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HEALTH

YOUR HEALTH. OUR PASSION.

ABOUT

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OBESITY MEDICINE

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BACKGROUND

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Patrick Stevens, DO

Hugh Chatham
Family Medicine-Jonesville

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THE WHY

There comes a point where we need to stop just pulling people out of the river. We need to go upstream and find out why they're falling in.

–Bishop Desmond Tutu

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THE WHY

- Type 2 Diabetes Mellitus (T2DM) and Metabolic Dysfunction
- Atherosclerotic Cardiovascular Disease (ASCVD
- Neurodegenerative Disease[1,2]
- Cancer (breast, endometrial, ovarian, prostate, thyroid, colorectal, esophageal, gall bladder, hepatic, pancreatic, gastric, renal, meningioma, multiple myeloma) [3,4,5]

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THE WHY

- Insulin Resistance
- Metabolic Syndrome
- Hypertension
- Dyslipidemia
- Metabolic-associated Fatty Liver Disease (MASLD previously NAFLD)
- Non-alcoholic Steatohepatitis (NASH)
- Obstructive Sleep Apnea (OSA)
- Osteoarthritis (OA)
- Depression
- Anxiety
- Polycystic Ovarian Disease (PCOS)
- Menstrual Irregularities
- Infertility
- Atrial Fibrillation
- Gallbladder Disease
- Cellulitis
- Intertrigo

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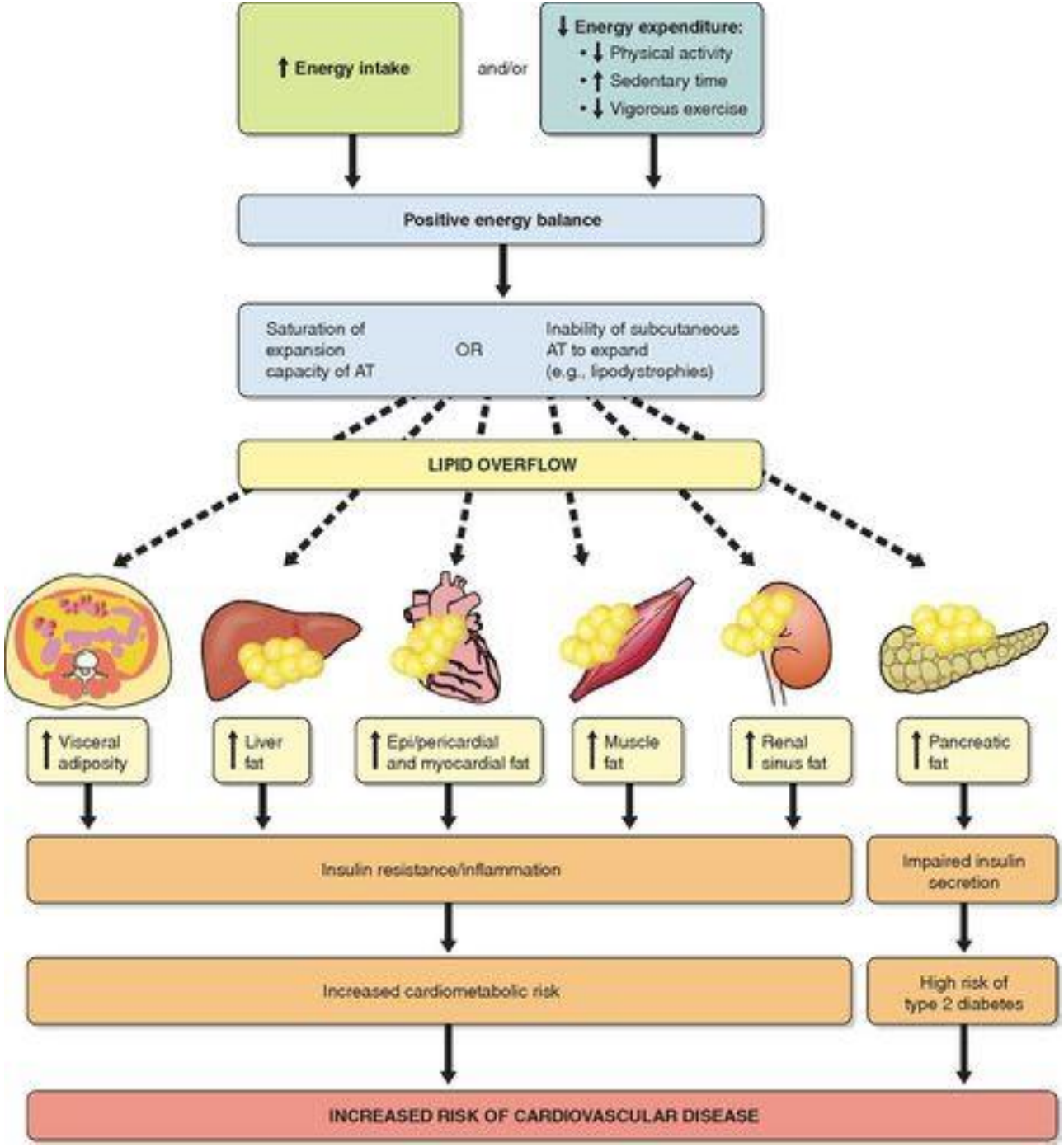

Source: Tchernof and Depres (2013)

MORTALITY

- At BMI of 30-35 kg/m^2, median survival is reduced by 2-4 years
- At BMI of 40-45kg/m^2, median survival is reduced by 8-10 years (comparable to the effects of smoking)
- Obesity & tobacco products, median survival is reduced by 13-14 years compared to normal weight patients who do not use tobacco products.

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THE WHY

- 5-10% decrease in body weight improves:
  - Blood pressure
  - Blood glucose
  - Lipid profile
- Joint pain and functional status in OA
- Weight loss of 10-15% body weight improves
  - Sleep apnea
  - MASLD

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PREVALENCE

- As of the latest data from the National Health and Nutrition Examination Survey (NHANES) covering August 2021 to August 2023, the prevalence of obesity among U.S. adults aged 20 and over was 40.3%[6]
- Men: 39.2%
- Women: 41.3%
- Although previously rates were increasing during this time rates were determined to be stable likely due to adoption of novel methods of treatment

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PREVALENCE

- Regarding severe obesity (defined as a Body Mass Index [BMI] of 40 or higher), the overall prevalence was 9.4% during the same period.
- Men: 6.7%
- Women: 12.1%
- The prevalence of severe obesity has shown a significant increase, rising from 7.7% in 2013–2014.

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DEFINITION

Obesity is defined as a *chronic*, *relapsing*, *multi-factorial*, *neurobehavioral* disease, wherein an increase in body fat promotes adipose tissue dysfunction and abnormal fat mass physical forces, resulting in adverse metabolic, biomechanical, and psychosocial health consequences.

-Obesity Medical Association (OMA)

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OBESITY AS A DISEASE

- Obesity is not caused by insufficient willpower, lack of discipline and/or bad choices.
- The outlook on this transformed after 2013 when the American Medical Association (AMA) labeled it as a disease.
- Patients have impaired metabolic pathways along with disordered signaling for hunger, satiety and fullness.
- There is not just one cause or type of obesity.

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IMPACTS OF STIGMA

- Weight-based stigma has negative consequences
- Those who experienced weight-based stigma are more likely to
  - Avoid physical activity
  - Engage in unhealthy diets
  - Have sedentary behavior
- Fear of prejudice and internalized weight bias make patients with obesity less likely to seek/receive treatment for obesity and other conditions

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TERMINOLOGY

- Use people-first language
  - Patient with obesity
  - Not obese patient
- Focus on health not weight alone
- Use weight-friendly language
  - Overweight, unhealthy weight instead of fat, obese
  - Eating habits instead of diet
  - Physical activity instead of exercise

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ECONOMIC IMPACT

- Obesity-related medical expenses are substantial, with estimates ranging from $147 billion to nearly $210 billion per year.[7]
- Individuals with obesity incur significantly higher medical costs than individuals without obesity, both overall and for most major categories of health expenditures.
- Because obesity is associated with several co-morbid diseases and conditions that require treatment, the rising rates of obesity have resulted in significant increases in direct medical spending for individuals with obesity.
- Other individual costs are also associated with obesity, including lost wages, short-term and long-term disability and insurance claims, and higher work-related costs such as presenteeism and absenteeism.[1]

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PATHOPHYSIOLOGY

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REGULATION OF APPETITE

- Outside the brain
  - Stomach: ghrelin
  - Small intestine: CCK, GLP1, OXM, PYY
  - Large intestine: GLP1, OXM, PYY
  - Pancreas: pancreatic polypeptide, insulin, amylin
  - Adipocytes: leptin, adiponectin

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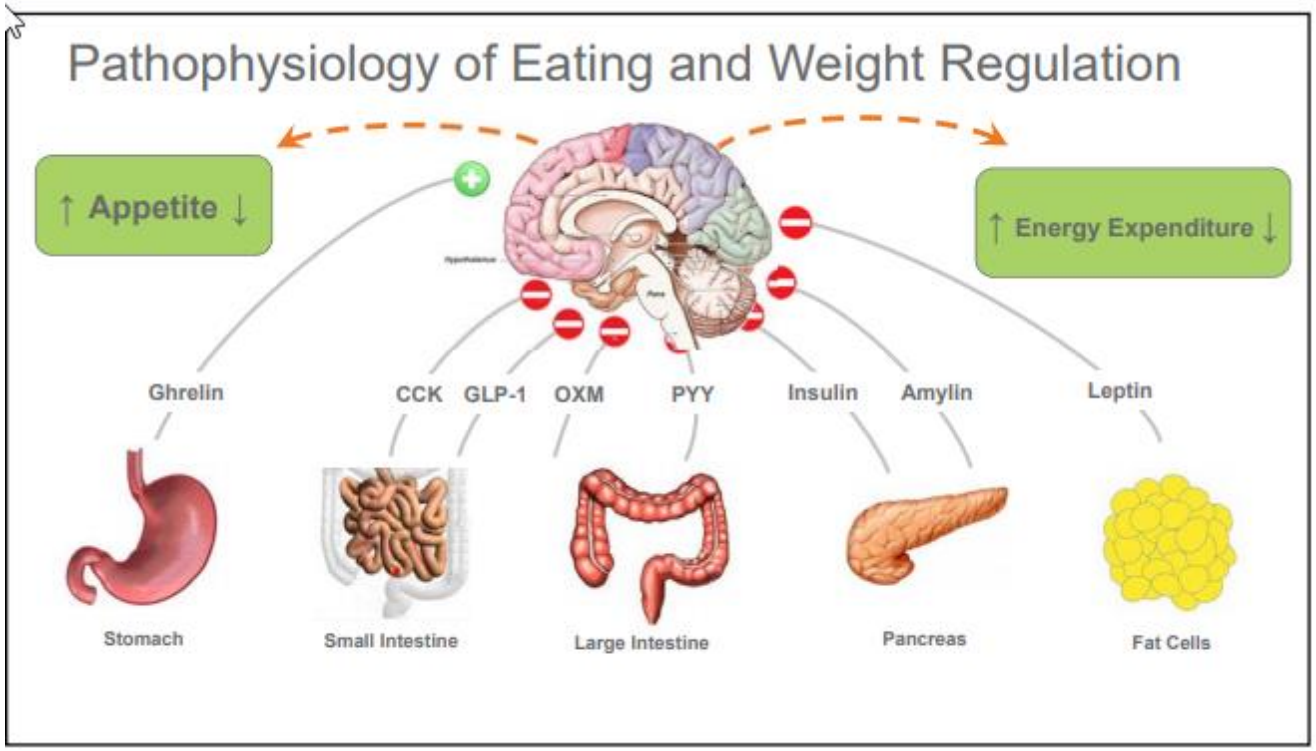
REGULATION OF APPETITE



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STOMACH

- Ghrelin
  - Hunger hormone
  - Secreted by the gastric fundus and body
  - When stomach is empty ghrelin is secreted. Levels surge and peak prior to meals.
  - When stomach is stretched secretion is inhibited, levels drop after meal and nutrient ingestion (less of a drop in patients with obesity)
  - Stimulates NPY/AgRP in CNS
  - Vagotomy inhibits ghrelin
  - Significant decrease with a sleeve gastrectomy

SMALL & LARGE INTESTINE

- CCK
  - I cells of proximal small bowel
  - Secreted in response to fat and protein ingestion
  - Short acting
  - Slows gastric emptying and reduces appetite
- Glucagon-like Peptide-1 (GLP-1)
  - L cells of distal small bowel and colon
  - Secreted in response to carbs
  - Glucose dependent insulin secretion, reduced gluconeogenesis, delayed gastric emptying and reduced appetite
- Oxyntomodulin (OXM)
  - L cells of distal small bowel
  - Co-secreted with GLP-1
  - Decreased appetite/feeding
  - Less gastrointestinal symptoms than GLP-1 when given exogenously
- Peptide YY
  - L cells distal small bowel, colon, rectum
  - Elevated within 1 hour post feeding.
  - Binds to the Y2 receptor
  - Potent appetite suppression

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PANCREAS

- Pancreatic polypeptide
  - F cells in response to caloric load
  - Binds to Y4 receptor in gut decreasing gastric emptying. Y4 is also present in hypothalamus inhibiting NPY and reducing hunger
- Insulin
  - B cells
  - In the hypothalamus it inhibits AgRP/NPY neurons and centrally deactivates the feeding response
- Amylin
  - B cells
  - Reduces food intake, slows gastric emptying, suppresses glucagon production
  - Similar effect to GLP1

ADIPOCYTES

- Leptin
  - Secreted by white adipose tissue
  - Promotes weight loss, fullness, satiety
  - Levels decline with weight loss
  - Stimulates POMC pathway and inhibits NPY/AgRP
- Adiponectin
  - Made in white adipose tissue
  - Improves insulin sensitivity.
  - Enhances insulin sensitivity in the liver, stimulates glucose use in the muscle, works in vascular endothelium to increase Nitric Oxide (NO) which reduces inflammation

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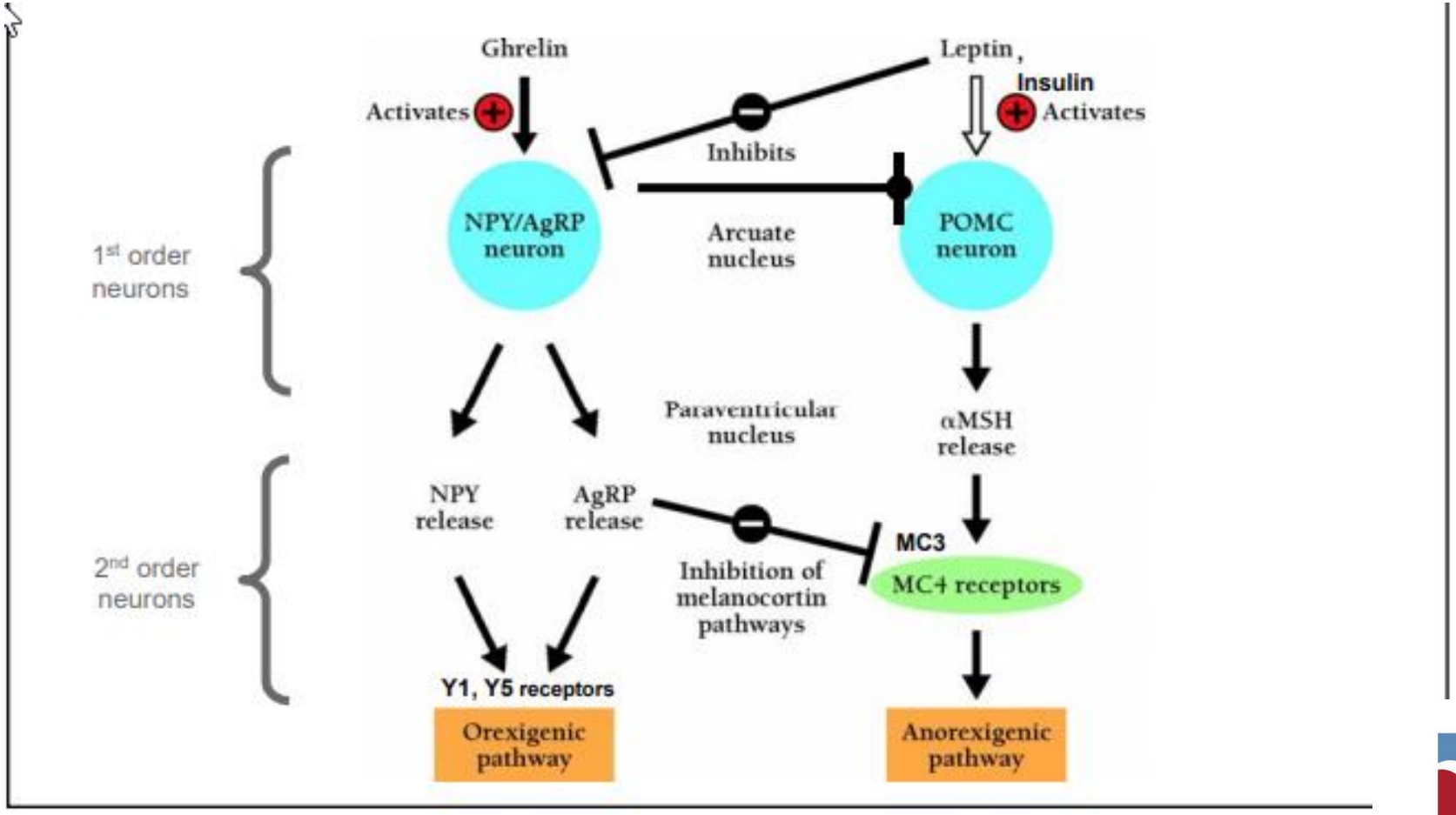
REGULATION OF APPETITE

- Inside the brain
  - Arcuate nucleus is part of the hypothalamus near the base and located near the blood brain barrier so it can take in peripheral circulating signals and relay them to the Central Nervous System (CNS)
    - First order neurons are in the arcuate nucleus
    - Second order neurons are deeper in hypothalamus

REGULATION OF APPETITE



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FIRST ORDER NEURONS

- Two neuron systems
  - Weight gaining (NPY/AgRP)
  - Weight losing (POMC/CART)
- Receives the peripheral signals and activates either of the 1st order neuron systems

FIRST ORDER NEURONS

- Neuropeptide Y (NPY)/ Agouti-related peptide (AgRP)
- Activated by ghrelin
- Inhibited by leptin
- When neuron activated, releases NPY/AgRP that proceed to second order neurons

- Proopiomelanocortin (POMC)/ Cocaine and amphetamine-regulated transcript (CART)
- Activated by leptin and insulin
- Inhibited by NPY/AgRP neurons
- Causes alpha-MSH release that proceed to second order neurons

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SECOND ORDER NEURONS

- Y1 and Y5 receptors
- Activated by NPY and AgRP
- AgRP also inhibits MC4 pathway
- Y1 causes MCH release→ sensory processing, anxiety, aggression, feeding, pleasure, reward, learning
- Y2 causes Orexin A&B release→ increased arousal, hunt for food

- MC3 & MC4 receptors
- Activated by alpha-MSH
- Causes decreased appetite, increased energy expenditure

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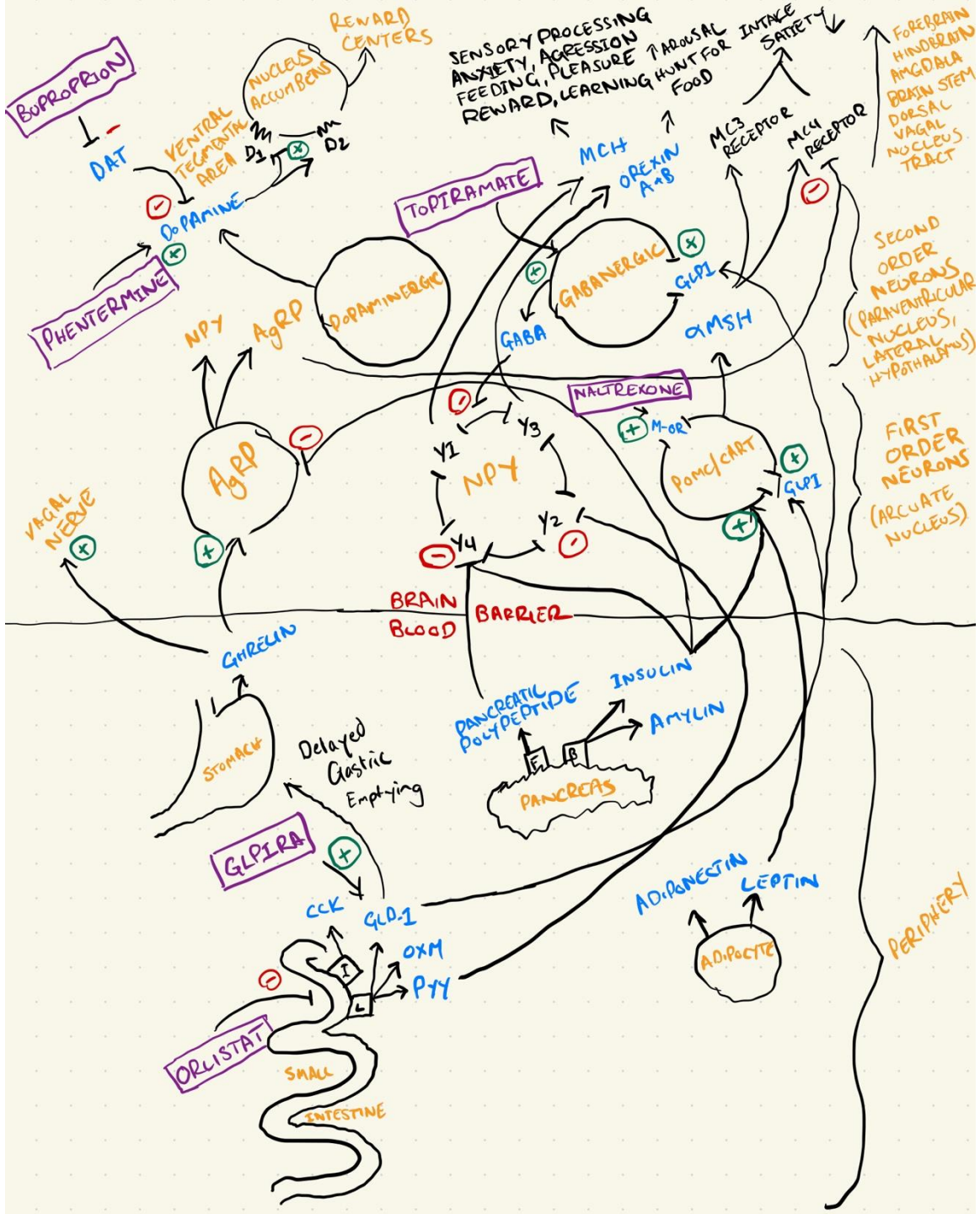

EVALUATION

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PURPOSE

- Overnourished vs undernourished
- Adequately muscled vs inadequately muscled
- Risk stratification
  - Cardiovascular
  - Metabolic
  - Eating Disorders
- Active disease processes
- Assessment for comorbidities
- Current therapies which contribute to weight gain or difficulty with weight loss.

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MEDICATION-ASSOCIATED WEIGHT GAIN

COMMON CLASSES	ASSOCIATED WITH WEIGHT GAIN	ALTERNATIVE(S)
Antidepressants	Tricyclics, mirtazapine, Many SSRIs	Bupropion, Fluoxetine, SNRIs
Anticonvulsants	Gabapentin, carbmazepine, valproate	Topiramate, zonisamide
Antipsychotics	Clozapine, risperdone, olanzapine, quetiapine	Ziprasidone, aripiprazole
Antihyperglycemics	Insulin, Sulfonylureas, TZDs, metaglinides	Metformin, acarbose, GLP-1s, SGLT-2s
Gynecologic medications	Depo-provera, Many estrogen containing contraceptives, Lupron	Paragard, Barrier methods, progesterone only pill, IUD, or implant
Antihypertensives	Beta-blockers, alpha-blockers	ACEi, ARB, CCB
Antihistamines	Diphenhydramine, Cetirizine, Cyproheptadine	Loratadine, Fexofenadine

*Not an exhaustive list of medications associated with weight gain

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BIOMETRICS

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BODY MASS INDEX (BMI)

- Normal weight 18.5-24.9
- Overweight 25.0-29.9
- Class 1 obesity 30.0-34.9
- Class 2 obesity 35.0-39.9
- Class 3 obesity >40.0

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PEDIATRIC BMI

- Normal weight <85th percentile
- Overweight 85th to <95th percentile
- Obesity ≥95th percentile
- Severe Obesity ≥99th percentile

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ETHNIC CRITERIA

- International Diabetes Federation (IDF)
  - China – overweight >23-24, obesity >27-29
  - Japan – overweight >24, obesity >29
  - India – overweight >23, obesity >27
  - Singapore – overweight>22, obesity >27
  - Ethnic south and central Americans similar to South Asians

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WAIST CIRCUMFERENCE

- Men
  - ≥40in
  - South Asian, Chinese, Japanese ≥90cm=35.4in
  - European ≥94 cm=37in
- Women
  - ≥35in
  - S. Asian, Chinese, Japanese ≥80cm=31.5in
  - European ≥80cm=31.5in

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BODY COMPOSITION

Method	Accuracy	Measures Bone?	Notes
DEXA Scan	Highest	Yes	Gold Standard
Bioelectrical Impedance (BIA)	Moderate	No	Inexpensive, but affected by hydration
Skinfold Calipers	Moderate-low	No	User skill-dependant
Bod Pod (Air Displacement)	High	No	Accurate, but less accessible
Hydrostatic Weighing	High	No	Was the previous gold standard

- Dual-Energy X-Ray Absorptiometry (DEXA Scan) considered the gold standard for body composition analysis in clinical and research settings
- Highly precise
- Low radiation exposure (about as much as background radiation in a typical flight)
- Costs $99-$250 depending upon location

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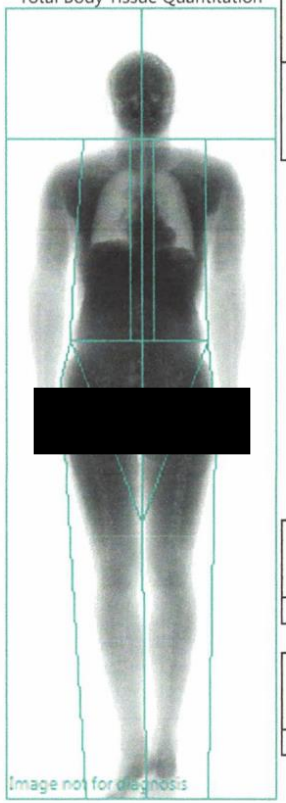
DEXASCAN REPORT

- Fat mass including android/gynoid distribution
- Lean body mass
- Bone mineral content including applicable z-score and t-score

Patient:	[redacted]			**Referring Physi**	[redacted]
Birth Date:		**Age:**	40.9 years	**Patient ID:**	
Height:	70.0 in.	**Weight:**	180.0 lbs.	**Measured:**	02/27/2025 8:51:13 AM (16 [SP 2])
Sex:	Male	**Ethnicity:**	White	**Analyzed:**	02/27/2025 8:51:17 AM (16 [SP 2])

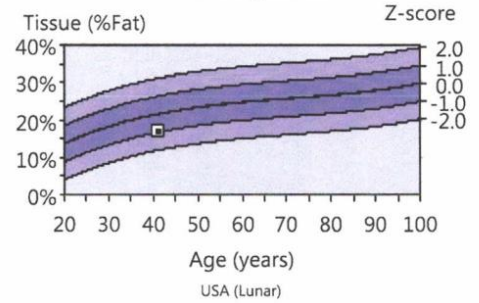
Total Body Tissue Quantitation



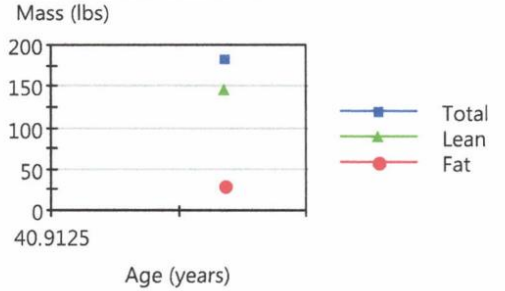
Composition (Enhanced Analysis)

Region	Tissue (%Fat)	Z-score	Total Mass (lbs)	Fat (lbs)	Lean (lbs)	BMC (lbs)
Legs	14.7	-	56.3	7.9	45.7	2.7
Trunk	18.2	-	91.5	16.2	72.7	2.5
Total	17.0	-0.9	182.5	29.7	145.0	7.8

Total Body: Total



Composition Trend: Total



USA (Combined NHANES/Lunar) Trend: Total (Enhanced Analysis)

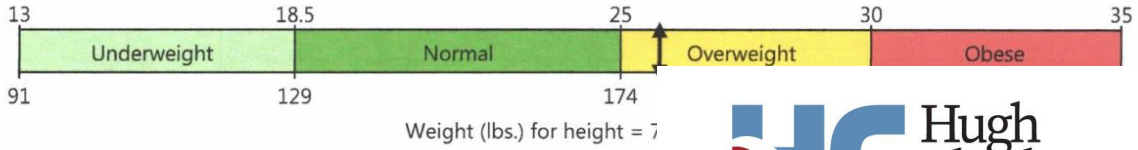
Measured Date	Age (years)	Tissue (%Fat)	Z-score	Total Mass (lbs)	Tissue (lbs)	Fat (lbs)	Lean (lbs)	BMC (lbs)	Fat Free (lbs)
02/27/2025	40.9	17.0	-0.9	182.5	174.7	29.7	145.0	7.8	152.9

USA (Combined NHANES/Lunar) Trend: Fat Distribution (Enhanced Analysis)

Measured Date	Age (years)	Android (%Fat)	Gynoid (%Fat)	A/G Ratio	Total (%Fat)
02/27/2025	40.9	17.7	18.4	0.96	17.0

World Health Organization BMI Classification

BMI = 25.8 (kg/m²)



COMMENTS:

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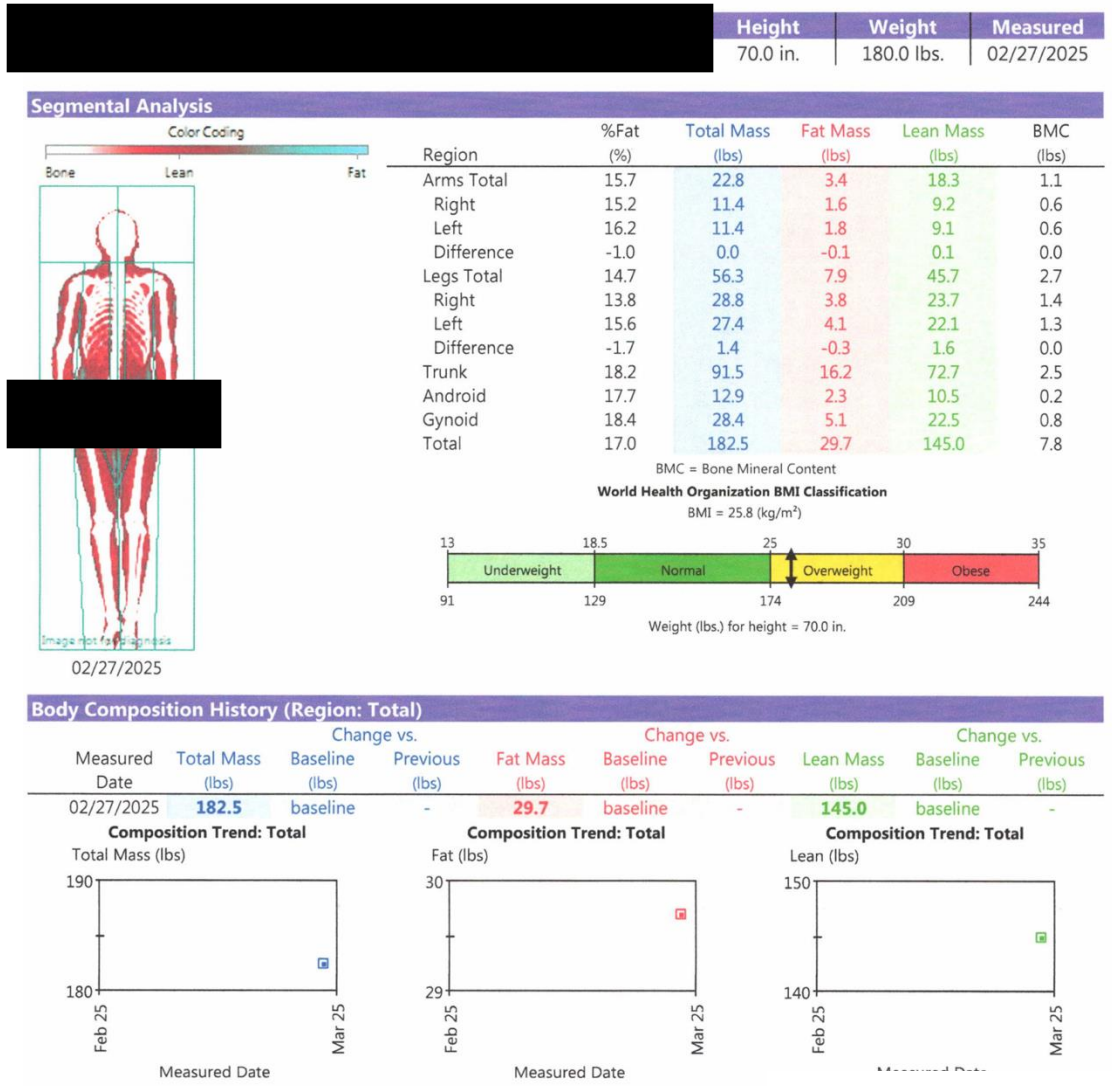
DEXASCAN REPORT

- Regional distribution of fat mass and lean mass
- Great for tracking progress over time in response to nutrition, training, or medical conditions.



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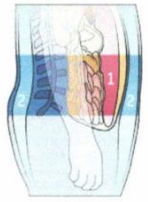
DEXASCAN REPORT

- Can detect regional fat distribution such as visceral vs subcutaneous not just total body fat

Client	Sex	Ethnicity	Birth Date	Height	Weight	Measured
[redacted]				70.0 in.	180.0 lbs.	02/27/2025

Abdomen Composition

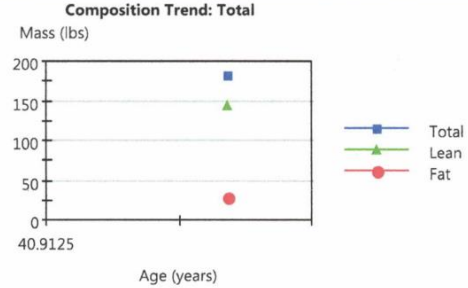


Adipose Tissue
1 Visceral
2 Subcutaneous

The Android region is that of the abdomen, and often the body type with increased fat in this area is described as "apple shaped." The Gynoid region is that around the hips and thighs and often the body type with increased fat in this area is described as "pear shaped." Understanding where fat is stored on the body is recognized as an important predictor of the potential health risks of obesity.

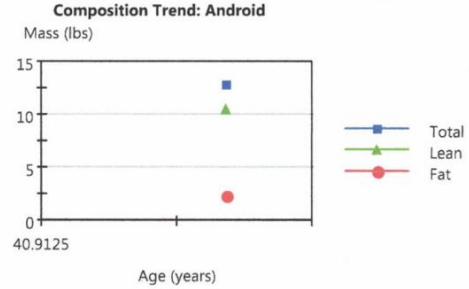
CoreScan estimates the VAT (Visceral Adipose Tissue) content within the android region, VAT is a specific type of fat that is associated with several types of metabolic diseases such as obesity, metabolic syndrome, and type 2 diabetes. CoreScan results have been validated for adults between ages 18-90, and with a BMI in the range of 18.5-40.

Total



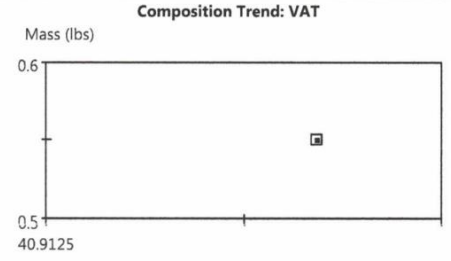
Date	Age	Total Mass (lbs)	Lean Mass (lbs)	Fat Mass (lbs)
02/27/2025	40.9	182.5	145.0	29.7

Android / Gynoid



Date	Age	Android Mass (lbs)	Android Lean (lbs)	Android Fat (lbs)	Android %Fat	Gynoid %Fat	A/G Ratio
02/27/2025	40.9	12.9	10.5	2.3	17.7	18.4	0.96

Visceral Adipose Tissue (VAT)



Date	Age	Fat Mass (lbs
02/27/2025	40.9	0.55

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BIOMARKERS

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EVALUATION

- ≥ 10 and obese
- ≥ 10 and overweight with positive family history of comorbidities
- ≥ 2 and severely obese -> genetics
- Fasting for 8-10 hours before
- Repeat biomarkers every 2 years if no abnormalities
- Repeat biomarkers every year if abnormal

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ORDERS

- Complete Blood Count (CBC) with Differential
- Lipid panel with calculated LDL
- Lipoprotein (a) (if not previously screened)
- Thyroid stimulating hormone (TSH)
- Complete metabolic panel (CMP) with glucose
- Fasting insulin level
- Hemoglobin A1c
- High-sensitivity C-reactive protein (hs-CRP)
- Fasting morning cortisol
- If considering Metformin: B-12 level
- For females evaluating for PCOS: add Free and Total Testosterone, DHEA-S, LH/FSH ratio (In PCOS usually 2:1),17-hydroxyprogesterone, prolactin ± Ovarian Ultrasound

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CARDIOVASCULAR SCREENING

- Risk factors for Cardiovascular Disease (CVD)
  - Modifiable
    - Tobacco use
    - High blood pressure
    - High bad cholesterol (LDL)
    - Low good cholesterol (HDL)
    - Lipoprotein (a)
    - Diabetes mellitus
    - High body fat or body weight
    - Physical Inactivity
    - Mental stress & depression
  - Non-modifiable
    - Age (>45 in men, >55in women)
    - Family history of early heart disease (<55 for father, <65 for mother)
    - Ethnicity (CVD death rate higher in African-Americans and South Asians, HDL lower in Asians)

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DYSLIPIDEMIA SCREENING

- Screening for genetic dyslipidemia[8]
  - Non-fasting Total Cholesterol and HDL
  - Abnormal if non-HDL cholesterol >145
    - Ages 9-11 once
    - Ages 17-21 once
- Screening for Lipoprotein(a)[9]
  - Non-fasting
  - Abnormal if > 30 mg/dL
    - Ages 18+ once

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METABOLIC SYNDROME SCREENING

- 3 out of 5 of the following:
  - Abdominal obesity (waist circumference in men =102 cm (40 in) and in women =88 cm (35 in)
  - Serum triglycerides =150 mg/dL (1.7 mmol/L) or treatment for elevated triglycerides
  - Serum high-density lipoprotein (HDL) cholesterol <40 mg/dL (1 mmol/L) in men and <50 mg/dL (1.3 mmol/L) in women or treatment for low HDL cholesterol
  - Blood pressure >=130/85 mmHg or treatment for elevated blood pressure
  - Fasting plasma glucose (FPG) > or =100 mg/dL (5.6 mmol/L) or treatment for elevated blood glucose

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POLYCYSTIC OVARIAN SYNDROME (PCOS) SCREENING

- Rotterdam Criteria (2003): **2 out of the following 3 criteria** must be met after ruling out other causes (e.g., thyroid dysfunction, hyperprolactinemia, Congenital Adrenal Hypeplasia, etc)
- Oligo or Anovulation
  - Infrequent or absent ovulation
  - Irregular menstrual cycles (e.g., cycles >35 days or <8 cycles/year)
  - Clinical and/or lab-confirmed Hyperandrogenism
  - Clinical signs: hirsutism, acne, androgenic alopecia
  - Biochemical evidence: elevated serum androgens (e.g., total or free testosterone, DHEA-S)
- Polycystic Ovarian Morphology on Ultrasound
  - ≥12 follicles in either ovary (2–9 mm in size) OR
  - Ovarian volume >10 mL
- Of note, in adolescents and perimenopausal women, diagnosis is more nuanced because ultrasound is less reliable. Emphasis is placed on clinical features and hormone labs.

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POLYCYSTIC OVARIAN SYNDROME (PCOS) SCREENING

- Important Exclusions Before Diagnosing PCOS:
  - Thyroid disorders (TSH)
  - Hyperprolactinemia (Prolactin)
  - Congenital adrenal hyperplasia (17-hydroxyprogesterone)
  - Androgen-secreting tumors (Markedly elevated androgens defined as rapid onset of androgenic characteristics, total testosterone >200 ng/dL, DHEA-S >700 µg/dL)
    - Pelvic ultrasound (to look for ovarian tumors)
    - Adrenal CT or MRI (if DHEA-S is high or adrenal mass suspected)

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INSULIN RESISTANCE SCREENING

- Normal: HOMA-IR < 1.0 (indicates normal insulin sensitivity)
- Insulin Resistance: HOMA-IR ≥ 1.0 (indicates varying degrees of insulin resistance, with higher values suggesting more severe resistance)
- Cutoff for metabolic syndrome: Some guidelines suggest a threshold of ≥ 2.5 to 3.0 as an indicator of significant insulin resistance, though this can vary depending on population and study.

$$\text{HOMA-IR} = \frac{\text{Fasting Insulin}(\mu U/mL) \times \text{Fasting Glucose}(mg/dL)}{405}$$

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TREATMENT

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MONITORING

- Several issues can arise during weight loss.
- During the initial appointment patients risk for these should be determined.
- During each follow-up there should be ongoing monitoring for:
  - Lean Muscle Loss/Sarcopenia
  - Gall stones/biliary colic
  - Fatigue
  - Mood changes

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SARCOPENIA

European Working Group on Sarcopenia in Older People EWGSOP (2019) Diagnostic Criteria

- Probable Sarcopenia
  - Low muscle strength (most reliable measure for initial suspicion)
    - Handgrip strength (<27 kg (men), <16 kg (women))
    - Chair stand test (≥15 seconds to complete 5 rises from a chair without using arms)
- Confirmed Sarcopenia
  - Low muscle strength AND
  - Low muscle quantity or quality
    - DXA (Dual-energy X-ray absorptiometry) <7.0 kg/m² (men), <5.5 kg/m² (women)
    - BIA (Bioelectrical impedance analysis)
- Severe Sarcopenia
  - All the above AND
  - Low physical performance
    - Gait speed (≤0.8 m/s)
      - Short Physical Performance Battery (SPPB)
      - Timed Up and Go (TUG) test
      - 400-meter walk test

***Patients >65 tend to be at increased risk of poor outcomes at lower to mid-range BMIs. I suggest a **modified target BMI in this population of 22-27** for overall better outcomes and lower mortality.

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LIFESTYLE

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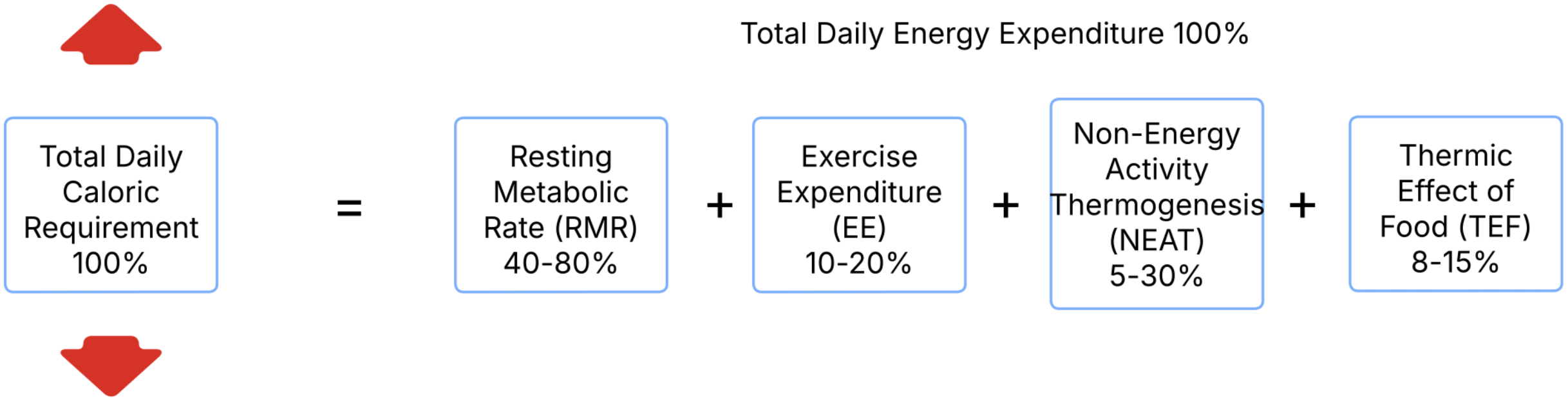
ENERGY BALANCE



PHYSICAL ACTIVITY

- Exercise Expenditure (EE) + Non-Energy Activity Thermogenesis (NEAT)
- Exercise is a planned activity
- Undervalued as means for weight loss and improved metabolic health
- Patient should be screened for appropriateness for exercise and sent for clearance if necessary
- Four main areas of focus:
  - Strength Training
    - Resistance
    - Concentric vs Eccentric (contributes to stability)
  - Aerobic Endurance
    - Zone 2 training (60-70% max heart rate) – should be 70-80% of aerobic physical activity.
  - Aerobic Intensity
    - High Intensity Interval Training (HIIT)
    - VO2 max
  - Stability
    - Core: Tai-chi, yoga, pilates

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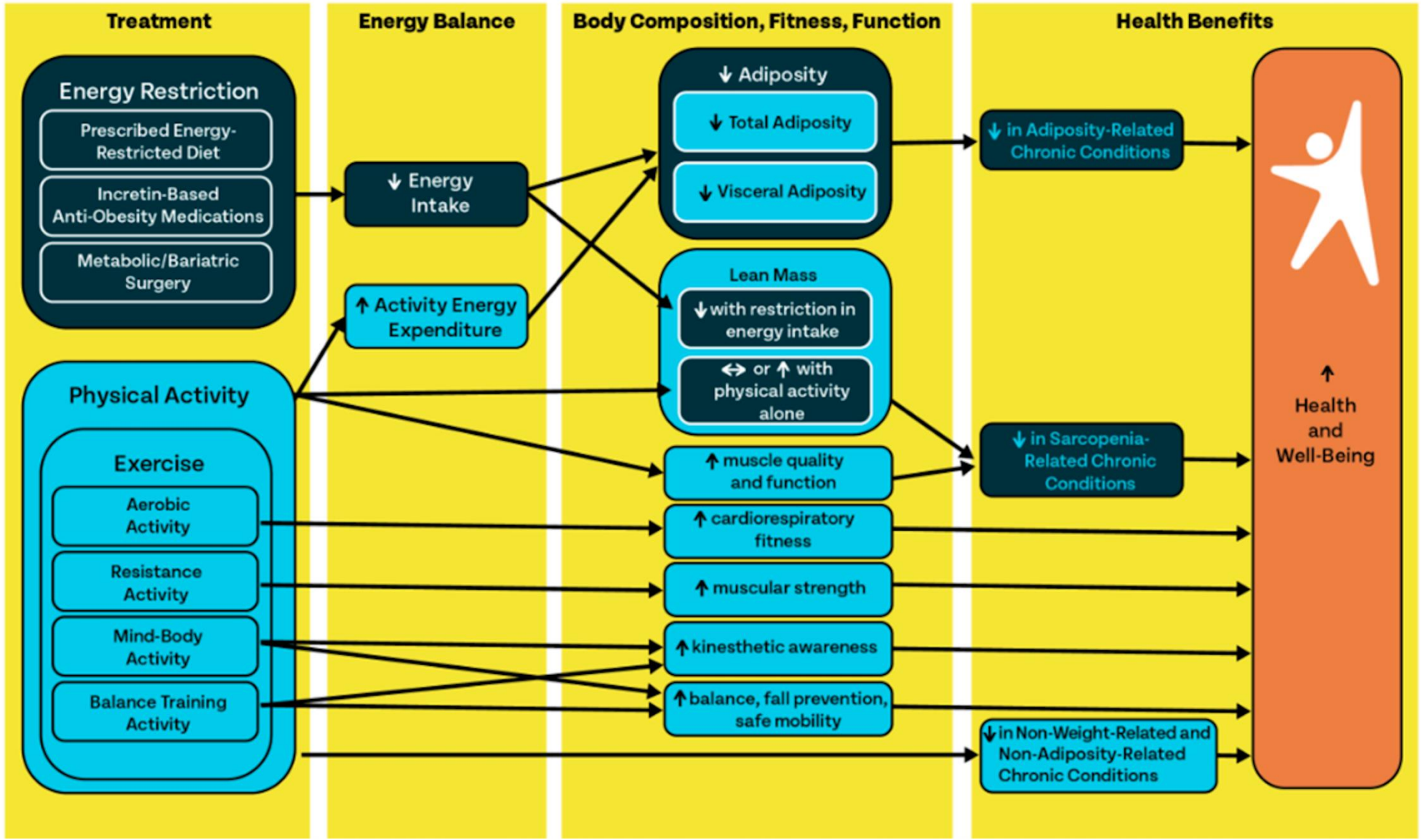

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PHYSICAL ACTIVITY

Maximum Heart Rate (MHR) is defined as 220-age

Zone	% Max HR	Intensity	Benefit	Feel
1	50-60%	Very light (warm-up/recovery)	Improves overall health, fat metabolism	Easy, relaxed
2	60-70%	Light (fat burning zone)	Builds endurance, uses fat for fuel	Conversational
3	70-80%	Moderate (aerobic zone)	Boosts aerobic fitness, heart health	Breathing heavier, still in control
4	80-90%	Hard (threshold zone)	Improves speed, lactate threshold	Talking is hard
5	90-100%	Very Hard (VO2 max zone)	Max performance, sprinting capacity	Breathless, max effort

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PHYSICAL ACTIVITY SCREENING

- ACC/AHA/ACSM Guidelines (2020+ simplified model)
  - Determine Current Physical Activity Level
    - Active: Regular exercise ≥3 days/week, 30 minutes/session for ≥3 months
    - Inactive: Not meeting the above
  - Look for Known Cardiovascular, Metabolic, or Renal Disease
    - Coronary artery disease (CAD)
    - Heart failure
    - Peripheral artery disease (PAD)
    - Diabetes Mellitus (Type 1 or 2)
    - Chronic kidney disease (CKD)
  - Assess for Signs or Symptoms Suggestive of Disease
    - Chest pain/discomfort with exertion
    - Shortness of breath at rest or with mild exertion
    - Dizziness or syncope
    - Ankle edema
    - Palpitations or irregular heartbeat
    - Known heart murmur
    - Unusual fatigue with usual activities

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PHYSICAL ACTIVITY SCREENING

Physical Activity Status	Known Disease?	Symptoms?	Medical Clearance?*	OK to Exercise?
Inactive	No	No	Not needed	Start light-moderate
Inactive	Yes	No	Recommended	After clearance
Inactive	Yes or No	Yes	Required	After clearance
Active	No	No	Not needed	Continue/intensify
Active	Yes	No	Not needed	Moderate OK, vigorous consider clearance
Active	Yes or No	Yes	Required	After clearance

*treadmill stress test and cardiologist evaluation

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NUTRITION

- There are only three changes that can be made to a patient's nutrition:
  - Restrict amount of food (Caloric restriction)
  - Restrict time of feeding (e.g., intermittent fasting)
  - Restrict type of food (e.g., macronutrients, type of food)
- Most conventional "diets" are one or a combination of these three changes
- Some patients may get discouraged or be set up to fail with too much restriction

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NUTRITION

Macronutrient	Kcal/gram	Recommended Daily Allowance (RDA)
Carbohydrates	4	130g
Alcohol	7	N/A
Protein	4	Male:56g, Female:46g
Fat	9	Omega 6: 7-17g, Omega 3: 0.5-1.6g

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PROTEIN

- Protein helps slow muscle loss which happens with weight loss.
- Protein promotes satiety.
- U.S. Recommended Dietary Allowance (RDA) of 0.8 grams per kilogram
- For weight loss 0.5-1 gram(s) per pound is recommended for patients without preexisting kidney disease

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FATS

- There is no specific goal
- There are significant cardiovascular health benefits of mono-unsaturated fatty acids (MUFAs)
- Extra virgin olive oil is a preferred source and is the backbone of the Mediterranean Diet which is endorsed with the American Heart Association (AHA).
- Balanced fat intake is recommended
  - 50–55% from MUFAs
  - 15–20% from saturated fats
  - 25–35% from polyunsaturated fats (PUFAs), including omega-3s (DHA/EPA/ALA)

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CARBOHYDRATES

- In general, it is recommended to limit simple and refined carbohydrates, however, there is no specific goal
- Significant restriction leads to ketosis
- Fiber is a type of insoluble carbohydrate that promotes satiety, improves cholesterol, improves blood glucose and promotes good gut health
- Adequate Intake according to the Dietary Guidelines for Americans:
  - Men (ages 19–50): 38 grams/day
  - Men (51+): 30 grams/day
  - Women (ages 19–50): 25 grams/day
  - Women (51+): 21 grams/day

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CONTINUOUS GLUCOSE MONITORING (CGM)

- We no longer must rely upon dietary recall alone.
- Tests interstitial fluid, not a capillary or venous blood sample.
- Great for monitoring diet and instituting dietary changes.
- Not meant for diagnosis.
- Readings may be up to 10 nmol/dL off and may be delayed by 15 minutes depending upon monitor.
- Goal is an average blood glucose of 95 nmol/dL ± 15

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CGM OPTIONS

- Prescription CGMs:
  - Dexcom G6:
    - Receiver (one-time): Approximately $437.
    - Sensors (monthly): Around $420 for a 30-day supply.
    - Transmitter (quarterly): About $300 every 90 days.
    - Total Estimated Monthly Cost: Approximately $500 without insurance.
  - Dexcom G7:
    - Cost: Varies; Dexcom offers a savings program providing over 50% off the standard monthly cash price.
  - Abbott FreeStyle Libre 2:
    - Reader: Approximately $130 to $150 (one-time).
    - Sensors: Around $130 for a month's supply.
    - Total Estimated Monthly Cost: About $130 without insurance.
  - Abbott FreeStyle Libre 3 Plus:
    - Cost with Insurance: Most commercially insured patients pay between $0 to $75 per month.
- Over-the-Counter (OTC) CGMs:
  - Dexcom Stelo:
    - One-time purchase: $99 for two sensors (30-day supply).
    - Monthly subscription: $89 per month for two sensors.
  - Abbott Lingo:
    - One-time purchase: $49 for a 14-day sensor.
    - Monthly subscription: $89 for two sensors (28-day supply).

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CGM DATA

Glucose

Average glucose
94 mg/dL

GMI
5.6 %

Time in Range

0% Very High
0% High
98% In Range
2% Low
<1% Very Low

Target Range:
70-180 mg/dL

Sensor usage

Days with data
21/90 days

Time active
91%

Avg. calibrations per day
0.0

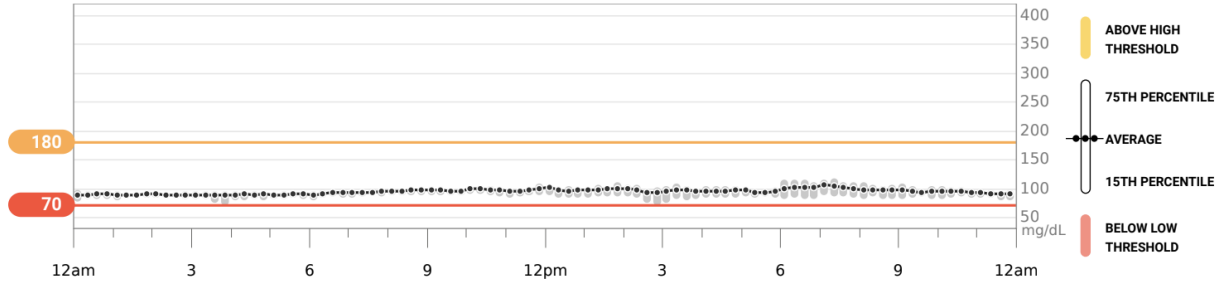
Standard deviation
13 mg/dL

Coefficient of Variation
13.6 %

Top Patterns

Patrick's best glucose day was March 4, 2025
Patrick's glucose data was in the target range about 100% of the day.

This graph shows your data averaged over 90 days



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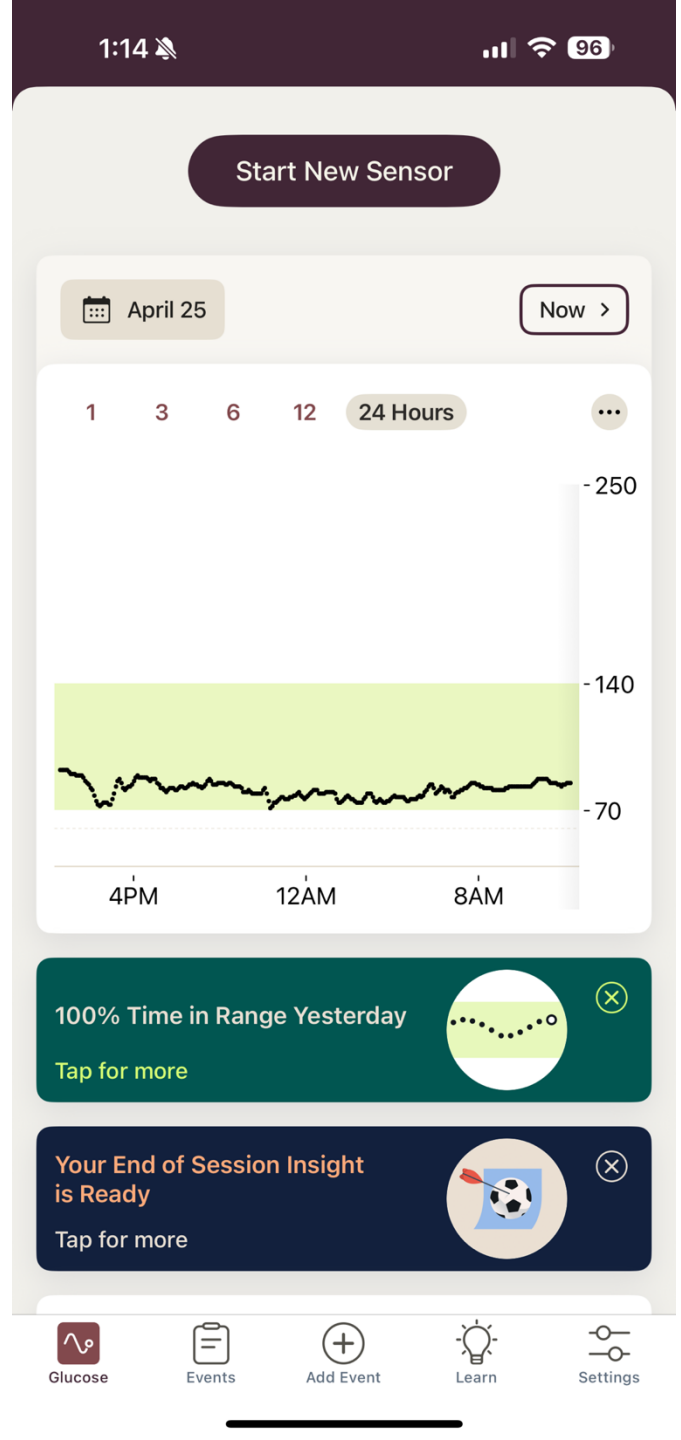

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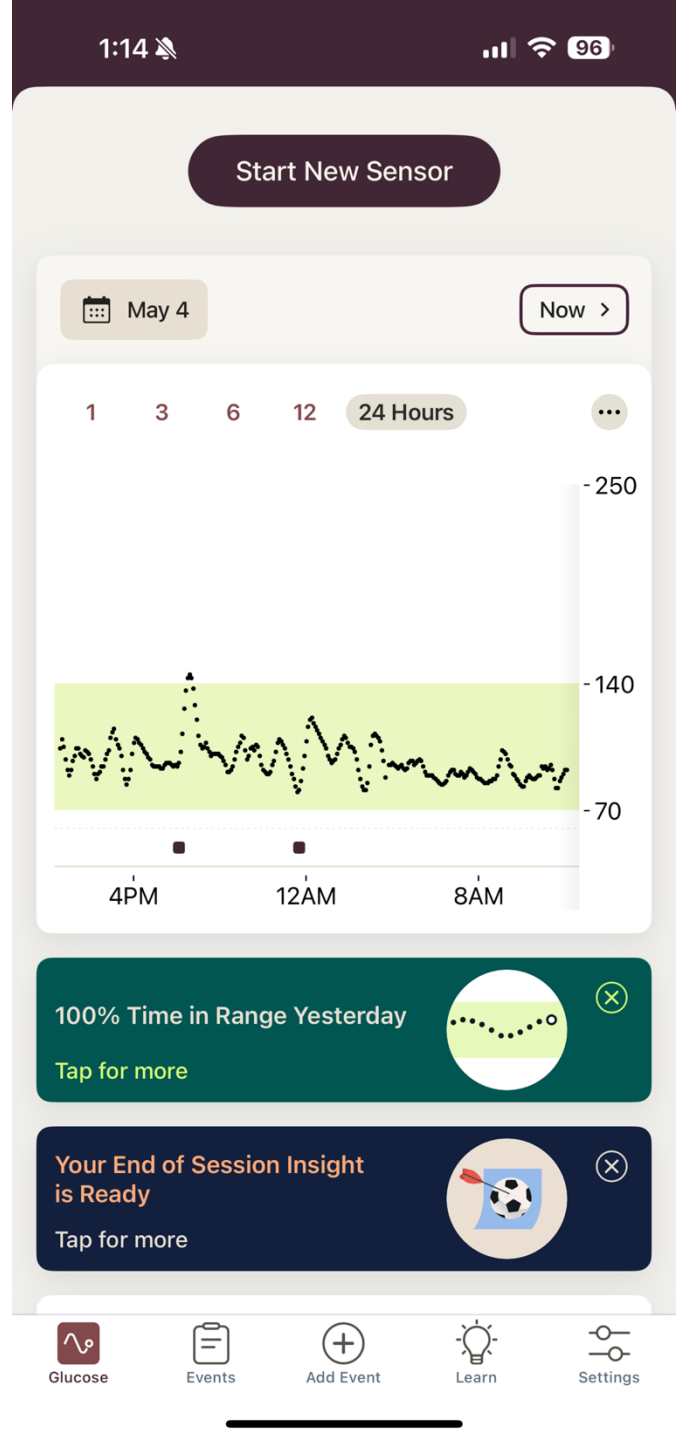

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ALCOHOL

- There is no healthy level of alcohol consumption.

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TIME RESTRICTION

- Intermittent fasting has shown varying levels of success depending upon the outcome being measured (e.g., weight loss, metabolic health, insulin sensitivity)
  - Time-Restricted Eating (TRE)
    - 16:8 is the most well studied
    - Average weight loss is 2-3kg over 12 weeks
    - Modest reduction in insulin resistance
    - No difference in lean muscle mass compared to control
    - 8:6 or 20:4 regimens often show faster weight loss, but may be harder to maintain and risk muscle loss if not combined with resistance training and sufficient protein
    - Early Time-Restricted Eating (eTRE) defined as eating window from 7a-3p did not show significant improvements in weight, but improvements in insulin sensitivity, lower blood glucose and oxidative stress
  - 5:2 Twice-Weekly fasting
    - Comparable weight loss to daily calorie restriction
    - Greater improvement in insulin sensitivity
    - Adherence can be better than daily restriction due to fewer fasting days
  - Alternate Day Fasting (ADF)
    - Comparable weight loss to daily calorie restriction (5–6% of body weight)
    - Improved LDL cholesterol and triglycerides
    - Adherence is often harder due to hunger and fatigue

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TIME RESTRICTION

Method	Weight Loss	Insulin Sensitivity	Adherence	Notable Benefit
16:8	Moderate	Good	Easy	Habit-forming
18:6 or 20:4	Faster	Good	Medium	Fast results
eTRE	Mild	High	Medium	Best metabolically
5:2	Moderate	High	High	Long-term success
ADF	High	High	Low	Rapid weight loss

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CALORIC RESTRICTION

- Sometimes patients fail despite adhering to a balanced nutrition regimen and require more intensive management
- Mifflin-St. Jeor Equation provides daily caloric need as well as daily caloric range for weight loss
- Harris-Benedict Equation is older and provides an estimated Basal Metabolic Rate (BMR)
- Equations are sometimes unreliable
- **Indirect Calorimetry is superior** to get an accurate Resting Metabolic Rate (RMR) but may cost $100-200.

Mifflin-St. Jeor

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SLEEP

- Poor sleep can significantly impair weight loss by affecting hormones, metabolism, appetite, and willpower
  - Hormonal disruption
    - Decreased Leptin (satiety hormone) and increased Ghrelin (hunger hormone)
    - Increased appetite, especially for high-carb, high-fat foods
    - Increased cravings & emotional eating
    - Impulse control drops which leads to overeating
  - Insulin resistance
    - Higher blood glucose and more fat storage, especially visceral fat
    - Even short-term sleep loss (4–5 nights) can increase insulin resistance.
  - Slower metabolism and reduced physical activity
    - Resting energy expenditure decreased
    - The body conserves energy when sleep-deprived.
    - Low energy leads to less motivation to exercise
    - Fatigue also makes workouts less effective or shorter.
- Patients who sleep <6 hours/night lose less fat mass than those who sleep 7–9 hours, even with the same calorie intake.
- Sleep-deprived patients tend to consume 200–500 more calories/day on average.
- Aim for 7–9 hours of quality sleep

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OBSTRUCTIVE SLEEP APNEA (OSA)

- Sleepy: Epworth Sleepiness Scale (EPSS)
- Scoring System (per question):
  - 0 = Would never doze
  - 1 = Slight chance of dozing
  - 2 = Moderate chance of dozing
  - 3 = High chance of dozing
- The 8 Situations:
  - Sitting and reading
  - Watching TV
  - Sitting inactive in a public place (e.g., a theater or meeting)
  - As a passenger in a car for an hour without a break
  - Lying down to rest in the afternoon when circumstances permit
  - Sitting and talking to someone
  - Sitting quietly after a lunch without alcohol
  - In a car, while stopped for a few minutes in traffic
- Interpretation of Total Score:
  - 0–7 = Normal sleepiness
  - 8–9 = Mild sleepiness
  - 10–15 = Moderate sleepiness (Needs further evaluation)
  - 16–24 = Severe sleepiness (strongly suggests a sleep disorder)

- Not Sleepy: STOP-BANG Questionnaire
  - Snoring: Do you snore loudly (louder than talking or loud enough to be heard through closed doors)?
  - Tired: Do you often feel tired, fatigued, or sleepy during the daytime?
  - Observed: Has anyone observed you stop breathing during your sleep?
  - Pressure: Do you have or are you being treated for high blood pressure?
  - BMI: Is your body mass index (BMI) over 35 kg/m^2?
  - Age: Are you over 50 years old?
  - Neck circumference: Is your neck circumference greater than 40 cm (15.75 inches)?
  - Gender: Are you male?
- Scoring:
  - 0–2 points: Low risk of OSA
  - 3–4 points: Intermediate risk
  - 5–8 points: High risk

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MENTAL HEALTH

Mental health can significantly impact weight loss efforts through:

- Mood disorders (e.g., MDD, SAD, etc): decreased motivation, increased emotional eating
- Anxiety and stress: increased cortisol, increased cravings, increased fat storage
- Emotional eating: Using food to cope with sadness, boredom, loneliness
- Negative self-talk: Shame, all-or-nothing thinking, giving up easily
- Executive dysfunction (e.g., ADHD, PTSD, etc): Inconsistent habits, poor planning

Support mental health to support weight loss: therapy, mindfulness, routines, sleep, and self-compassion.

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ANTI-OBESITY MEDICATIONS (AOMs)

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INDICATIONS*

- BMI ≥ 30 kg/m^2
- BMI ≥ 27kg/m^2 plus comorbidities
  - Type 2 Diabetes Mellitus
  - Hypertension
  - Dyslipidemia
  - Cardiovascular disease
    - Coronary Artery Disease
    - History of CVA
    - History of MI
    - Peripheral Artery Disease
  - Obstructive Sleep Apnea
- To be used alongside lifestyle modifications

* With exception of Setmelanotide

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LONG-TERM AOMs

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ORLISTAT (ALLI)

Approval	FDA approved 1999, study duration 4 years, approved for use in pediatrics
Mechanism	Lipase inhibitor – causes malabsorption of 30% of ingested fat
Percent weight loss	2.9-3.4%
Dose	60-120mg TID before meals
Side effects	Steatorrhea, fecal incontinence, urgency, flatulence, decreased absorption of vitamins A,D,E, and K
Contraindications/Cautions	Pregnant, breastfeeding, cholestasis, malabsorption syndromes, warfarin, antiepileptic medications
Additional outcomes	Reduced incidence of T2DM, mixed effect of lipid profiles (lower LDL & HDL), decreased blood pressure, better glycemic control in T2DM

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PHENTERMINE/TOPIRAMATE (QSYMIA)

Approval	FDA approved 2012, study duration 2 years
Mechanism	NE releasing agent/GABA receptor modulator
Percent weight loss	6.6-8.6%
Dose	3.75/23mg daily, then 7.5/46mg daily, then 11.25/69mg daily then 15/92mg daily
Side effects	Drowsiness, insomnia, paresthesia cognitive changes, nephrolithiasis, constipation, hypokalemia, metabolic acidosis
Contraindications/Cautions	Pregnancy, breastfeeding, nephrolithiasis, hyperthyroid, glaucoma, MAOi use, severe depression, uncontrolled hypertension
Additional outcomes	Decreased incidence of T2DM, lowered blood pressure, improved lipid profile

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BUPROPRION/NALTREXONE (CONTRAVE)*

Approval	FDA approved in 2014
Mechanism	Opiate antagonist/reuptake inhibitor of dopamine and NE
Percent weight loss	4.8-6.0%, study duration 2 years
Dose	8mg/90mg tablets Titration: 1 tab daily, 1 tab BID, 2 tab qAM and 1 tab qPM, 2 tabs BID (increase dose weekly as tolerated.
Side effects	Headache, constipation, nausea, vomiting, anxiety, dizziness, increased blood pressure
Contraindications/Cautions	Uncontrolled blood pressure, seizure disorder, bulimia, MAOi use, history of withdrawal from drugs or ETOH, pregnancy or breastfeeding
Additional outcomes	Better HDL and TG, improved glycemia control, improved weight related QoL, control overeating behaviors and sexual function

*Can consider generic bupropion & naltrexone separately off-label for an affordable alternative.

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LIRAGLUTIDE (SAXENDA)

Approval	FDA approved 2014, approved in pediatric patients >12
Mechanism	GLP-1 RA – decreases appetite in hypothalamus, slows gastric emptying, etc
Percent weight loss	7-8%, study duration 1 year
Dose	**0.6mg, 1.2mg, 1.8mg (diabetic doses 1.8mg and below available as generic),** 2.4mg, 3.0mg, subcutaneously daily
Side effects	Nausea, vomiting, diarrhea, constipation, fatigue, reflux
Contraindications/Cautions	History of medullary thyroid cancer or MEN-2 syndrome, history of pancreatitis, gastroparesis, diabetic retinopathy, pregnancy or breastfeeding
Additional outcomes	Better cardiovascular outcomes in T2DM

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SEMAGLUTIDE (WEGOVY)

Approval	FDA approved in June 2021 for weight loss
Mechanism	GLP-1 RA – decreases appetite in hypothalamus, slows gastric emptying, etc
Percent weight loss	14.9% over 68 weeks (STEP 3 trial showed 16% with intensive lifestyle modification)
Dose	Titrate: 0.25mg, 0.5mg, 1.0mg, 1.7mg, 2.4mg subcutaneously weekly
Side effects	Nausea, vomiting, diarrhea, constipation, fatigue, reflux
Contraindications/Cautions	History of medullary thyroid cancer or MEN-2 syndrome, history of pancreatitis, gastroparesis, diabetic retinopathy, pregnancy or breastfeeding
Additional outcomes	Increased physical functioning scores, decreased BP, improved QoL, decreased CV events in T2DM

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TIRZEPETIDE (ZEPBOUND)

Approval	FDA approved in November 2023 for weight loss, Feb 2025 for OSA
Mechanism	GLP-1/GIP RA – decreases appetite in hypothalamus, slows gastric emptying, etc
Percent weight loss	20.8% over 68 weeks (SURMOUNT trial)
Dose	Titrate: 2.5mg, 5.0mg, 7.5mg, 10.00mg, 12.50mg, 15.00mg subcutaneously weekly
Side effects	Nausea, vomiting, diarrhea, constipation, fatigue, reflux
Contraindications/Cautions	History of medullary thyroid cancer or MEN-2 syndrome, history of pancreatitis, gastroparesis, diabetic retinopathy, pregnancy or breastfeeding
Additional outcomes	Increased physical functioning scores, decreased BP, improved sleep apnea

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SETMELANOTIDE (IMCIVREE)*

Approval	November 25, 2020 for use only in patients > 2 years with **obesity due to Bardet-Biedl syndrome (BBS), or** due to pro-opiomelanocortin (*POMC*), proprotein convertase subtilisin/kexin type 1 (*PCSK1*), or leptin receptor (*LEPR*) deficiency **confirmed by genetic testing demonstrating variants in *POMC*, *PCSK1*, or *LEPR* genes** that are interpreted as pathogenic, likely pathogenic, or of uncertain significance.
Mechanism	MC4R agonist that restores the function of the melanocortin-4 receptor in the brain to regulate hunger and metabolism, thereby reducing appetite and promoting weight loss in individuals with rare genetic forms of obesity.
Percent weight loss	POMC deficiency: Mean weight loss of 25.4%, approximately 31.9 kg (70.2 lbs), with 80% of participants achieving at least 10% weight loss LEPR deficiency: Mean weight loss of 12.5%, about 16.7 kg (36.8 lbs), with 45.5% of participants achieving at least 10% weight loss Hypothalamic obesity: Mean BMI reduction of 25.5%
Dose	2 mg once daily for 2 weeks, then increase to the maintenance dose of 3 mg once daily
Side effects	Nausea, vomiting, diarrhea, fatigue, headache, mood changes, skin darkening
Contraindications/Cautions	Pregnancy or breastfeeding, patients < 2 years
Additional outcomes	N/A

* Special indication only for rare genetic forms (BBS, POMC, PCSK1 or LEPR) of obesity

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SHORT-TERM AOMs

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PHENTERMINE (ADIPEX-P, LOMAIRA)*

Approval	FDA approved in 1952 for short-term use (12 weeks), study duration 2-52 weeks, approved for adolescents (defined as 17+)
Mechanism	Norepinephrine (NE) – releasing agent reduces reuptake of NE from the synapse, effects serotonin and dopamine reuptake
Percent weight loss	5-7.8%
Dose	8-37.5mg, lower doses 2-3x daily
Side effects	Palpitations, tachycardia, increased blood pressure, ischemic events, insomnia, anxiety, headache, psychosis, euphoria, dysphoria, tremor
Contraindications/Cautions	Pregnancy, breastfeeding, history of heart disease, uncontrolled blood pressure, hyperthyroidism, glaucoma, history of substance abuse, MAOi use, concurrent stimulant use
Additional outcomes	Controlled substance, Long term use (off-label) associated with mild elevations in blood pressure (+3 points SBP), stimulant medications are generally limited due to concerns for side effects (hypertension, tachycardia) and risk of addiction, Most well studied of all stimulant based AOMs

*Other short acting stimulant-based medications include diethylpropion, phendimetrazine, and benzphetamine. Of these, phentermine has been studied the most extensively and has the most favorable safety profile.

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OFF-LABEL AOMs

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METFORMIN (off-label)

Approval	FDA approved for diabetes in 1995, approved for T2DM in pediatrics
Mechanism	Reduces hepatic glucose production, decreased interstitial glucose absorption, increases peripheral insulin sensitivity, may reduce appetite by raising GLP-1 levels
Percent weight loss	Average of 3kg (6.6lbs) over 12 months
Dose	500mg-2000mg
Side effects	Diarrhea, nausea, flatulence, dyspepsia, vomiting, abdominal pain, lactic acidosis, B12 deficiency
Contraindications/Cautions	Renal dysfunction, history of metabolic acidosis, pregnancy or breastfeeding (although used in pregnancy, not for weight loss)
Additional outcomes	Prevention of T2DM, treatment of PCOS, prevents antipsychotic weight gain

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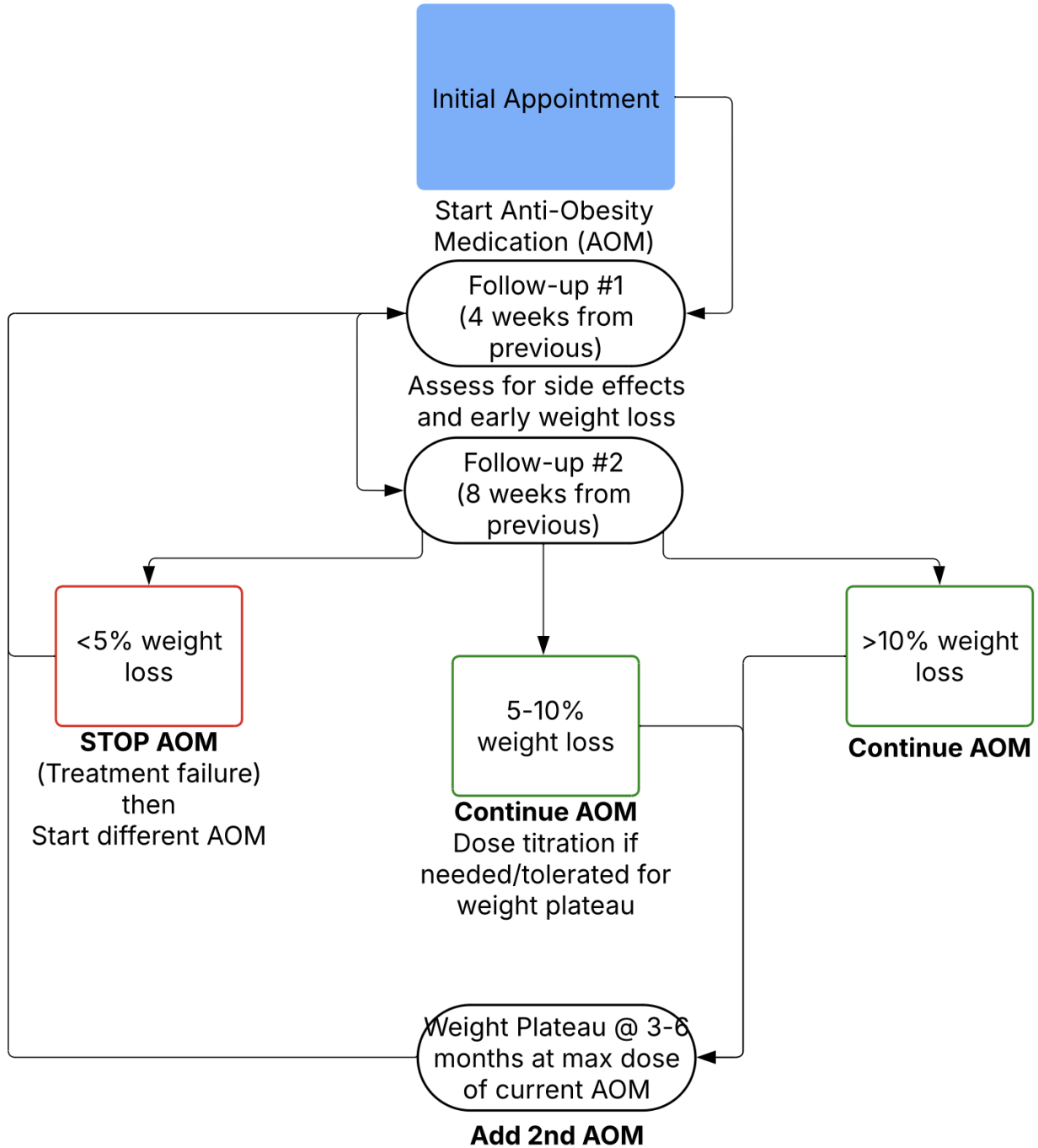
TOPIRAMATE (off-label)

Approval	FDA approved for seizures in 1998, also approved for migraine prophylaxis
Mechanism	Unknown
Percent weight loss	6% weight loss at 6 months. Study duration 60 weeks.
Dose	Starting dose 25mg qhs, titrate to 200-300mg/day
Side effects	Paresthesias, dizziness, dysgeusia, insomnia, constipation, dry mouth, and cognitive dulling
Contraindications/Cautions	Pregnancy (teratogenic– oral cleft deficits), glaucoma, nephrolithiasis
Additional outcomes	Migraine prevention, also useful in Binge-Eating Disorder



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CONSIDERATIONS FOR PRESCRIBING

If:	Consider
T2DM	GLP-1, metformin
Headaches	Topiramate
Binge-Eating	Topiramate or bupropion/naltrexone
Desires pregnancy or PCOS	Metformin
ETOH/tobacco use	Bupropion/naltrexone

If:	Avoid
Bulimia or seizures	Bupropion/naltrexone
Nephrolithiasis	Topiramate
Opioid use	Bupropion/naltrexone
Glaucoma	Phentermine
Cardiovascular disease or uncontrolled Hypertension	Phentermine

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COVERAGE*

- Medicare does not *currently* cover anti-obesity medications for weight loss
- Coverage by private insurances is variable

* For commonly prescribed AOMs, not a complete list

Medication	Lowest Cost/Month	Where
Orlistat	$77.00	Amazon
Phentermine	$13.05	GoodRx (Publix)
Phentermine/Topiramate (Qsymia)	$98.00	Qsymia Engage (mail-order partner pharmacy)
Wellbutrin/ Naltrexone (Contrave)	$99.00	CurxAccess Program (Ridgeway mail-order pharmacy)
Liraglutide (Saxenda)	$375.96 $1,369.80	1.8mg, GoodRx (Target) 3.0mg, GoodRx (Food Lion)
Semaglutide (Wegovy)	$499.00	Wegovy savings card through NovoCare Pharmacy
Tirzepatide (Zepbound)	$349.00-499.00*	Lilly Direct Cash Pay (or Self Pay) Pharmacy *vials, not pens
Topiramate (off-label)	$4.93	GoodRx (Walmart)
Metformin (off-label)	$4.00	GoodRx (Walmart)

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EMERGING THERAPIES

Company	Drug	MoA	Expected Launch Date	RoA	Phase I	Phase II	Phase III
Lilly	Orforglipron	GLP-1 agonist	2026				
novo nordisk	CagriSema	GLP-1 agonist + amylin analogue cagrilintide	2027				
Boehringer Ingelheim	Survodutide	Glucagon/GLP-1 receptor dual agonist	2027				
Lilly	Retatrutide	GLP-1/GIP/glucagon tri-agonist	2027				
AMGEN	AMG-133	GLP-1 agonist	2027				
Pfizer	Danuglipron	GLP-1 agonist	2026				
VIKING THERAPEUTICS	VK-2735	GLP-1 + GIP dual agonist	2027				

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BARIATRIC SURGERY

- 18–65 years old
- Failure of conservative treatments (nutrition, physical activity, medical therapy).
- BMI $\geq$ 40 kg/m^2
- BMI $\geq$ 35kg/m^2 plus 1+ comorbidities
  - Type 2 Diabetes Mellitus
  - Hypertension
  - Dyslipidemia
  - Metabolic-associated Steatotic Liver Disease LSLD
  - Obstructive Sleep Apnea
  - Osteoartritis
- BMI $\geq$ 30kg/m^2 in select cases
  - Poorly-controlled Type 2 Diabetes Mellitus

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CODING

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CODING

Obesity	E66.9	Exogenous	E66.09	Gene mutation, Leptin Receptor (LEPR)	E88.82
w/alveolar hypoventilation	E66.2	Drug-induced	E66.1	Melanocortin 4 (MC4)	E88.82
Adrenal	E27.8	Endocrine, Constitutional	E66.89	Nuclear Receptor Coactivator 1 (NCOA1)	E88.82
Class 1	**E66.811**	Excess calories, nutritional	E66.09	Proopiomelanocortin (POMC)	E88.82
Class 2	**E66.812**	Severe	E66.01	Proprotein Convertase Subtilisin/kexin type 1 (PCSK1)	E88.82
Class 3	**E66.813**	Pituitary	E23.6	SRC Homology 2B Adaptor Signaling Protein (SH2B1)	E88.82
Complicating childbirth	O99.214	Pregnancy	O99.21	Puerperium	O99.215

* Morbid obesity is no longer an appropriate diagnosis. It has been replaced with Obesity Class 3.

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SEQUENCING

1. Obesity Diagnosis* E66.XX
2. BMI Diagnosis* Z68.XX
3. Comorbidities I.10
4. Dietary Counseling & Surveillance Z71.3

This sequencing aligns with how most payer policy's structure coverage criteria for both weight loss medications and bariatric surgery.

* Based on starting weight. This is the disease state you are treating for.

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QUESTIONS

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