Indian Health Service

Division of Diabetes
Treatment and Prevention

Identifying and Managing Obesity-related Conditions

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Faculty Disclosure

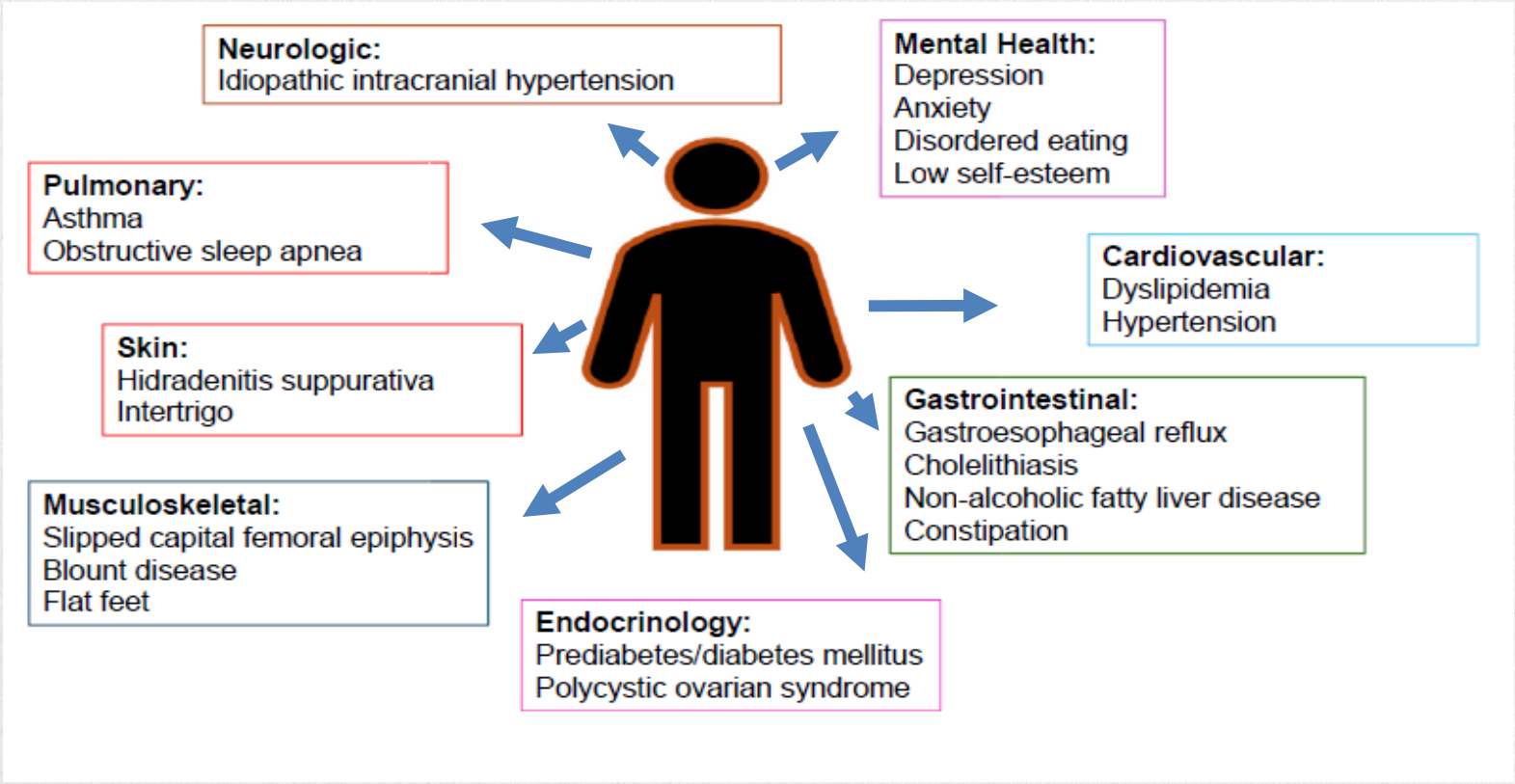
I have no relevant financial relationships with the manufacturer(s) of any commercial product(s) and/or provider(s) of commercial services discussed in this CME activity.

Learning Objectives

As a result of participating in this training, the healthcare team will be able to:

1. Implement evaluation recommendations for common pediatric obesity comorbidities encountered in the primary care setting.
2. Incorporate national guidelines for management of pediatric obesity comorbidities.
3. Identify chronic and emergent comorbidities of pediatric obesity and resources for management.

Obesity Health-Related Conditions



Comorbidities

"There is compelling evidence that obesity increases the risk for comorbidities, and that weight loss interventions can improve comorbidities." - CPG

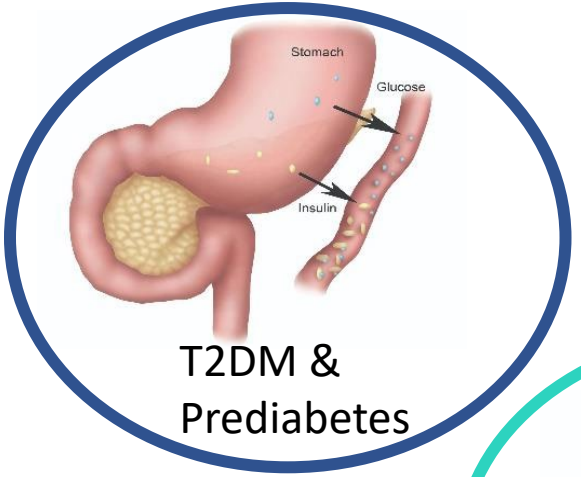
Key Action Statements for Evaluation of Comorbidities in Children and Adolescents with Overweight and Obesity

- Prediabetes/T2DM
- Dyslipidemia
- NAFLD
- Hypertension

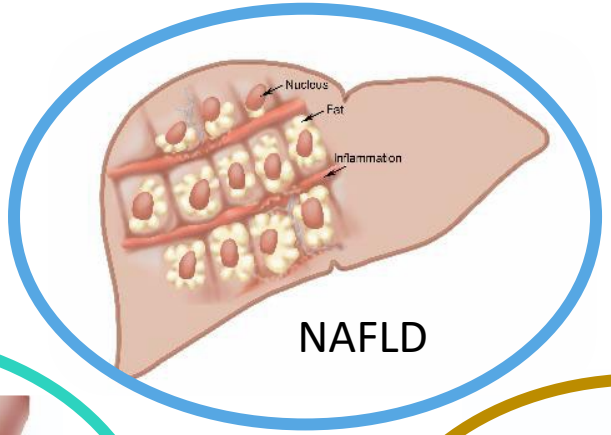
KAS 2. Pediatricians and other PHCPs should evaluate children 2 to 18 years of age with overweight (BMI ≥85th percentile to <94th percentile) and obesity (BMI ≥95th percentile) for obesity-related comorbidities by using a comprehensive patient history, mental and behavioral health screening, SDoH evaluation, physical examination, and diagnostic studies.	Grade B, Strong	Evaluation
KAS 3. In children 10 years and older, pediatricians and other PHCPs should evaluate for lipid abnormalities, abnormal glucose metabolism, and abnormal liver function in children and adolescents with obesity (BMI ≥95th percentile) and for lipid abnormalities in children and adolescents with overweight (BMI ≥85th percentile to <95th percentile).	Grade B, Strong	Comorbidities
KAS 3.1. In children 10 years and older with overweight (BMI ≥85th percentile to <95th percentile), pediatricians and other PHCPs may evaluate for abnormal glucose metabolism and liver function in the presence of risk factors for TD2M or NAFLD. In children 2 to 9 years of age with obesity (BMI ≥95th percentile), pediatricians and other PHCPs may evaluate for lipid abnormalities.	Grade C, Moderate	Comorbidities
KAS 4. Pediatricians and other PHCPs should treat children and adolescents for overweight (BMI ≥85th percentile to <95th percentile) or obesity (BMI ≥95th percentile) and comorbidities concurrently.	Grade A, Strong	Comorbidities
KAS 5. Pediatricians and other PHCPs should evaluate for dyslipidemia by obtaining a fasting lipid panel in children 10 years and older with overweight (BMI ≥85th-94th percentile) and obesity (≥95th percentile) and may evaluate for dyslipidemia in children 2 through 9 years of age with obesity.	Grade B (children ≥10 years with obesity), Strong; Grade C (children 2-9 years), Moderate	Comorbidities
KAS 6. Pediatricians and other PHCPs should evaluate for prediabetes and/or diabetes mellitus with fasting plasma glucose, 2-hour plasma glucose after 75-g oral glucose tolerance test (OGTT), or glycosylated hemoglobin (HbA1c).	Grade B, Moderate	Comorbidities
KAS 7. Pediatricians and other PHCPs should evaluate for NAFLD by obtaining an alanine transaminase (ALT) test.	Grade A, Strong	Comorbidities
KAS 8. Pediatricians and other PHCPs should evaluate for hypertension by measuring blood pressure at every visit starting at 3 years of age in children and adolescents with overweight (BMI ≥85 to <95th percentile) and obesity (BMI ≥95th percentile).	Grade C, Moderate	Comorbidities

Hampl S, et al, *Pediatrics*, 2023

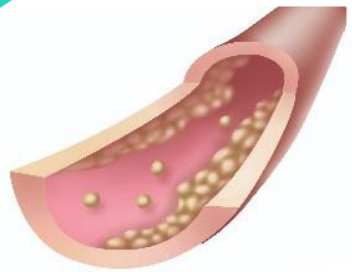
Silent Cardiometabolic Comorbidities



T2DM &
Prediabetes



NAFLD



Dyslipidemia

Hypertension

Insulin Resistance

Prevalence: 40% of adolescents with obesity have prediabetes (NHANES 2015-2018)[1]

Risk factors: GDM, FH of T2DM, signs of insulin resistance or conditions associated (dyslipidemia, PCOS, HTN), use of obesogenic psychotropic medication[2]

Symptoms: polydipsia, polyuria, polyphagia; typically asymptomatic

Exam findings: acanthosis nigricans

Test: Fasting glucose, HbA1c, or OGTT[2]

- Children ≥ 10 years with obesity
- Children ≥ 10 years with overweight and ≥ 1 risk factor

[1]Liu J, et al, JAMA Pediatr, 2022

[2]Hampl S, et al, *Pediatrics*, 2023

Dx and Management

Dx:	Prediabetes	T2DM
Fasting glucose	100-125 mg/dL	≥ 126 mg/dL
HbA1c	5.7-6.4	≥ 6.5
2-hour glucose (OGTT)	140-199 mg/dL	≥ 200 mg/dL

Management: Lifestyle modifications with concurrent obesity treatment

- Nutrition: Decrease SSBs, added sugars, increase fiber
- Increase activity level
- Referral to pediatric endocrinology for comprehensive care for T2DM
- Metformin continues to be first-line medication treatment for T2DM

ADA, Standards of care in Diabetes, Diabetes Care, 2024

Insulin resistance and follow-up

Follow-up evaluation:

HbA1c	Action
Normal: < 5.7	Repeat in 2 years
Prediabetes: 5.7-5.9 + at least one risk factor*	Repeat in 1 year
Prediabetes: 6-6.4	Repeat in 3-6 months
Diabetes: ≥ 6.5	Refer to Endocrinology

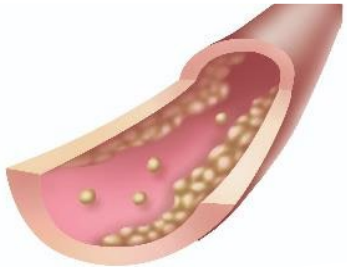
Complications:

- Progression to T2DM
- Clustering of other cardiometabolic comorbidities

Hampl S, et al, *Pediatrics*, 2023

Dyslipidemia

- Prevalence:
  - 43% among children with obesity (NHANES 2011-2014) [1]
  - 10% of preschool-aged children with obesity (NHANES 1999-2012)[2]
- Most common lipid abnormality: high TG and low HDL (atherogenic dyslipidemia)
- Risk factors: FH of cardiovascular disease, insulin resistance, HTN, ACEs
- Symptoms: none
- Exam findings: none
- Test: Fasting lipid panel[3,4]
  - children ≥ 10 years with overweight and obesity
  - children 2 - 9 years with obesity



[1]Nguyen D, et al, *NCHS Data Brief, 2015*
[2]Skinner AC, et al, *N Engl J Med*, 2015
[3]NHLBI, Expert panel on integrated guidelines for cardiovascular health and risk reduction in children and adolescents, *Pediatrics*, 2011
[4]AHA, Guideline on the Management of Blood Cholesterol, *Circulation*, 2018

Dyslipidemia diagnosis and management

- Dx:
  LDL ≥ 130 mg/dL
  HDL < 40 mg/dL
  TG ≥ 100 mg/dL (<10 years of age)
  TG ≥ 130 mg/dL (≥ 10 years of age)
  Non-HDL ≥ 145 mg/dL

- Management:
  - Lifestyle modifications with concurrent obesity treatment
  - Nutrition: Cardiovascular Health Integrated Lifestyle Diet
    - limit SSBs, increase fiber, decrease saturated fat, no trans fat
  - Increase activity level

NHLBI, Expert panel on integrated guidelines for cardiovascular health and risk reduction in children and adolescents, *Pediatrics*, 2011

Dyslipidemia follow-up

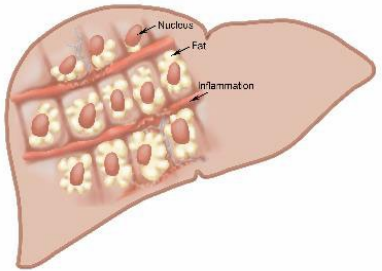
Follow-up evaluation in conjunction with lifestyle treatment

Lipid Panel Components	Action
TG Elevated: **< 10 years: ≥ 100 mg/dL** **≥ 10 years: ≥ 130 mg/dL** **TG High: ≥ 500 mg/dL**	Lifestyle treatment, repeat in 6 months Lifestyle treatment, repeat in 6 months Referral to endocrinology
LDL **Elevated: ≥ 130 mg/dL** **High: ≥ 250 mg/dL**	Lifestyle treatment, repeat in 6 months Refer to cardiology or endocrinology

NHLBI, Expert panel on integrated guidelines for cardiovascular health and risk reduction in children and adolescents, *Pediatrics*, 2011

Nonalcoholic fatty liver disease (NAFLD)

- Prevalence of suspected NAFLD (NHANES 2011-2018)[1]
  Adolescents with obesity: 40%
  Adolescents with overweight: 14%
- Risk factors: Family history, males, prediabetes/T2DM, dyslipidemia, OSA
- Symptoms: Typically asymptomatic
- Exam findings: +/- hepatomegaly
- Test: ALT
  - Children ≥ 10 years with obesity
  - Children ≥ 10 years with overweight and ≥1 risk factor
- Dx: Elevated ALT (2x ULN boys: 52 IU/L; ULN girls: 44 IU/L)[2]
  Liver bx for definitive dx and staging



[1]Mischel Ak, et al, *J Pediatr Gastroentrol Nutr*, 2023
[2]Vos MB et al, NASPGHAN CPG, *J Pediatr Gastroentrol Nutr,* 2017

NAFLD Management

Management:[1]

- Lifestyle modifications with concurrent obesity treatment
- Nutrition: decrease SSBs, added sugars, fructose
- Increase activity level

Follow-up evaluation[1,2]

ALT	Action
Normal: Boys < 26 IU/L Girls < 22 IU/L	Repeat in 2 years
Elevated: Twice the upper limit of normal Boys: ≥ 52 IU/L Girls: ≥ 44 IU/L	Lifestyle management Repeat in 3-6 months Exclude other causes of elevated ALT
≥80 IU/L	Exclude other causes of elevated ALT Refer to gastroenterology/ Consider liver biopsy

[1]Vos MB, et al, NASPGHAN CPG, *J Pediatr Gastroentrol Nutr,* 2017
[2]Hampl S, et al, *Pediatrics*, 2023

Differential Dx

- Exclude autoimmune causes of elevated ALT
  - total IgA, IgG, transglutaminase antibody, ANA, anti-smooth muscle antibody, anti-liver/kidney microsomal antibody
- Exclude genetic causes of elevated ALT
  - ceruloplasmin, alpha-1 antitrypsin
- Exclude infections
  - hepatitis panel
- Exclude endocrine disorders
  - TSH, free T4
- Exclude medications
  - valproic acid, chronic corticosteroid use, obesogenic psychotropic medications
- Additional screening labs
  - AST, GGT, bilirubin, alkaline phosphatase, total protein & albumin

Vos MB, et al, NASPGHAN CPG, *J Pediatr Gastroentrol Nutr,* 2017

NAFLD to MASLD

- Complications:[1,2]
  - Progressive: NAFL → NASH → Cirrhosis
  - Higher ALT correlated with more advanced disease
  - High correlation with T2DM (50% of T2DM with elevated ALT)

- NAFLD → MASLD (metabolic dysfunction-associated steatotic liver disease)[2,3]
  - Recognition of underlying biology
  - Removes stigmatizing language
  - Dx criteria evidence of steatosis with at least 1 metabolic condition: obesity, insulin resistance, HTN, high TG low HDL

[1]Vos MB, et al, NASPGHAN CPG, *J Pediatr Gastroentrol Nutr,* 2017
[2]Xanthakos SA, et al, *Gastroenterology*, 2020
[3]Rinella ME, et al, *Hepatology*, 2023

Hypertension

- Prevalence: 5-30% of children with overweight and obesity have elevated blood pressure[1]
- Risk Factors: Family history, ACEs, medications, preterm birth, insulin resistance, dyslipidemia, obstructive sleep apnea
- Symptoms: Typically asymptomatic; +/- HA, fatigue, blurred vision, dizziness
- Exam: Auscultation or oscillometry (ensure appropriate cuff size)
  - Children ≥ 3 years with overweight or obesity
- Dx: Determined by blood pressure percentiles from pediatric BP charts based on gender, age, and height percentile[2]
  - If initial BP ≥ 90th percentile, repeat twice and average the 2 follow-up measurements
  - Confirm by manual auscultation

[1]Skinner AC, et al, *Pediatrics,* 2023
[2]NHLBI, Expert panel on integrated guidelines for cardiovascular health and risk reduction in children and adolescents, *Pediatrics*, 2011

Screening BP Values Needing Further Evaluation

	Boys		Girls	
Age	Systolic	Diastolic	Systolic	Diastolic
3	101	58	102	60
4	102	60	103	62
5	103	63	104	64
6	105	66	105	67
7	106	68	106	68
8	107	69	107	69
9	107	70	108	71
10	108	72	109	72
11	110	74	111	74
12	113	75	114	75
≥ 13	120	80	120	80

BP Categories

BP Category	Children < 13 years of age	Children ≥ 13 years old	Number of Visits to Diagnosis
Normal	BP < 90th percentile	BP < 120/80 mm Hg	n/a
Elevated	BP ≥ 90th percentile to < 95th percentile	120/<80 to 129/<80 mmHg	3
Stage 1	BP ≥ 95th percentile to < 95th percentile + 12 mmHg	130/80 to 139/89 mmHg	3
Stage 2	BP ≥ 95th percentile + 12 mmHg	≥140/90 mmHg	2

Flynn JT, et al, AAP HTN CPG, *Pediatrics*, 2017

Hypertension Management

Management:[1,2]

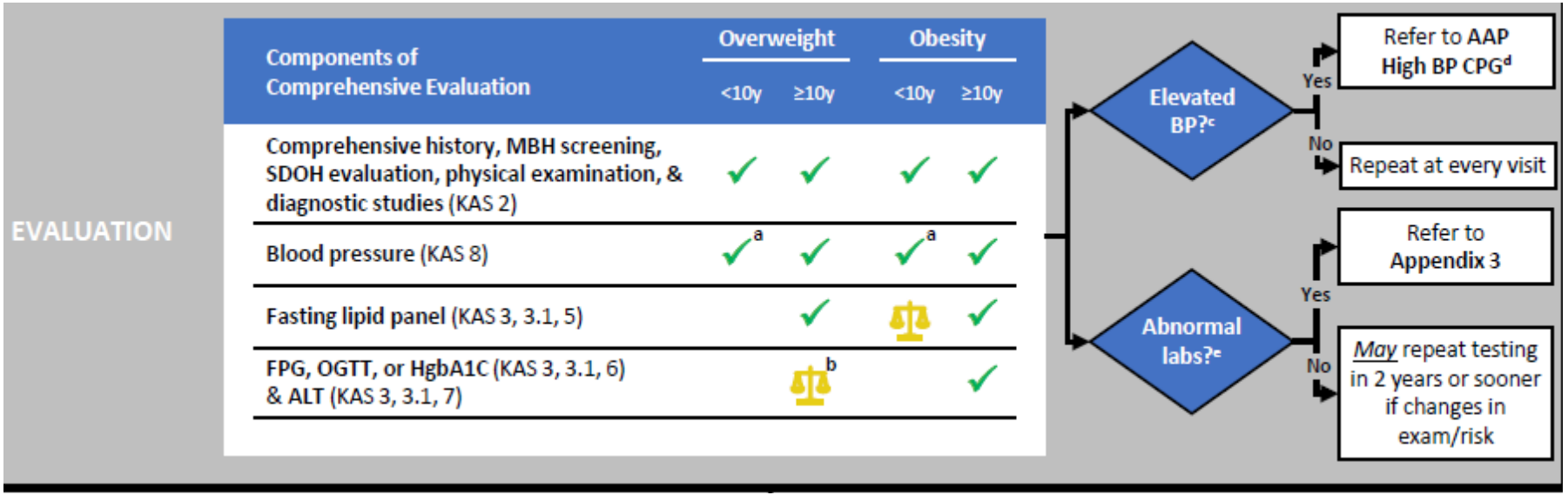
- Lifestyle modifications with concurrent obesity treatment
- Nutrition: Dietary Approaches to Stop Hypertension (DASH) diet
    - Increase F/V, whole grains, fish, lean meats
    - Limit sodium (< 2300 mg/day) and added sugars
- Increase activity level
- Improve sleep duration
- For Stage 1 or 2 HTN – obtain UA, chemistry panel, ABPM
  ECHO and refer to cardiology or nephrology
- Medication: 1st line: ACE, ARB, thiazide, CCB

Complications:

- Untreated HTN ⟹ LVH, increased cIMT

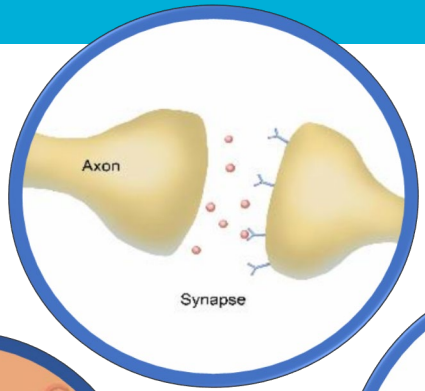
[1]Expert panel on integrated guidelines for cardiovascular health and risk reduction in children and adolescents, *Pediatrics*, 2011
[2]Flynn JT, et al, HTN CPG, *Pediatrics*. 2017

Summary of Evaluation Recommendations

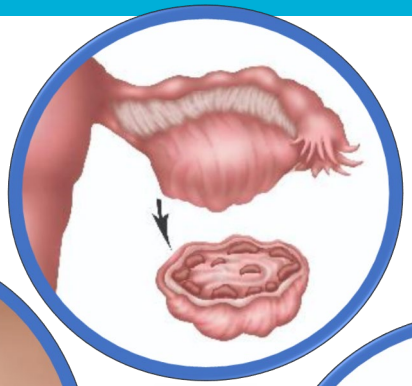


AAP CPG Obesity Evaluation Algorithm, Institute for Healthy Childhood Weight

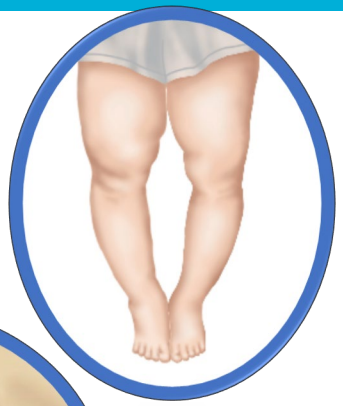
Comorbidities



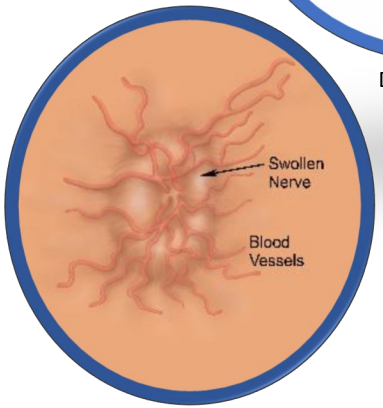
Depression



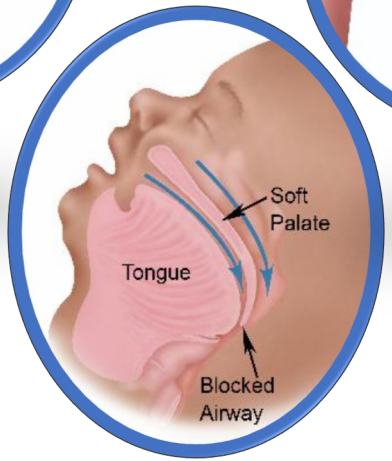
PCOS



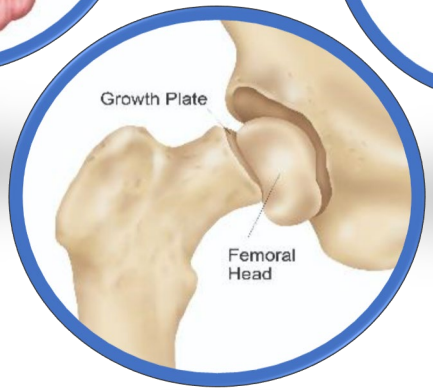
Blount disease



Idiopathic Intracranial Hypertension



Obstructive Sleep Apnea



SCFE

Obstructive Sleep Apnea

- Prevalence: 45% among children with obesity[1]
- Symptoms: snoring, irregular breathing pauses or gasping, restless sleep, daytime sleepiness, nocturnal enuresis, morning headaches, inattention/learning difficulties
- Exam findings: +/- tonsillar hypertrophy, elevated BP
- Dx: polysomnography (AHI ≥ 1 episodes/hour)[2]
- Management:
  - Referral to ENT for T&A
  - Referral to pulmonologist or sleep medicine specialist / CPAP
  - Weight loss
- Complications:

  Untreated OSA ⟹ HTN and LVH

[1]Andersen IG, *Eur Arch Otorhinolaryngol*, 2019
[2]Marcus CL, *Pediatrics*, 2012

Obstructive Sleep Apnea

EPWORTH SLEEPINESS SCALE FOR CHILDREN AND ADOLESCENTS (ESS-CHAD)

After you or your child completes this screener, share the responses with your healthcare provider. He or she will use the instructions on the reverse to calulate the score.

Your Name: _____ How old are you? _____ (years) Boy? ☐ Girl? ☐ Today's Date: _____

Over the past month, how likely have you been to fall asleep while doing the things that are described below (activities)? Even if you haven't done some of these things in the past month, try to imagine how they would have affected you.[1]

Use the following scale to choose one number that best describes what has been happening to you during each activity over the past month. Write that number in the box below.[1]

0 Would **Never** Fall Asleep
1 **Slight** Chance of Falling Asleep
2 **Moderate** Chance of Falling Asleep
3 **High** Chance of Falling Asleep

It is important that you answer each question as best you can.

Activity	Chance of Falling Asleep (0-3)
Sitting and reading	
Sitting and watching TV or a video	
Sitting in a classroom at school during the morning	
Sitting and riding in a car or a bus for about half an hour	
Lying down to rest or nap in the afternoon	
Sitting and talking to someone	
Sitting quietly by yourself after lunch	
Sitting and eating a meal	

This screening tool is not intended to make a diagnosis or take the place of an evaluation by a sleep specialist.

[About the ESS-CHAD – Epworth Sleepiness Scale]

[Available at https://epworthsleepinessscale.com/about-the-ess-chad/]

Polycystic Ovarian Syndrome

- Prevalence: 3-11% among adolescents[1]
- Risk factors: maternal family history, insulin resistance
- Symptoms: menstrual irregularities
- Exam findings: hirsutism, acne, alopecia
- Dx:[2,3]
    - irregular menstrual cycles 2 years post-menarche or cycles > 90 days 1-year post-menarche or primary amenorrhea (> 3 years post thelarche)
    - hyperandrogenism (clinical or biochemical)
    - ovarian imaging is no longer indicated for dx of PCOS in adolescents
    - dx of exclusion (rule out other causes of hyperandrogenism)

[1]Naz MSG, et al, *Int J Reprod Biomed*, 2019
[2]Ibanez L, et al, *Hormone Res Paed*. 2017
[3]Pena AS, et al, *BMC Med*, 2020

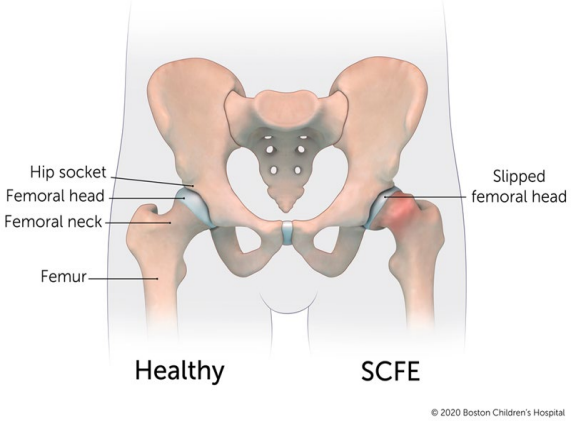
Polycystic Ovarian Syndrome Management

- Management:
  - Lifestyle modifications with concurrent obesity treatment
  - OCP to regulate menses
  - +/- metformin for those also with insulin resistance
  - Consider referral to endocrinology, adolescent medicine, or gynecology

- Complications: Increased risk for T2DM, infertility, cancer

Slipped Capital Femoral Epiphysis

- Characterized by displacement of the proximal femoral epiphysis from the metaphysis
- Incidence: ~11:100,00 in all children[1]
- Risk factors: early adolescence, males
- Symptoms: limp, complaints of dull hip, groin, thigh, or knee pain
- Exam findings: pain with passive internal rotation of the hip, limited interior rotation, external rotation w/ hip flexion
- Dx: Bilateral hip xrays with AP and frog-leg lateral views
- Management: Activity restriction with u*rgent* referral to orthopedics for surgical intervention; weight loss
- Complications: Degenerative hip disease and gait abnormalities



[1]Lehmann J, et al, *Pediatr Orthop*, 2006
[2]Chan G, Chen CT, *Curr Opin Pediatr*. 2009

Blount disease

- Pathologic deformity resulting from disruption of normal cartilage growth at the medial aspect of the proximal tibial physis
- 2 classifications:[1]
  - Early onset: 1-4 years, early ambulation, 50% bilateral, asymmetrical
  - Late onset: adolescents, boys, unilateral
- Symptoms: knee pain
- Exam findings: bowed legs; tibial torsion, abnormal gait
- Dx: Bilateral lower extremity x-rays (AP and lateral)
- Management: Referral to orthopedics, bracing, surgery, weight loss
- Complications: deformity, leg length discrepancy, premature osteoarthritis

[1]Janoyer M, *Orthop Traumatol Surg Res, 2019*

Common musculoskeletal conditions

Lower extremity pain is associated with limitations in physical function[1]

- Knee and ankle pain ⟹ PT referral
- Foot pain / pes planus ⟹ Orthotics referral

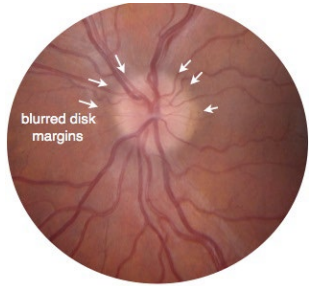
Key Points:

- Asking about pain and performing a thorough musculoskeletal exam should be a routine part of the evaluation and follow-up of every child with obesity who reports pain
- For children with obesity and musculoskeletal complaints, caution recommendation of activity before thorough exam and consider referral to physical therapy

[1]Taylor ED, et al, *Pediatrics*, 2006

Idiopathic intracranial hypertension

- Neuro-ophthalmologic condition characterized by increased intracranial pressure (ICP) with normal cerebrospinal fluid and brain parenchyma
- Incidence: 15:100,000 among adolescents[1]
- Risk factors: 12-19 years, females, medications
- Symptoms: persistent HAs; +/- nausea and vomiting, visual changes, pulsatile tinnitus, shoulder/neck pain
- Exam findings: papilledema, +/-visual field defects (6th nerve palsy)
- Dx: MRI; LP (opening pressure > 28 cmH_20 in children with obesity)[2]
  - dx of exclusion after other causes of increased ICP are eliminated
- Management: *Urgent* referral to ophthalmology and neurology, acetazolamide, weight loss
- Complication: Visual impairment or blindness



Papilledema

[1]Shaia JK, et al, Neurology, 2024
[2]Friedman D, Neurology, 2013

Psychological Comorbidities

- Low self esteem
- Depression
- Anxiety
- Disordered eating
- Impaired quality of life!
- Be mindful of weight bias and stigma
- Screen by using validated questionnaires
- Refer to psychological services

Consensus Recommendations

Comorbid Condition	Consensus Recommendation
OSA	• Obtain a sleep history, including symptoms of snoring, daytime somnolence, nocturnal enuresis, morning headaches, and inattention, among children and adolescents with obesity to evaluate for OSA. • Obtain a polysomnogram for children and adolescents with obesity and at least one symptom of disordered breathing.
PCOS	• Evaluate for menstrual irregularities and signs of hyperandrogenism (ie, hirsutism, acne) among female adolescents with obesity to assess risk for PCOS.
Depression	• Monitor for symptoms of depression in children and adolescents with obesity and conduct annual evaluation for depression for adolescents 12 years and older with a formal self-report tool.
Blount	• Perform a musculoskeletal review of systems and physical examination (eg, internal hip rotation in growing child, gait) as part of their evaluation for obesity.
SCFE	• Recommend immediate and complete activity restriction, non–weight-bearing with use of crutches, and refer to an orthopaedic surgeon for emergent evaluation, if SCFE is suspected. PHCPs may consider sending the child to an emergency department if an orthopaedic surgeon is not available.
IIH	• Maintain a high index of suspicion for IIH with new-onset or progressive headaches in the context of significant weight gain, especially for females.

Summary: Review of Systems

System	Symptom	Possible Cause
General	Fatigue	Disordered sleep, OSA
Neurological	Headaches	OSA, IIH
ENT	Snoring	OSA
Pulmonary	Cough (with activity)	Asthma
Endocrine	Polyuria, polydipsia	T2DM
	Menstrual irregularity	PCOS
Gastrointestinal	Abdominal pain	NAFLD, GERD, constipation, gallbladder
Musculoskeletal	Joint Pain	SCFE, Blounts, mechanical stress
Urinary	Nocturia, enuresis	OSA, T2DM
Psychological	Social isolation	Depression, anxiety, bullying, disordered eating
	Skipping meals	

Summary: Physical Exam

Finding	Possible Cause
Elevated blood pressure	Hypertension
Acanthosis nigricans	Insulin resistance, T2DM
Hirsutism	PCOS
Papilledema	Pseudotumor cerebri
Tonsillar hypertrophy	Obstructive sleep apnea
Wheezing	Asthma
Hepatomegaly	NAFLD, NASH
Limited hip range of motion	SCFE
Lower leg bowing	Blounts
Flat affect	Depression

Summary: Comorbidities

- Promptly identify comorbidities requiring immediate attention/referral:
  - Slipped capital femoral epiphysis
  - Blount
  - Idiopathic intracranial hypertension
  - Type 2 Diabetes
  - Obstructive sleep apnea
  - Hypertension

- Evaluate and monitor for co-morbidities on a *regular* basis, especially for children with continued weight gain:
  - Prediabetes
  - Dyslipidemia
  - NAFLD /MASLD
  - Depression, anxiety, eating disorders
  - PCOS
  - Musculoskeletal pain

Next Steps

- Perform laboratory evaluation as part of obesity assessment
- All comorbidities require lifestyle modifications and weight management – **manage comorbidities concurrently with obesity**
- Cardiometabolic conditions improve with lifestyle modifications – evaluation offers an opportunity to assess and discuss lifestyle behaviors and health with families
- Partnership with allied health colleagues (dietitian, physical therapist, and psychology) and community resources for dietary, activity, and behavioral support
- Re-evaluate after intervention and on routine basis, especially for children with continued weight gain.

Assessment & Evaluation

BMI Measurement

Comprehensive Evaluation
(PE, ROS, Hx, etc)

Risk Assessment
(Whole child)

Comorbidity Evaluation
(labs, tests)

9 year-old referred for obesity

CC: "Concern about weight and health"

HPI: "Always above growth curve" but concerned about increase in weight gain beginning last year – 25# weight gain last year
Mom concerned about future health problems. Working on increasing activity
With prompting, mom also reports concern for self-esteem.

Nutrition: 2 meals (skips breakfast) + 2 snacks/day; +2nd portions at home
School lunch. Fast food 4x/week; dad cooks 3x/week; distracted eating
+ excess SSBs (90 oz/day of soda, gatorade, juice)
+ excess refined foods; limited fruits & vegetables
No food insecurity, hiding/sneaking food, emotional eating

Activity: Softball (1 hr 3-4x/week); PE 2x/week; enjoys going to park, riding bikes

Screens: TV in room; 4 hours/day before bed; 8 hours on weekends

Sleep: 11 pm – 6 am; +fatigue, snoring

PMH / PSH

PMH:
Term newborn, BW 8#, 4oz.
Formula-fed for 10 months
Normal development
Allergies – on Zyrtec and Flonase
Obesity – followed by PCP x 1 year for weight gain

PSH:
T&A at 2 yo due to “noisy breathing”

Family History

Obesity – mom, dad, paternal grandparents

HTN – mom (dx age 36 yo)

T2DM – dad (dx age 25 yo) with ESRD (on dialysis), PGM

Hypercholesterolemia – dad (dx 40 yo)

CVD – PGM (stroke); PGF (MI)

Depression – mom, MGF

Hypothyroidism – mom (dx 13 yo)

Migraines – mom, MGF

Social History

Lives with parents in suburb of OKC; dad on disability

Dad has tribal affiliation; Mom is Korean

No siblings or extended family in home

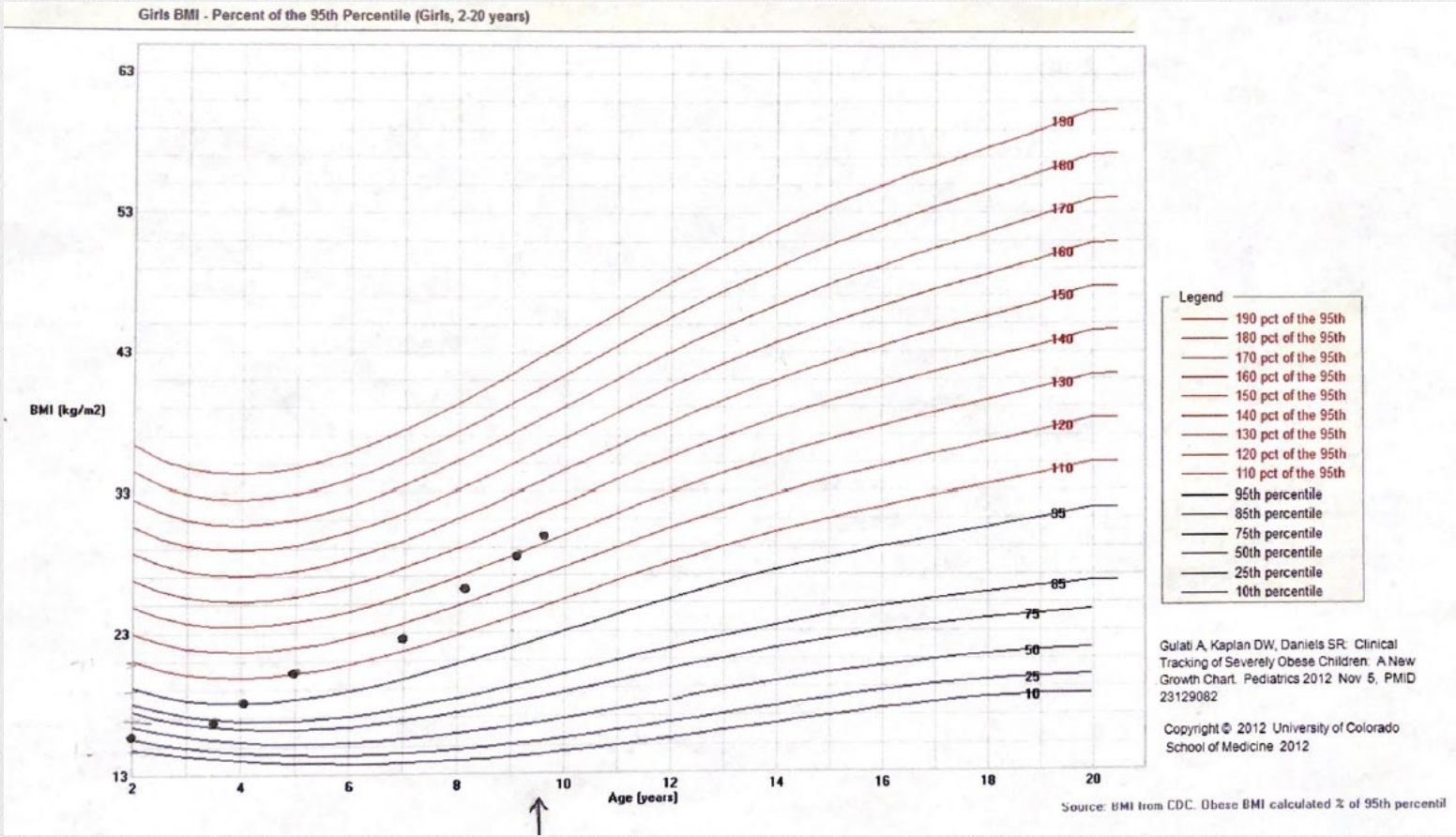
Attends 3rd grade in-person school; As & Bs

School activities: plays softball

H/o teasing at school last year

Vitals

Weight:	131.1 lbs	(100%ile)
Height:	56.1 in	(86th %ile)
BMI:	29.4 kg/m^2	(130th %ile)
BP:	110(74 %ile) / 76	(91 %ile)
Repeat BP (avg)	106 (60 %ile) / 74	(87 %ile)


Girls BMI - Percent of the 95th Percentile (Girls, 2-20 years)
BMI (kg/m2)
63
53
43
33
23
13
2
4
6
8
10
12
14
16
18
20
Age (years)
190
180
170
160
150
140
130
120
110
95
85
75
50
25
10
Legend
190 pct of the 95th
180 pct of the 95th
170 pct of the 95th
160 pct of the 95th
150 pct of the 95th
140 pct of the 95th
130 pct of the 95th
120 pct of the 95th
110 pct of the 95th
95th percentile
85th percentile
75th percentile
50th percentile
25th percentile
10th percentile
Gulati A, Kaplan DW, Daniels SR: Clinical Tracking of Severely Obese Children: A New Growth Chart. Pediatrics 2012 Nov 5; PMID 23129082
Copyright © 2012 University of Colorado School of Medicine 2012
Source: BMI from CDC. Obese BMI calculated % of 95th percentil

ROS

General: +weight gain, fatigue

ENT: +snoring

Resp: +cough w/activity

Musculoskeletal: +foot pain

Neuro: +HAs

Psych: low self-esteem; mild anxiety

CV: negative

GI: negative

GU: negative

Endo: negative

Skin: negative

Physical Exam

General: well-appearing
HEENT: normocephalic; EOMI; Malampatti 3
Neck: normal
Respiratory: CTAB; no wheezing
Chest: RRR; no murmurs; Tanner Stage 2
Abdomen: soft; non-tender; no hepatomegaly
Genital: normal female; Tanner Stage 2
Musculoskeletal: WNL
Extremities: pes planus
Skin: +acanthosis nigricans—neck & axilla
Psych: alert and interactive

Laboratory results

FG: 107 ⇒ IFG

ALT: 48 ⇒ Elevated

TG: 278 ⇒ Dyslipidemia

Chol: 165 ⇒ Normal

LDL: 64 ⇒ Normal

HDL: 40 ⇒ Borderline low

A1c: 5.8 ⇒ Prediabetes

	Prediabetes	Diabetes
Fasting glucose	100-125	≥126
HbA1c	5.7–6.4	≥6.5

	Girls (IU/L)	Boys (IU/L)
ALT	≥22	≥26

Lipid Category	Low (mg/dL)	Normal (mg/dL)	Borderline (mg/dL)	High (mg/dL)
Total cholesterol	-	< 170	170-199	≥ 200
LDL	-	< 110	110-129	≥ 130
HDL	<40	>45	-	-
Triglycerides 0-9 10-19 yrs	 - -	 <75 <90	 75-99 90-129	 ≥ 100 ≥130

Management

Obesity

Lifestyle modifications – MI to focus on health concerns

- Decrease SSBs: set goal of eliminating Big Gulp; replacing Gatorade w/Gatorade 0
- Increase activity level due to interest in sports: parents plan to change softball league to more intensive one
- Sleep: work up possible OSA; discussed increasing sleep duration but no goal set
- Parent support
- Follow-up in 4 weeks

Management

Insulin resistance, dyslipidemia, elevated ALT

- Decrease SSBs, increase activity level
- Follow-up visits to work on decreasing fast foods, balanced meals, healthy snacks, meal regulation
- Repeat labs in 6 months

Snoring/daytime fatigue/HAs

- Referral for sleep study

Cough w/ activity

- Albuterol prior to activity

Foot pain/pes planus

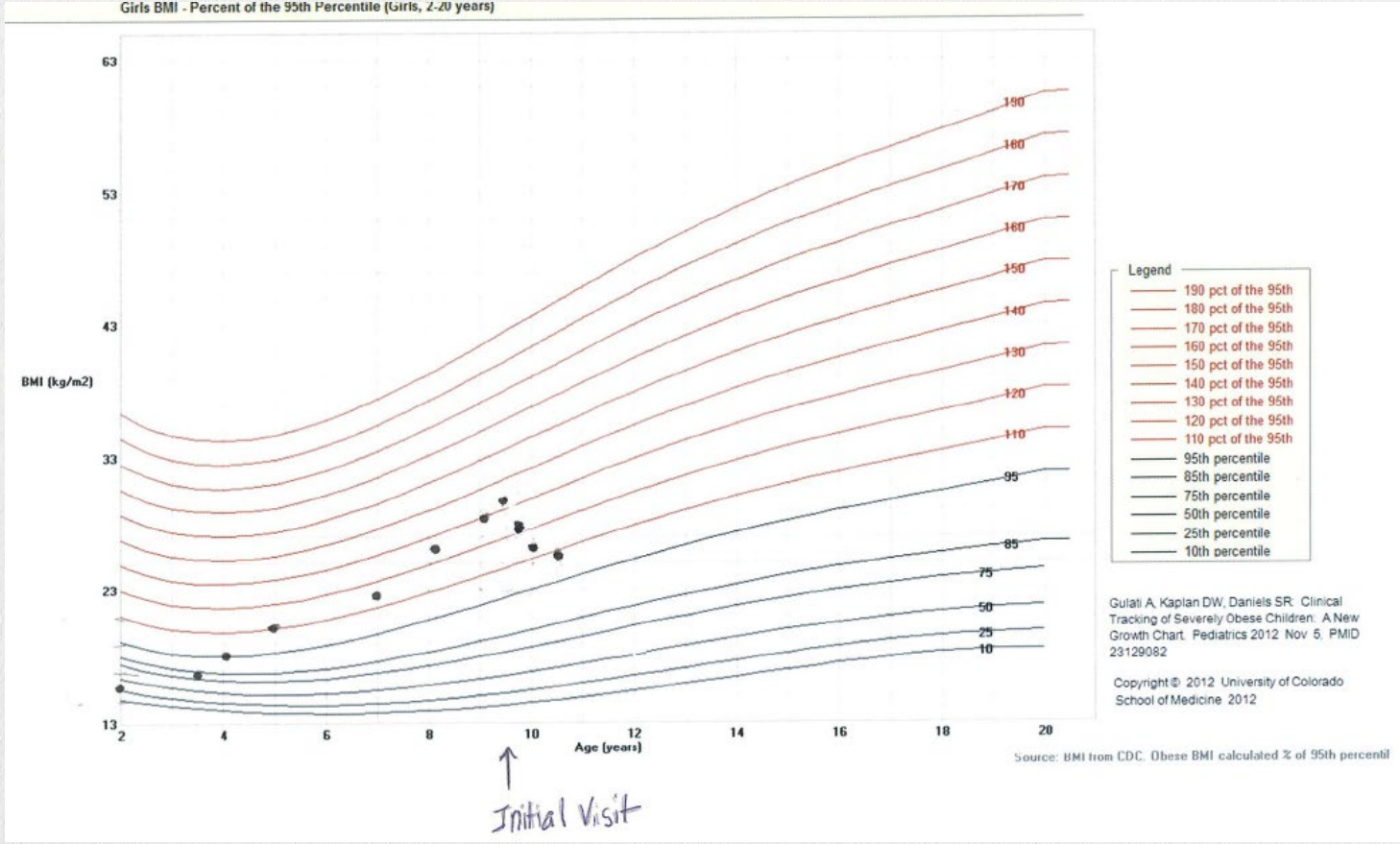
- Referral to orthotics

Anxiety

- BASC and Peds QL assessments; f/u by psychologist in clinic

6 & 12-month follow-up visits

- Weight stable; decreasing BMI & BMI percentile
- Eliminated SSBs; drinking water + occasional Gatorade 0
- No longer meal skipping with improved portions + vegetables
- Packs healthy snacks for game days; skips concession foods
- Still consuming fast food 3x/week; choosing healthier options
- Activity increased to 2 hours 5x/week
- Sleep improved to 8 hours/night (10 pm-6am)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50
25
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Legend
190 pct of the 95th
180 pct of the 95th
170 pct of the 95th
160 pct of the 95th
150 pct of the 95th
140 pct of the 95th
130 pct of the 95th
120 pct of the 95th
110 pct of the 95th
95th percentile
85th percentile
75th percentile
50th percentile
25th percentile
10th percentile
Gulati A, Kaplan DW, Daniels SR. Clinical Tracking of Severely Obese Children: A New Growth Chart. Pediatrics 2012 Nov 5. PMID 23129082
Copyright © 2012 University of Colorado School of Medicine 2012
Source: BMI from CDC. Obese BMI calculated % of 95th percentil
Initial Visit

6 and 12-month follow-up visits

Insulin resistance, elevated ALT, dyslipidemia

➢ FG:	97	98
➢ ALT:	25	16
➢ HbA1c:	5.4	5.2
➢ FLP:		
TG:	96	64
HDL:	49	57

Snoring/Fatigue/HAs

- Sleep study with AHI of 3 with REM AHI of 5.7
  Mild OSA – symptoms improved with weight management

Asthma

- Pre-treating with albuterol

Foot pain

- Pain resolved with orthotics

Anxiety

- Re-evaluation was WNL; Peds QL improved

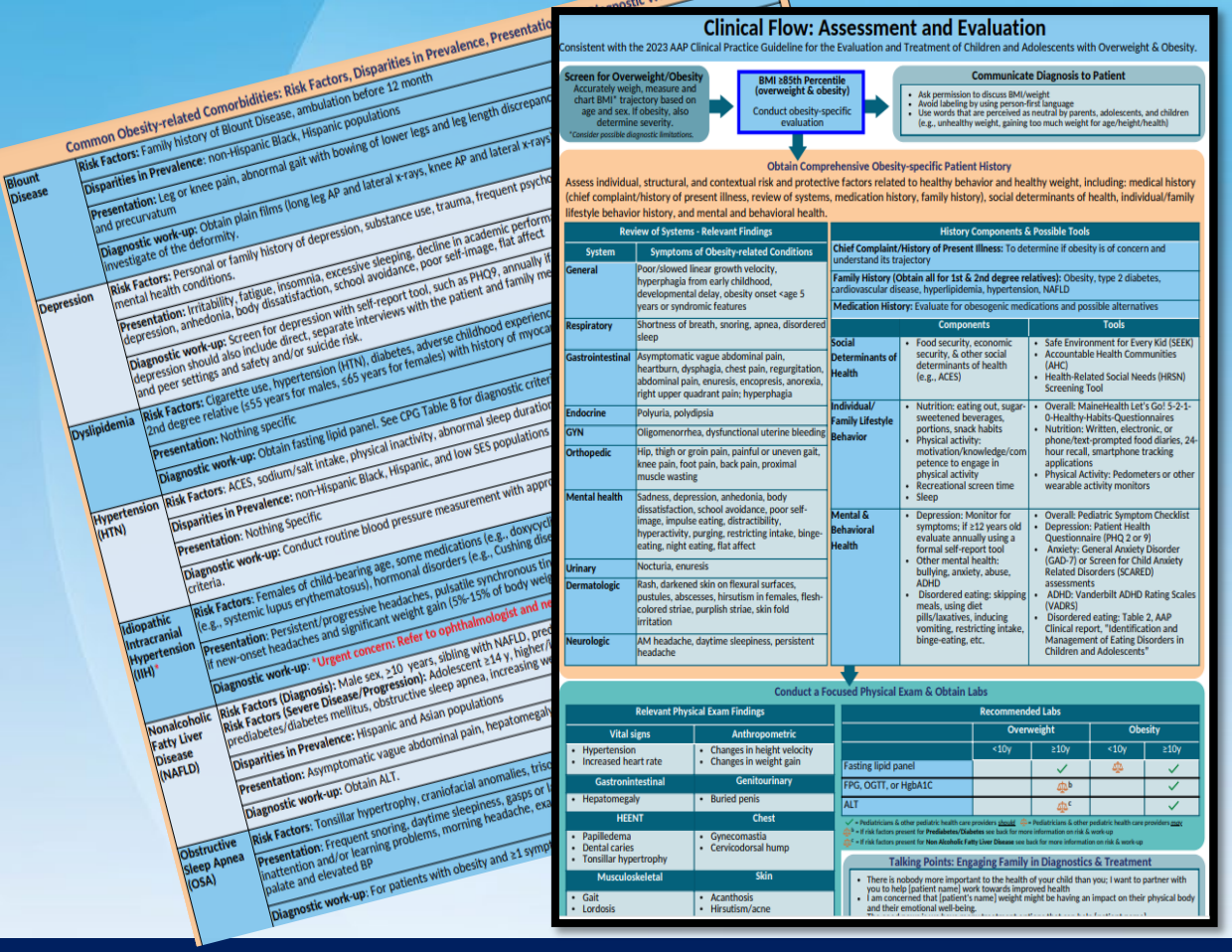
CPG

Evaluation & Treatment of Pediatric Obesity

Implementation Supports

AAP Resources & Website

www.aap.org/obesitycpg



Clinical Flow: Assessment and Evaluation

Screening, Diagnosis, and Evaluation

Clinical Practice Supports: Evaluation

Conduct a Focused Physical Exam & Obtain Labs

Relevant Physical Exam Findings

Vital signs	Anthropometric
• Hypertension • Increased heart rate	• Changes in height velocity • Changes in weight gain
Gastronintestinal	**Genitourinary**
• Hepatomegaly	• Buried penis
HEENT	**Chest**
• Papilledema • Dental caries • Tonsillar hypertrophy	• Gynecomastia • Cervicodorsal hump
Musculoskeletal	**Skin**
• Gait • Lordosis • Hip pain and/or limp • Genu varum/valgum • Ped planus	• Acanthosis • Hirsutism/acne • Striae • Intertrigo • Pannus

Recommended Labs

	Overweight		Obesity	
	<10y	≥10y	<10y	≥10y
Fasting lipid panel		✓	⚖	✓
FPG, OGTT, or HgbA1C		⚖[b]		✓
ALT		⚖[c]		✓

✓ = Pediatricians & other pediatric health care providers *should* ⚖ = Pediatricians & other pediatric health care providers *may*

⚖[b] = If risk factors present for **Prediabetes/Diabetes** see back for more information on risk & work-up

⚖[c] = If risk factors present for **Non Alcoholic Fatty Liver Disease** see back for more information on risk & work-up

Talking Points: Engaging Family in Diagnostics & Treatment

- There is nobody more important to the health of your child than you; I want to partner with you to help [patient name] work towards improved health
- I am concerned that [patient's name] weight might be having an impact on their physical body and their emotional well-being.
- The good news is we have many treatment options that can help [patient name].
- One of the ways I can best help you and [patient name] is to understand the impact [overweight/obesity] is having on their body is to get [labs and/or insert diagnostic test].
- Together, with information from the labs and test and key information from your family, we can work to develop a treatment plan specific to [patient name].
- If it is okay with you, I would like for us to meet again in a month to develop a treatment plan that we can collectively work on over this next year.

REFER TO BACK: Obesity-related Co-morbid Conditions ➡

Review of Systems - Relevant Findings	
System	**Symptoms of Obesity-related Conditions**
General	Poor/slowed linear growth velocity, hyperphagia from early childhood, developmental delay, obesity onset <age 5 years or syndromic features
Respiratory	Shortness of breath, snoring, apnea, disordered sleep
Gastrointestinal	Asymptomatic vague abdominal pain, heartburn, dysphagia, chest pain, regurgitation, abdominal pain, enuresis, encopresis, anorexia, right upper quadrant pain; hyperphagia
Endocrine	Polyuria, polydipsia
GYN	Oligomenorrhea, dysfunctional uterine bleeding
Orthopedic	Hip, thigh or groin pain, painful or uneven gait, knee pain, foot pain, back pain, proximal muscle wasting
Mental health	Sadness, depression, anhedonia, body dissatisfaction, school avoidance, poor self-image, impulse eating, distractibility, hyperactivity, purging, restricting intake, binge-eating, night eating, flat affect
Urinary	Nocturia, enuresis
Dermatologic	Rash, darkened skin on flexural surfaces, pustules, abscesses, hirsutism in females, flesh-colored striae, purplish striae, skin fold irritation
Neurologic	AM headache, daytime sleepiness, persistent headache

History Components & Possible Tools		
Chief Complaint/History of Present Illness: To determine if obesity is of concern and understand its trajectory		
Family History (Obtain all for 1st & 2nd degree relatives): Obesity, type 2 diabetes, cardiovascular disease, hyperlipidemia, hypertension, NAFLD		
Medication History: Evaluate for obesogenic medications and possible alternatives		
	Components	**Tools**
Social Determinants of Health	• Food security, economic security, & other social determinants of health (e.g., ACES)	• Safe Environment for Every Kid (SEEK) • Accountable Health Communities (AHC) • Health-Related Social Needs (HRSN) Screening Tool
Individual/ Family Lifestyle Behavior	• Nutrition: eating out, sugar-sweetened beverages, portions, snack habits • Physical activity: motivation/knowledge/competence to engage in physical activity • Recreational screen time • Sleep	• Overall: MaineHealth Let's Go! 5-2-1-0-Healthy-Habits-Questionnaires • Nutrition: Written, electronic, or phone/text-prompted food diaries, 24-hour recall, smartphone tracking applications • Physical Activity: Pedometers or other wearable activity monitors
Mental & Behavioral Health	• Depression: Monitor for symptoms; if ≥12 years old evaluate annually using a formal self-report tool • Other mental health: bullying, anxiety, abuse, ADHD • Disordered eating: skipping meals, using diet pills/laxatives, inducing vomiting, restricting intake, binge-eating, etc.	• Overall: Pediatric Symptom Checklist • Depression: Patient Health Questionnaire (PHQ 2 or 9) • Anxiety: General Anxiety Disorder (GAD-7) or Screen for Child Anxiety Related Disorders (SCARED) assessments • ADHD: Vanderbilt ADHD Rating Scales (VADRS) • Disordered eating: Table 2, AAP Clinical report, "Identification and Management of Eating Disorders in Children and Adolescents"

Clinical Practice Support: Labs

NHLBI Criteria for Lipid Testing Results▲				
Lipid Category	**Low (mg/dL)**	**Acceptable (mg/dL)**	**Borderline High (mg/dL)**	**High (mg/DL)**
Total cholesterol	-	<170	170-199	≥200
LDL cholesterol	-	<110	110-129	≥130
HDL cholesterol	<40	>45	-	-
Triglycerides • 0-9 years • 10-19 years	 - -	 <75 <90	 75-99 90-129	 ≥100 ≥130
Non-HDL cholesterol	-	<120	120-144	≥145

▲From CPG Table 8, adapted from the NHLBI Expert Panel on Integrated Guidelines for Cardiovascular Health

Criteria for Diagnosing Prediabetes and T2DM♦		
	Prediabetes/Impaired Glucose tolerance	**Diabetes Mellitus[a]**
Fasting plasma glucose (FBG)[b]	100-125 mg/dL	≥126 mg/dL
2-hour plasma glucose (OGTT)[c]	140-199 mg/dL	≥200 mg/dL
Random plasma glucose (RBG)[d]	Not applicable	≥200 mg/dL
Hemoglobin (HbA1c)[e]	5.7% - 6.4%	≥6.5%

[a] In the absence of unequivocal hyperglycemia, diagnosis is confirmed if 2 different tests are above threshold or a single test is above threshold on 2 separate occasions.
[b] Fasting for at least 8 hours with no calorie intake.
[c] Oral glucose tolerance test (OGTT) using a load 1.75 g/kg of body weight of glucose with a maximum of 75 g.
[d] In patients with hyperglycemic crises or classic symptoms of hyperglycemia (eg, polyuria, polydipsia).
[e] Glycosylated hemoglobin (HbA1c) is the preferred test for monitoring prediabetes.

♦From CPG Table 10, based on American Diabetes Association Standards of Medical Care in Diabetes- 2021

BP Categories by Age and Number of Visits Needed for Diagnosis■			
BP Category	**Children 1-13 Years of Age**	**Children ≥13 Years of Age**	**Number of Visits to Diagnosis**
Normal	BP <90th percentile	BP <120/80 mm Hg	n/a
Elevated	BP ≥90th percentile to <95th percentile	120/<80 to 129/<80 mm Hg	3
Stage 1	BP ≥95th percentile to <95th percentile + 12 mmHg	130/80 to 139/89 mm Hg	3
Stage 2	BP ≥95th percentile + 12 mm Hg	≥140/90 mm Hg	2

■Used in CPG Table 12 with permission, adapted from the AAP HTN CPG, Figure 2, and AAP Pediatric Obesity Clinical Decision Support Chart

Clinical Practice Support: Billing

ICD -10 Diagnosis Codes: Obesity, Comorbidities & Lab Abnormalities

Obesity as a Primary Diagnosis	BMI Specification
E66. 3 Overweight	Z68.53 (85th %ile to <95th %ile for age)
E66.8 Obesity, other	Z68.54 (≥95th %ile for age)
E66.01 Severe Obesity	

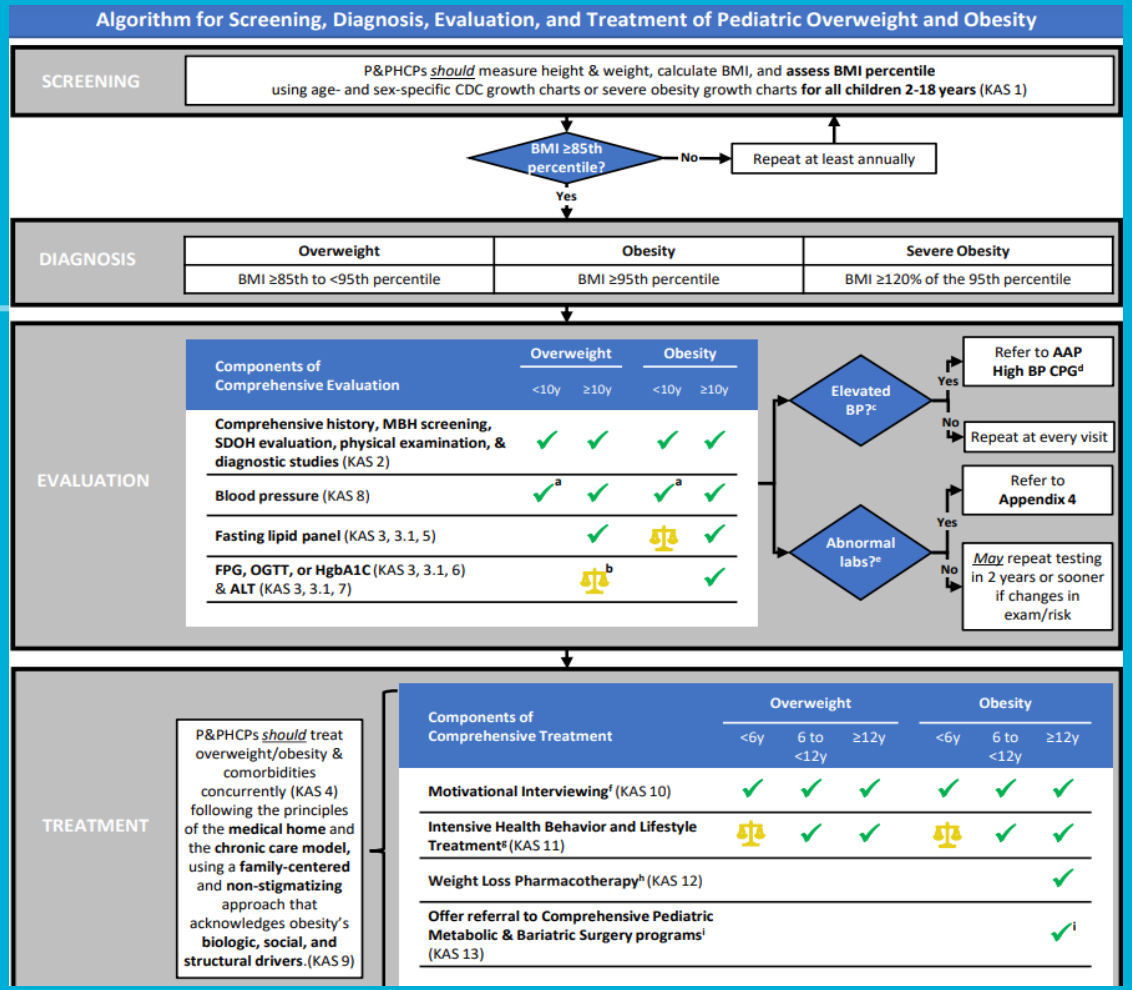
Code	Description
I10	Hypertension
E78.5	Dyslipidemia aka Hyperlipidemia
E78.0-	Hypercholesterolemia (elevated LDL or VLDL)
E78.2	Mixed hyperlipidemia aka Combined hyperlipidemia (elevated LDL, VLDL, and/or TG)
E78.1	Hypertriglyceridemia

Code	Description
E28.2	Polycystic Ovarian Syndrome (PCOS)
E55.9	Vitamin D Deficiency
R73.03	Other abnormal glucose; prediabetes
R73.01	Impaired Fasting Glucose
E03.8	Hypothyroidism, other unspecified
G47.33	Obstructive Sleep Apnea
K76.0	Non-Alcoholic Fatty Liver Disease (NAFLD)
R74.01	Elevated ALT
R74.8	Elevated liver enzymes
K21.9	Esophageal Reflux

Code	Description
K59.00	Constipation
F50.9	Eating Disorder, unspecified
F41.9	Anxiety Disorder
F32.9	Depression, single episode
G93.2	Idiopathic Intracranial Hypertension (IIH)
M92.51	Blount Disease
M93.00-	Slipped Capital Femoral Epiphysis (SFCE)

This resource was developed by the American Academy of Pediatrics Institute for Healthy Childhood Weight

CPG Algorithm



https://www.aap.org/en/patient-care/institute-for-healthy-childhood-weight/clinical-practice-guideline-for-the-evaluation-and-treatment-of-pediatric-obesity/

Changes you may wish to make in practice

1. Perform a comprehensive evaluation for children with obesity to identify comorbidities and treat them concurrently with obesity.
2. Identify “silent” metabolic comorbidities through laboratory evaluation.
3. Use AAP resources to help with implementation of recommendations in your practice.

Summary: Assessment and Evaluation

Assessment	Tool
Determine weight classification	BMI percentile
Awareness of risk factors using a whole child approach	Bio-socio-ecological model
Identify current behaviors and context of behaviors	Brief questionnaires and HPI
Evaluate medical risk	Family medical hx, ROS, PE, Labs
Determine readiness to change to engage family in treatment	Motivational interviewing

Questions?

"Because obesity is a chronic disease with escalating effects over time, a life course approach to identification and treatment should begin as early as possible and continue longitudinally through childhood, adolescence, and young adulthood, with transition into adult care. – CPG"

THANK YOU!

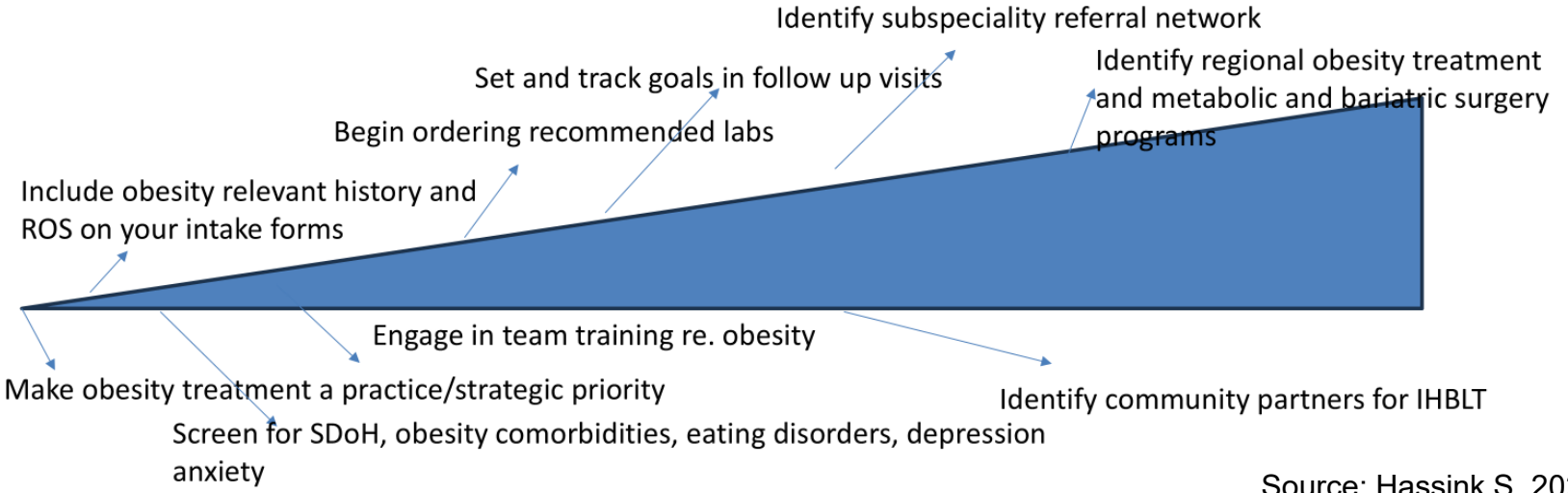
Back Up Slides

Gulati A, Kaplan DW, Daniels SR: Clinical Tracking of Severely Obese Children: A New Growth Chart. Pediatrics 2012 Nov 5, PMID 23129082

Source: BMI from CDC. Obese BMI calculated % of 95th percentile.

Treating Childhood and Adolescent Obesity

Know where you are and start there.
This is a marathon not a sprint.
Practice change is most successful when it is based on your capacity and needs, goals are achievable, clear, measurable and supported by the team and the system you are working in.



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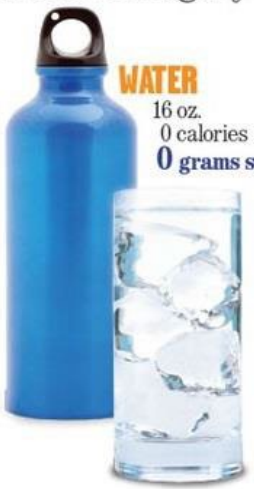
SUGAR SHOCKERS

Drink Water instead of Sugary Drinks



WATER
16 oz.
0 calories
0 grams sugar

100% JUICE SMOOTHIE
15.2 oz. bottle ▲ 300 calories
60 grams sugar

LEMON-LIME SODA*
20 oz. bottle ▲ 285 calories
77 grams sugar

ORANGE SODA*
20 oz. bottle ▲ 325 calories
85 grams sugar

COLA* WITH ICE
44 oz. cup ▲ 510 calories
38 oz. cola, 6 oz. ice
128 grams sugar

ICED COFFEE* MOCHA FLAVOR
9.5 oz. bottle ▲ 180 calories
31 grams sugar

SPORTS DRINK*
20 oz. bottle ▲ 125 calories
35 grams sugar

SWEETENED ICED TEA*
16 oz. bottle ▲ 140 calories
36 grams sugar

ENERGY DRINK*
15 oz. can ▲ 200 calories
54 grams sugar

100% ORANGE JUICE
8 oz. glass ▲ 110 calories
21 grams sugar

CHOCOLATE SKIM MILK*
8 oz. glass ▲ 145 calories
23 grams sugar

100% APPLE JUICE
8 oz. glass ▲ 115 calories
27 grams sugar

CRANBERRY JUICE COCKTAIL*
8 oz. glass ▲ 130 calories
30 grams sugar

COFFEE
8 oz. cup ▲ 0 calories
0 grams sugar

VEGETABLE JUICE
8 oz. glass ▲ 50 calories
8 grams sugar

PLAIN SOY MILK*
8 oz. glass ▲ 120 calories
8 grams sugar

SKIM MILK
8 oz. glass ▲ 90 calories
12 grams sugar

* Contains added sugar. Dietary guidelines recommend consuming no more than 10% of daily calories from added sugar. Sugar in milk and most juices are naturally occurring and do not contribute added sugar.
One sugar cube = 2.5 grams of sugar. NOTE: Nutrition information based on typical values for drinks shown and may vary by brand or manufacturer. The number of sugar cubes pictured are rounded to the nearest whole cube.