



Stanford
Children's Health

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Fellow Project: Postoperative Management of MBS in Adolescents.

Objectives

- Review the post-operative care for patient following bariatric surgery for adolescent patients
- Describe the outcomes for adolescent patients, including metabolic improvements and complications

LPOCH Group Program

Pre and post operative weight management Program



- Designed to improve eating/activity habits
- Participants set monthly goals for lifestyle change
- Runs preop and postop
- Meets a minimum
 - 3 months preop
 - 4 months postop

Pre and Postop Lifestyle Interventions

Summary of Nutrition Goals

NUTRITION GOALS

THE "60/60/60"



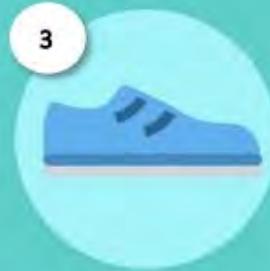
60g Protein

Eat **60 grams** of protein per day. Include lean protein at every meal and snack.



60 oz Water

Drink 60 ounces of water per day. Keep a water bottle with you throughout the day.



60 min Exercise

Work towards 60 minutes of physical activity/exercise per day. It doesn't have to all be at once!

Simple guidelines:

- Stop all Soda and Juice
- Stop all Chips
- Don't skip meals
- Take 1 MVI daily

Compliance in the era of Telehealth

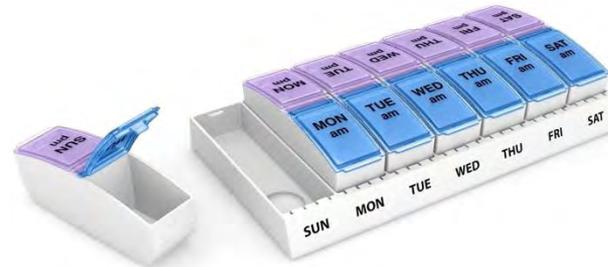
Get a Scale

Get a water bottle

Get a pill box

Purchase all postop vitamins

- Calcium chews
- Chewable MVI with Iron
- Sublingual B12 1000mcg
- Vitamin B1 100mg



Pre-op and Intra-op Enhanced Recovery after Surgery (ERAS)

Home Medications to be Taken Prior to Arrival

Take 2-4 hours preoperatively to prevent catabolism and minimize PONV

- PO Gatorade 20 oz
- PO Gabapentin 600 mg
- PO Tylenol 1000 mg

Medications on Arrival for Prophylaxis (in PreOp)

- SQ heparin 5000 units
- IV cefazolin 2-3 g (3 g for > 120 kg actual body weight)
- Pneumatic Compression Boots

Intraop pain and Nausea control

- IV methadone
- IV dexmedetomidine
- IV ketamine
- IV dexamethasone
- IV ketorolac 30 mg (0.5 mg/kg)
- IV ondansetron 8 mg
- IV fosaprepitant 150 mg
- IV acetaminophen 1000 mg

Surgeons to Perform Bilateral Laparoscopically Guided TAP Blocks

Bilateral subcostal, transversus abdominis plane 2 x 20 ml 0.25% bupivacaine.

2 x 3 ml 0.25% Bupivacaine Local Rectus Muscle block near trans fascial closure in midline.

Peri-op

Enhanced Recovery after Surgery (ERAS)

MEDICATIONS

For Pain:

- IV Tylenol 650 mg q6 hrs – ONLY POD #0, THEN PO Tylenol
- PO Tylenol 650 mg pills q6 hrs – starts POD #1
- IV Ketorolac 15 mg q6 hrs
- PO Gabapentin 600 mg BID
- PO Oxycodone 5 mg-10 mg q6hrs PRN moderate pain
- IV Hydromorphone 0.005-0.15 mg/kg/dose q2hrs PRN severe pain

For PONV:

- IV Metoclopramide 15 mg q8 hrs
- IV Ondansetron 8 mg IV q8 hrs PRN nausea
- SL Lorazepam 0.5 mg q6 hrs PRN nausea
- Scopolamine Patch (can add if needed)
- Consider acupressure massage of PC-6 and ST-36 as an adjunct

For gastroesophageal reflux:

- IV pantoprazole 40 mg daily

FLUIDS

IV LR at 125 ml/hour until discharge.
(DO NOT STOP until discharge) unless cardiac compromise.

RESPIRATORY

Allow non-invasive positive pressure ventilation (CPAP/BIPAP), especially if patient has known obstructive sleep apnea and uses it at baseline

ACTIVITY

Out of bed and ambulate within 4 hours of surgery with physical therapy

Ambulate every 2-4 hours while awake for DVT and pulmonary toilet

DVT PROPHYLAXIS

SCDs while in bed
Ambulate out of bed as much as possible
Heparin 5000 units sq BID or (TID if >150 kg)

Post-op

Enhanced Recovery after Surgery (ERAS)

DIET

POD #0: 1 oz (30 ml) every 15 min

Includes: Water, Sugar-Free Non-Carbonated Beverage, broth or Sugar Free Jello, No Juice or Soda

POD #1: 2 oz (60 ml) every 15 min

Include protein shakes, milk, other sugar free full liquids or sugar-free pudding, yogurt,
No postop swallow study unless indicated by persistent vomiting, persistent tachycardia or fever.

CONSULTS

- If diagnosis of diabetes or hypothalamic obesity, please consult Endocrinology.
- If diagnosis of chronic pain or on pain meds at home, please consult Pain Service.
- If history of transplant, please consult Transplant Team.
- If using CPAP/BIPAP at home, please consult Respiratory Therapy for CPAP/BIPAP to be initiated postop. If not using at home, do not initiate unless issues with oxygen desaturation.
- Consult Physical Therapy for every patient.
- Diet Education Technician will automatically see every patient

DISCHARGE CRITERIA:

Patients May Go Home Postop Day 1, 2, or 3 If Meeting ALL Criteria

- Afebrile, VSS
- Able to perform activities of daily living same as pre-operatively
- Pain and nausea controlled with oral meds
- Tolerates oral intake of 500 mL over one 12 hr shift
 - (Protein shakes not required prior to discharge)
- Systolic blood pressures under 140 mmHg

Post-op

Enhanced Recovery after Surgery (ERAS)

DISCHARGE MEDICATIONS

For Pain:

- PO Tylenol 650 mg QID - 2 wk supply (60 doses, 0 refills)
- PO Ibuprofen 600 mg TID PRN - 2 wk supply (42 doses, 0 refills) unless bypass patient
- Only offer oxycodone if needed in hospital in last 12 hours - PO Oxycodone 5-10 mg q6 hrs PRN – 3-day supply (12 doses, 0 refills)

For PONV:

- PO Metoclopramide 15 mg BID ATC – 2 wk supply (28 doses, 0 refills)
- PO Ondansetron 8 mg BID PRN – 1 wk supply (14 doses, 0 refills)

For Constipation Prevention:

- PO Polyethylene glycol 17 g daily PRN if no bowel movements (BM) in 24 hours - 4-wk supply (28 each, 0 refill)
- ADD PO Senna 17 mg (2 tabs of 8.6 mg) daily PRN if no BM x 48 hours – 2 wk supply (28 tab, 0 refill)

For DVT prophylaxis:

- SubQ low molecular weight heparin/enoxaparin 40 mg/0.4 mL syringe daily – 2 to 4 wk supply (14 to 28 doses)
 - Indications: personal or FH of blood clots, travel by plane in first 2 weeks postop, >4hrs by car in first 2 weeks postop, Continuing oral contraceptive pills, BMI >55

DISCHARGE MEDICATIONS (Send to Local Home Pharmacy):

For Complication Prevention:

8. PO Ursodiol 600 mg (300 mg x 2 pills) daily – 6 month supply (180 doses, 1 refill)
9. PO Prilosec 40 mg daily – 6 month supply (180 doses, 0 refill)

VITAMINS

- PO 2 (Two) Pediatric multivitamin chewable with iron (not gummy) daily
- PO Calcium (1000 mg) with vitamin-D chewable daily
 - Take with meals and NOT at same time as MVI or B vitamins
- PO Vitamin B1 100 mg daily and SL (sublingual) Vitamin B12 1000 µg daily

OR:

- PO Neurobion Classico Vitamin B complex 1 tablet daily

Postop Diet Advancement

Stages (Timeframe) ^a	•Examples of Types of Foods
Clear liquids Day 1-3	•Water, Sugar free drinks, Sugar free popsicles, Broth
Full liquids Day 3 to 3-4 weeks	•Protein shakes, Sugar free high protein smoothies, Yogurt- high protein options, sugar -free, Milk- Dairy, Oat, Soy - (all unflavored) Sugar free-hot chocolate, Strained soups or cream soups, added protein supplement powders or meal replacement drinks
Pureed/Blended Foods Week 3-4 to 4-5	•Hot cooked cereal (sugar-free), mashed potatoes, naturally sweetened applesauce, cottage cheese, egg substitute or scrambled eggs softly cooked, Stage 1 and 2 Baby food jars (no added sugars), Blended soft meats e.g., chicken, pork, beef, Cream soups, Silken Tofu, packaged Tuna
Soft Foods Week 4-5 to 6-8	•Well cooked or blended vegetables/meats, soft pasta/rice
Regular foods Week 6-8 - through Lifetime	•Regular foods as tolerated (emphasis on high protein sources). Raw vegetables. Avoid juices, sugar sweetened drinks and foods, large portions, high fat food options

Ihuoma Eneli, Faith Anne N. Heeren, Rochelle L. Cason-Wilkerson, Keeley J. Pratt, Metabolic and Bariatric Surgery for Adolescents, Pediatric Clinics of North America, Volume 71, Issue 5, 2024,

Early Complications

Common Short Term

- Nausea and vomiting in first week
 - treat with fluids and anti-nausea medications
- Pain in first week after surgery
 - treat with pain medications
- Constipation first Month after surgery
 - treat with medications

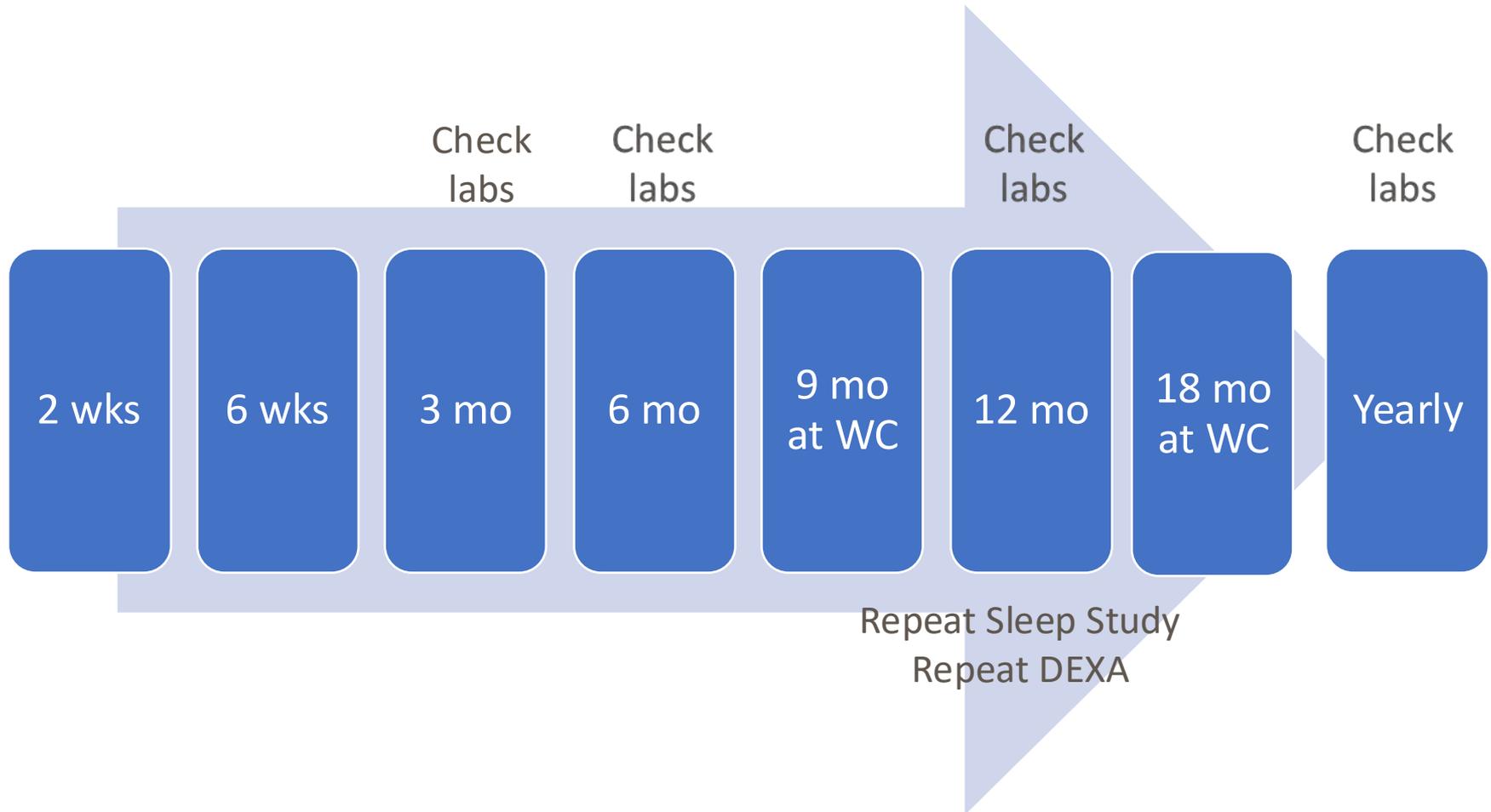
Rare <1% overall

- Leak from staple line
 - Leak test in the OR
 - LIQUID DIET for TWO WEEKS
- Infections in wound, urine or lungs
 - Prophylactic Antibiotics used
- Internal bleeding
 - Care to stop all bleeding before leaving the OR
- blood clots (DVT or Portal Vein Thrombosis)
 - MOVE and WALK every 2-3 hours - BED is BAD

Late Complications in Bypass and Sleeve

- In Both
 - Nutritional deficiencies - **taking vitamins can prevent**
 - Anemia in menstruating females
 - Osteoporosis from lack of calcium
 - Hernia (weakness at incisions) – **avoid lifting for 4 weeks postop**
 - Dumping syndrome - **avoiding carbohydrates can prevent**
 - Reaction to rapid weight loss from meds or surgery (tired, dry skin, hair thinning/loss, changes in mood and/or bowel habits)
 - Inadequate weight loss or weight regain - **regular follow-up, regular physical activity, obesity management medications**
- In bypass:
 - Risk of reoperation for obstruction, gallstones, kidney stones 20%
 - Risk of alcohol/drug addiction – **avoiding alcohol and drugs can prevent**
 - Ulcers – **avoiding nicotine (smoking or vaping) and NSAIDs can prevent**
- In sleeve:
 - Risk of Reflux disease – **screening endoscopies recommended postop**
 - Gallstones – **taking Ursodiol for six months can prevent**

Post-Operative Clinic Appointments



Transition of Care

What should PCP follow-up look like -

Check Vitamin levels

- symptoms of B12 or B1 deficiency (neuropathy, ataxia, double vision)
- Symptoms of anemia – more common in menstruating females, consider suppressing menstruation.
- Symptoms of fat-soluble vitamin deficiencies - loss of night vision, easy bruising

Screen for Reflux symptoms after sleeve

- Needs EGD- follow-up with bariatric surgeon

If abdominal pain or vomiting regularly after MBS - NOT NORMAL

- Needs follow-up with bariatric surgeon

Ask about risk taking behaviors, body dysmorphic symptoms or disordered eating.

- Referral to psychologist and/or eating disorder program.

Address Concerns about hanging skin if >2 years postop

- Referral to plastic surgery.

Treat inadequate weight loss or weight regain

- Referral to Medical obesity specialist or start Obesity Management Medications if comfortable prescribing
- Refer to Bariatric Surgeon

Prenatal or Bariatric Vitamins at all times and watch for pregnancy

Annual monitoring of appropriate labs

Programs should have a transition of care policy and plan based on AAP recommendations. 6 steps to transition.

Adolescent Bariatric Surgery Outcomes

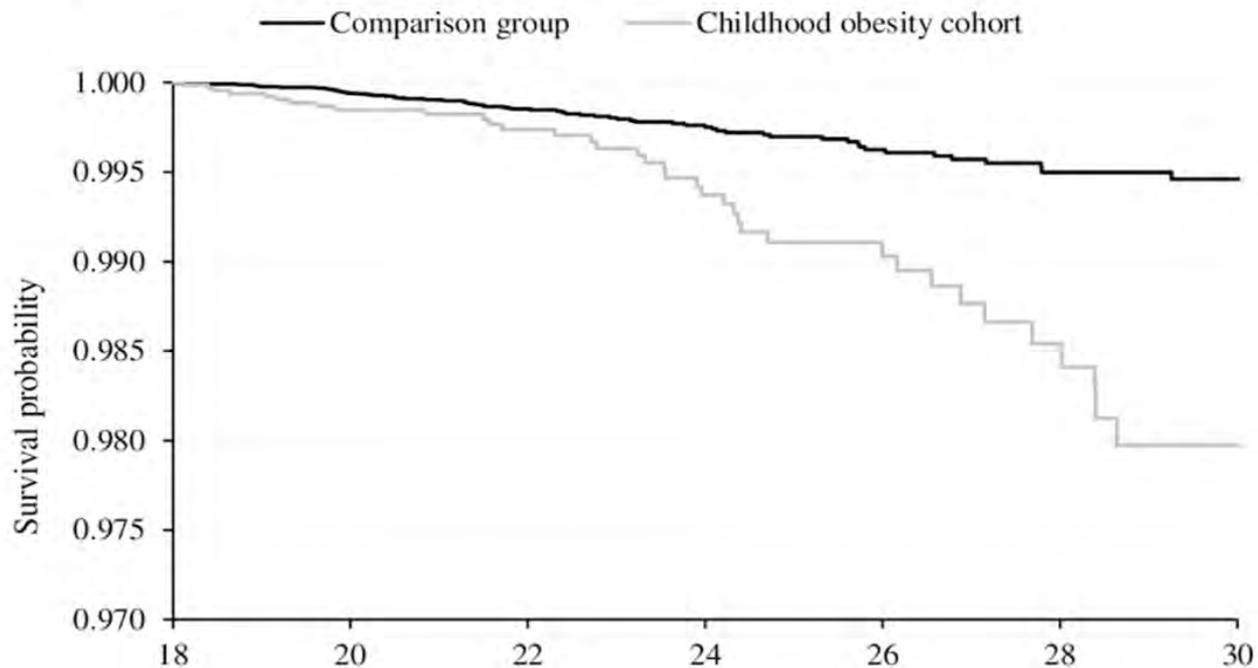
Why treat obesity in childhood?

There is a 3-fold increase in mortality before age 30 with childhood obesity

Association of childhood obesity with risk of early all-cause and cause-specific mortality: A Swedish prospective cohort study

Fig 1

Survival curves of all-cause mortality in the childhood obesity cohort and the comparison group.



Number at risk

	18	20	22	24	26	28	30
Childhood obesity cohort	7049 (100%)	4861 (69%)	3213 (46%)	2077 (29%)	1286 (18%)	754 (11%)	427 (6%)
Comparison group	34310 (100%)	23562 (69%)	15554 (45%)	10075 (29%)	6201 (18%)	3647 (11%)	2066 (6%)

What does the data show??

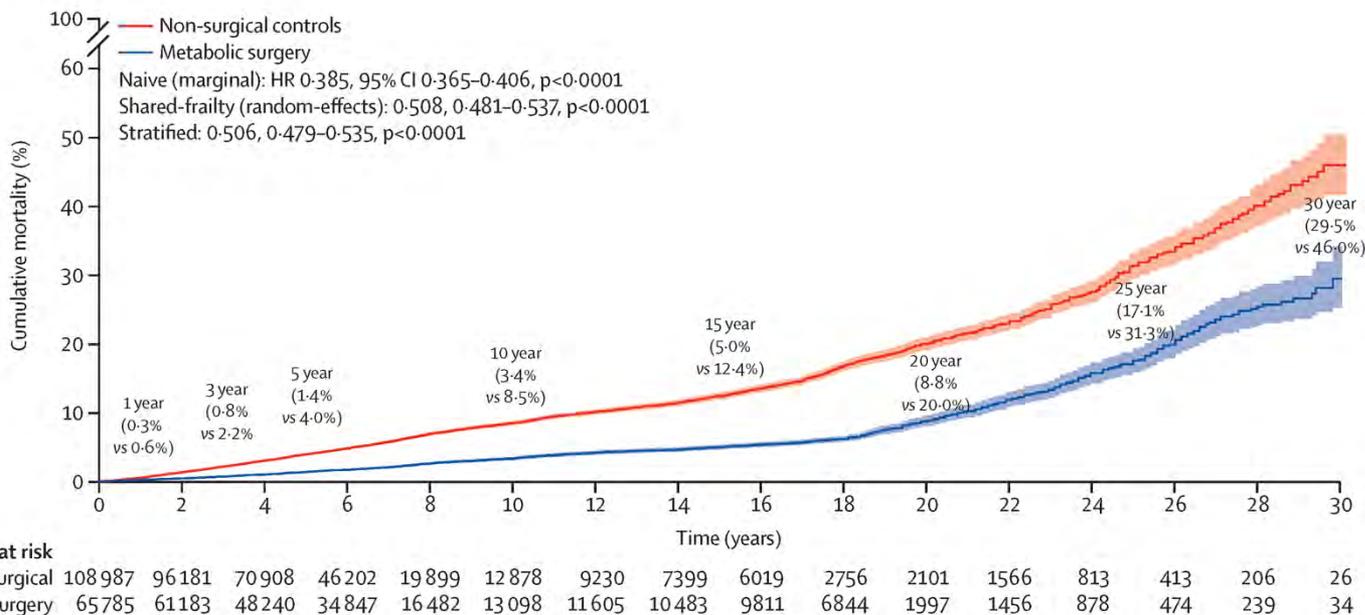
In Patients with Obesity those who undergo bariatric surgery live longer

(Adult Data)

Figure 2. Cumulative mortality and numbers-at-risk table for all participants who underwent metabolic–bariatric surgery vs usual non-surgical management of obesity

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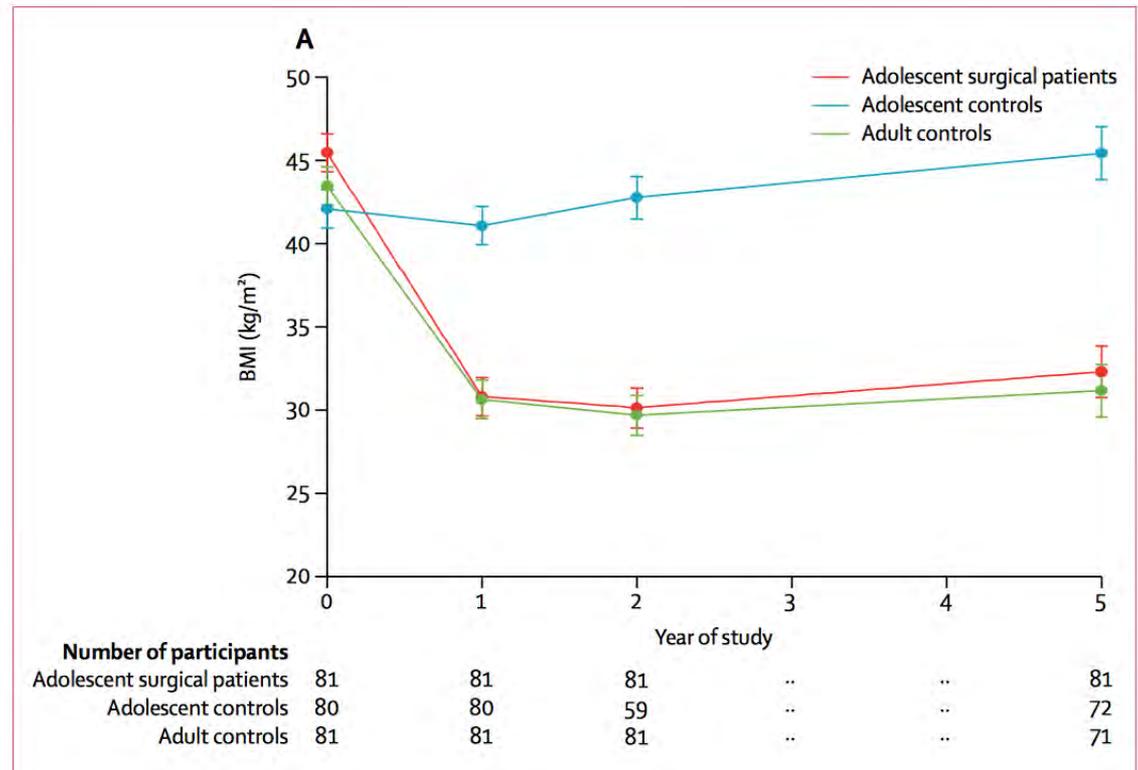
- Life Expectancy increases by 6.1 years following MBS
- In patient with T2DM it increases by 9 years with MBS versus medical therapy



Nicholas L Syn et al. Association of metabolic–bariatric surgery with long-term survival in adults with and without diabetes: a one-stage meta-analysis of matched cohort and prospective controlled studies with 174 772 participants, *The Lancet*, Volume 397, Issue 10287, 2021, Pages 1830-1841

Adolescent Morbid Obesity Study (AMOS)

- 81 patients underwent RYGB in three centers in Sweden
- 80 case matched controls
- Average 16.5 years
- 25% required additional surgery
- 72% developed nutritional deficiencies
 - *Note that this is lower than the rate of nutrition deficiency in our preop population.*



Olbers et al, Lancet Diabetes Endocrinol 2017; 5: 174–83

Largest study in the USA - Teen Labs Study

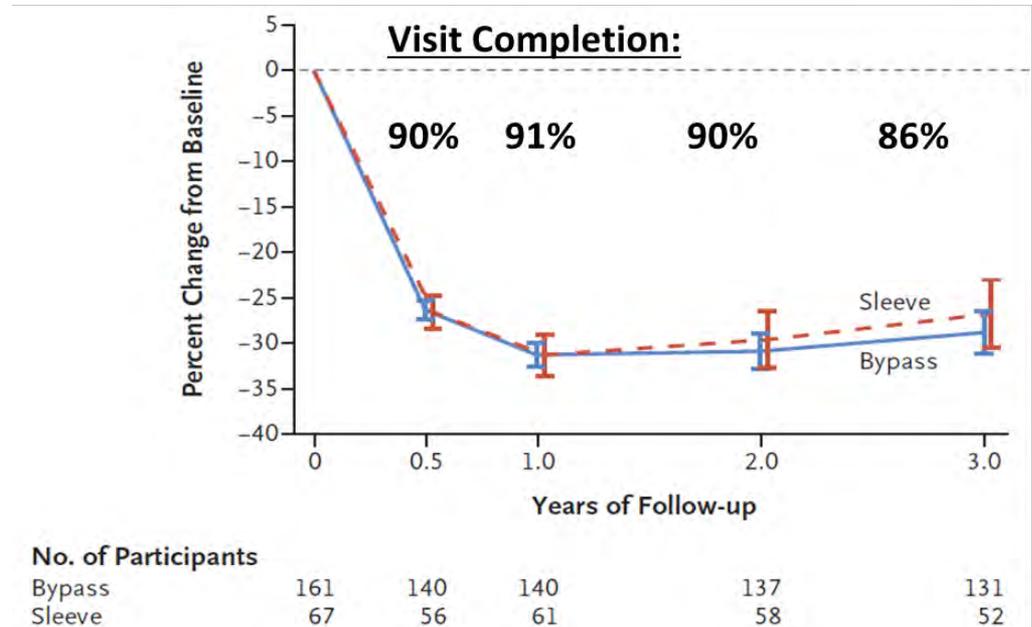
Multi-institutional prospective observational study of 242 consecutive patients in 5 institutions

Assess the safety and efficacy of WLS teens

Age 13-19 years , 76%female, median BMI 53 kg/m²

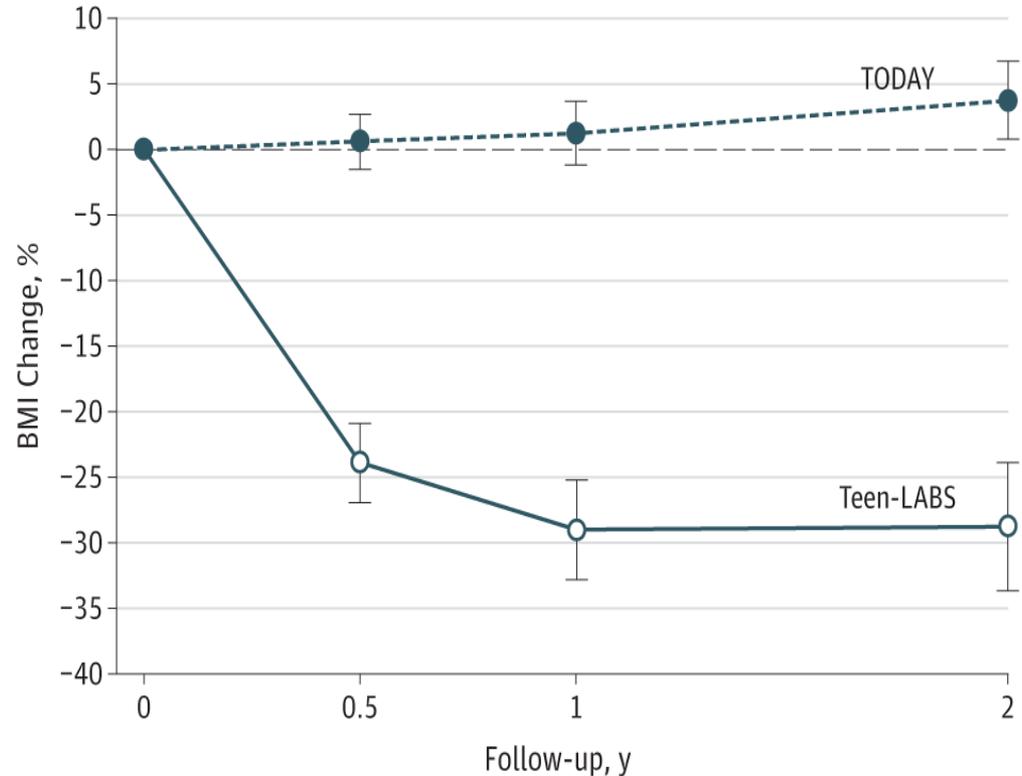
Outcomes -

- Significant improvement in co-morbidities
- Significant improvement in HRQOL
- Vitamin deficiencies
- Sleeve and Bypass equivalent weight loss



Teen-LABS vs Today trial - 5 years in diabetic youth

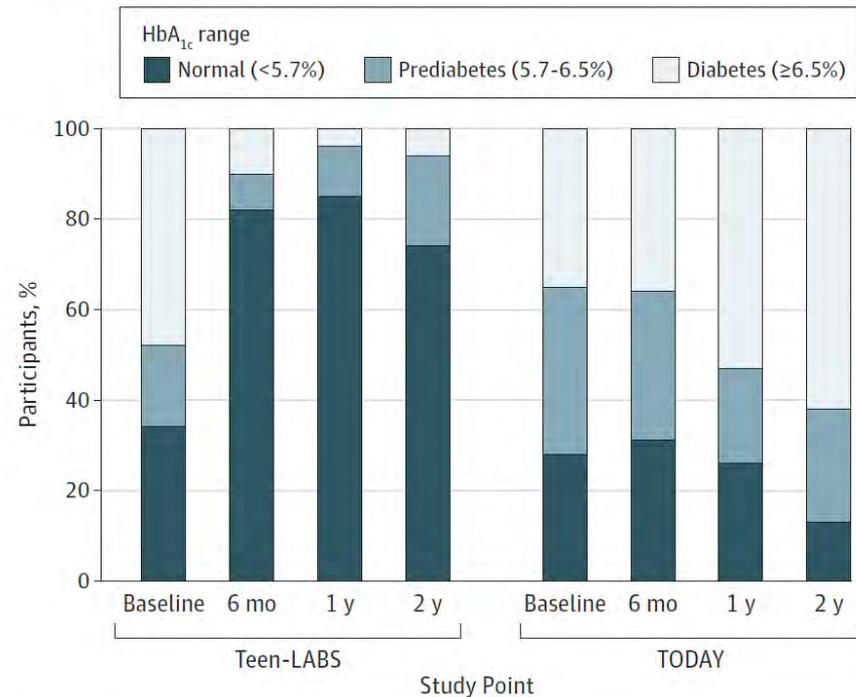
- **TODAY** - 699 children ages 10-17 patients receiving intensive lifestyle intervention
- **Teen-LABS**- 242 children ages <19yo patients receiving bariatric surgery



Teen-LABS vs Today HbA1c outcomes

Diabetes and prediabetes go away at two years in 75% of those who have Surgery, but only 10% of those on Medical treatment.

Figure 2. Changes in the Proportion of Participants With Hemoglobin A_{1c} (HbA_{1c}) Concentrations



Teen-LABS indicates Teen-Longitudinal Assessment of Bariatric Surgery; TODAY, Treatment Options of Type 2 Diabetes in Adolescents and Youth.

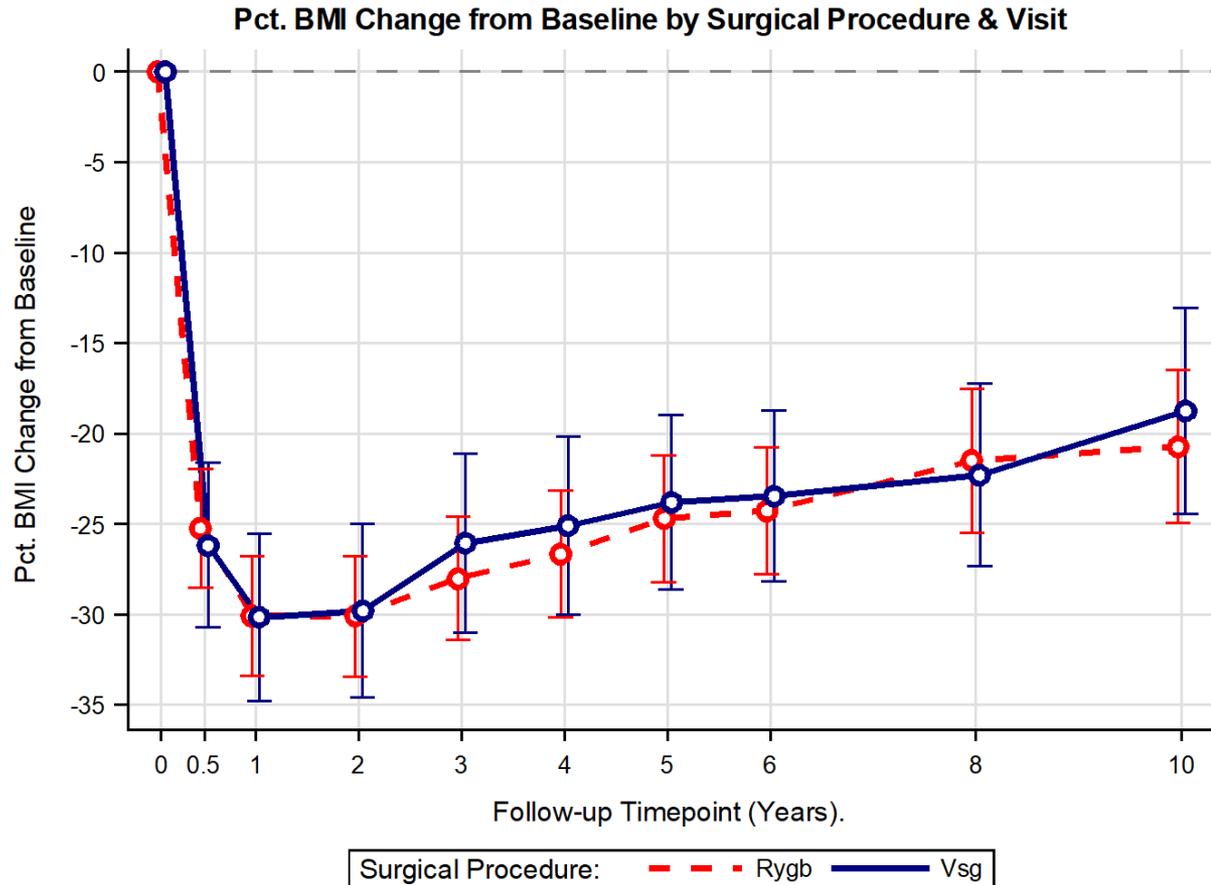
Teen Labs 10-year Data

1. No difference in RYGB or Sleeve in Remission of:

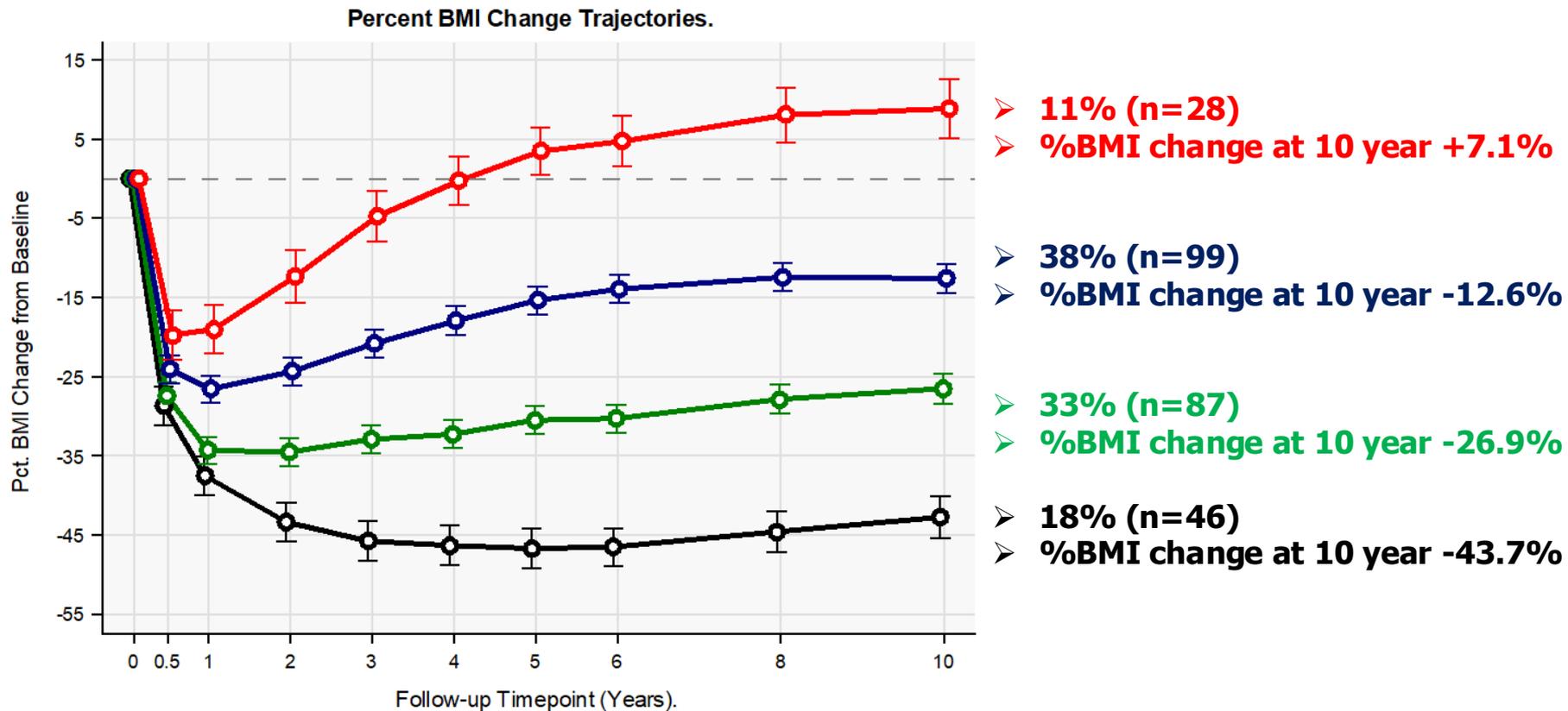
- Diabetes
- Hypertension
- Triglycerides

2. Sleeve patients less likely to have Low:

- Ferritin
- Vitamin B12



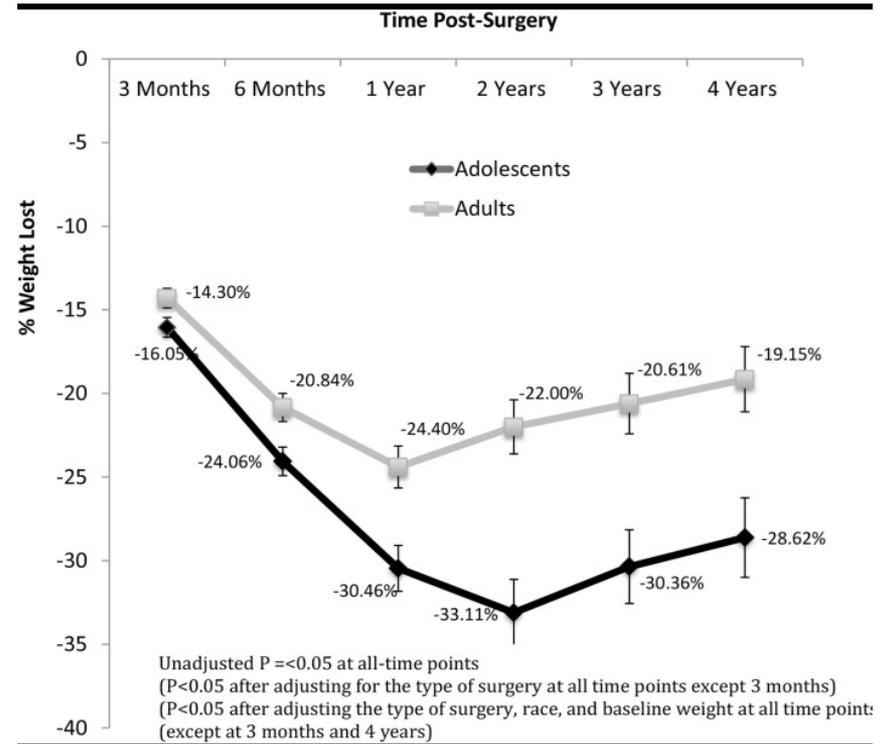
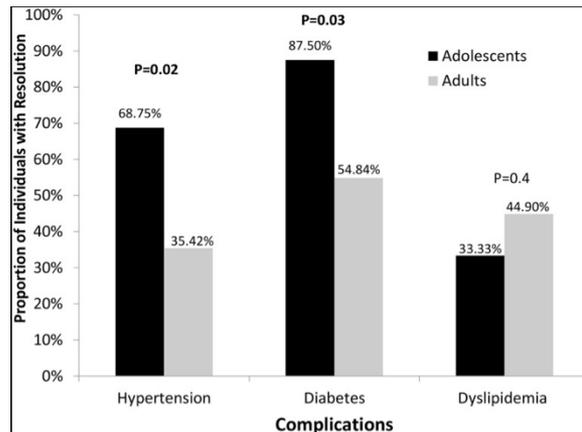
Teen Labs Ten-year data: Only predictor of long-term weight loss is 6-month weight loss.



Adult versus Adolescent Sleeve Gastrectomy

4-year follow-up

- Single Center 76 adolescents and 74 adults
- Adolescents preop BMI was higher (50 vs 44)
- Adults had more co-morbidities.
- % total body weight loss higher in adolescents than in adults
- Comorbidity resolution higher in adolescents than adults



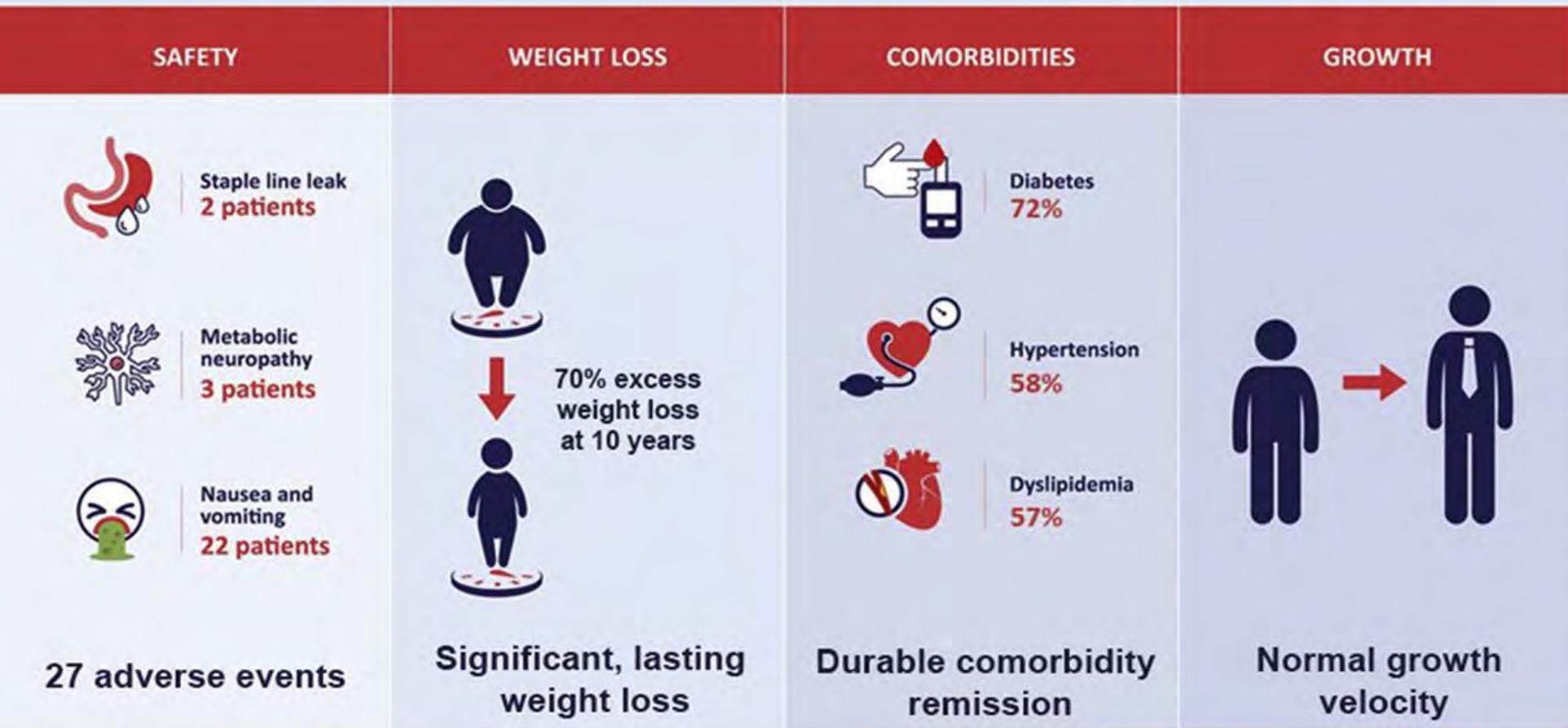
Stanford FC et al, Comparison of Short and Long-Term Outcomes of Metabolic and Bariatric Surgery in Adolescents and Adults. Front Endocrinol (Lausanne). 2020 Mar 24

Ten-Year Outcomes of Children and Adolescents Who Underwent Sleeve Gastrectomy: Weight Loss, Comorbidity Resolution, Adverse Events, and Growth Velocity

2,504 Children and Adolescents

Baseline Age: 16 ± 4 years

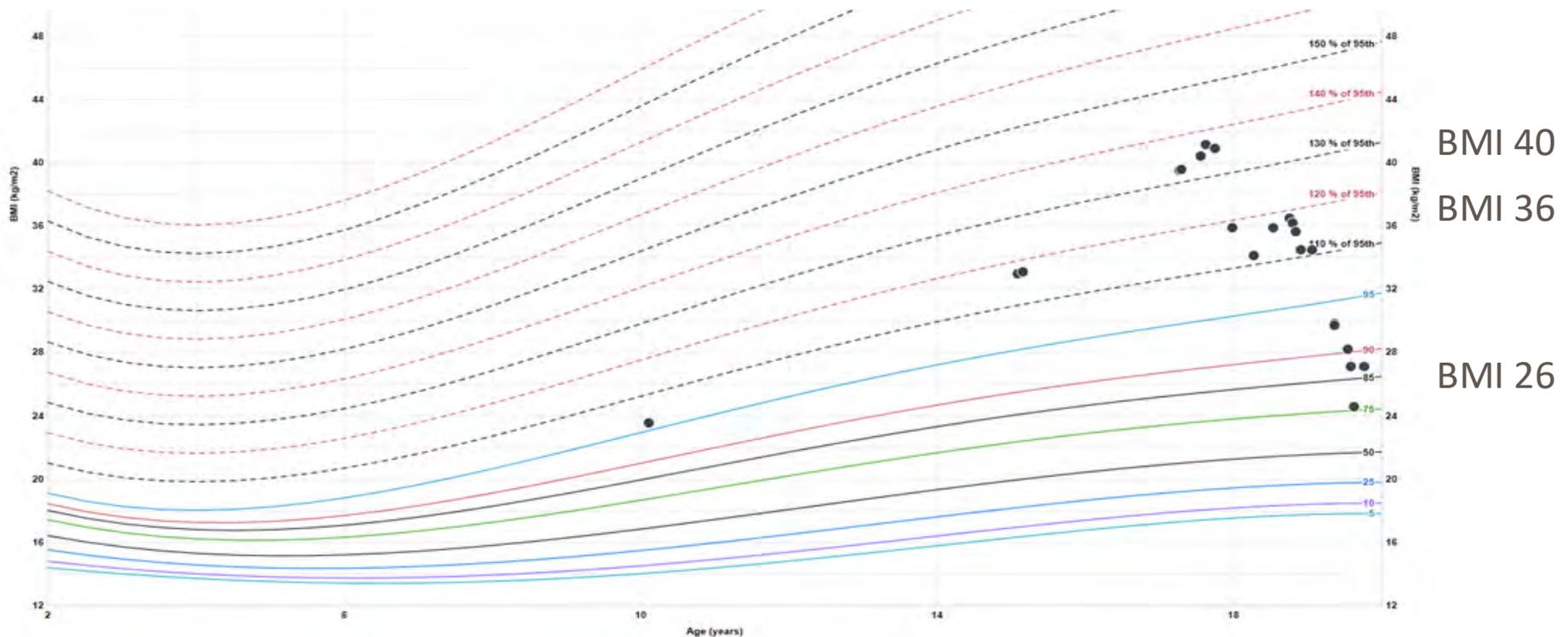
Baseline BMI: 45 ± 11 kg/m²



Patient Stories

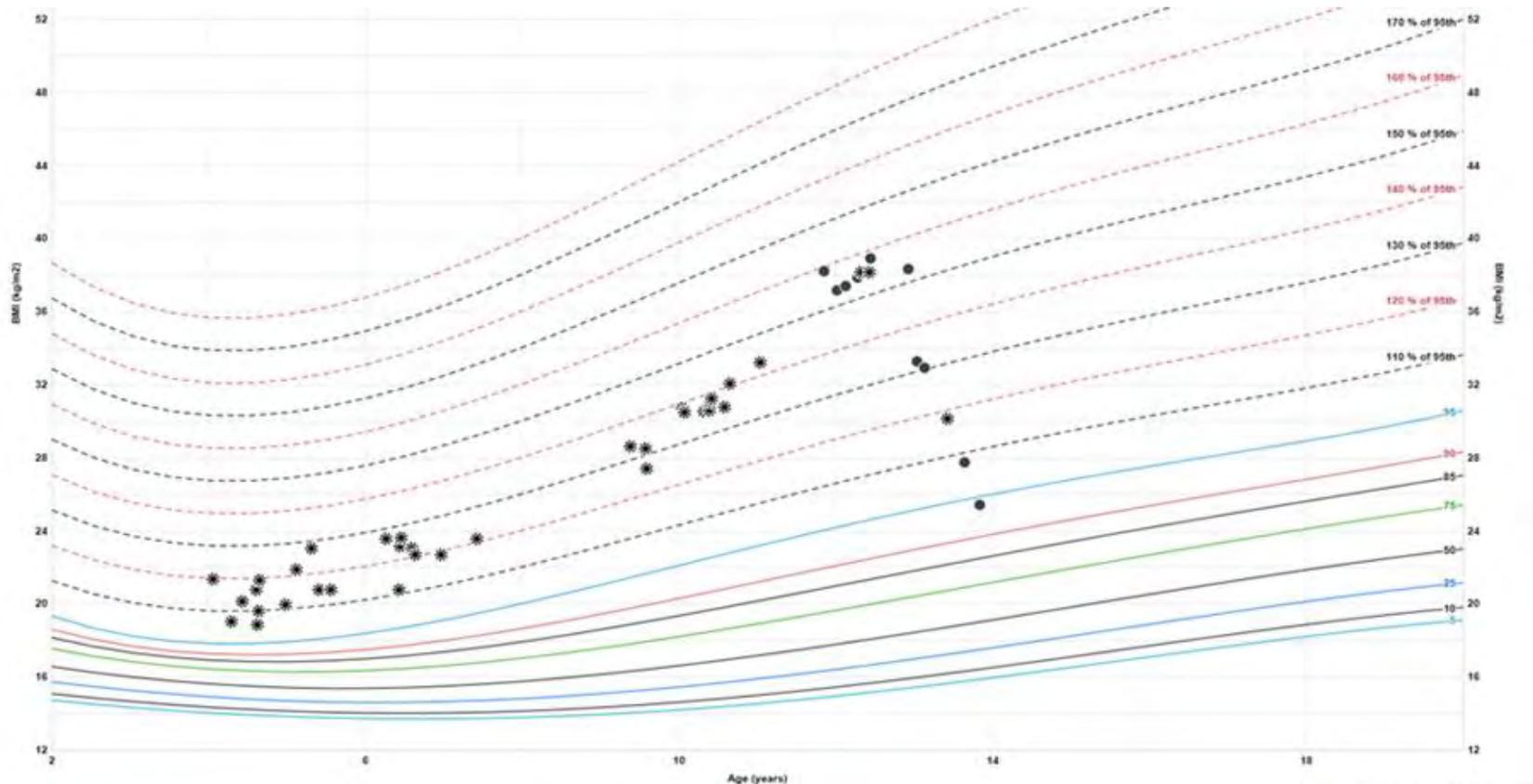
Case Example # 1 Surgery + Medications

- 17 yo Hispanic Female who weighs 276lbs, with BMI 40kg/m²
- Obesity started as a Teenager.
- Has PCOS, Insulin Resistance, Depression
 - Sleeve Gastrectomy lost 44 lbs (16%TBWL) BMI 36 then gained
 - Semaglutide (Wegovy) lost another 52 lbs (18% TBWL) BMI 26
- Weight is stable. Comorbidities resolved.



Case Example #2 Surgery at younger age

- 12-year-old white male weighs 233lbs his BMI is 39 kg/m²
- Has obesity since age 2
- Has Sleep Apnea, Steatohepatitis, Celiac and Depression.
- Sleeve Gastrectomy with 64 lbs (26% TBWL)
- OSA and NASH resolved, significantly improved quality of life and mood.

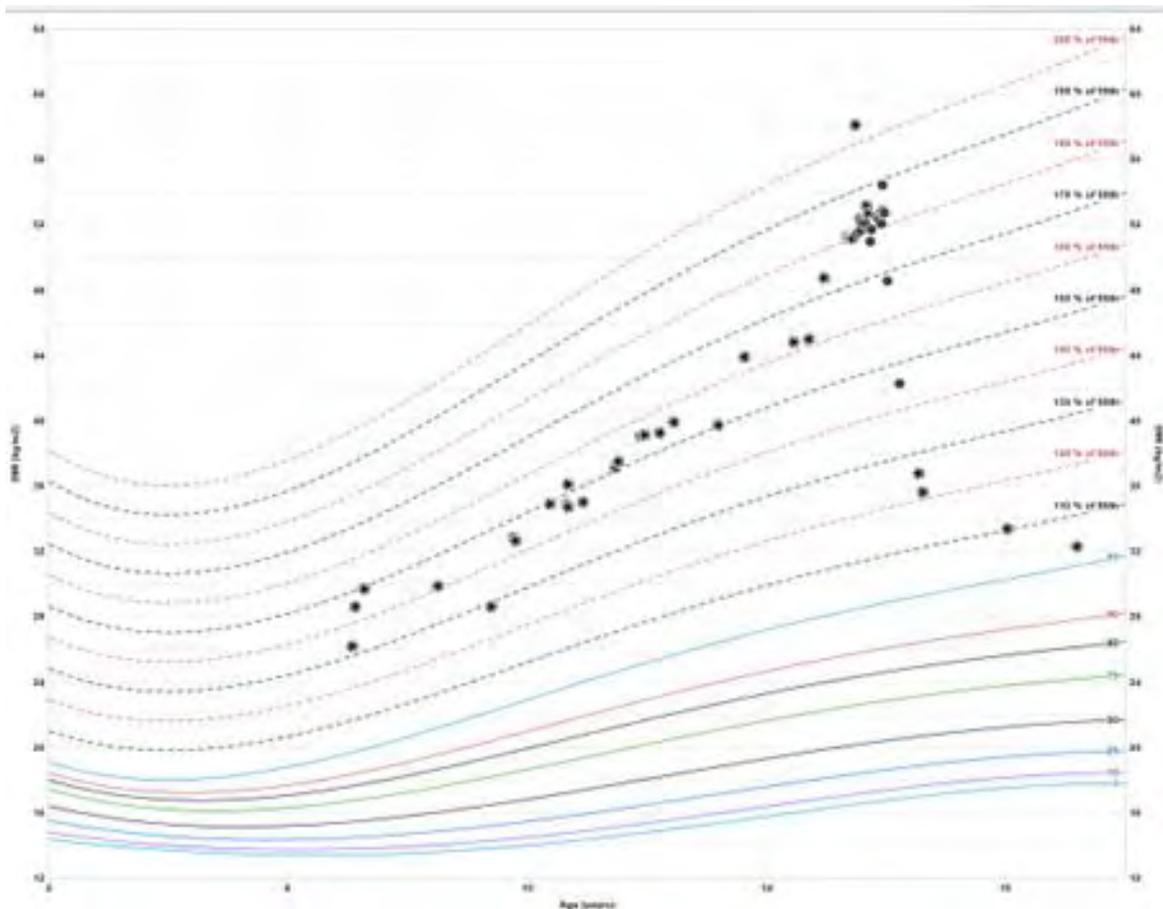


BMI 39

BMI 26

Case Example #3 - Surgery in Teen excellent response

- 16-year-old black female presents with a weight of 325lbs and BMI 54 kg/m²
- Has obesity since age 2
- Has severe hypertension, sleep apnea, insulin resistance, steatohepatitis, and depression.
- Sleeve Gastrectomy with 140lbs, 41% TBWL
- All comorbidities resolved.

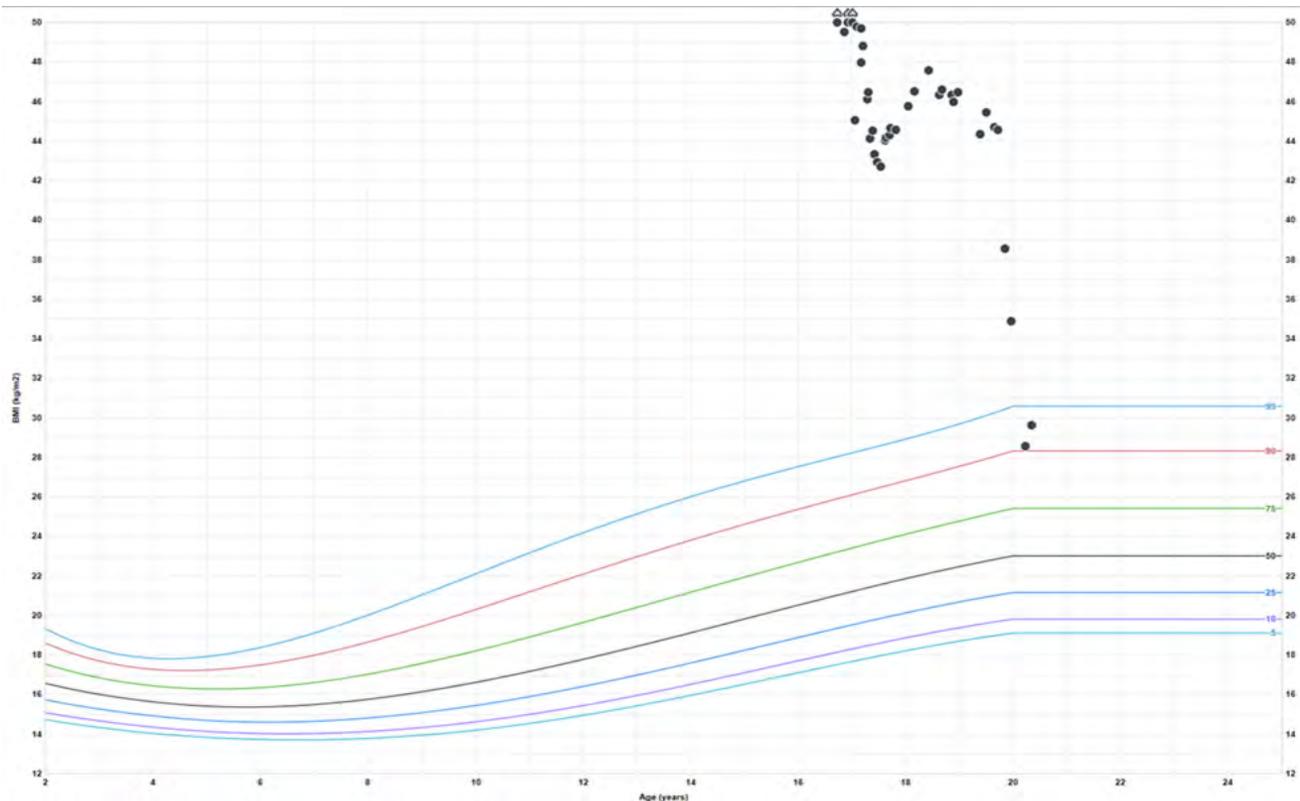


BMI 54

BMI 32

Case Example #4 - Sleeve in Teen, inadequate weight loss, converted to gastric bypass with excellent weight loss

- 16-year-old Hispanic male presented with a weight of 350 lbs and BMI of 50 kg/m²
- Has obesity since 2nd grade
- Has insulin resistance, Fatty liver disease, and dyslipidemia.
 - Sleeve gastrectomy lost 14% TBW then regained 8%.
 - At age 19 underwent RYGB another 36% TBWL
- All comorbidities resolved, weight stable



BMI 50

BMI 46

BMI 28

MBS provides life-long benefit for children

Provides sustained weight loss by changing signals for hunger and feeling full

Increases life expectancy

Improves quality of life

Is more effective in children than in adults

Results in over 95% improvement or resolution of diseases related to obesity

Based on excellent effectiveness and safety, MBS is the **standard of care** for children who meet criteria with class II and class III obesity per AAP, IFSO and ASMBS guidelines