting
- Dextrose infusion



WHEN YOU THINK OF IT:

GIVE IT

Routine Vitamin and Mineral Supplementation for RYGB Patients

Supplement	Dosage
Multivitamin	1 to 2 daily
Calcium citrate with vitamin D	1200 to 1500 mg/day + 3000 U/day vitamin D
Elemental iron	40 to 60 mg/day
Vitamin B_{12}	350 to 1000 µg/day orally* OR 1000 µg/month IM OR 500 µg weekly intranasal

***disintegrating tablet, sublingual, or liquid**
IM = intramuscularly; RYGB = Roux-en-Y gastric bypass.

Kushner R, Still C. *Nutrition and Bariatric Surgery*. 2014; CRC Press. Boca Raton, FL.Mechanick JI, … Still CD, et al. *Surg Obes Relat Dis.* 2020;16(2):175-247.

Nutrient Screening Time Points

X = ALL PROCEDURES

Adapted from: Stein J, et al. *Aliment Pharmacol Ther*. 2014;40(6):582-609; Parrott J, et al. *Surg Obes Relat Dis*. 2017;13(5):727-741.

Nutrient/Marker	Pre-op	3 Month	6 Month	Annually
Vitamin B_1		Anytime with N/V →	→	→
Vitamin B_{12}	X	RYGB VSG BPD/DS	RYGB VSG BPD/DS	X
Folate	X	X	X	X
Vitamin A	X		BPD/DS	X
Vitamin D	X	X	X	X
Vitamin K / E	X			X
Iron	X	X	X	X
Zinc	X			RYGB VSG BPD/DS
Copper	X			RYGB VSG BPD/DS
Calcium	X	X	X	X
PTH	X	X	X	X
DEXA	X			q 2-5 yrs

DEXA = dual-energy X-ray absorptiometry; N/V = nausea/vomiting; PTH = parathyroid hormone; VSG = vertical sleeve gastrectomy.

Post Gastric Bypass Hypoglycemia

- Prevalence ~10% to 15%
- Usually occurs 2 to 4 years after gastric bypass
- *Most susceptible:*
  - *Undergone Roux-en Y gastric bypass*
  - *NO preoperative diabetes*
  - *Long interval since surgery*
  - *Female*
- Differentiating endogenous causes can be challenging since all have similar biochemical profile
  - *Insulinoma*
  - *Early and late dumping syndrome*
  - *Post-gastric bypass hypoglycemia*

Salehi M, et al. *J Clin Endocrinol Metab*. 2018;103(8):2815-2826.

Assessment and Treatment Recommendations

Monitoring
- Glucometer to check capillary glucose when symptomatic
- Food diary to identify provocative foods
- Consider CGM; low and trend alarms may help prevent low glucose

Dietary Modification
- Complex CHO in controlled portions, avoid simple CHO
- Complete avoidance of CHO not recommended
- Emphasize adding protein and healthy fats to all meals
- Ongoing vigilance for vitamin deficiency, supplementation as needed
- Dietitian referral for additional teaching
- Review/adjust meal plan at each visit based on glycemic patterns

Hypoglycemia Safety/Education
- Treatment
  - Severe: treat acutely for safety with 15 g CHO – glucose tabs/gel, glucagon if unable to take oral glucose
  - Mild/moderate: may be able to use complex carbs in lower amount to avoid "yo-yo" effect
  - Recheck glucose 15 min & retreat if necessary
- Educate patient about driving, need to maintain safety
- Educate family members:
  - Medical nutrition therapy
  - Hypoglycemia treatment
  - Use of glucagon emergency kit

Medical Therapy
- Acarbose
- Diazoxide
- Octreotide

Severe & refractory to diet and medical therapy

Surgical Therapy
- Feeding through gastrostomy tube into remnant stomach
- Gastric outlet restriction
- Reversal of RYGB

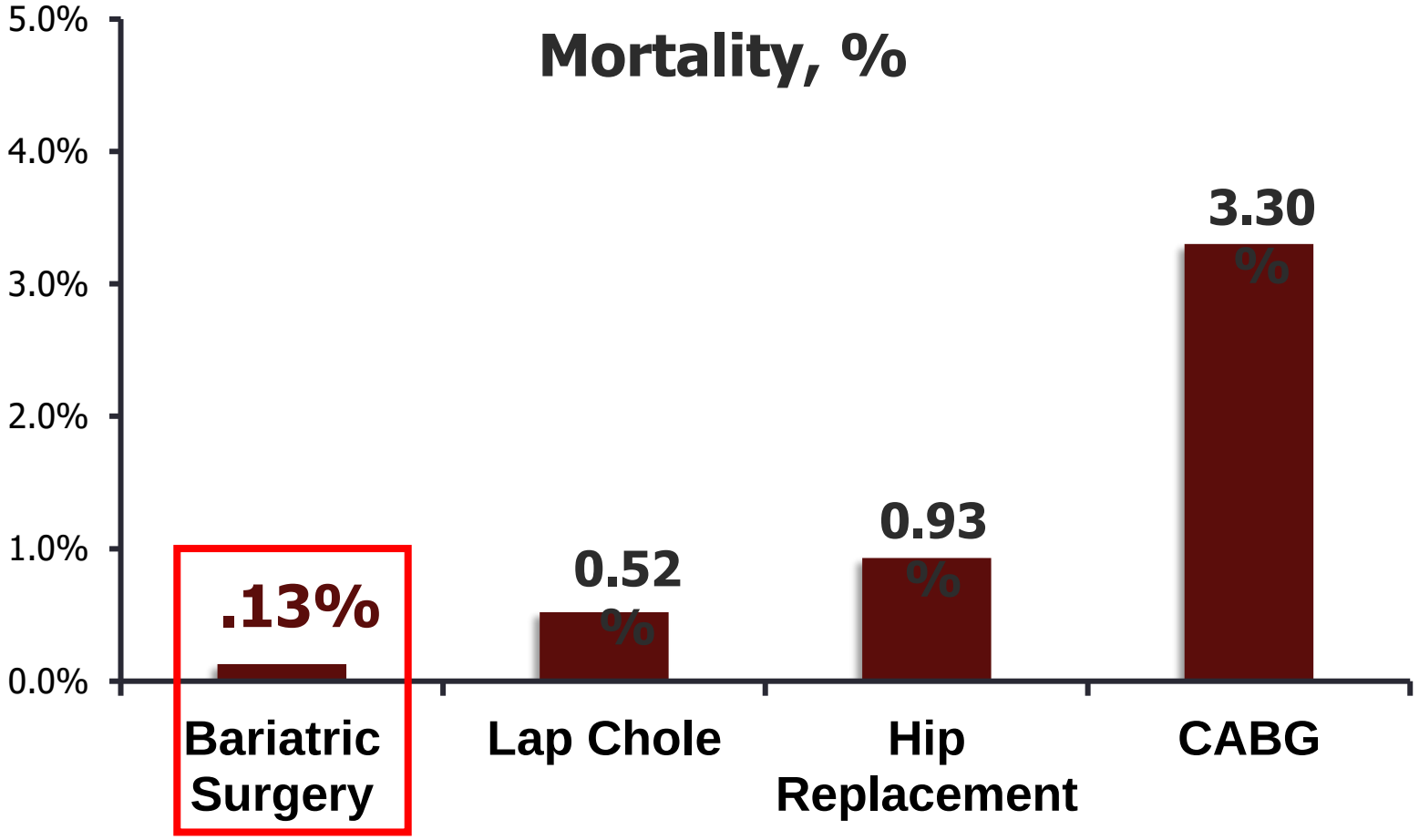
CGM = continuous glucose monitoring
CHO = carbohydrates

Salehi M, et al. *J Clin Endocrinol Metab*. 2018;103(8):2815-2826.

Bariatric Surgery: Low Mortality

0.13% Mortality; n=5365 Bariatric Surgery Patients From 1998–June 2006

When performed at a bariatric Surgery Center of Excellence



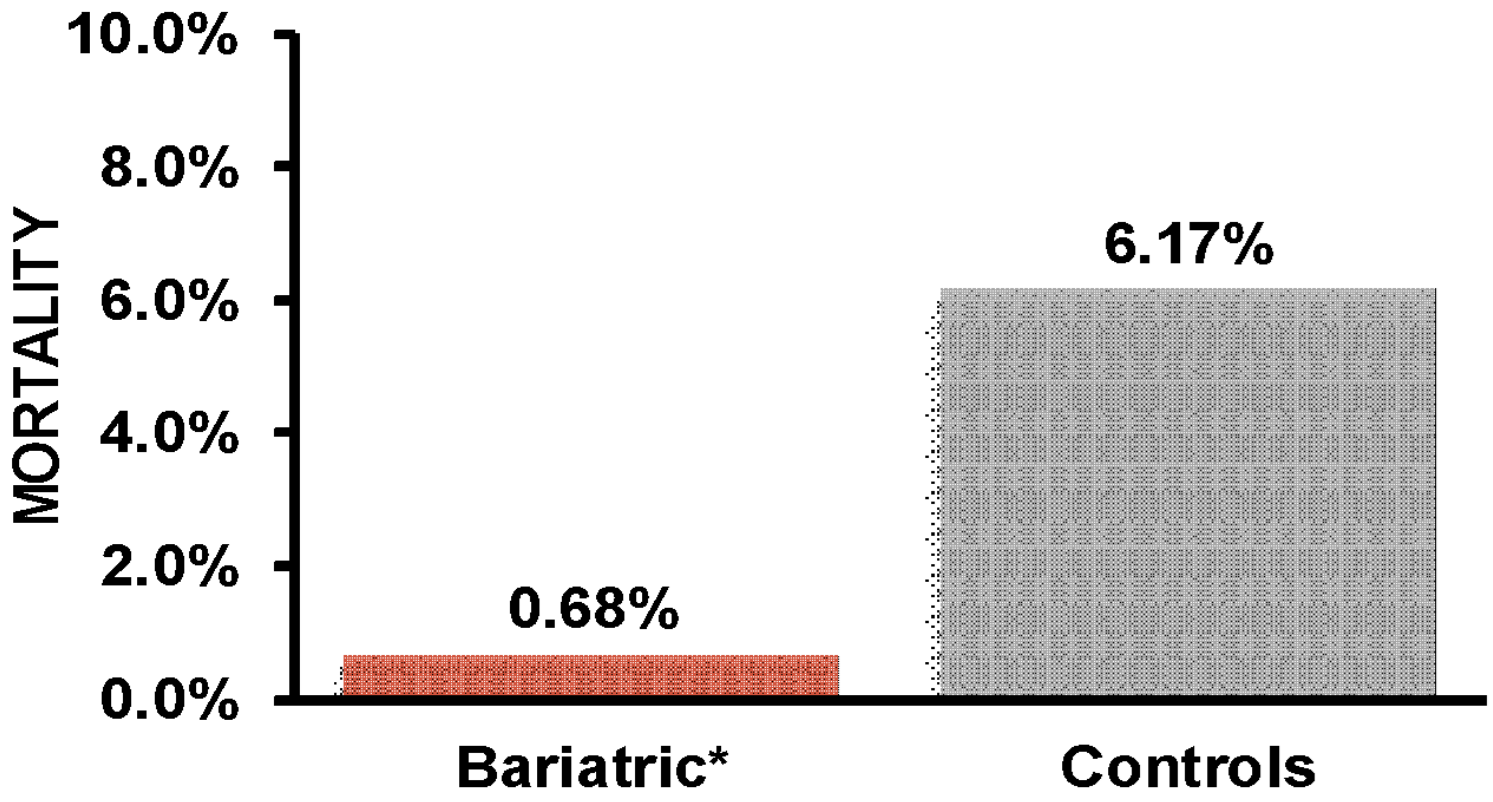
CABG = coronary artery bypass grafting; lap chole = laparoscopic cholecystectomy.

Adapted From: Ballantyne GH, et al. *Obes Surg.* 2008;18(6):660-667.

American Society of Metabolic and Bariatric Surgery. Accessed June 25, 2021. http://asmbs.org/patients/bariatric-surgery-misconceptions

Reduction of Premature Death

89% Reduction in Risk of Death Over 5 Years



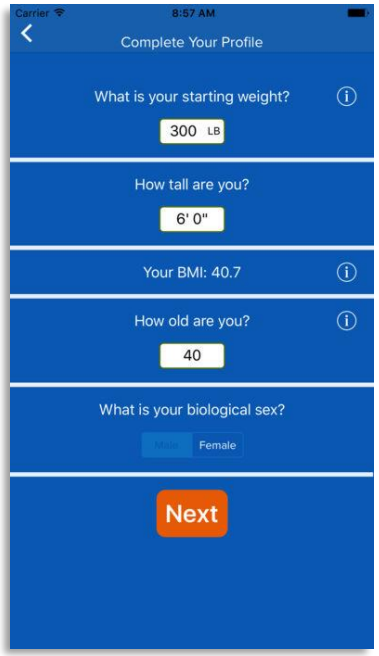
* Includes perioperative (30-day) mortality of 0.4%; $p = .001$

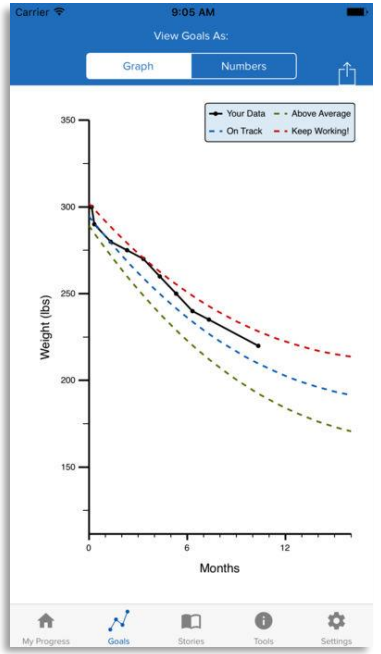
Christou NV, et al. *Ann Surg*. 2004;240(3):416-424.

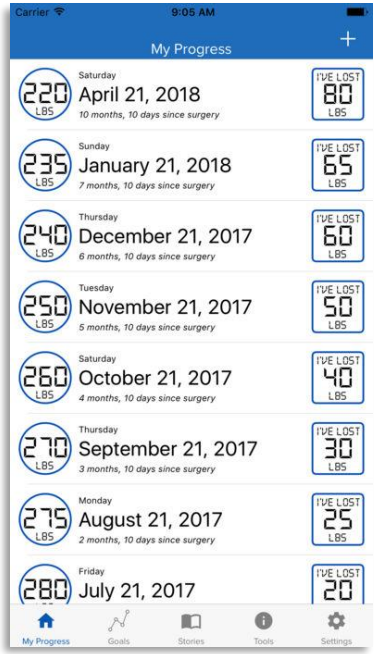
Realistic Expectations

Get~2~Goal

Assists current, future, and prospective patients with weight management after Roux-en-Y Gastric Bypass Surgery







Free app

- Provides <u>personalized</u> weight goals
- Tracks weight over time
- Calculates probability of surviving Roux-en-Y procedure
- Calculates probability of resolving diabetes (for diabetes patients)
- For prospective patients: displays trends of expected weight loss over time after surgery

https://itunes.apple.com/us/app/get-2-goal/id553264330?mt=8

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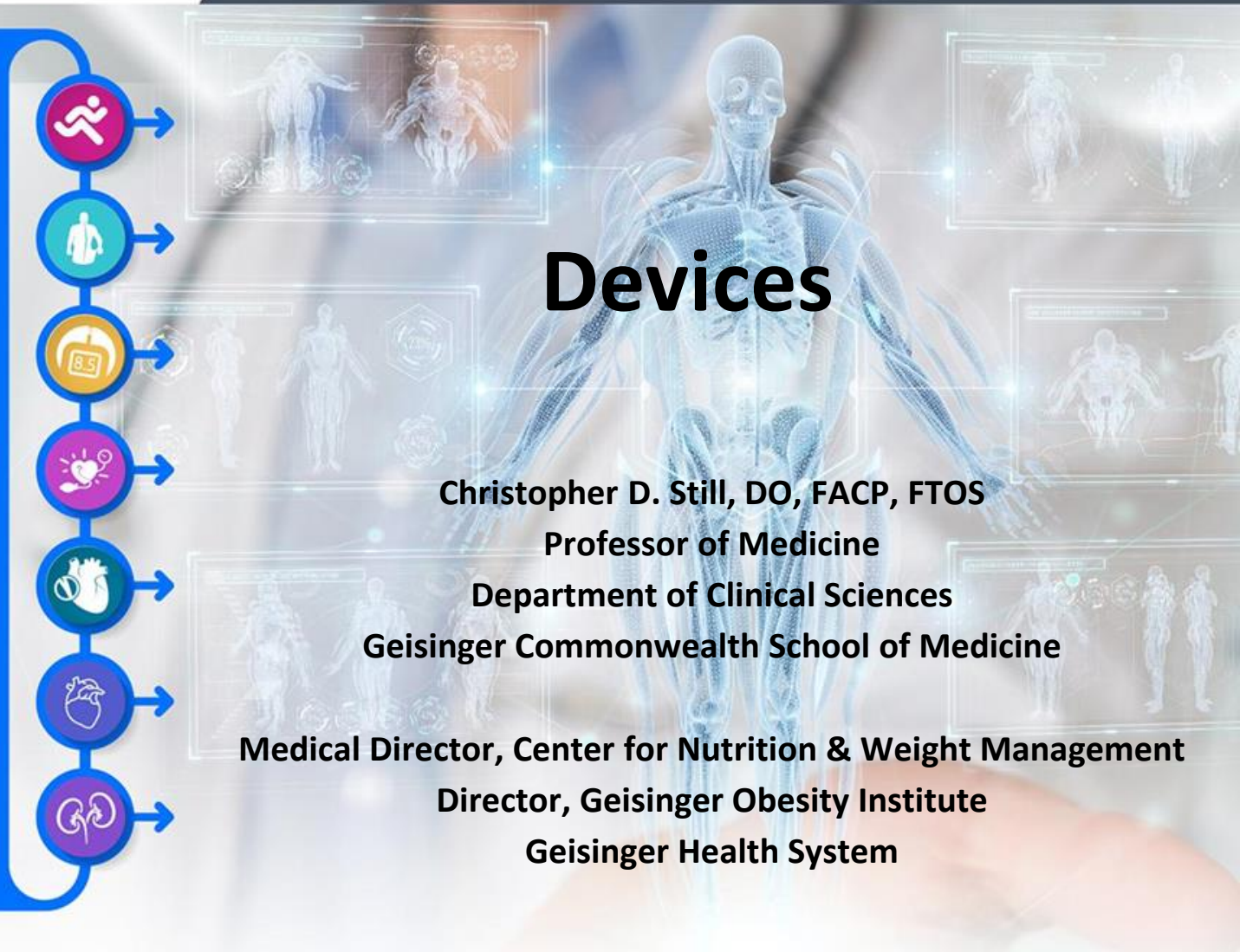

Devices

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Gelesis100 Hydrogel in the Gastrointestinal Tract

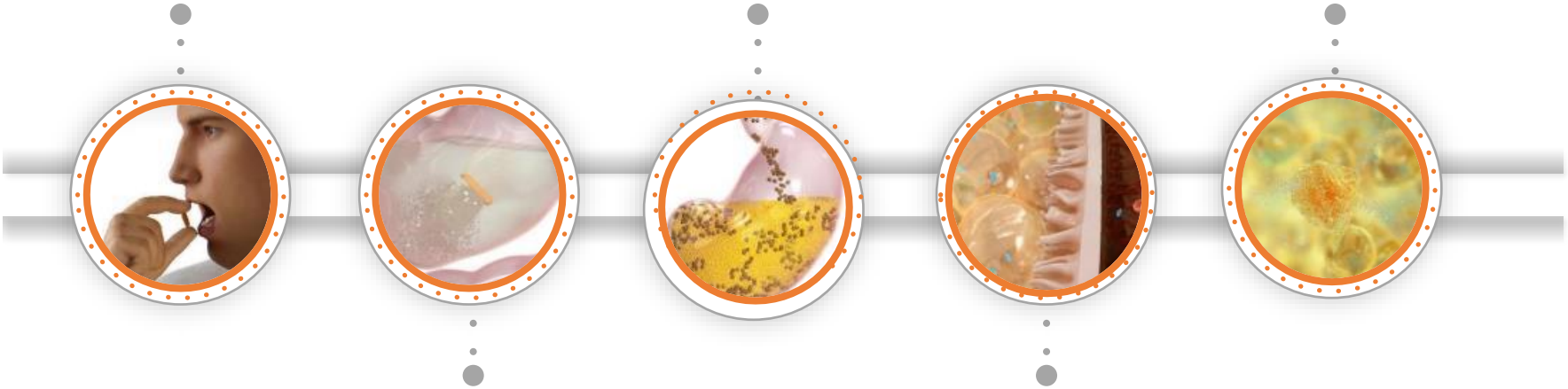
3 Gelesis100 capsules administered **with water** 20–30 minutes prior to lunch or dinner

Particles are released and **expand in stomach** by absorbing water

Particles mix homogenously with food to **increase volume and elasticity** of stomach contents, induce fullness, and reduce food intake

Particles maintain their structure and mechanical properties through the small intestine

Particles degrade in the large intestine, **water is released and reabsorbed** by body, and remnants are eliminated from body



Kahan S, Kumbhari V. *Obesity (Silver Spring).* 2019;27(2):189. Plenity [Instructions for Use].

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Metabolic Surgery: Perspectives and Concluding Remarks

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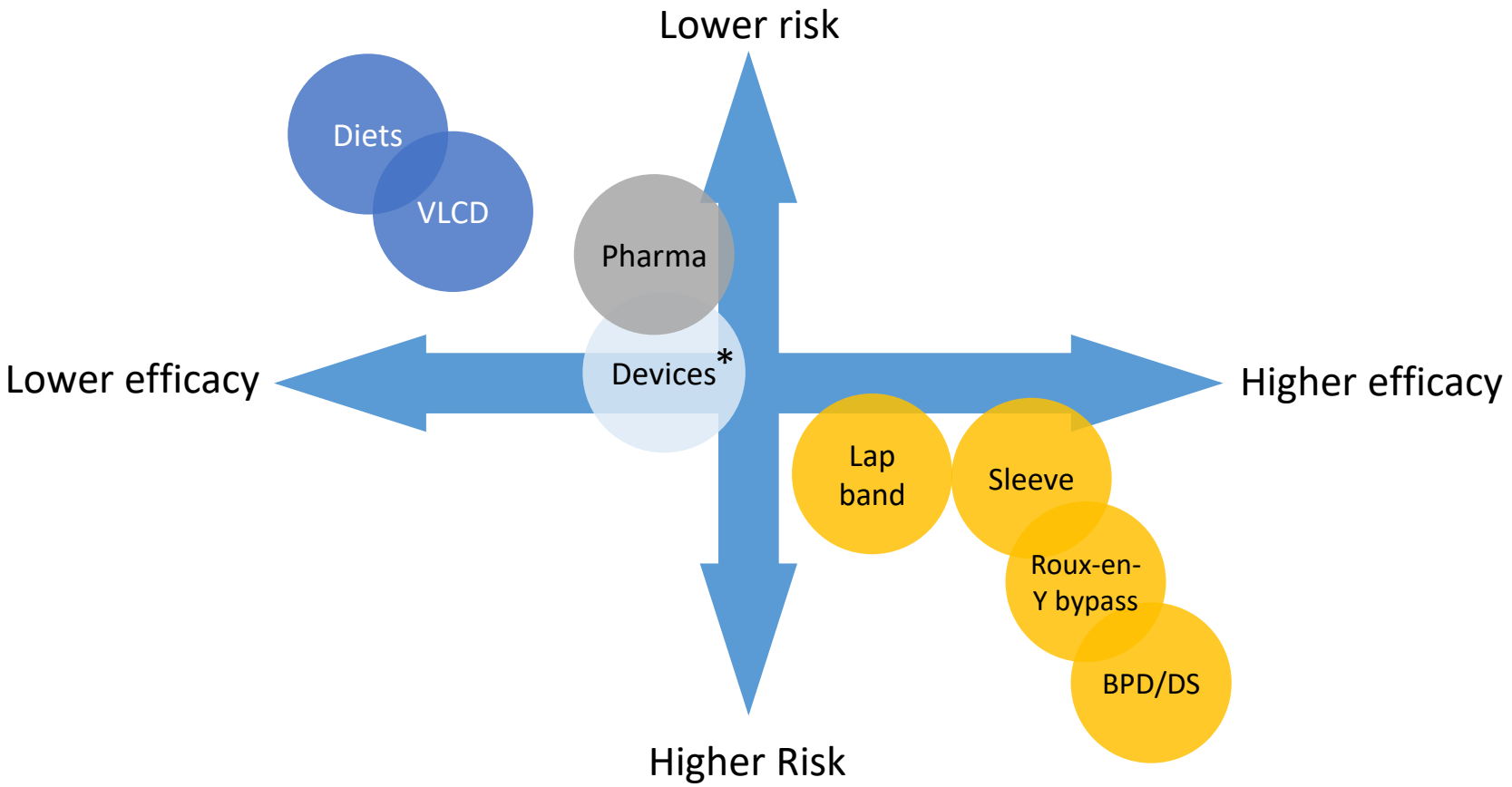
Currently Available Treatments: Risks and Efficacy



***Gastric sleeve and vagal stimulator under phase 3 study.**
VLCD = very low calorie diet.

Jensen MD, et al. *Circulation*. 2014;129(25 Suppl 2):S102-S138.

Conclusions – Bariatric Surgery

- Bariatric surgery is highly effective treatment for morbid obesity and its comorbidities and should be offered to patients in whom conservative management fails.
- Compared to medical management, surgery results in more profound and long-term weight and comorbidity improvements.
- To ensure optimal outcomes, surgery needs to be performed within a multidisciplinary program with aggressive pre and postoperative management.
- Bariatric surgery is a key part of the spectrum of treatments for patients with morbid obesity.