

# Surgical Management of Obesity

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NATIONAL LEADERS IN MEDICINE

# Disclosures

- Gore Consultant

# Objectives



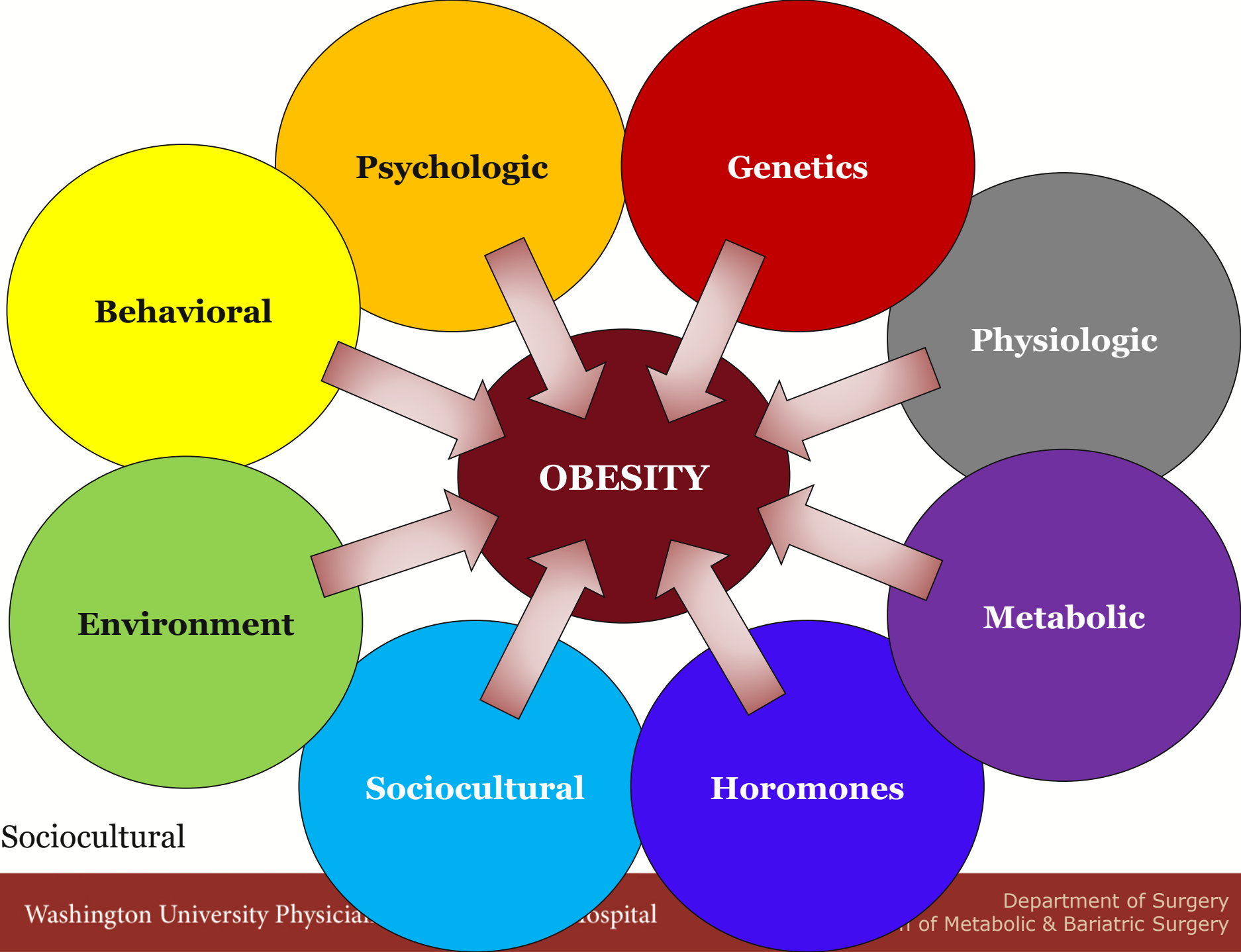
- Obesity Trends and Risks
- Surgical Indications and Evaluation
  - Pre-operative evaluation
- Current Procedures
- Bariatric Surgery
  - Outcomes and Adverse Events

# Obesity Classification

$$\text{Body Mass Index (BMI)} = \text{Wt(kg)} / \text{Ht(m}^2\text{)}$$

Underweight	< 20
Normal	20 - 25
Overweight	25 - 30
Obese Class I	30 - 35
<b>Obese Class II</b>	<b>35 - 40</b>
<b>Morbid Obesity</b>	<b>&gt; 40</b>
<b>Super Obesity</b>	<b>&gt; 50</b>
<b>Super-super Obesity</b>	<b>&gt;60</b>

BMI 40 = approximately 100 lbs above ideal weight



Sociocultural



# 20 Years Ago vs. Today

## Bagels



140 calories



350 calories

## Pasta



500 calories



1,025 calories

## Sandwiches



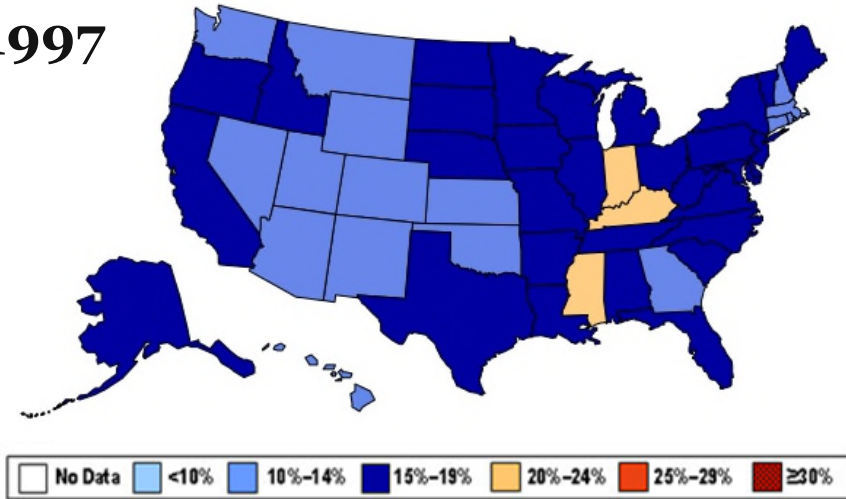
320 calories



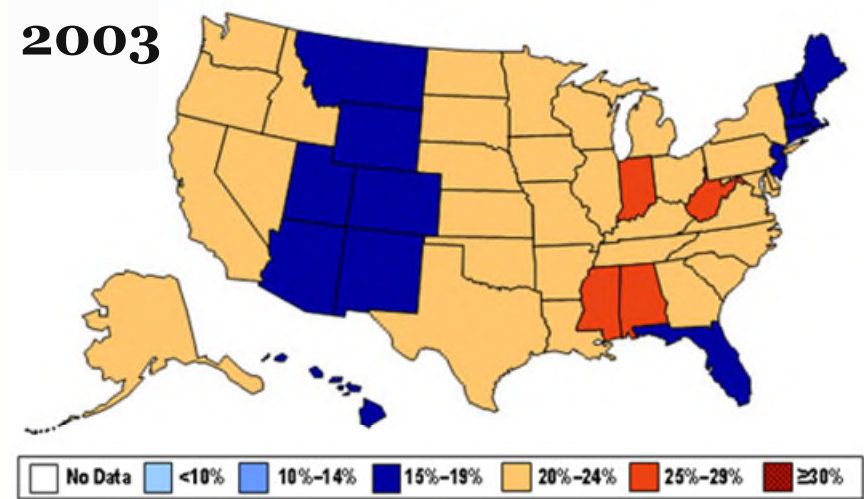
820 calories

# Obesity Trends Among U.S. Adults

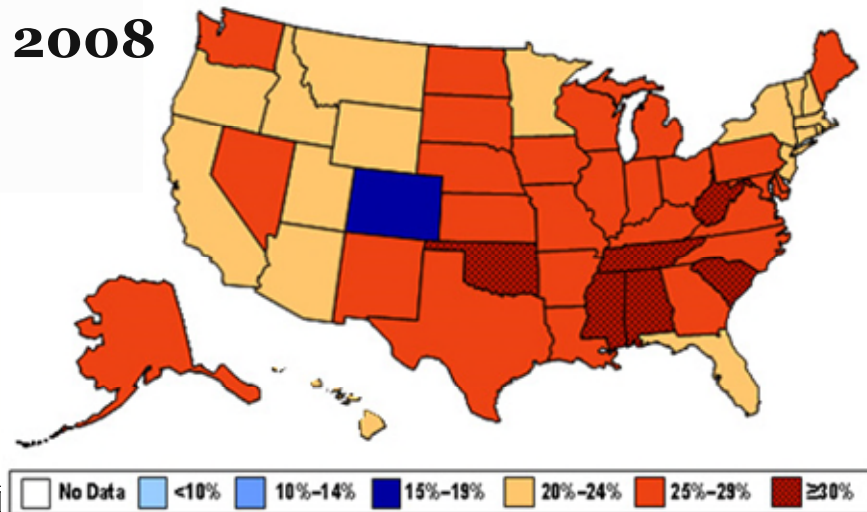
1997



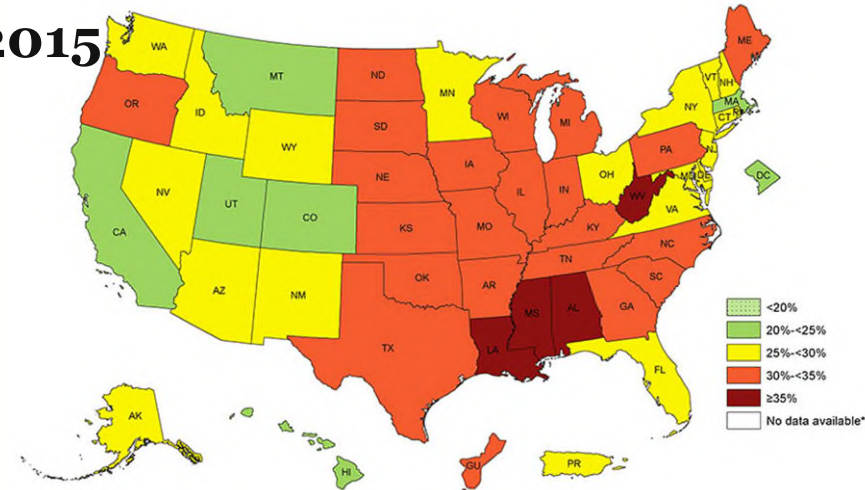
2003



2008



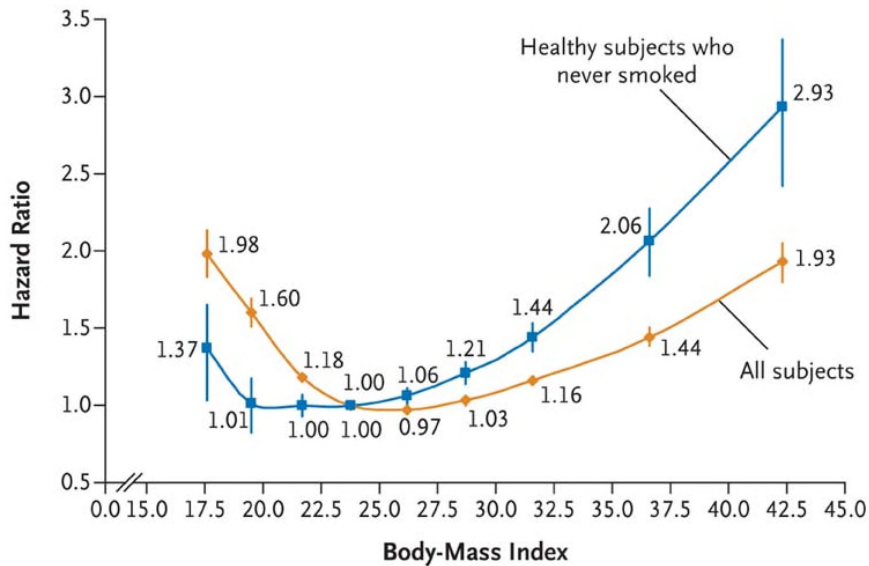
2015



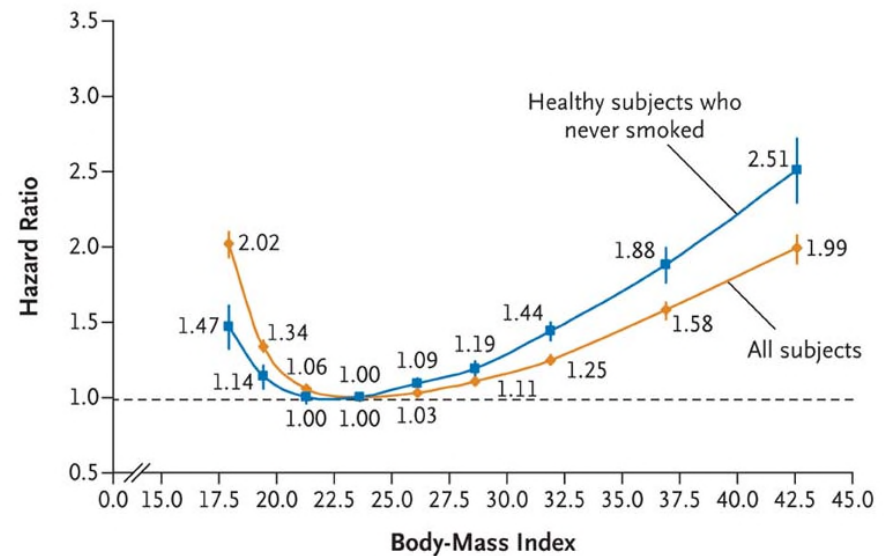


# Mortality Risk in Obesity

Men



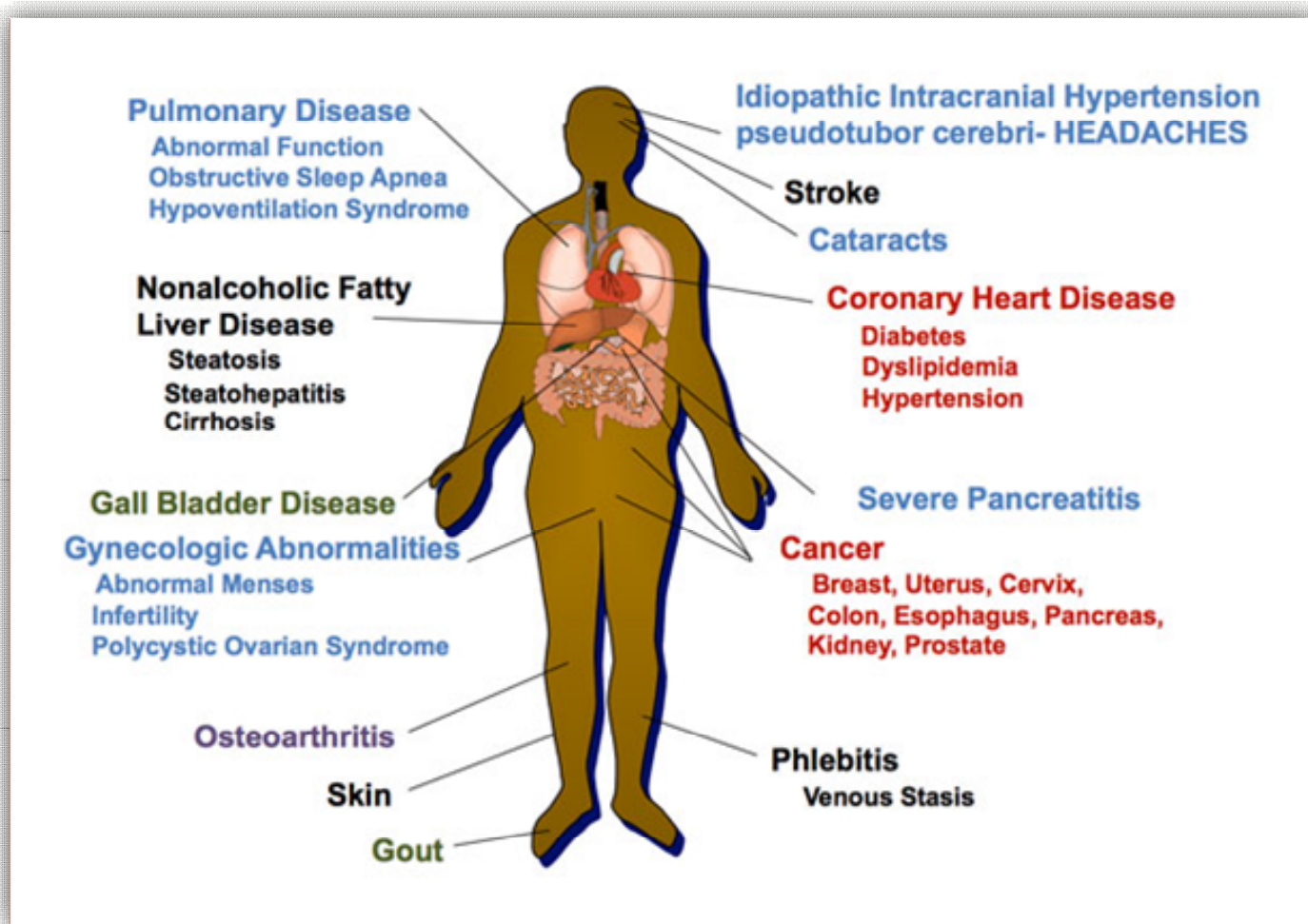
Women



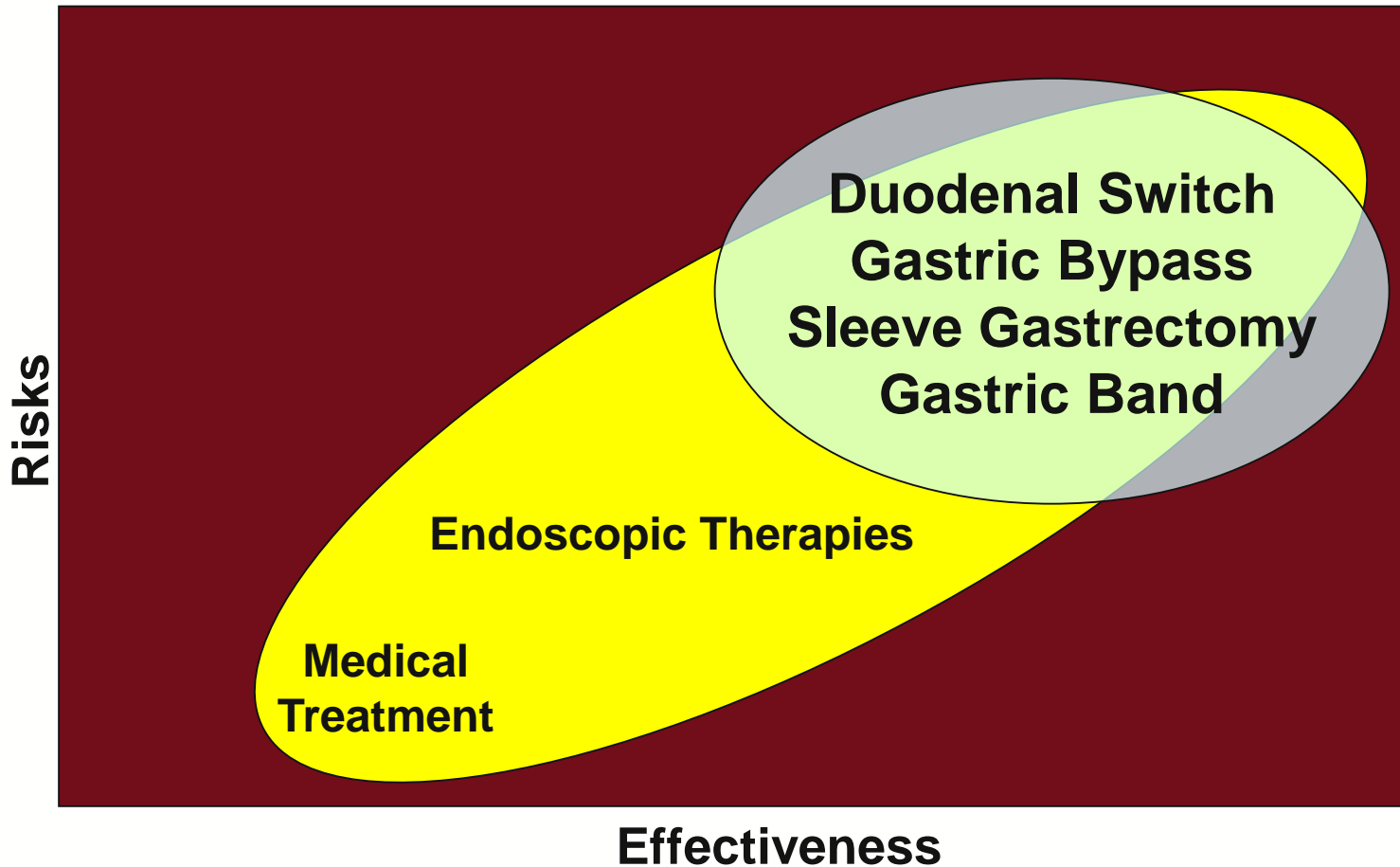
Berrington de Gonzalez A et al. N Engl J Med 2010;363:2211-2219



# Risk of Obesity



# Treatment Options



# Which of the following are required for a patient to undergo bariatric surgery?

BMI over 40

BMI 35-40 with a high risk  
comorbid condition

Pre-operative dietary  
evaluation

Previous failure of a  
weight reduction program

All of the above

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# 1991 NIH Consensus Conference: Indications for Surgery

- Previous failure in an established weight reduction program
- Body Mass Index (BMI) > 40
- BMI 35-40 with high risk comorbid conditions
- Children and Adolescents initially excluded
  - Accreditation obtained 08/2018
- Pregnancy avoided until weight has stabilized
- Minimize peri- and post-operative risks using multidisciplinary team
  - Offer non-surgical alternatives
  - Psychology evaluation
  - Physical Therapy evaluation
  - Dietician evaluation
  - Labs including vitamin levels





# Nutritional Deficiencies Preoperatively

- Consumption of excess calories does not equate to consumption of nutrient-dense, vitamins and mineral rich food, such as fruits, vegetables and whole grains.
- Morbidly obese patients can have **micronutrient deficiencies** despite excess in intake of macronutrients.



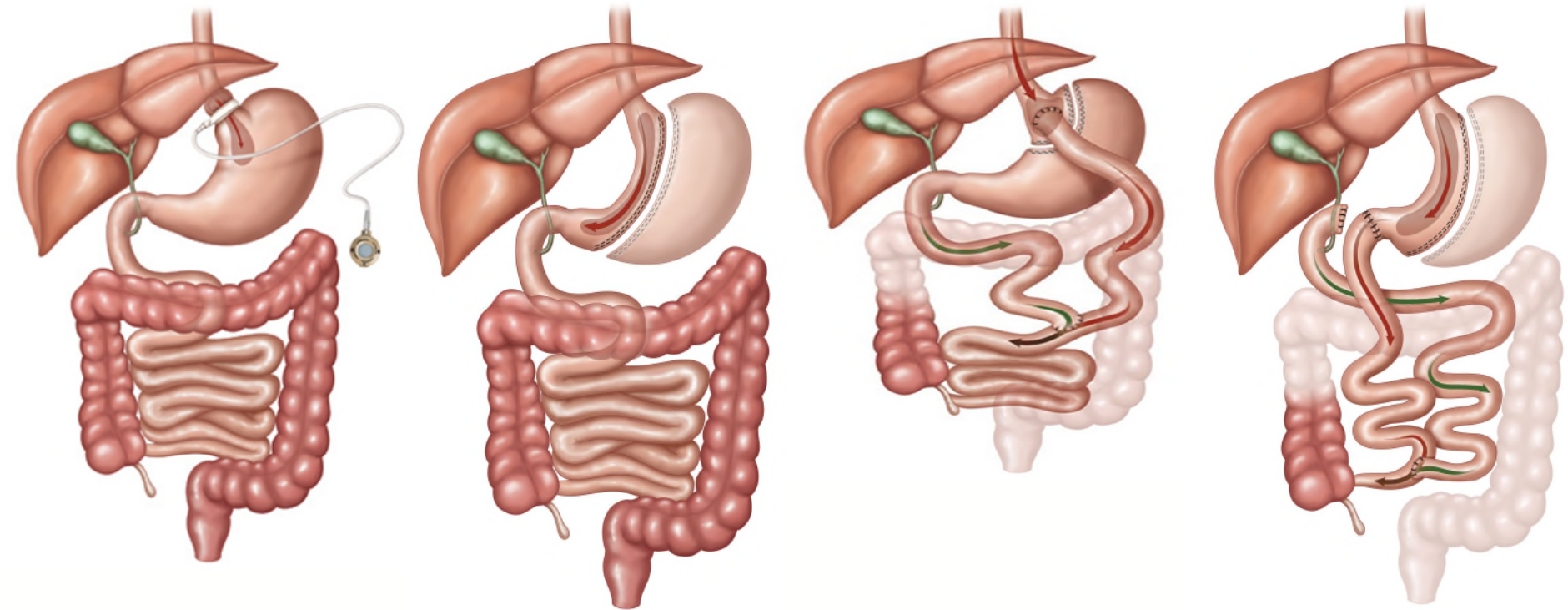
# Nutritional Deficiencies Preoperatively

- Pre-operatively, the most common micronutrient deficiencies include vitamin D and iron.
- **Vitamin D deficiency:** related to inadequate exposure to sunlight, sunscreen use, geographic location, dark skin, age, or decreased intake of dairy and vitamin D rich food.
- **Iron deficiency:** associated with blood loss, inability to absorb enough iron (ex. Crohn's disease or PPI use), or poor diet



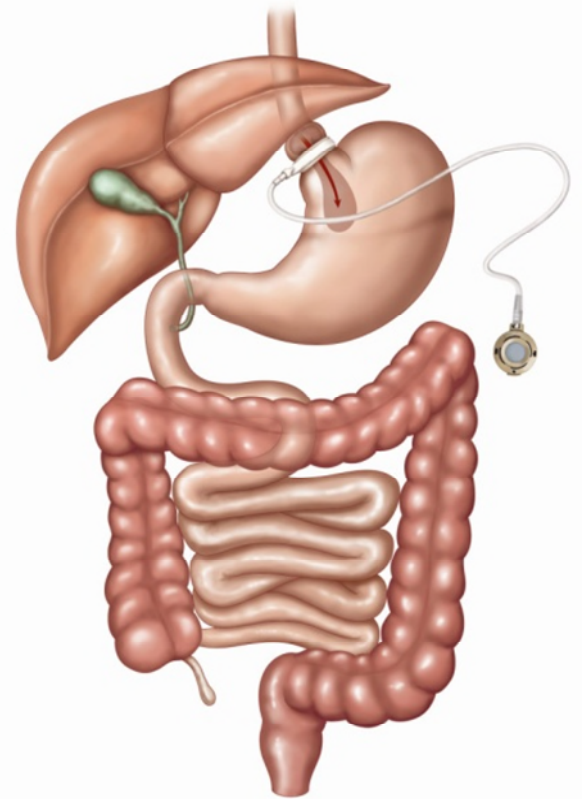
# WUWLS Bariatric Surgery Options

## Revisions



# Adjustable Gastric Band

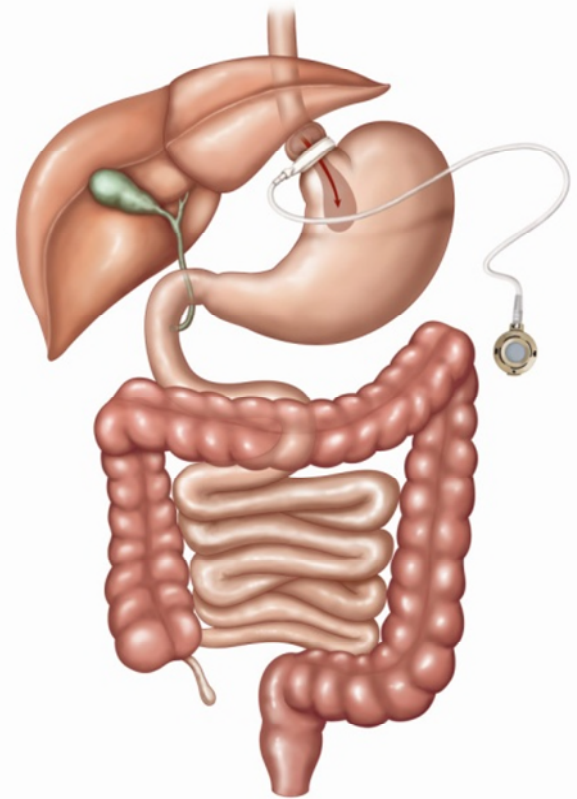
- Restrictive procedure
  - The pouch above the band is ~15 mL
- Approved for BMI of 30-35 kg/m<sup>2</sup> with a comorbid condition
- Adjustment of the band adjust the stoma diameter
- Excess weight loss 30-40%





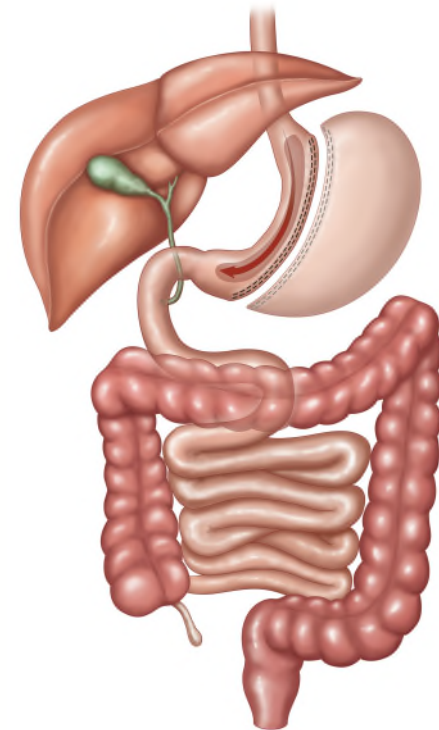
# Adjustable Gastric Band

- Can be performed in patients with a BMI of 30-35
- Vitamin Supplementation—
  - Multivitamin containing:
    - 400 micrograms folic acid
    - 15mg zinc
    - 18mg iron
  - Calcium Citrate 1200-1500 mg/day



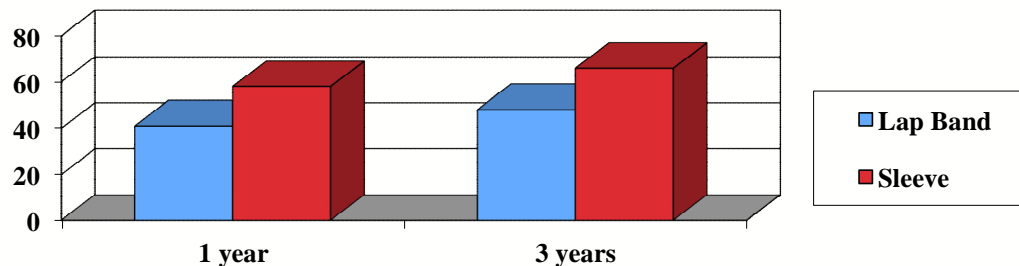
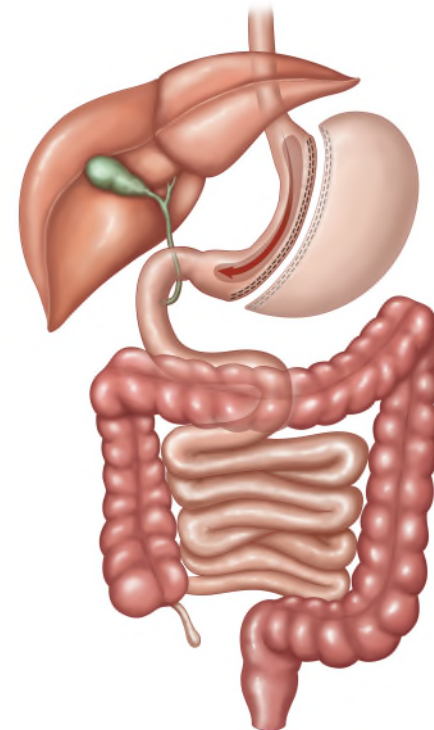
# Sleeve Gastrectomy

- Better option for patients with
  - NSAID use
  - Nicotine history
  - Need for prednisone
  - Inflammatory Bowel Disease
  - Abdominal wall hernias
  - Transplant candidates
    - Cardiac
    - Liver
    - Kidney
  - History of multiple abdominal surgeries or adhesive disease



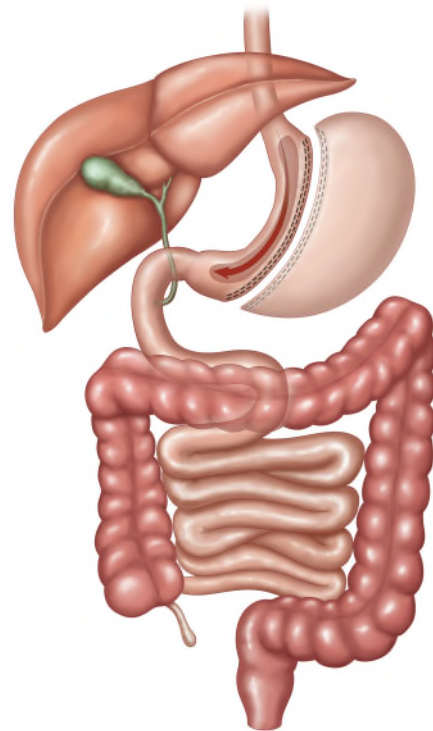
# Sleeve Gastrectomy

- Restrictive procedure
  - Resect the greater curvature
  - Leave the antrum and pylorus intact
- Excess weight loss 50-70%
- Most common surgery performed in the United States



# Sleeve Gastrectomy

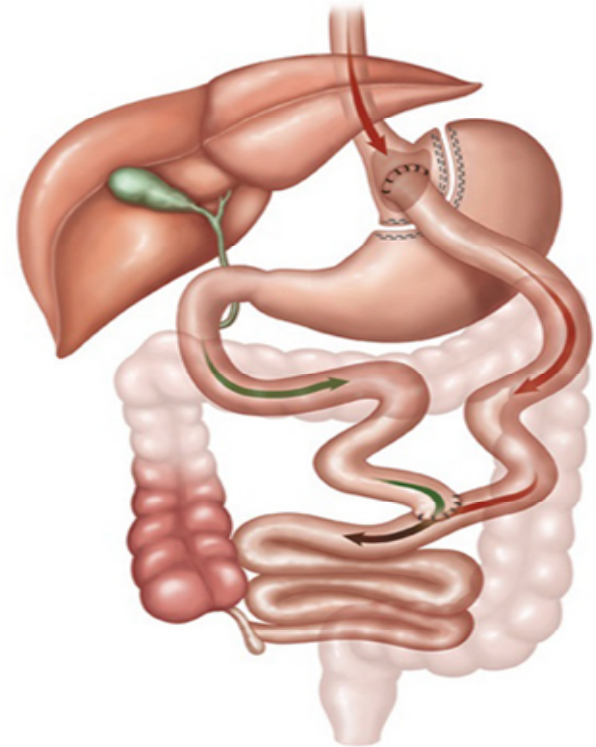
- Vitamin Supplementation—
  - Multivitamin containing:
    - 400 micrograms folic acid
    - 15mg zinc
    - 18mg iron (45-60mg iron if menstruating female or history of anemia)
    - 1-2mg copper
    - 12mg thiamine
  - Calcium Citrate with Vitamin D3: 1500-2000 mg/day
  - Vitamin B12: 300-500 micrograms/day OR 1000 micrograms/month





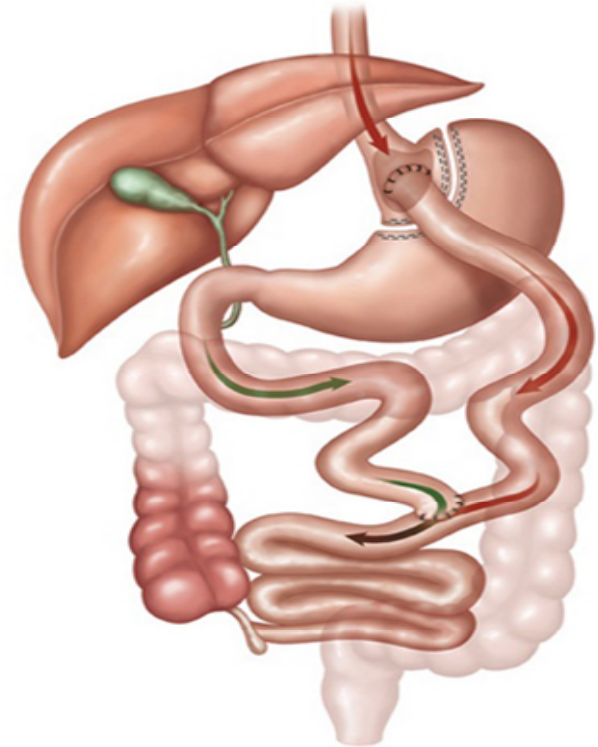
# Roux-en-Y Gastric Bypass

- Better option for patients with:
  - Candidate for lung transplantation
  - Diabetes Mellitus
  - Hiatal hernias
  - Gastroesophageal reflux disease
  - Esophageal motility disorders
- Second choice for kidney transplant patients or post-op liver transplant patients



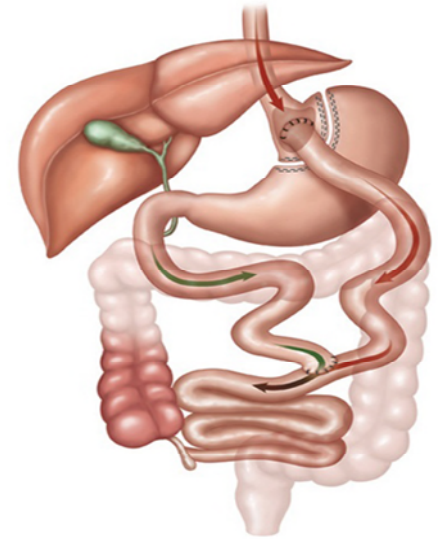
# Roux-en-Y Gastric Bypass

- Restriction
  - Stomach pouch based on the lesser curvature and the left gastric artery
  - 25-30 mL pouch
- Malabsorption
  - 75-150cm in length
- Excess weight loss of 60-80%



# Roux-en-Y Gastric Bypass

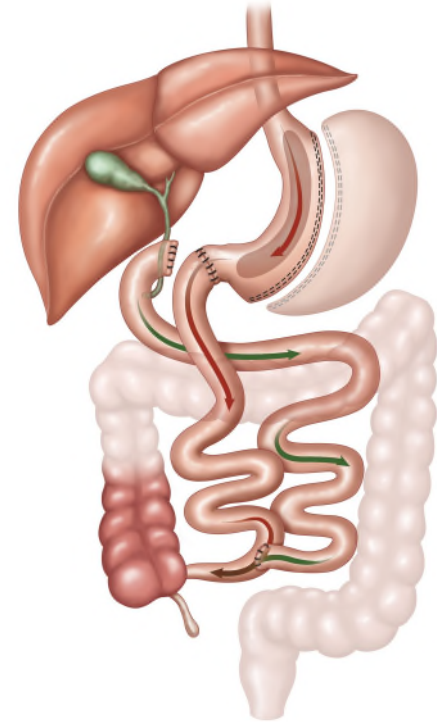
- Vitamin Supplementation—
  - Multivitamin containing:
    - 400 micrograms folic acid
    - 15mg zinc
    - 18mg iron (45-60mg iron if menstruating female or history of anemia)
    - 1-2mg copper
    - 12mg Thiamine
  - Calcium Citrate 1500-2000 mg/day with 3,000 IU Vitamin D



- Vitamin B12:
  - 300-500 micrograms/day
  - 1000 micrograms/month

# Duodenal Switch

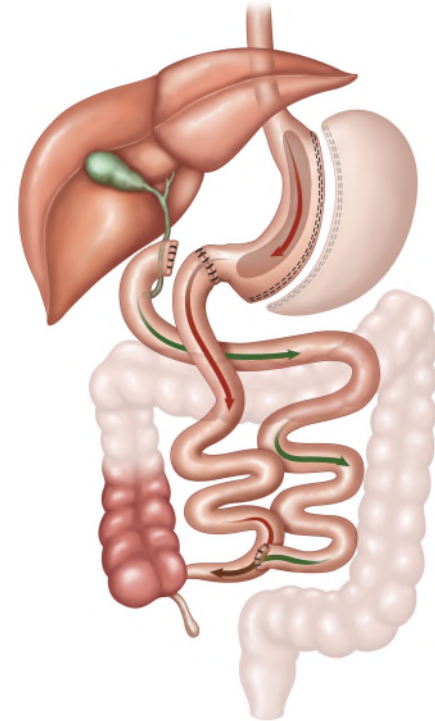
- Not indicated in patients undergoing transplant evaluation at this time
- Not indicated for noncompliant patients
- Consider in the following patients:
  - BMI>50
  - BMI>45 with diabetes mellitus
  - Revision for inadequate weight loss after a sleeve gastrectomy





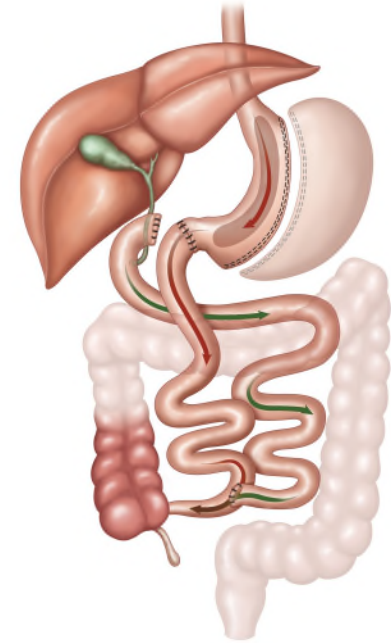
# Duodenal Switch

- Restriction = Sleeve gastrectomy
- Malabsorption
  - Bypass all the small bowel except 250cm (150cm Roux limb and 100 cm common channel)
- Excess weight loss of over 80%
- Fewer health insurance providers will cover it



# Duodenal Switch

- Vitamin Supplementation—
  - Multivitamin x2 containing:
    - 400 micrograms folic acid
    - 15mg zinc
    - 18mg iron (45-60mg iron if menstruating female or history of anemia)
    - 2mg Copper
  - Calcium Citrate with Vitamin D3: 1800-2400 mg/day
  - Vitamin B12:
    - 300-500 micrograms/day
    - 1000 micrograms/month
- Fat Soluble Vitamins:
  - 10,000 IU Vitamin A
  - 3,000 IU Vitamin D
  - 300 micrograms Vitamin K



# Expected Outcomes

- Dietary Changes
  - Alterations in food choices and eating patterns
  - Taste changes
- Weight Loss
  - Most patients fail to achieve ideal body weight
  - Most patients have unrealistic expectations regarding weight loss
- Comorbidity Reduction
  - Varies between procedures

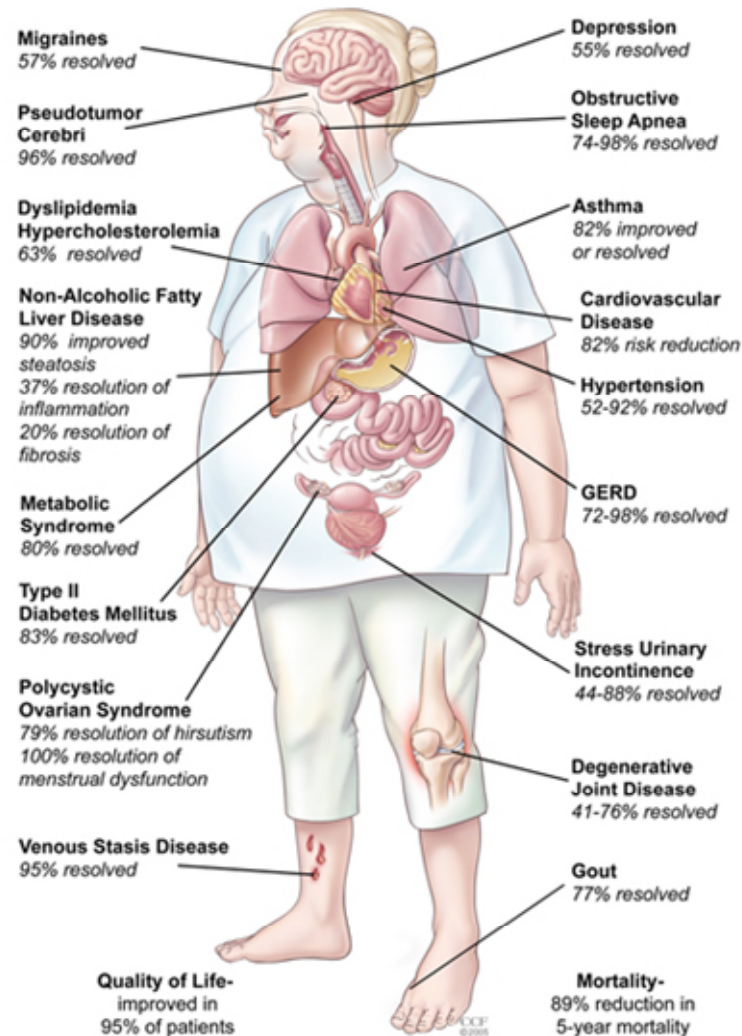


# Reduction in Body Weight

**Table 4 Reported weight loss as percentage of excess body weight after bariatric surgery**

Procedure	Follow-up period (years)		
	1–2	3–6	7–10
Vertical banded gastroplasty <sup>a</sup>	50–72	25–65	—
Gastric banding <sup>b</sup>	29–87	45–72	14–60
Sleeve gastrectomy <sup>c</sup>	33–58	66	—
Roux-en-Y gastric bypass <sup>d</sup>	48–85	53–77	25–68
Banded Roux-en-Y gastric bypass <sup>e</sup>	73–80	66–78	60–70
Long-limb Roux-en-Y gastric bypass <sup>f</sup>	53–74	55–74	—
Biliopancreatic diversion ± DS <sup>g</sup>	65–83	62–81	60–80

# Morbidity of Obesity





# In a randomized controlled trial with 5 year follow up, type 2 diabetes mellitus is best treated by

lifestyle changes

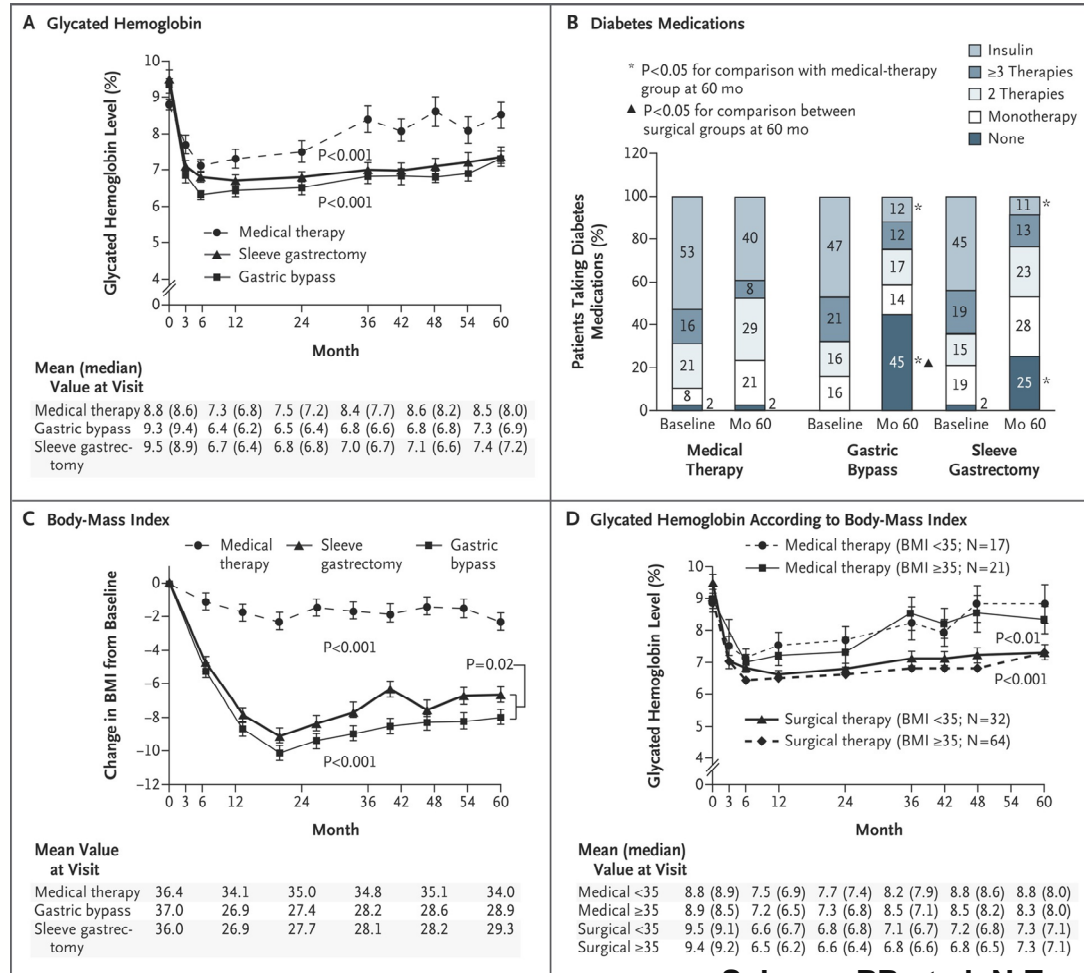
sleeve gastrectomy

Roux-en-Y gastric bypass

Both sleeve gastrectomy and  
Roux-en-Y gastric bypass

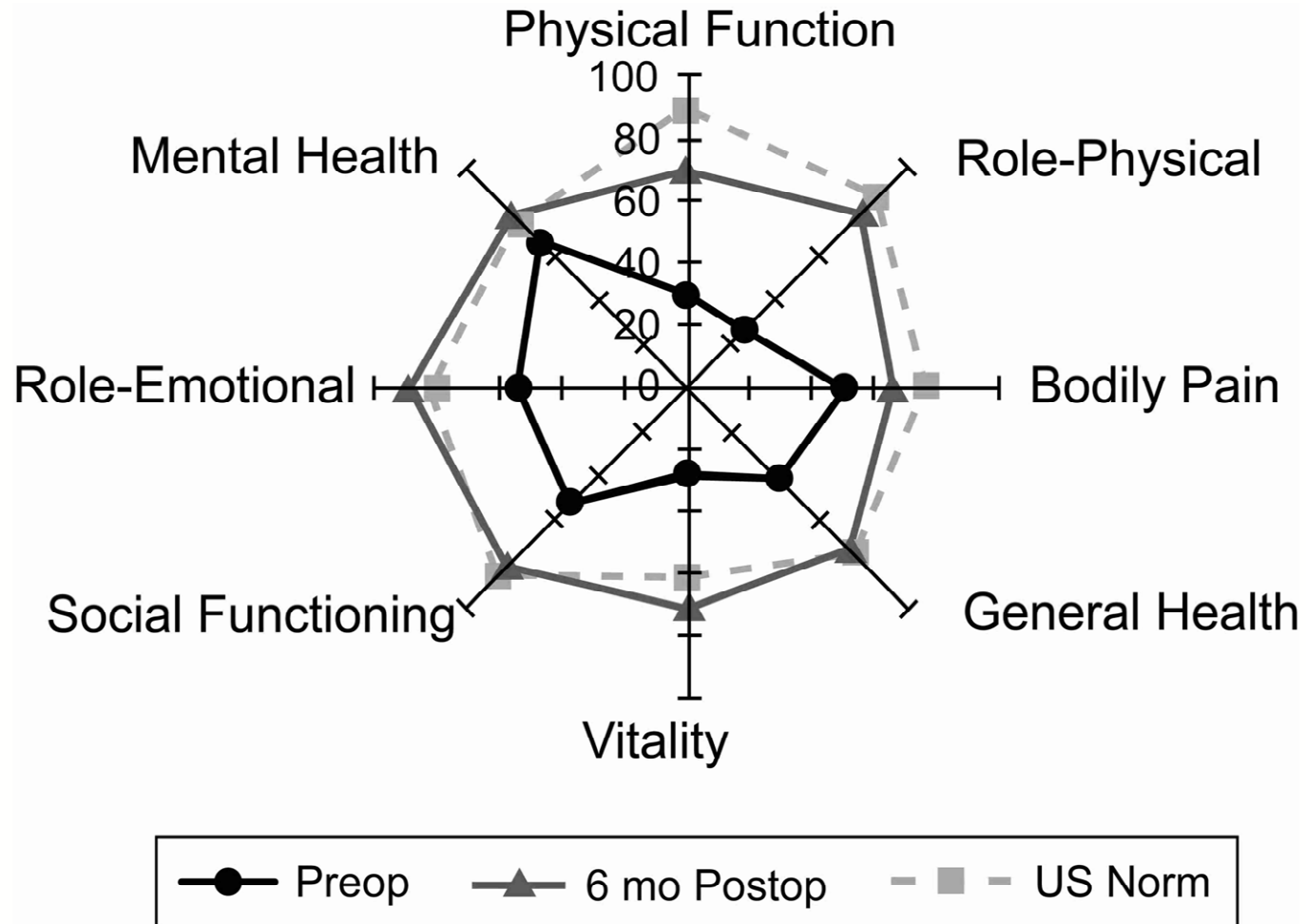
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# Reduction in Diabetes: STAMPEDE 5 year follow up

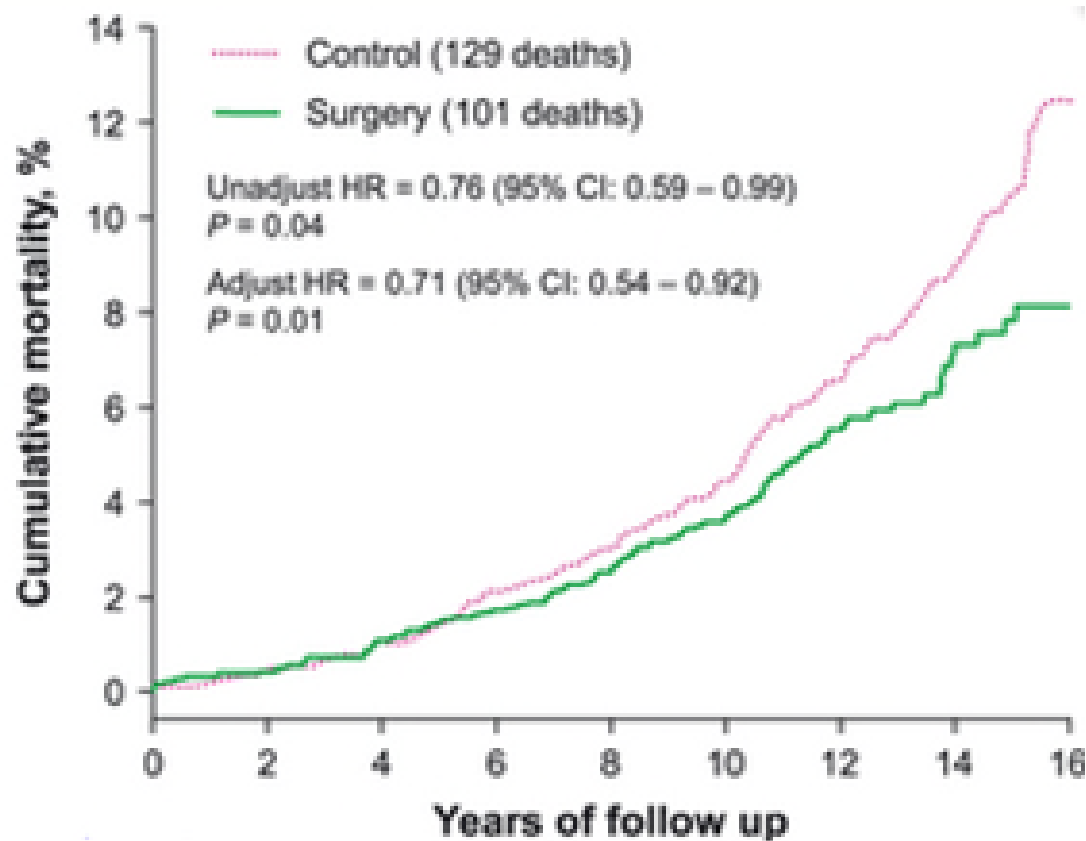


Schauer PR et al. N Engl J Med 2017;376:641-651

# Quality of Life Outcomes



# Decreased Risk of Dying



Sjostrom et al. NEJM. 2007; 357(8): 741-752.

# Complications

- Procedure specific
- Perioperative complications
- Nutritional complications
- Weight loss complications



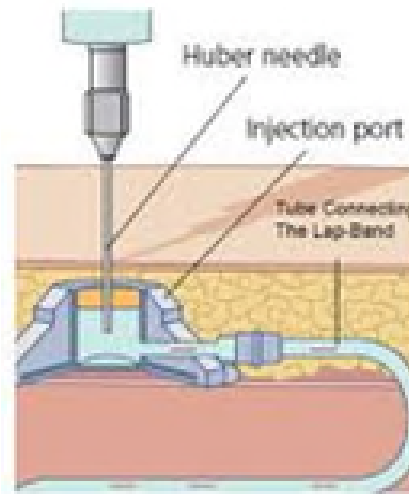
Surgical Approach	Procedure	Complication	0-2 wks	2-4 wks	4-8 wks	2-6 mo	6-12 mo	1-5 yrs
	Gastric Bypass And Duodenal Switch	Leak	++					
		PE	++	+	+	+		
		MI	+	+	+			
		Pneumonia	+					
		Wound Infection	+++	+				
		SBO	+	+	+	+	+	+
		Stomal Stenosis		+	+++	+		
		Nausea		++	++	++	+	
		Incisional Hernia (open)				++	++	+
		Cholelithiasis				+	+	
		Nutritional Complications			+	+	++	+++
		Suboptimal Weight Loss						+
	Gastric Bypass only	Dumping	+++	+++	++	++	+	+
		Ulcer		+	++	++	+	+
		Gastro-gastric fistula				+	+	+
Endoscopic Approach	Adjustable Gastric Band	Acute Obstruction	++					
		PE	+	+				
		MI	+	+				
		Slip				+	+	+
		Esophageal Dilation				+	+	+
		Band Erosion					+	+
		Port/Tubing Problems			++	++	+	+
		Maladaptive Eating				+	+	+
		Suboptimal Weight Loss				+	+	++

# Complications: Uncommon but Severe

- Death within 3 months of surgery
  - Gastric bypass: 0.7%
  - Band: 0.1%
  - Sleeve Gastrectomy: 0.5%
  - Duodenal switch: 1.1%
- Heart Attack: 1%
- Pulmonary Embolism (Blood Clot): 2-4%
- Leak: 1-4%
  - Gastric bypass: 0% in 2016
  - Sleeve Gastrectomy: 1.19% in 2016
- Not always fatal, but can be severe enough to cause death even when detected and treated

# Complications: Common but Less Severe Adjustable Gastric Band

- Band Erosion 1-2%
- Band Slippage 2-4%
- Port and Tubing Problems 5-10%
- Esophageal Dilation



# What is the most common cause of readmission for patients undergoing laparoscopic sleeve gastrectomy and laparoscopic Roux-en-Y gastric bypass?

staple line or  
anastomotic leak

pulmonary embolism

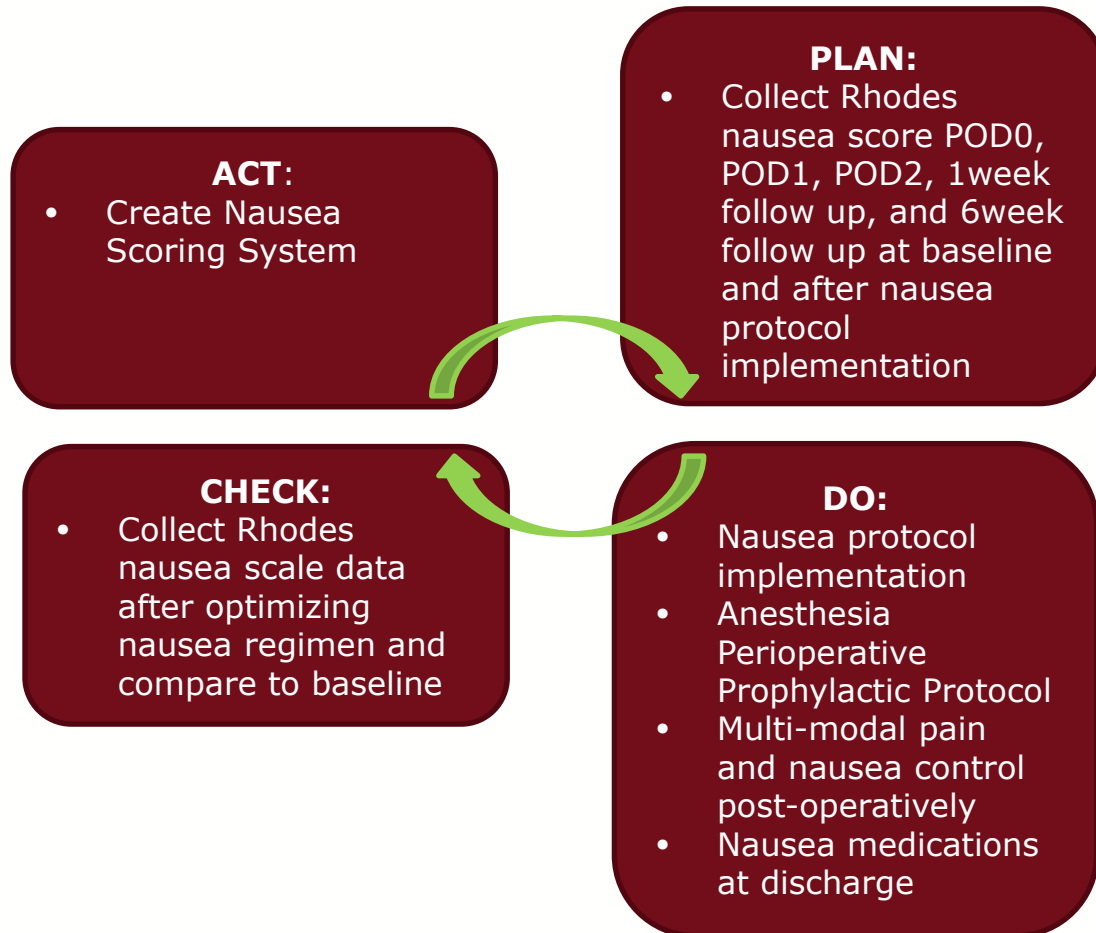
nausea, vomiting, and  
dehydration

gastroesophageal  
reflux disease

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# Nausea, Vomiting, & Dehydration

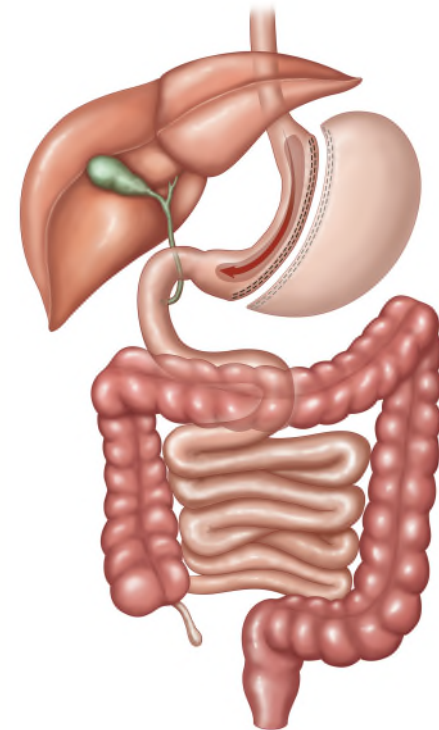
- Up to 7-11% risk of readmission for these complains
- Secondary to:
  - Difficulty with habit changes
  - Inadequate protein intake





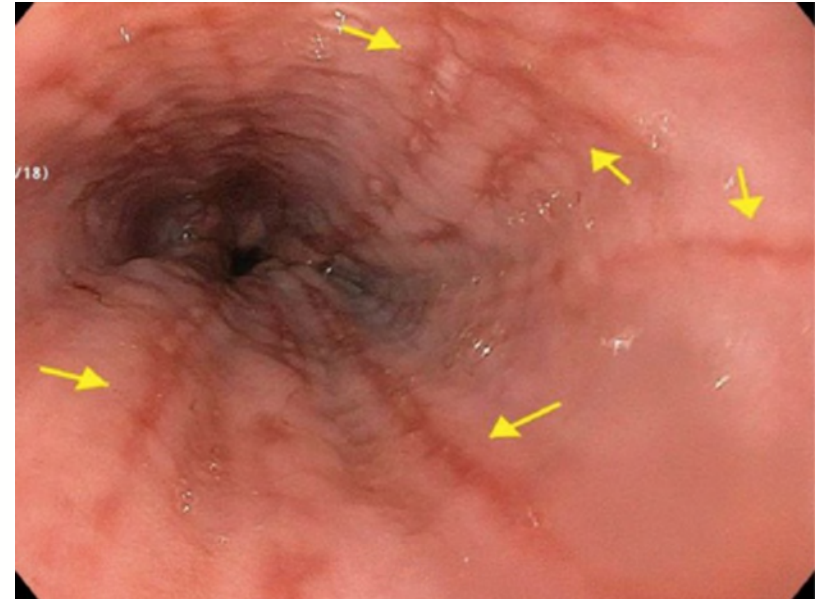
# Complications: Common but Less Severe Sleeve Gastrectomy

- Wound Infection (1%)
- **Nausea & Vomiting**
- Hernia (<5%)
- **Gallstones**
- Stricture
- **Acid Reflux**



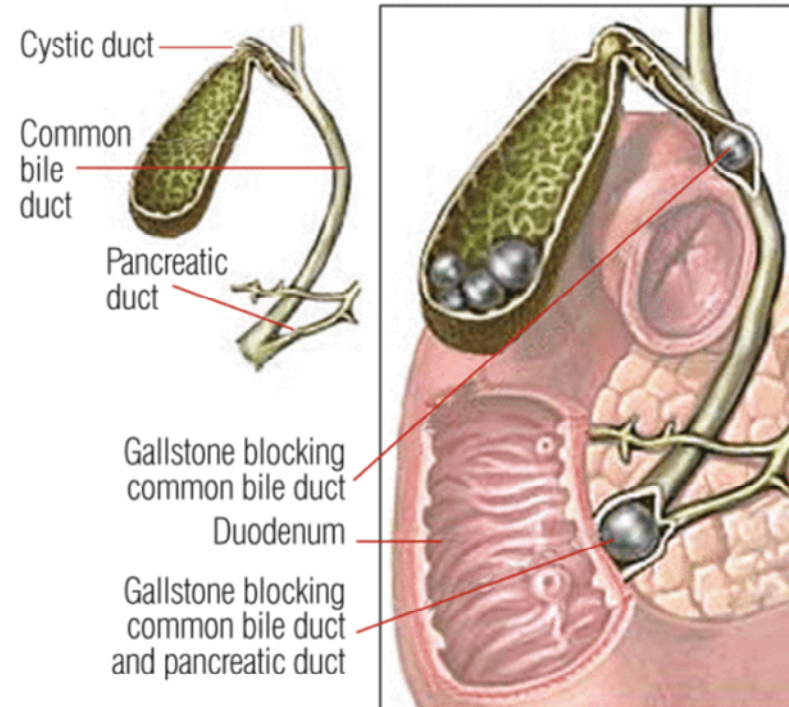
# Gastroesophageal Reflux Disease

- 10-20% risk
- Higher risk in patients with hiatal hernias
- Increased risk of Barrett's esophagus



# Gallstone Formation

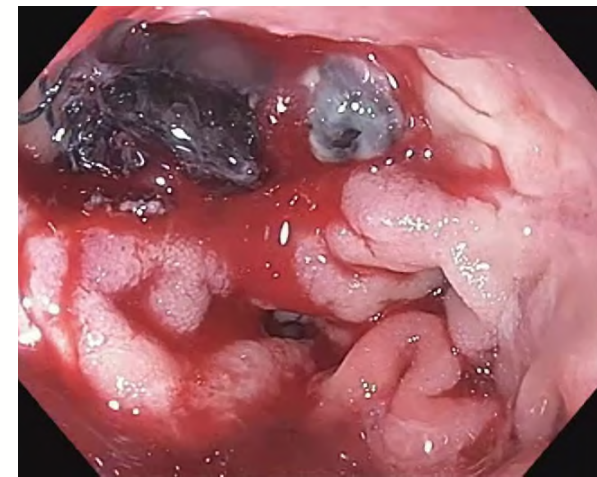
- 35-50% incidence without treatment
- 10% will become symptomatic
- Use Actigall (Ursodiol) 300mg twice a day by mouth for 6 months post-operatively
  - Decreases gallstone formation by 15-30%



# Complications: Common but Less Severe Gastric Bypass

- Wound Infection (1%)
- **Nausea & Vomiting**
- **Dumping Syndrome**
- Hernia (<5%)
- **Gallstones**
- Stomal Stenosis
- **Marginal Ulcers**
- Gastrogastroic Fistula
- **Bowel Obstruction**
- Decreased absorption of medications
  - Anticoagulation
  - Immunosuppression
- Kidney stones
- Oxalosis

# Marginal Ulcer

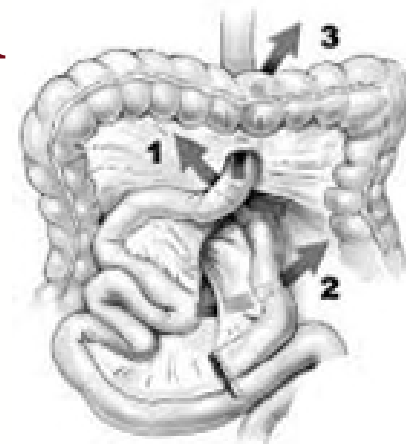


- Incidence 4-15% over many years
- Risk factors = NSAIDs, Tobacco, Steroids
- Rare for duodenal ulcer to occur, but poor access may warrant routine H pylori screening and treatment
- Often responds to acid suppression and sucralfate
- Ischemia and gastro-gastric fistula may play role in refractory ulcers
- Rarely requires reoperation

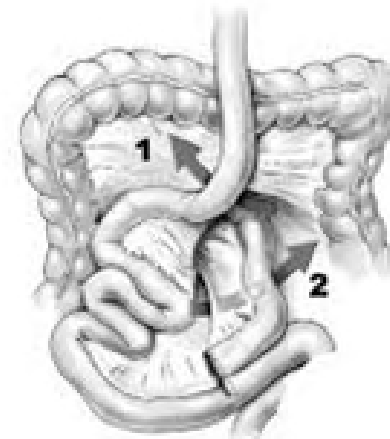


# Small Bowel Obstruction

- Incidence ~1-3%
- Must take care during Roux limb creation not to rotate the bowel
- Close mesenteric defect at jejunojejunostomy and transverse mesocolon
- Roux limb may be placed retrocolic or antecolic
  - Retrocolic = 3 mesenteric defects
  - Antecolic = 2 mesenteric defects



RETROCOLIC



ANTECOLIC

# Dumping Syndrome



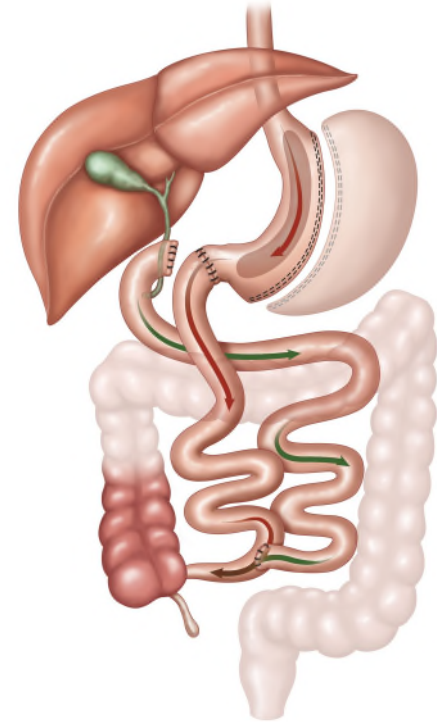
- Early Dumping Syndrome
  - A dense mass of food “dumps” into your small intestine at an earlier stage of digestion
  - Fluid shifts from the bloodstream into the small intestines
  - Symptoms:
    - Bloating
    - Diarrhea 30—60minutes later
    - Lightheadedness
    - Sweating
    - Abdominal cramps
    - Nausea
    - Facial flushing
    - Heart palpitations
- Late Dumping Syndrome
  - Reactive hypoglycemia 1 to 3 hours after a large surge of insulin
- Higher risk with high starch, high sugar, and high carbohydrate foods

# Stomal stenosis

- Incidence 3-10%
- Stereotypical time course, occurs 4-8 weeks post-operatively
- Generally well treated with single endoscopic balloon dilation using 15 mmHg

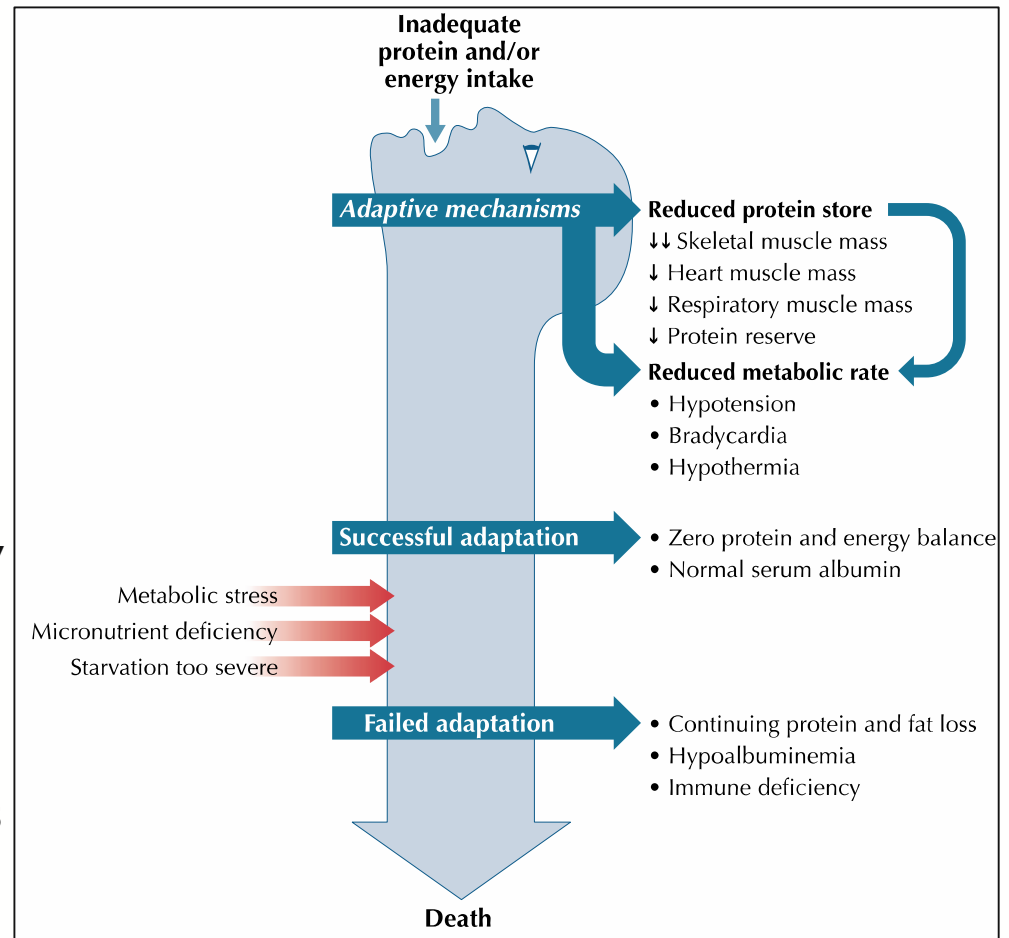
# Complications: Common but Less Severe Duodenal Switch

- Wound Infection (1%)
- Nausea & Vomiting
- Hernia (<5%)
- Stomal Stenosis
- Bleeding
- **Dumping Syndrome**
- **Diarrhea**
- **Vitamin Deficiencies**
- **Malnutrition**



# Protein Energy Malnutrition

- Primary PEM: insufficient dietary intake
- Secondary PEM: impaired utilization of nutrients, increased requirements, increased metabolic losses
- Symptoms
  - Fatigue, thin, brittle hair, fat and muscle wasting
  - Regurgitation of saliva/phlegm, gagging, dysphagia
  - Infection, dental cavities
  - Diarrhea, anemia, edema, ascites



L. John Hoffer CMAJ 2001;165:1345-1349

# Protein Energy Malnutrition

- 1-8% after RYGB (1-2yr)
- 4-19% after BPD/DS (1-2yrs)
- Studies
  - CC lengths RYGB 150-250cm vs 50cm BPD
  - Albumin <3 g/dl (catabolic/starving)
  - 15-30gm protein/day
  - 400cal/day
- Treatment
  - Goal 80-90 grams protein/day
  - Symptomatic treatment (nausea, emesis, abdominal pain)
  - IVF, electrolyte replacement
  - TPN or Tube Feeding

		Anthropometric changes after			Tab
		GB			
		<i>n</i>	<i>Mean</i>	<i>SD</i>	
Initial data	Weight	92	139.1	20	
	BMI	92	51.4	6.	
3 Months	Weight	92	118.2	19	
	BMI	92	43.8	7.	
	%FWI	92	27.0	14	

Llano Nutr Hosp. 2015  
Strohmayer 2010



# Nutritional Deficiencies

- Most common long term complication
- Less common with the adjustable gastric band
- Requires yearly follow up
- Causes
  - Persistence of pre-operative deficiency
  - Inadequate micronutrient and protein intake
  - Poor quality of diet
  - Altered digestion and absorption
  - Non-adherence to vitamin and mineral supplementation
  - Small intestine bacterial overgrowth
  - Alcohol and Substance abuse
  - Eating Disorder

# Micronutrient Deficiency Risk by Surgery

Surgery Type	Vitamins at Risk	Minerals at Risk
<b>Roux-en-Y Gastric Bypass</b>	Vitamin B12 Vitamin D Folate Thiamin	Calcium Iron
<b>Sleeve Gastrectomy</b>	Vitamin B12 Thiamin	Calcium Iron
<b>Duodenal Switch</b>	Vitamin A Vitamin D Vitamin K	Calcium Iron Zinc
<b>Adjustable Gastric Banding</b>	Vitamin B12 Folate Thiamin	

# Post-operative Vitamin Deficiencies

Vitamin	Normal Range	Postoperative Deficiency
Vitamin A	20-80 µg/dL	Common (50%) with BPD/DS after 1 year, up to 70% after 4 years; may occur with RYGB/AGB
B1 (thiamine)	10-64 ng/mL	Rare; occurs with RYGB, AGB, BPD/DS
B6 (pyridoxine)	5-24 ng/mL	Rare
B12 (cyanocobalamin)	200-1,000 pg/mL	Common with RYGB in absence of supplementation
Folate (Folic Acid)	280-791 ng/mL	Uncommon; occurs in the absence of supplementation; critical for childbearing women
Vitamin D	25-40 ng/mL	Common with BPD/DS after 1 year; may occur with RYGB; decreased Vitamin D absorption from proximal small bowel
Vitamin E	5-20 µg/mL	Uncommon
Vitamin K	PT: 10-13 seconds	Common with BPD/DS after 1 year

# Post-operative Mineral Deficiencies

Minerals	Normal Range	Postoperative Deficiency
<b>Calcium</b>	4.8-5.6 mg/dL (ionized calcium)	Serum calcium usually maintained WNL
<b>Iron</b>	15-200 ng/mL (males) 12-150 ng/mL (females)	20-49% of patients; common w/ RYGBP for menstruating women or super obese patients
<b>Zinc</b>	60-130 µg/dL	Common w/ BPD/DS post 1 year; may occur with RYGBP
<b>Copper</b>	Copper: 70 - 145 µg/dL Ceruloplasmin: 27 - 37 mg/dL	Uncommon
<b>Selenium</b>	70-150 ng/mL	Uncommon

# QUESTIONS?

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