

Pediatric Obesity

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**Phoenix
Children's**

Disclosure of Conflicts of Interest

- I have no actual or potential conflict of interest in relation to this presentation.

Objectives

- Apply medical knowledge to define pediatric obesity & recognize populations at risk
- Identify associated comorbidities of obesity
- Demonstrate appropriate screening using evidence-based, preventive osteopathic care
- Recognize referral indications to ensure coordinated, patient-centered care
- Summarize evidence-based treatment options
- Integrate community & public health resources to manage pediatric obesity

Obesity
is...BMI
≥95thile for
age/sex

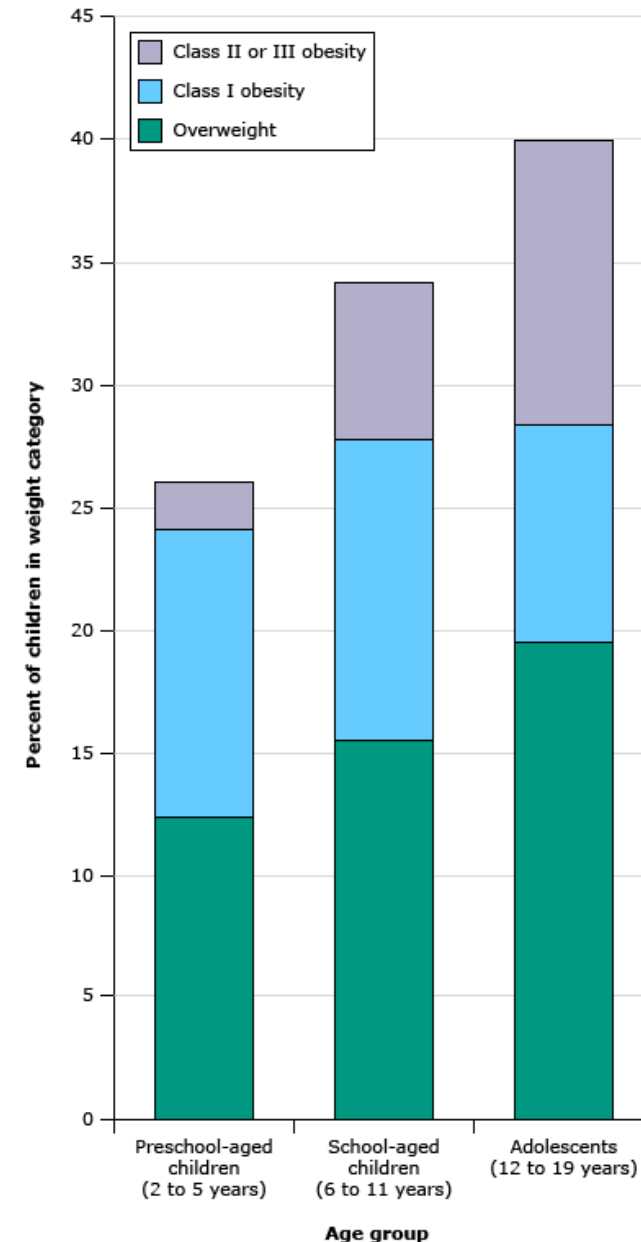
Weight categories for adults and youth

Category	Adults 18 years and older ^[1] (kg/m ²)	Youth 2 to 18 years (CDC, AAP, IOM, ES, IOTF ^[2])
Underweight	BMI <18.5	BMI <5 th percentile for age
Normal weight	BMI 18.5 to <25	BMI ≥5 th to <85 th percentile
Overweight	BMI 25 to <30	BMI ≥85 th to <95 th percentile (or BMI ≥25 to <30 kg/m ² , if lower)
Obesity		
▪ Class I obesity	BMI ≥30 to <35	BMI ≥95 th percentile to <120% of the 95 th percentile (or BMI ≥30 to <35 kg/m ² , if lower)
▪ Class II obesity	BMI ≥35 to <40	BMI ≥120 to 140% of the 95 th percentile (or BMI ≥35 to <40 kg/m ² , if lower)*
▪ Class III obesity	BMI ≥40	BMI ≥140% of the 95 th percentile (or BMI ≥40 kg/m ² , if lower)

Obesity is...

- Common in children (>14.4 million)
- Chronic disease
- Unequal - Disproportionately impacts:
 - Adolescents (12-19y)
 - Hispanic & non-Hispanic Black
 - Lower income
- Stigmatized (consequence of personal choice)
- Expensive
 - \$1.3 Billion = annual medical cost of obesity among US children
- Increasing

Obesity in children and adolescents, United States, 2016



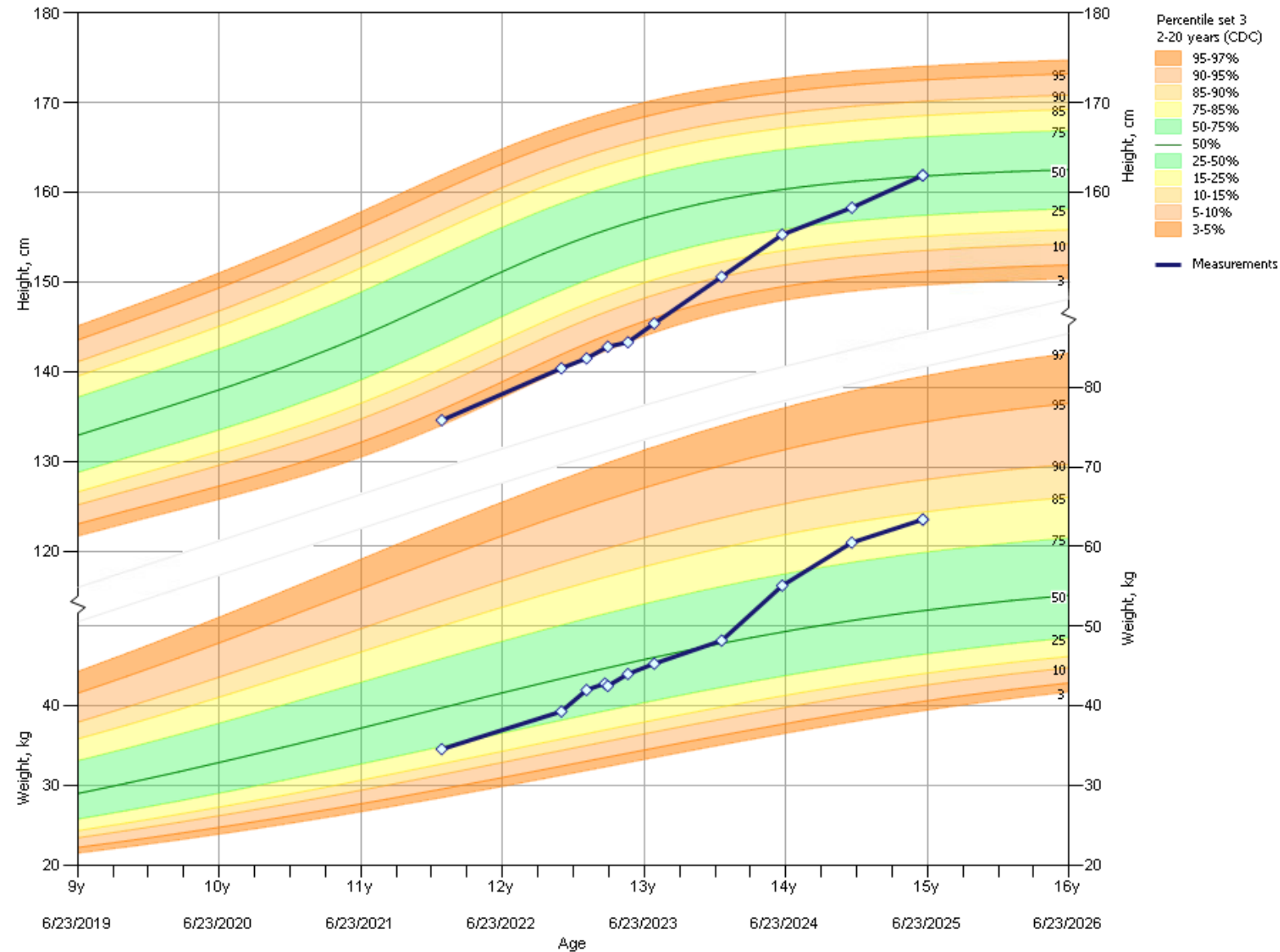
Why does it matter?



Consider Endogenous if:

- Short stature (inappropriate for genetics) or growth failure with obesity
 - Consider:
 - Growth hormone deficiency
 - Cushing's (look for deep purple, wide stretch marks, thinning skin, easy bruising)
 - Pseudohypoparathyroidism (shortened 4th & 5th metacarpal, cognitive impairment)
- Endocrine disorders <1% of all causes of pediatric obesity

- Example of elevated weight in the context of short stature →
- Mom 68.5", dad 70.5"
- MPH ~90%ile
- Ectopic posterior pituitary gland with GHD and central hypothyroidism



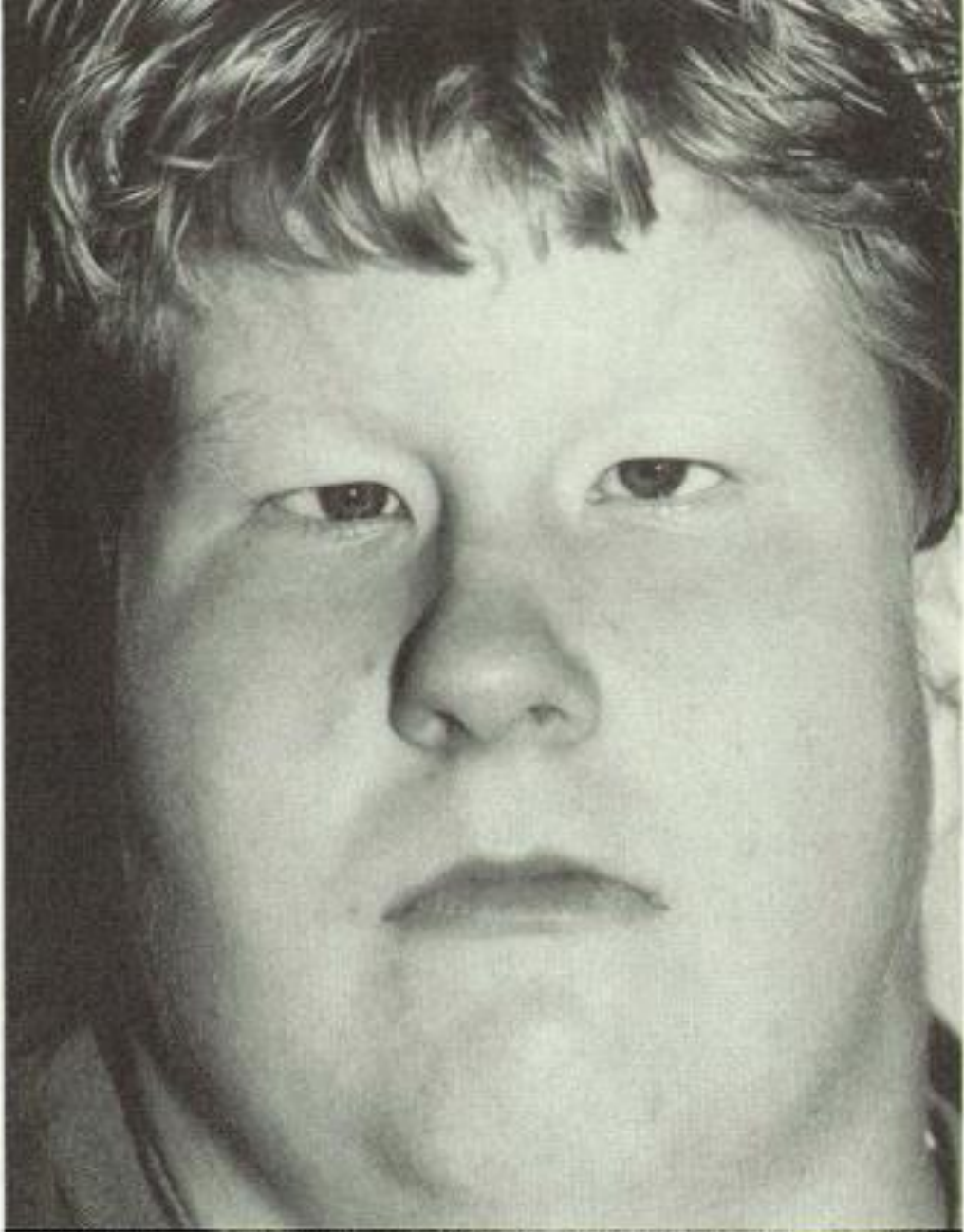


FIGURE 2: Facial features of the Prader-Willi syndrome include narrow bifrontal diameter, almond-shaped palpebral fissures, and a thin, triangular upper lip.

Genetic Obesity Syndromes

- Early onset obesity (<5y)
- Extreme hyperphagia – never full, eat until vomit
- Neonatal hypotonia or FTT
- Family hx of extreme obesity
- Other features of genetic syndromes
 - Renal abnormalities
 - Polydactyly (sometimes removed at birth)
 - Intellectual disability
- Can do free gene testing thru Rhythm Pharmaceuticals @uncoveringrareobesity.com (+2 genetic counseling sessions)
 - Doesn't test for Prader Willi
 - Does test for Bardet-Biedl, MC4R Pathway variants, etc.

More likely EXOGENOUS if:

- Family hx of obesity/GDM
- IUGR/SGA (increased risk of T2D as well)
- Under-resourced communities
 - Food insecurity
 - Access to safe physical activity, etc.
- Sedentary
- Screen time
- Sugared drinks
- Short sleep time
- Psychosocial stress/mental health
- Weight-promoting medications (atypical antipsychotics, steroids, anti-convulsants, etc.)





Associated Comorbidities

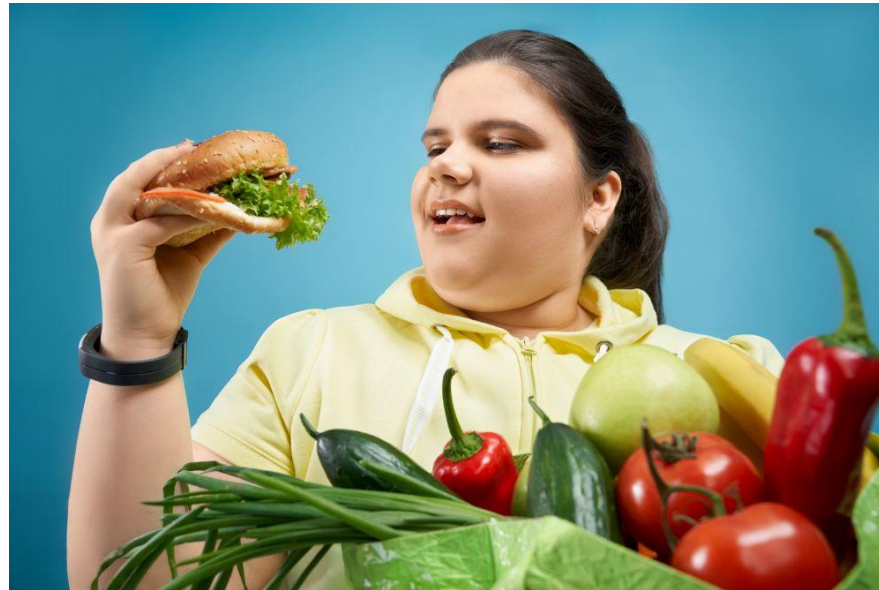
Obesity-Related Diseases

Metabolic Syndrome

- Clustering of metabolic risk factors for T2D + CVD (adults)
 - Abdominal adiposity
 - Hyperglycemia
 - Dyslipidemia
 - HTN
- Definition in children...?
- Estimated 10% of adolescents in US
 - Puberty complicates this → hormones change things

Why do we care?

- Met Syn in kids predicts T2D & CVD in adults¹
- Identifying early = risk stratification & treatment
- Main treatment = lifestyle modification
 - Healthy eating
 - Exercise/activity
 - Weight loss
 - Smoking cessation



¹Morrison, John A., et al. "Metabolic syndrome in childhood predicts adult cardiovascular disease 25 years later: The Princeton Lipid Research Clinics follow-up study." *Pediatrics*, vol. 120, no. 2, 1 Aug. 2007, pp. 340–345, <https://doi.org/10.1542/peds.2006-1699>.

Type 2 Diabetes

Associated Comorbidities

Who Should I Screen for T2D?

- 10+ years old (or pubertal) WITH
- BMI $\geq$ 85%ile AND
- At least 2 other risk factors:
 - Family history of T2D in $\geq$ 1 first or second-degree relative
 - Native American, African American, Latino, Asian American, or Pacific Islander race/ethnicity
 - Signs of insulin resistance (acanthosis nigricans, HTN, dyslipidemia, PCOS)
 - IUGR/SGA birth weight
 - Maternal hx of gestational DM

*BEFORE symptoms (don't wait for polydipsia/polyuria/enuresis to **screen**)

A 6y girl presents for a check up. You note that she had normal birth weight but crossed the 90%ile for weight by 1 year and her weight has continued to climb since then. She has primary nocturnal enuresis but no daytime urinary frequency. She's otherwise healthy. There is a family hx of T2D in mom & paternal grandpa.

On PE her height is 47.2" (90%ile) and weight is 86lb (>99%ile), BMI 27kg/m² (>99%ile). BP is 88/50. She has acanthosis nigricans, Tanner Stage 1 pubic hair, no palpable breast buds.

The family inquires about screening for diabetes. You decide that there is no reason to screen her currently based on which of the following factors?

A) Symptoms

B) Prepubertal status

C) Lack of type 2 diabetes in *both* parents

D) Normal blood pressure

E) Normal growth

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Who Should I Screen for T2D?

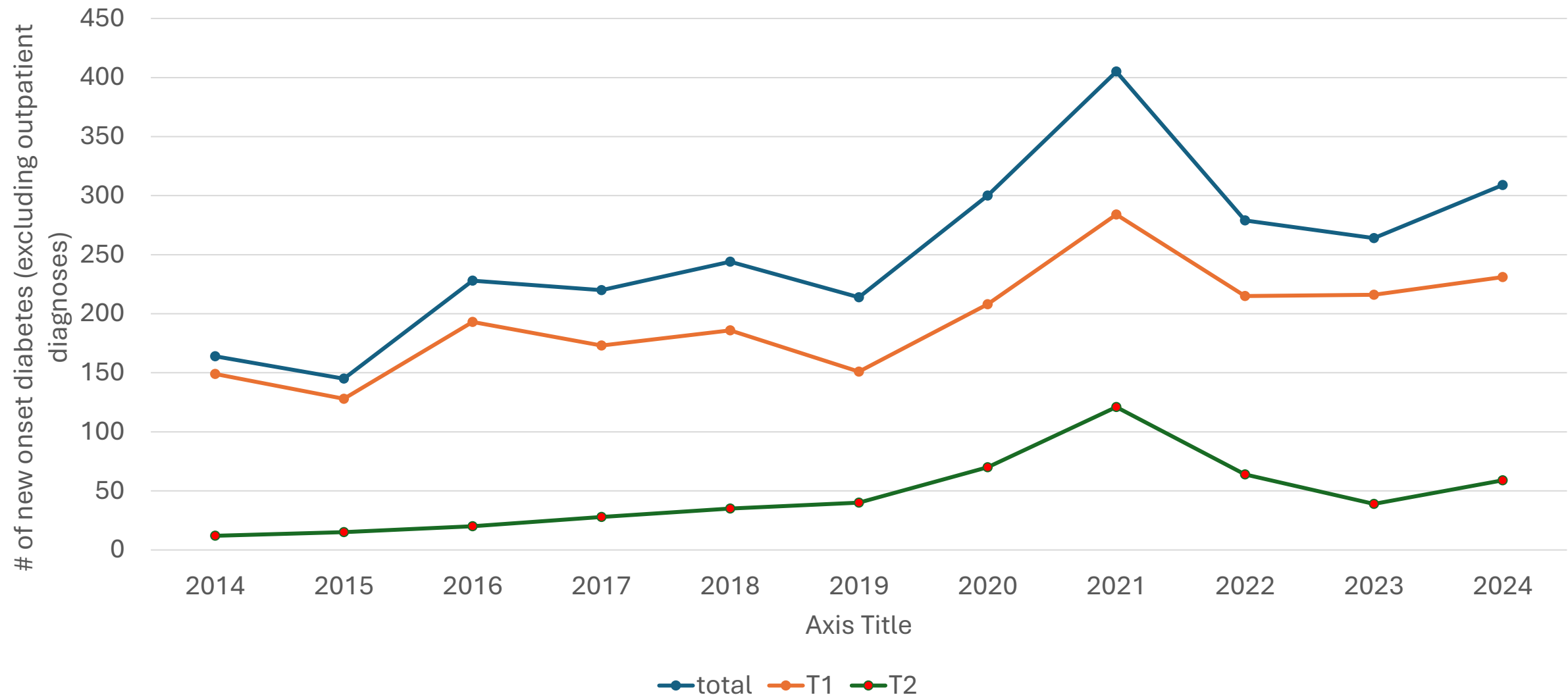
- 10+ years old (or pubertal) WITH
 - BMI $\geq$ 85%ile AND
 - At least 2 other risk factors
-
- Most youth with T2D are >12y w/BMI >95%ile

T2D – Presentation & Treatment

- >10% of patients with T2D present with DKA
 - HHS (hyperosmolar hyperglycemic state) more common in adults
 - Both require PICU
- If severe hyperglycemia, $\geq 2+$ ketones, typically recommend inpatient for high insulin + fluids

T2D – What do #s look like here?

PCH Inpatient New Onset DM by Year & Type

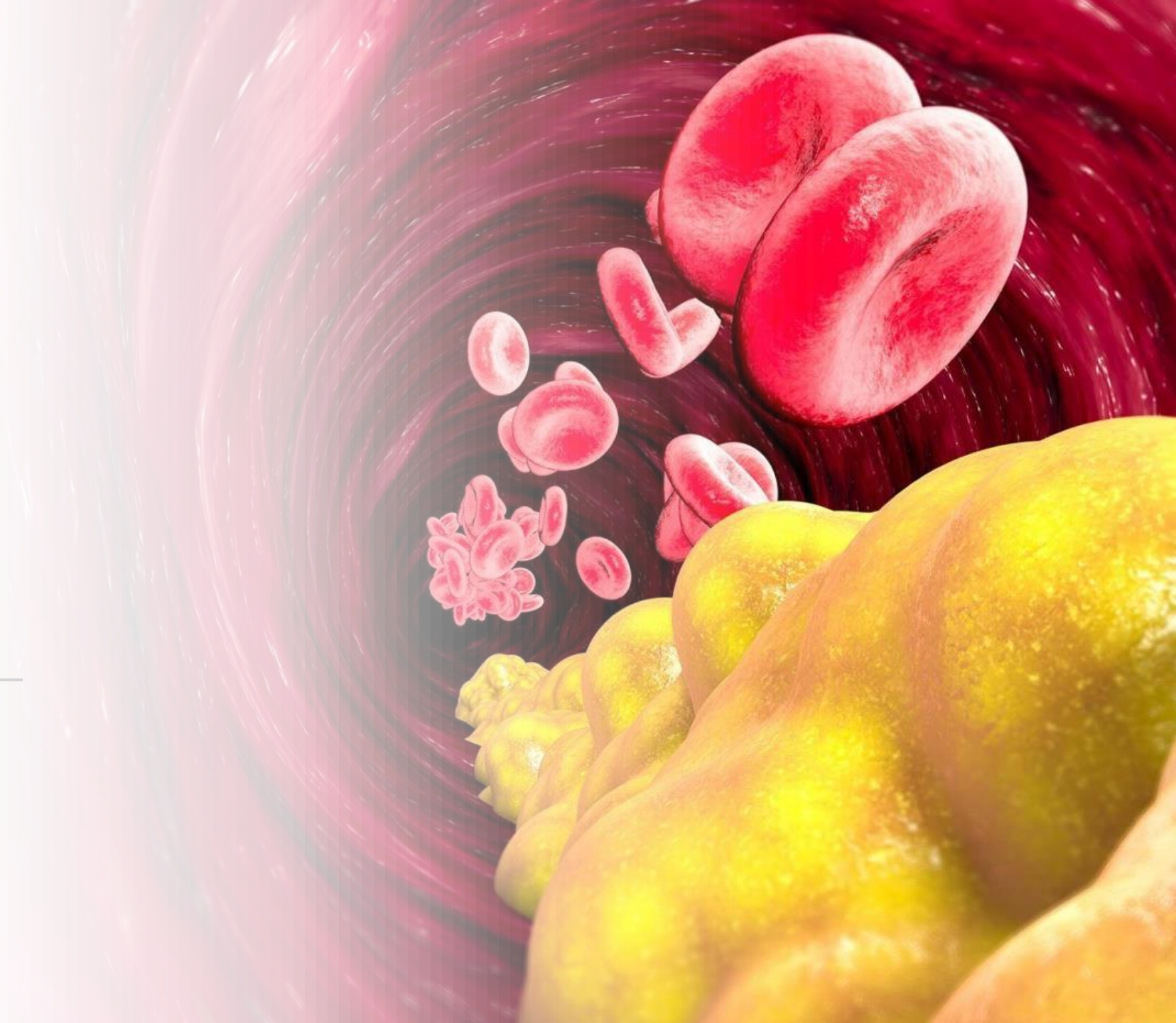


- Glucose monitoring
 - qAC + qHS/2h after last meal
 - BID if A1c in target & not on insulin
 - CGM if on insulin
- Goal A1c <6.5% (can individualize to <7.5%)
 - Lower than adults d/t youth onset → greater risk of early vascular complications
- Lifestyle changes
 - Weight reduction thru ↑activity and ↓glycemic index diet
- If A1c <8.5%:
 - Start metformin (if normal renal fxn)
 - If challenges meeting weight and glycemic goals with LMT
 - Add GLP-1 RA
- If A1c ≥8.5%:
 - Insulin (Basal + bolus)
 - +Metformin



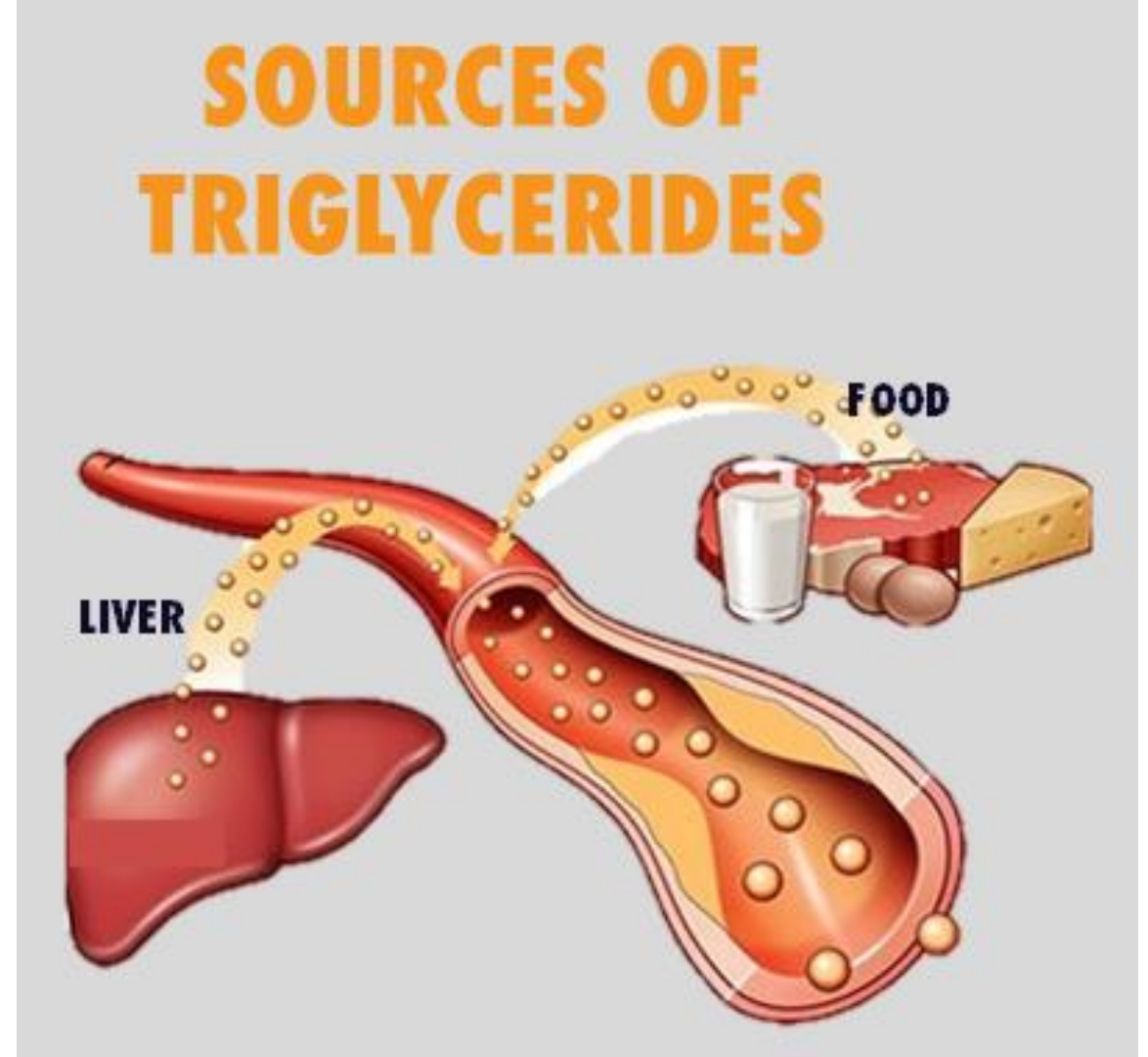
Dyslipidemia

Associated Comorbidities



Dyslipidemia

- Occurs in >40% of kids with obesity
- Total-C & HDL-C are stable regardless of fasting
- Triglycerides climb a lot after meal – primary reason to fast



Dyslipidemia - Treatment

- Treat kids ≥ 10 y if:
 - LDL-C > 130 mg/dL + DM despite lifestyle changes
 - LDL-C > 160 mg/dL + family hx of early CVD
 - LDL-C > 190 mg/dL despite 6m lifestyle changes
- Statins lower LDL-C by more than 25% and trigs by 10-20%
 - Goal once on tx is LDL-C < 100 mg/dL

Skin Conditions

Associated Comorbidities

Intertrigo

- Inflammation caused by skin friction
- Moist, red, dyspigmented, homogenous patch in deep skin folds
- Worsened by heat/moisture
- Treat w/ drying powders, absorbent material to separate skin folds, athletic/drying clothes to decrease friction, barrier creams



DermGroup.org



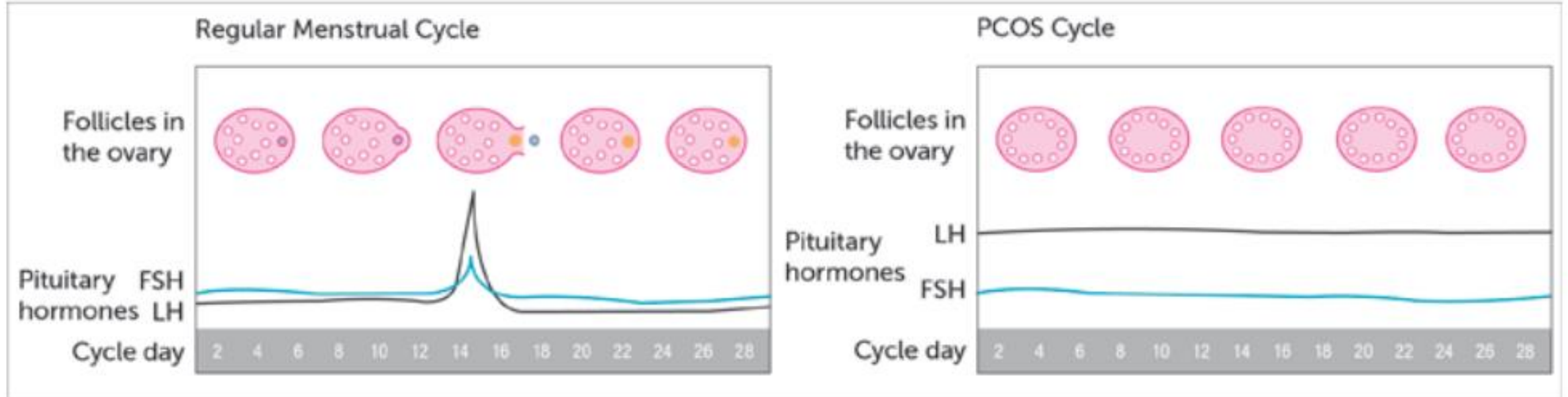
Hidradenitis Suppurativa

- Small, painful lumps under the skin
- Usually areas where skin rubs together
- Heal slowly, recur, can have tunneling and infection under the skin
- Girls > Boys
- Black > any other race
- Metformin might help
- Newer biologics that block overproduction of IL-17A



PCOS

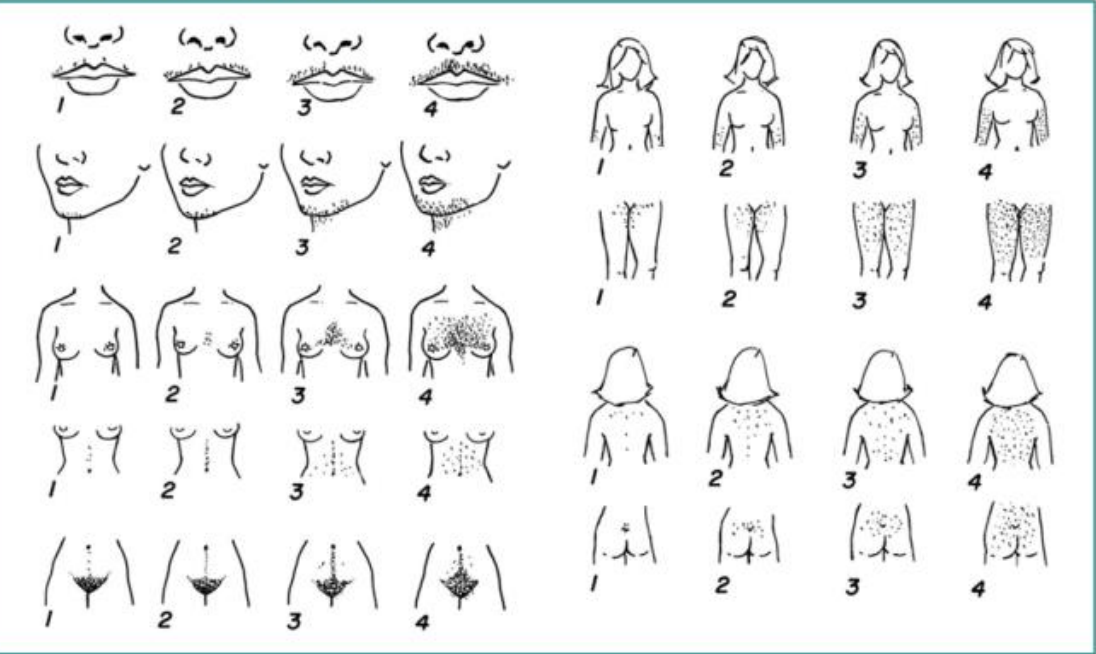
- Basal LH is elevated (so no normal LH surge)
- Ovulation doesn't occur
- Periods are irregular
- Increased insulin → increased testosterone (from ovaries) → increased hair/acne



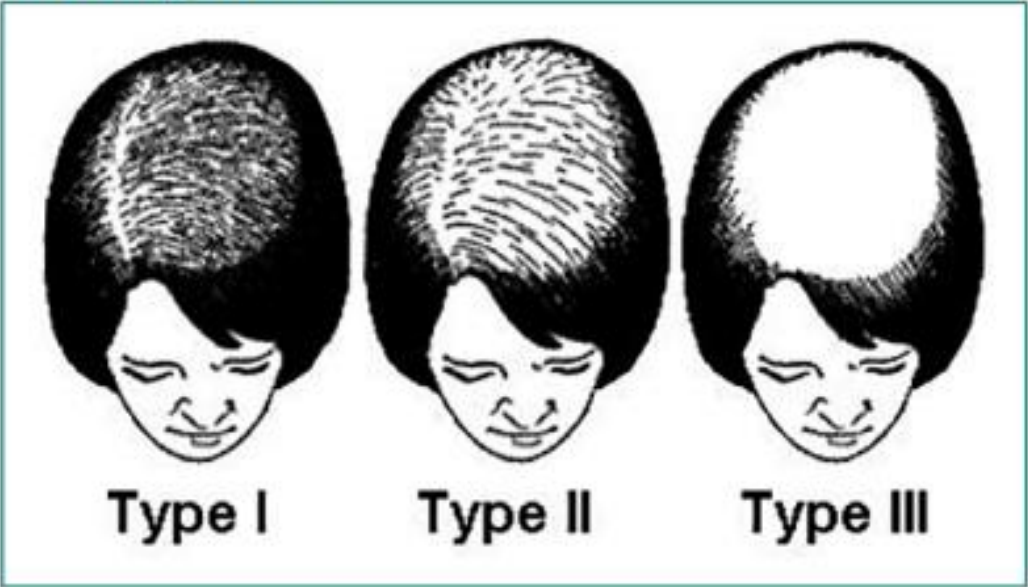
Regular menstrual cycle vs. PCOS menstrual cycle

Signs of Hyperandrogenism

Ferriman-Gallwey Score



Ludwig Scale



Hatch, R., et al., *Hirsutism: Implications, etiology, and management*. Am J Obstet Gynecol, 1998, 178(1): 1-10.



PCOS

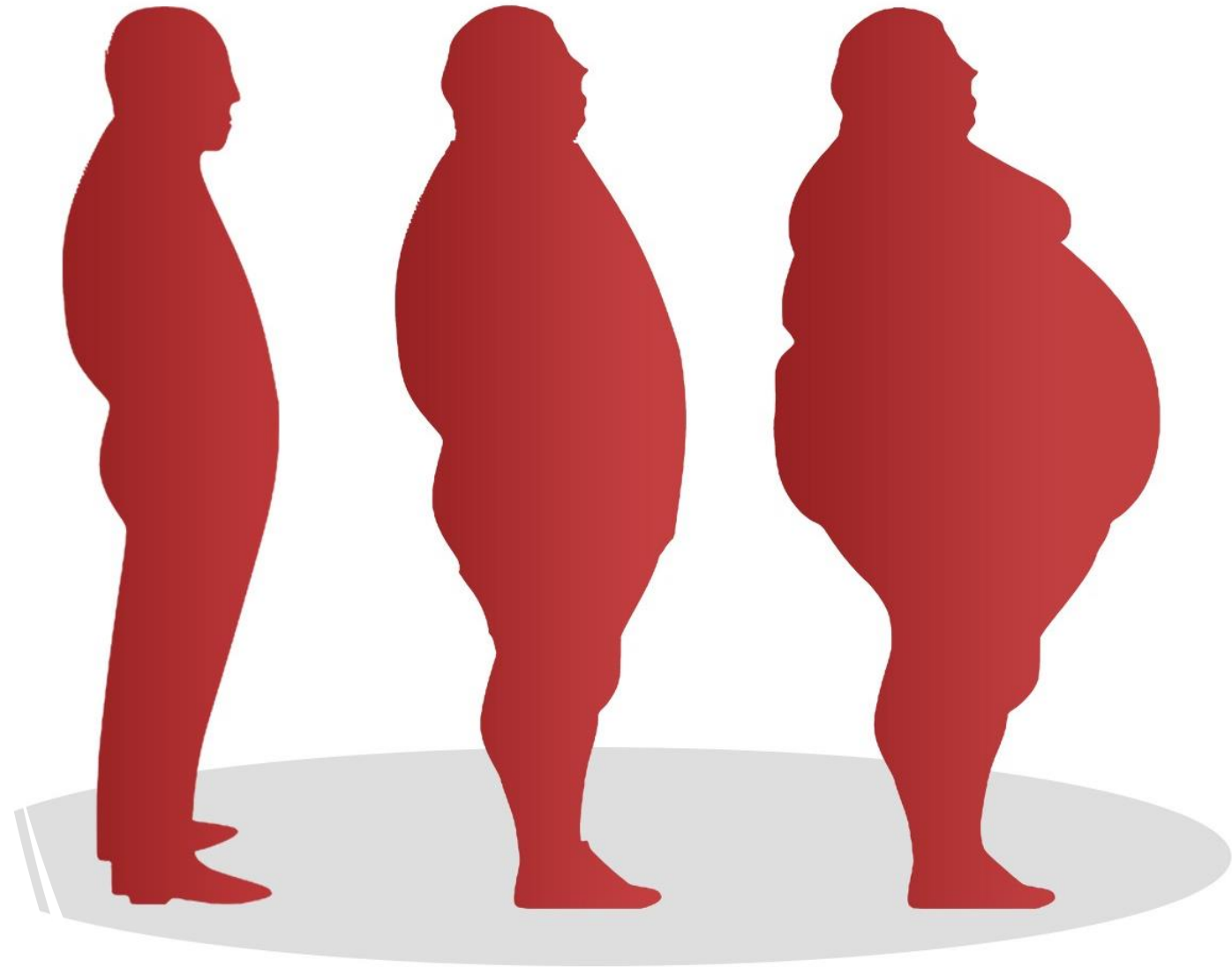
- Multifactorial (genetics, lifestyle, insulin resistance) w/variable presentation
- Present in 6-18% of adolescent girls
- Most common cause of infertility (up to 40% of female infertility)

PCOS – Implicated in other diseases:

- Endometrial cancer from endometrium having prolonged unopposed estrogen exposure from anovulation
- Estrogen-positive breast cancer (still exploring how androgen excess → carcinogenesis)
- Endocrinopathies & metabolic disease (T2D, GDM, CVD, HTN, OSA, stroke, depression/anxiety)

Obesity – How to evaluate

OBESITY



- Plot BMI at every visit
- Monitor trend (not single point unless significant)
- Ask about family hx
 - Parents w/obesity = 6-15-fold increase in offspring obesity as adult
- ROS – look for markers of genetic or endo causes
- Blood pressure at every visit

How Do I Bring it Up?

Ask!

- “Is it ok if we talk about weight today?”

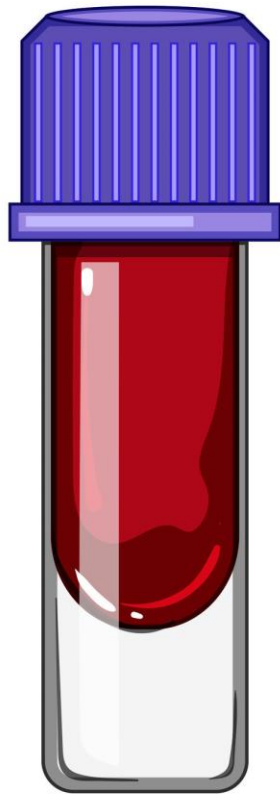
Use 1st Person language

- Child with obesity or
- Affected by obesity

Use neutral words

- “Gaining too much weight for age, height or health”
- “Unhealthy weight”
- NOT obese, fat, large, overweight, chubby, or sobrepeso (overweight)





Screening Labs

Conglomeration of Recommendations from the NHLBI (National Heart, Lung, and Blood Institute), AHA (American Heart Association), NASPGHAN (North American Society of Pediatric Gastroenterology, Hepatology and Nutrition), ADA (American Diabetes Association)

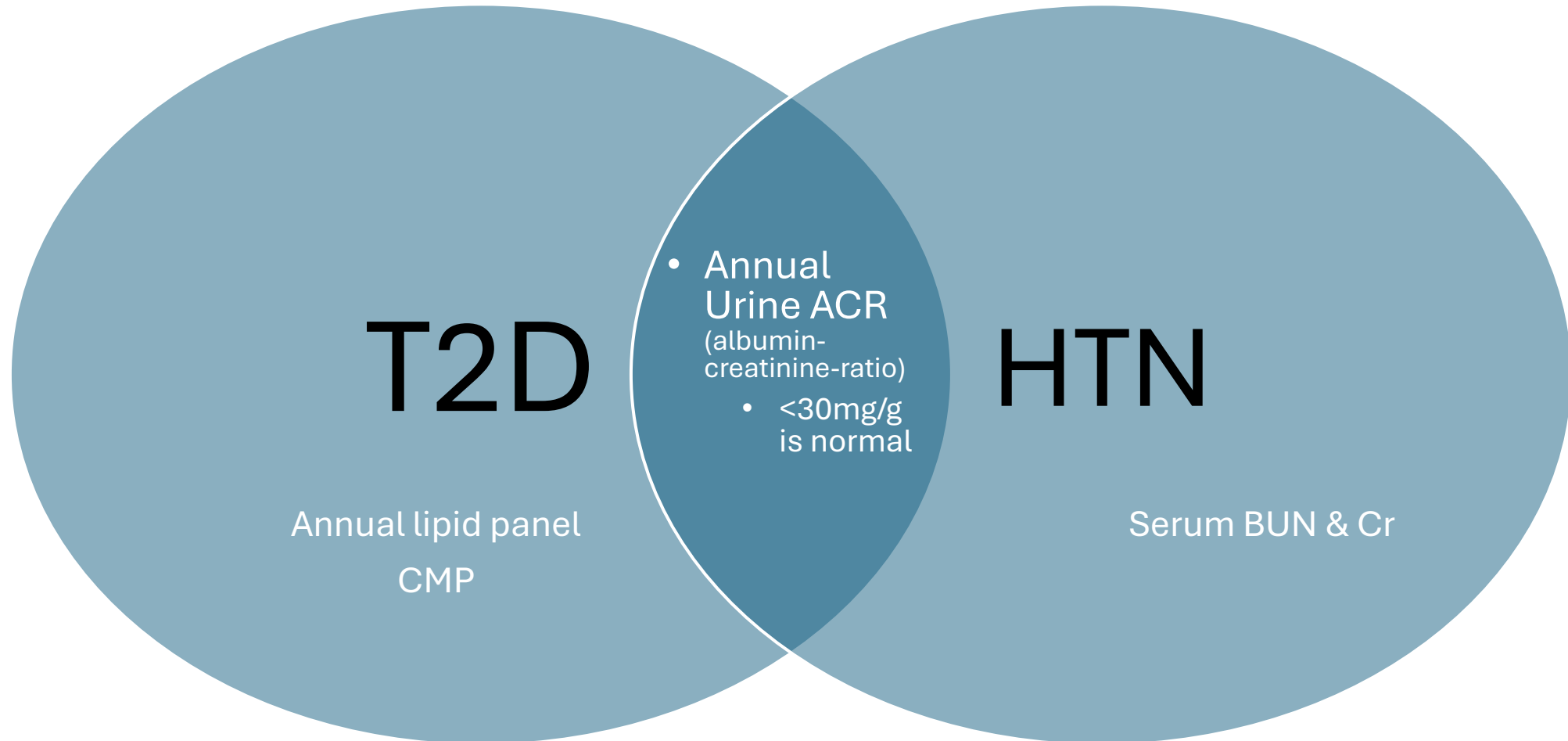
General obesity

- In children ≥ 10 y with BMI ≥ 85 %ile for age/sex:
 - Fasting lipid profile
 - Serum ALT (CMP) to eval for MASLD (metabolic dysfunction-associated steatotic liver disease)
 - If normal, repeat q2-3y
 - If ALT > 80 , persistently > 2 x ULN x6m, or other signs/symptoms of liver dz then pursue additional workup or refer Hepatology/GI
- If also 1+ RF for T2D:
 - Fasting glucose, HbA1c, or OGTT
- If T2D, HTN, or severe obesity:
 - BUN, Cr, Urine ACR (albumin-creatinine ratio)

+Irregular menses (>2y post-menarche), excessive acne, hirsutism

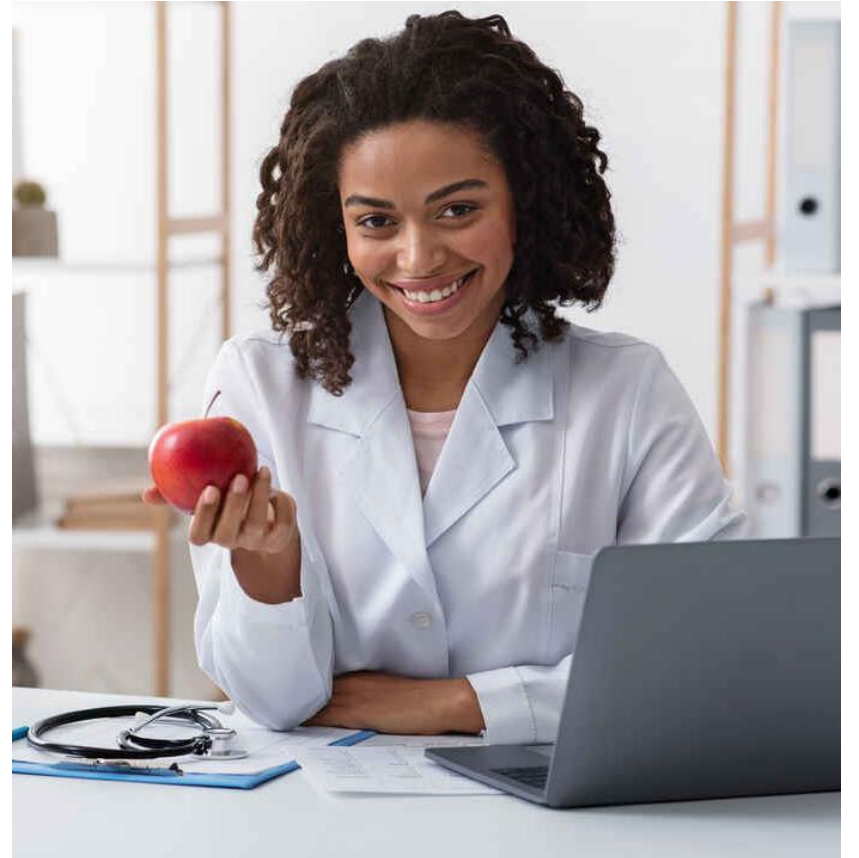
- Total testosterone (by LMS) [or can do free testosterone]
- Beta-hCG [r/o pregnancy]
- TSH [can consider +FT4]
- Prolactin [r/o pituitary cause]
- DHEAS [r/o adrenal tumor]
- Morning 17-hydroxyprogesterone [r/o NCCAH]

If +T2D or +HTN



Obesity – When to refer

- You don't have access to resources
 - Dietician
 - Mental Health counselor (behavior/lifestyle coaching, etc.)
- Child w/comorbidities
 - ↑LFTs – GI/Hepatology
 - Dyslipidemia – Endo or Cardiology
 - HTN – Nephrology
- You want help prescribing weight-loss meds
 - Don't have time to counsel
 - Don't have experience with ever-changing options and risks/benefits
 - Insurance won't approve unless “specialist” prescribes



Obesity – Treatment options



AAP Guidelines – 2/2023

- “...weight loss pharmacotherapy should be **offered to adolescents aged 12 years and older with obesity (BMI $\geq$ 95th percentile)** as an adjunct to health behavior and lifestyle treatment.”
- Pharmacotherapy is reserved for those with **more severe obesity** and/or **life-threatening comorbidities**
- Must weigh potential benefits against risks and side effects
 - significant consideration of patient and family preference

Drug	Age	Indication	Wt Loss	Cost	PCH CARE clinical practice and experience
Phentermine	≥17	Obesity	>5%	\$	Often 1 st choice, starting at age ~8y off-label
Topiramate	≥2 ≥12	Epilepsy Migraines	5%	\$	Often 2 nd choice
Orlistat	≥12	Obesity	5%	\$	Bad side-effects, low adherence
Phentermine/topiramate (Qsymia)	≥12	Obesity	5-10%	\$\$	More affordable if prescribed separately
Lisdexamphetamine	≥6 ≥18	ADHD Binge eating	3-10%	\$\$	Not always covered by insurance without ADHD
Liraglutide Saxenda Victoza	≥12	Obesity T2D	5-10%	\$\$\$	Daily injection
Semaglutide Wegovy Ozempic	≥12 ≥18	Obesity T2D	16%	\$\$\$	Weekly injection Best known
Tirzepatide Zepbound Mounjaro	≥17 ≥18	Obesity, OSA T2D	17-	\$\$\$	Weekly injection Most effective Pending further pediatric approval
Dulaglutide (Trulicity)	≥10	T2D ONLY	5-8%	\$\$\$	Covered by MEDICAID
Setmelanotide (Mclvree)	≥2	Genetic obesity (PCSK1/LEPR/POMC deficiency, BBS)	>15%	\$\$\$\$	Not many people have these diagnoses Phase 3 trial for hypothalamic obesity promising

GLP-1s

- Mimic incretin – improve energy balance
- Leads to central appetite suppression
- Delayed gastric emptying
- Pediatric versions are both SQ injectable (semaglutide [weekly] and liraglutide [daily])
- FDA Approved for 12+ years old
 - Lack long-term safety data in kids

GLP-1s Side Effects

- Nausea & vomiting (from slowed gastric emptying)
 - Typically in the first 24h after dosing & w/dose increase
 - Short doses of ondansetron can help
 - Slower up-titration, sour drinks, avoidance of large or fatty meals helps
- Severe abdominal pain
 - Requires eval
 - 4% of teens on semaglutide w/weight loss → cholecystitis
 - Moderate pancreatitis
- Myositis
- C-cell tumors in rats (avoid if medullary thyroid carcinoma or MEN type 2)
- Muscle wasting, hair loss
- Vision issues in adults – non-arteritic anterior ischemic optic neuropathy

GLP-1s Limitations

- Lack of insurance approval
- High cash-pay prices
 - Recently around \$350/month with savings programs

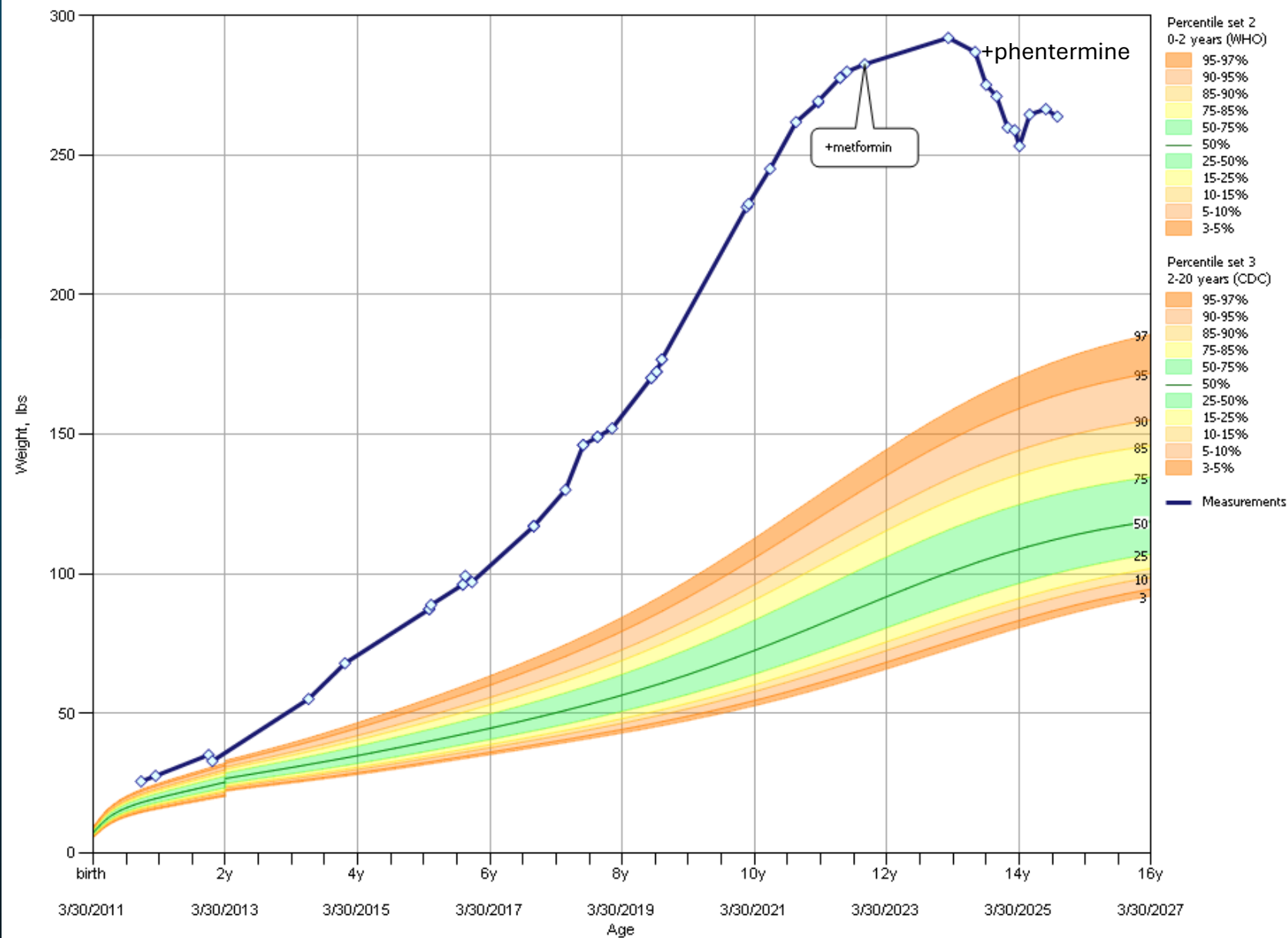


Dosing Info

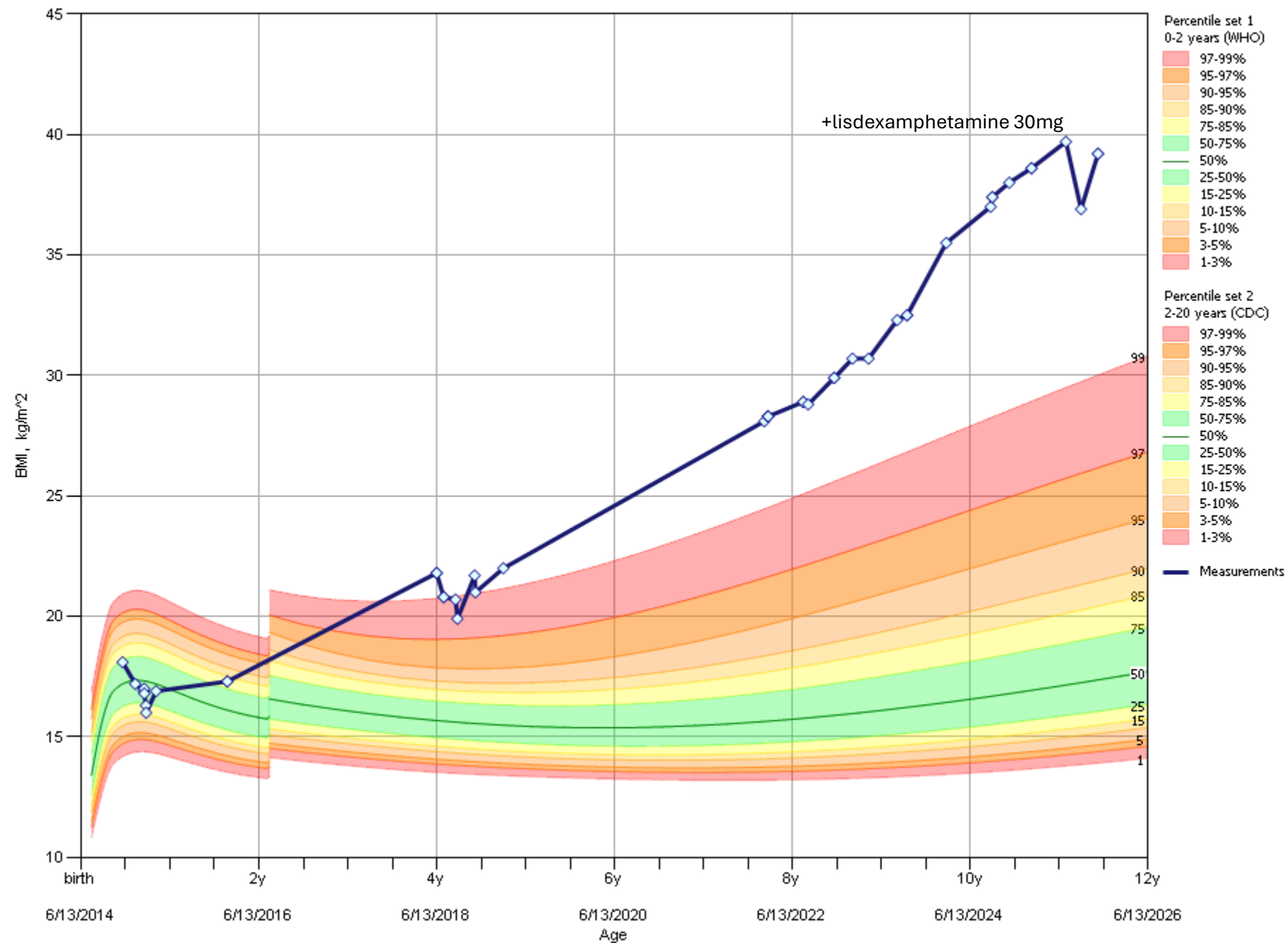
TABLE 1.
FDA-Approved Antiobesity Medications for Pediatric Patients

Generic Name	Drug Class	Trade Name	Expected Weight Loss	Dosing
Semaglutide	GLP-1RA	Wegovy (Novo Nordisk)	~15%	0.25 mg/wk × 4 wk 0.5 mg/wk × 4 wk 1.0 mg/wk × 4 wk 1.7 mg/wk × 4 wk 2.4 mg/wk
Liraglutide	GLP-1RA	Saxenda (Novo Nordisk)	~5%–10%	0.6 mg/d × 7 d 1.2 mg/d × 7 d 1.8 mg/d × 7 d 2.4 mg/d × 7 d 3.0 mg/d × 7 d
Phentermine-topiramate	Stimulant	Qsymia (VIVUS)	5%–10%	3.75 mg/23 mg × 14 d 7.5 mg/46 mg May increase to 11.25 mg/69 mg or 15 mg/92 mg in stepwise fashion

14y Female



11y Male



Obesity – Community resources

Food Sources

- Farm Express – Mobile produce market

- Walk-in, no personal info required
- Phoenix, Tempe, Mesa
- Accept cash, credit, debit, SNAP, Double Up Food Bucks
- ActivateFoodAZ.org



- Borderlands Produce Rescue

- \$15 = 70lb of rescued produce



Borderlands
Produce Rescue

- St. Vincent De Paul

- Food pantries, food boxes, holiday meals
- Emergency vouchers for thrift store use



Activities/Exercise

- YMCA

- Income-based memberships
- Family < \$80K/yr, Individual < \$50K/yr
- Free for family of 4 < \$44K/yr (at/below 150% federal poverty guidelines)



- Planet Fitness

- Free teen membership 14-19y
- June 1st to August 31st annually



- KROC Center – Salvation Army

- Income-based memberships
- Classes, pool & gym access, game room, sports, summer camp, etc.





Questions?