MaineHealth

LET'S GO!

5-2-1-0

Let's Go!
Childhood Obesity Project ECHO®

Dr. Tory Rogers
Dr. Carrie Gordon
Dr. Sandy Hassink
Meg Nadeau

February 3, 2022

The Barbara Bush Children's Hospital
At Maine Medical Center

Project ECHO®

Housekeeping

- This session will be recorded for educational and quality improvement purposes.
- Please do not provide any protected health information (PHI) during any ECHO session.
- Zoom trouble? Chat to Meg Nadeau

Please turn on your video!

Please enter your name, organization, and email address (needed for CME) in the chat.

If you are watching as a group, please put everybody's information in the chat.

Introduce Yourself

Please mute your microphone when not speaking.

Microphones

Welcome and Introductions (5 min)

Lecture & Q&A (25 min)

Case/Discussion (25 min)

Close (5 min)

Agenda

MaineHealth LET'S GO! 5-2-1-0

The Barbara Bush Children's Hospital At Maine Medical Center

Project ECHO

Focus of this Project ECHO®

- Increase the understanding and minimization of bias and stigma that is associated with obesity
- Promote a supportive, health-forward approach in your workforce and office environment around treatment of obesity
- Model health-focused language for parents
- Put Motivational Interviewing into practice
- Develop individualized treatment plans based on obesity physiology to help families reach their healthy goals
- Initiate treatment early and provide timely follow up

Obesity Comorbidities

Sandra G Hassink, MD
Medical Director AAP Institute for Healthy Childhood Weight

Learning Objectives

- Understand the appropriate workup of the most common comorbidities associated with obesity.
- Be familiar with treatment of obesity comorbidities.
- Be prepared to co manage obesity comorbidities with pediatric specialists.

Common Co-morbidities of Obesity

Obesity-related conditions: The following conditions are associated with obesity and should be considered for further work-up. Additional lab tests may be warranted if indicted by the patient's clinical condition.[5] In 2014, consensus statements from The Children's Hospital Association described the management of a number of these conditions.[6,7]

Dermatologic:

- Acanthosis nigricans
- Hirsutism
- Intertrigo

Endocrine:

- Polycystic ovarian syndrome (PCOS)
- Precocious puberty
- Prediabetes: Impaired fasting glucose and/or impaired glucose tolerance as demonstrated during a GTT
- Premature adrenarche
- Type 2 Diabetes

Gastrointestinal:

- Cholelithiasis
- Constipation
- GERD
- Nonalcoholic fatty liver disease or steatohepatitis

Neurologic:

- Pseudotumor cerebri

Orthopedic:

- Blount's Disease
- Slipped capital femoral epiphysis (SCFE)

Psychological/Behavioral Health:

- Anxiety
- Binge eating disorder
- Depression
- Teasing/bullying

https://ihcw.aap.org/Documents/Assessment%20%20and%20Management%20of%20Childhood%20Obesity%20Algorithm_FINAL.pdf

Identifying Comorbidities - Review of Systems

Symptoms	Probable causes
Snoring/sleep disturbances	Obstructive sleep apnea
Abdominal pain	GERD, constipation, gall bladder disease, NAFLD
Menstrual irregularities	Polycystic ovary syndrome/Prader-Willi syndrome
Hip, Knee, Leg pain	SCFE
Foot Pain	Musculoskeletal stress from weight
Polyuria/Polydipsia	Type 2 DM
Anxiety, school avoidance, social isolation	Depression
Severe recurrent headaches	Pseudotumor cerebri
Shortness of breath	Asthma

Barlow S, Expert Committee. Expert committee recommendations regarding prevention, assessment, and treatment of child and adolescent overweight and obesity: Summary report. Pediatrics. 2007;120(4):S164-S192.
www.ihcw.aap.org

Identifying Comorbidities - Physical Examination

Findings	Possible Explanations
Elevated Blood Pressure (correct cuff)	Hypertension on 3 or more occasions
Short Stature	Underlying endocrine conditions
Acanthosis nigricans	Increased risk of insulin resistance
Acne, Hirsutism	Polycystic ovary syndrome
Skin irritation, inflammation	Intertrigo
Papilledema, cranial nerve VI paralysis	Pseudotumor cerebri
Tonsillar hypertrophy	Obstructive sleep apnea
Goiter	Hypothryroidism
Wheezing	Asthma
Tender Abdomen	GERD, gallbladder disease, NAFLD
Abnormal gait, limited hip range	SCFE
Bowing of tibia	Blount disease
Small hands and feet, polydactyly	Some genetic syndromes
Reproductive (Tanner stage, apparent micropenis, undescended testes)	Premature puberty, may be normal penis buried in fat, Prader-Willi syndrome

Barlow S, Expert Committee. Expert committee recommendations regarding prevention, assessment, and treatment of child and adolescent overweight and obesity: Summary report. Pediatrics. 2007;120(4):S164-S192.

Common Obesity Comorbidities

- Hypertension
- Type 2 Diabetes
- Dyslipidemia
- Obstructive Sleep Apnea Syndrome
- Slipped Capital Femoral Epiphysis
- Blount Disease
- Polycystic Ovary Syndrome
- Depression
- Obesity Related Emergencies

Hypertension

Hypertension	
History	Family history of hypertension or other obesity-related comorbidity
Review of systems	Usually asymptomatic
Physical examination	Elevated systolic and/or diastolic blood pressure
Laboratory/imaging	Evaluation for other causes of hypertension as indicated
Treatment	Referral to pediatric hypertension specialist, dietary treatment, pharmacologic treatment; Weight reduction is the primary therapy for obesity-related hypertension

Hypertension (HTN)

- Obesity
  - Thought to be the strongest modifiable risk factor for HTN in childhood.
- HTN early in life predicts adult hypertension
  - Associated with shorter lifespan from higher cardiovascular mortality.
- Weight reduction is the primary therapy for obesity-related hypertension
  - Prevention of excess weight gain will limit future increases in BP.
- Regular physical activity has cardiovascular benefits.
  - Regular aerobic PA (30-60 moderate PA on most days) and limitations of sedentary activities to <2 hours/day are recommended).
- Beneficial diet
  - Fresh vegetables and fruits, fiber, and nonfat dairy as well as a reduction of sodium.

AAP Hypertension CPG

http://pediatrics.aappublications.org/content/early/2017/08/21/peds.2017-1904

High Blood Pressure Screening

- Measure BP annually in children and adolescents ≥3 y of age.
- Measure BP in all children and adolescents ≥3 y of age at every health care encounter if they have:
  - Obesity
  - Taking medications known to increase BP
  - Renal disease
  - History of aortic arch obstruction or coarctation
  - Diabetes.
- Children and adolescents ≥6 y of age do not require an extensive evaluation for secondary causes of HTN if:
  - Positive family history of HTN
  - Have overweight or obesity
  - And/or do not have history or physical examination findings suggestive of a secondary cause of HTN
    - Flynn JT, et.al. CPG for Screening and Management of High Blood Pressure in Children and Adolescents. Pediatrics. 2017 Sep;140(3):e20171904.

TABLE 10 Screening Tests and Relevant Populations

Patient Population	Screening Tests
All patients	Urinalysis
	Chemistry panel, including electrolytes, blood urea nitrogen, and creatinine
	Lipid profile (fasting or nonfasting to include high-density lipoproteina and total cholesterol)
	Renal ultrasonography in those <6 y of age or those with abnormal urinalysis or renal function
In the obese (BMI >95th percentile) child or adolescent, in addition to the above	Hemoglobin A1c (accepted screen for diabetes)
	Aspartate transaminase and alanine transaminase (screen for fatty liver)
	Fasting lipid panel (screen for dyslipidemia)
Optional tests to be obtained on the basis of history, physical examination, and initial studies	Fasting serum glucose for those at high risk for diabetes mellitus
	Thyroid-stimulating hormone
	Drug screen
	Sleep study (if loud snoring, daytime sleepiness, or reported history of apnea)
	Complete blood count, especially in those with growth delay or abnormal renal function

Adapted from Wiesen J, Adkins M, Fortune S, et al. Evaluation of pediatric patients with mild-to-moderate hypertension: yield of diagnostic testing. *Pediatrics*. 2008;122(5). Available at: www.pediatrics.org/cgi/content/full/122/5/e988.

AAP Hypertension CPG
http://pediatrics.aappublications.org/content/early/2017/08/21/peds.2017-1904

AAP Hypertension Clinical Practice Guideline (CPG) Treatment

- Key Action Statement
  - At the time of diagnosis of elevated BP or HTN in a child or adolescent, clinicians should provide
    - Advice on the DASH diet and
    - Recommend moderate to vigorous physical activity at least 3 to 5 days per week (30–60 minutes per session) to help reduce BP
- Key Action Statement
  - If lifestyle modifications are unsuccessful in children/adolescents (particularly those with LVH, symptomatic HTN, or stage 2 HTN without a clearly modifiable factor [e.g., obesity])
    - Clinicians should initiate pharmacologic treatment with an ACE inhibitor, ARB, long-acting calcium channel blocker, or thiazide diuretic.

AAP Hypertension CPG

http://pediatrics.aappublications.org/content/early/2017/08/21/peds.2017-1904

Type 2 Diabetes

Type 2 Diabetes	
History	Maternal diabetes during pregnancy, small for gestational age, intrauterine growth retardation, family history of diabetes
Review of systems	Polyuria; polydipsia; nocturia; recurrent vaginal, bladder, or other infections; recent weight loss
Physical examination	Acanthosis nigricans
Laboratory/imaging	Elevated fasting glucose, glycosuria, positive glucose tolerance test, hyperinsulinemia, hemoglobin A1C
Treatment	Referral to pediatric endocrinologist for treatment with metformin or insulin or lifestyle change

Screening

•In children with overweight or obesity, clinicians should evaluate for prediabetes and/or Type 2 diabetes after the onset of puberty or after 10 years of age in the presence of one or more additional risk factors

- Maternal history of diabetes or GDM during the child's gestation
- Family history of type 2 diabetes in first- or second-degree relative
- Race/ethnicity (Native American, African American, Latino, Asian American, Pacific Islander)
- Signs of insulin resistance or conditions associated with insulin resistance (acanthosis nigricans, hypertension, dyslipidemia, polycystic ovary syndrome, or small-for-gestational-age birth weight),
- Use of atypical antipsychotic medications

- Note: Persistent weight gain is a predictor of persistent pre-diabetes and progression to diabetes.
  - American Diabetes Association; 2. Classification and Diagnosis of Diabetes Diabetes Care 1 January 2017; 40 (Supplement_1): S11–S24.

HbA1c

- "HbA1c is a useful non fasting test in children and adolescents, regardless of screening eligibility."
- Youth with prediabetic levels of HbA1c or fasting glucose have a high burden of other cardiometabolic risk factors.
- This suggests that intensive lifestyle interventions in this high-risk population could help prevent future diabetes and cardiovascular risk in adulthood."

  - Wallace AS, Wang D, Shin JI, Selvin E. Screening and Diagnosis of Prediabetes and Diabetes in US Children and Adolescents. Pediatrics. 2020 Sep;146(3):e20200265.

Criteria for diagnosing pre-diabetes and diabetes

	Prediabetes	Diabetes[4]
Fasting plasma glucose (FBS)[1]	100-125 mg/dl	≥126 mg/dL
2-hour plasma glucose (OGTT)[2]	140–199 mg/dL	≥200 mg/dL
Random plasma glucose (RBG)[3]	Not applicable	≥200 mg/dL
Hemoglobin A1c	5.7–6.4%	≥6.5%

[1] Fasting for at least 8 hours with no calorie intake.
[2] OGTT using a load 1.75 g/kg of body weight of glucose with a maximum of 75 g.
[3] In patients with hyperglycemic crises or classic symptoms of hyperglycemia (e.g., polyuria, polydipsia).
[4] In the absence of unequivocal hyperglycemia, diagnosis is confirmed if two different tests are above threshold or a single test is above threshold twice.
OGTT, oral glucose tolerance test; A1c, glycosylated hemoglobin.

5 Children with Sickle Cell Disease can have artificially low HgA1c

Adapted from the American Diabetes Association Recommendations

American Diabetes Association; 2. Classification and Diagnosis of Diabetes Diabetes Care 1 January 2017; 40 (Supplement_1): S11–S24. https://doi.org/10.2337/dc17-S005

Treatment Considerations-Prediabetes

- Lifestyle modifications:
  - Nutrition, activity, sleep, stress, sedentary behavior
- BMI reduction
- Educate patient on symptoms that require they contact provider between visits (polyuria, polydipsia, nocturia, signs of dehydration, abdominal pain).
- Consider referral to pediatric endocrinologist
- Follow up 3 months repeat HbA1c
- If after 6 months of lifestyle modification, HbA1c 6-6.5% and/or impaired fasting glucose, and/or impaired glucose tolerance could consider metformin (but not consensus on this treatment).

- Magge SN, Silverstein J, Elder D, Nadeau K, Hannon TS. Evaluation and Treatment of Prediabetes in Youth. J Pediatr. 2020;219:11-22.

Treatment Considerations-Diabetes

- Lifestyle changes- Nutrition & activity
- BMI reduction
- Metformin and liraglutide remain the only non-insulin treatments formally approved in the US for use in this population.
- Use of insulin with poor Hgb A1c control
- Refer to team with endocrinologist
- Social support
- Bariatric Surgery- Sleeve gastrectomy

- Currie, B. M., et.al. (2021)A Review of Interventional Trials in Youth-Onset Type 2 Diabetes: Challenges and Opportunities. Diabetes therapy : research, treatment and education of diabetes and related disorders, 12(11), 2827–2856.

Dyslipidemia

Dyslipidemia	
History	Family history of lipid disorders, cardiovascular disease
Review of systems	Asymptomatic; other obesity comorbidities, particularly signs of metabolic syndrome
Physical examination	No specific signs; acanthosis nigricans may indicate metabolic syndrome
Laboratory/imaging	Lipid panel
Treatment	Referral to lipid specialist, dietary management

Dyslipidemia

Category	Acceptable (mg/dL)	Borderline (mg/dL)	High (mg/dL)
Total Cholesterol	<170	179-199	>=200
LDL-C	<110	110-129	>=130
Non-HDL-C	<120	120-144	>=145
Triglycerides (y)			
0-9	<75	75-99	>=100
10-19	<90	90-129	>=130
HDL-C	>45	40-45	<40

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Grundy SM, Stone NJ, Bailey AL, et al. Guideline on the Management of Blood Cholesterol: A Report of the American College of Cardiology/American Heart Association Task Force on Clinical Practice Guidelines. J Am Coll Cardiol. 2019; 73(24):e285-e350.

Recommendations AHA and American College of Cardiology Guidelines

- Reasonable to measure fasting lipid profile or non-fasting non-HDL-C between 9-11 yrs. and between 17 and 21 yrs. in patients without cardiovascular risk factors or family history of early cardiovascular disease,
- reasonable to measure lipids as early as 2 yrs. to detect FH or rare forms of hypercholesterolemia in children with positive family history of early cardiovascular disease or hypercholesterolemia.
- Reasonable to measure a fasting lipid profile In patients with obesity or other metabolic risk factors.

- Grundy SM, et al. Guideline on the Management of Blood Cholesterol: A Report of the American College of Cardiology/AHA Task Force on Clinical Practice Guidelines. J Am Coll Cardiol. 2019; 73(24):e285-e350.

Recommendations for Screening and Treatment - AHA and American College of Cardiology Guidelines

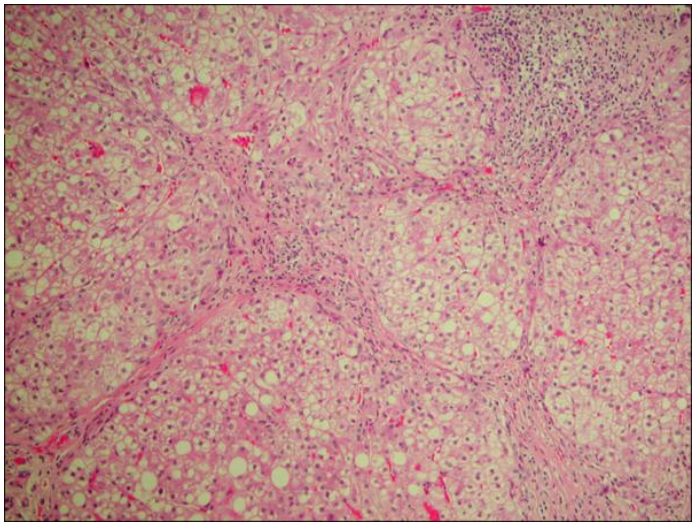
- Intensify lifestyle therapy in children with obesity related lipid disorders (Beneficial for lowering LDL-C).
- Reasonable to initiate statin therapy in children>10 yrs. with persistently elevated LDL-C 190mg/dl or higher and clinical presentation consistent with FH who do not respond to lifestyle therapy in 3-6 mos.
- Reasonable to screen other family members to detect familial forms of hypercholesterolemia in patients found to have moderate or severe hypercholesterolemia

- Grundy SM, et al. Guideline on the Management of Blood Cholesterol: A Report of the American College of Cardiology/AHA Task Force on Clinical Practice Guidelines. J Am Coll Cardiol. 2019; 73(24):e285-e350.

Nonalcoholic Fatty Liver Disease (NAFLD)

Nonalcoholic Steatohepatitis	
History	No specific history; some cases have other family members affected
Review of systems	Possible nausea and upper right quadrant discomfort
Physical examination	Hepatomegaly
Laboratory/imaging	Elevated serum aminotransferases, echogenicity of liver on ultrasound
Treatment	Referral to pediatric gastroenterologist for evaluation and definitive diagnosis, weight loss

Nonalcoholic Fatty Liver Disease (NAFLD) to Nonalcoholic Steatohepatitis (NASH)



Obesity

Fatty Liver/Steatosis

Genetic Predisposition

2nd "Hit"

Inflammation → Fibrosis → Cirrhosis

- Day CP, James OF. Gastroenterology 1998;114(4):842-5.
Harrison SA, Diehl AM. Semin Gastrointest Dis 2002;13(1): 3-16.

Screening in NAFLD– Risk factors

- Screen children with obesity beginning between ages 9–11 yrs. and children with overweight with additional risk factors
  - Central adiposity, insulin resistance, pre-diabetes or diabetes, dyslipidemia, sleep apnea or family history of NAFLD/NASH).
- Earlier screening
  - Consider in younger patients with risk factors such as severe obesity, family history of NAFLD/NASH or hypopituitarism.
- Consider screening of siblings and parents of children with NAFLD if they have known risk factors for NAFLD (obesity, Hispanic ethnicity, insulin resistance, pre-diabetes, diabetes, dyslipidemia).

- Vos MB, Abrams SH, Barlow SE, et al. NASPGHAN Clinical Practice Guideline, Journal of pediatric gastroenterology and nutrition 2017;64:319-34.

Screening Labs

- Currently, best screening test for NAFLD in children is ALT
  - Use gender specific upper limits of normal in children (22 U/L for girls and 26 U/L for boys),not individual laboratory upper limits of normal.
  - ALT more than 2X upper limit of normal for > 3 months should be evaluated for NAFLD or other causes of chronic hepatitis.
  - If ALT of >80 U/L is clinically concerning, needs timely evaluation-likelihood of significant liver disease.
  - Routine ultrasound is not recommended as a screening test for NAFLD (inadequate sensitivity and specificity).
- Follow-up screening for NAFLD.
  - If initial screening test is normal, consider repeating ALT every 2–3 years if risk factors remain unchanged.
    - Repeat sooner risk factors of NAFLD increase in number or severity.
    - Examples include excessive weight gain, development of medical problems that increase risk of NAFLD, such as type 2 diabetes or obstructive sleep apnea.
      - Vos MB, Abrams SH, Barlow SE, et al. NASPGHAN Clinical Practice Guideline, Journal of pediatric gastroenterology and nutrition 2017;64:319-34.

Diagnosis of NAFLD

- Dx requires presence of hepatic steatosis and exclusion of other causes of hepatic steatosis
  - DDX: Metabolic disorders e.g., Poorly controlled D2M, Wilson's disease, Medications e.g., antipsychotics, genetic e.g., Familial combined hyperlipemia, Infectious e.g., hepatitis, dietary causes e.g., rapid weight loss, parenteral nutrition, ETOH
- Liver biopsy should be considered for the assessment of NAFLD in children who have increased risk of NASH and/or advanced fibrosis.
  - Such as higher ALT (>80 U/L), splenomegaly, and AST/ALT >1. Known clinical risk factors, panhypopituitarism and type 2 diabetes.
- Neither ultrasound nor CT recommended for the determination or quantification of steatosis.
  - Vos MB, Abrams SH, Barlow SE, et al. NASPGHAN Clinical Practice Guideline, Journal of pediatric gastroenterology and nutrition 2017;64:319-34.

Diagnosis of NASH

- Liver biopsy is the current standard to define the presence and severity of NAFLD, including the presence of NASH, and to eliminate alternative and/or concurrent diagnoses.
  - Clinical parameters, do not adequately distinguish patients with NAFL from those with NASH.
- The optimal timing of liver biopsy to confirm the diagnosis of NAFLD and to follow-up on its progression has not been established.
- Benefits of liver biopsy include identifying those with more severe or progressive disease so that they can pursue more intensive treatment.
  - Liver biopsy differentiates other chronic liver diseases, such as autoimmune hepatitis, which can be challenging to exclude non-invasively.
    - Vos MB, Abrams SH, Barlow SE, et al. NASPGHAN Clinical Practice Guideline, Journal of pediatric gastroenterology and nutrition 2017;64:319-34.

NAFLD -Treatment

- First line treatment
  - -Lifestyle modifications to improve diet and increase physical activity
  - Avoidance of sugar-sweetened beverages is recommended as a strategy to decrease adiposity.
  - Increasing moderate to high intensity physical activity and limiting screen time activities to < 2 hours per day is recommended for all children including those with NAFLD.
- No currently FDA approved medications or supplements are recommended to treat NAFLD because none have been proven to benefit the majority of NAFLD patients.
- Bariatric surgery may be considered for selected adolescents with BMI ≥ 35 kg/m2, who have non-cirrhotic NAFLD and
- other serious comorbidities.

- Vos MB, Abrams SH, Barlow SE, et al. NASPGHAN Clinical Practice Guideline, Journal of pediatric gastroenterology and nutrition 2017;64:319-34.

Treatment follow up of NAFLD

- Sustained decrease in ALT from baseline may be used as a surrogate marker of response to treatment, particularly for durations of ≤ 1 yr.
  - Pending the development of more accurate biomarkers to non-invasively assess improvement in NAFLD,
- Assessment of change in fibrosis over time is reasonable as a treatment outcome in children over longer time periods (≥ 2 years) and currently requires a liver biopsy for staging.

Vos MB, Abrams SH, Barlow SE, et al. NASPGHAN Clinical Practice Guideline, Journal of pediatric gastroenterology and nutrition 2017;64:319-34.

NAFLD - Follow up

- Evaluate for other obesity related comorbidities.
- Counsel regarding the potential effects of increased fibrosis progression with binge drinking, smoking,2nd hand smoke and vaping.
- Children with NAFLD should be vaccinated routinely against hepatitis A and B.
- Evaluate transaminases and monitor
  - At diagnosis of T2DM
  - Before starting metformin and atypical antipsychotics
    - Vos MB, Abrams SH, Barlow SE, et al. NASPGHAN Clinical Practice Guideline, Journal of pediatric gastroenterology and nutrition 2017;64:319-34

Obstructive Sleep Apnea (OSAS)

Sleep Apnea	
History	Family history of sleep apnea
Review of systems	Snoring, snoring with apnea, daytime tiredness, napping, poor concentration in school, enuresis
Physical examination	Large tonsils or adenoids
Laboratory/imaging	Nighttime polysomnography
Treatment	Referral to pediatric pulmonologist, weight loss

Obstructive Sleep Apnea

- Complete or partial collapse of the upper airway leading to oxygen desaturations and arousals from sleep
  - Yu JL, Afolabi-Brown O. Updates on management of pediatric obstructive sleep apnea. Pediatr Investig. 2019 Dec 21;3(4):228-235.
- Associated sleep fragmentation, intermittent hypoxia, leading to sympathetic overactivity and an over-production of radical oxygen species involved in the development of type 2 diabetes, hypertension, and dyslipidemia
  - Patinkin ZW, Feinn R, Santos M. Metabolic consequences of obstructive sleep apnea in adolescents with obesity: a systematic literature review and meta-analysis. Child Obes. 2017;13:102–10

Diagnosis of OSAS

- Sleep Study (Polysomnography) is the gold standard for diagnosing OSA.
- Clinical presentation in children and adolescents can vary from minimal to overt
- Can includes symptoms and signs of upper airway obstruction.
  - Habitual snoring (≥3 nights/wk.),
  - Labored breathing and or gasps snorting noises during sleep
  - Sleeping in a seated position or with the neck hyperextended
  - Headaches on awakening
  - Daytime sleepiness, poor school performance, inattention
  - Enuresis
- Reliance on physical examination findings, such as tonsillar size, may not correlate well with the degree of airway obstruction

- Baker-Smith CM, et. al. Sleep-Disordered Breathing and Cardiovascular Disease in Children and Adolescents: A Scientific Statement From the American Heart Association. J Am Heart Assoc. 2021 Sep 21;10(18):e022427.

OSAS Diagnosis and Severity

- Severe OSA and young age (<3yrs) with significant comorbidities greater risk for potentially life-threatening airway obstruction with anesthetic administration and immediately after surgery.
  - Hospitalization for high-risk patients for the first 23 hours immediately after surgery is indicated.
- The severity of OSA is based on obstructive apnea and hypopnea index (AHI)
  - Mild - AHI is between 1 to 5 events per hour
  - Moderate - AHI > 5 to ≤ 10 events per hour
  - Severe - AHI is greater than 10 events per hour
    - Baker-Smith CM, et. al. Sleep-Disordered Breathing and Cardiovascular Disease in Children and Adolescents: A Scientific Statement From the American Heart Association. J Am Heart Assoc. 2021 Sep 21;10(18):e022427

Treatment OSAS in children with obesity

- In youth with obesity, multidisciplinary weight loss interventions are encouraged as a first treatment approach.
- Adenotonsillectomy has shown low success in treating OSA in youth with obesity
- Continuous positive airway pressure (CPAP) is effective but adherence in youth with OSA is relatively poor
- Surgical weight loss interventions have been shown effective in improving OSA severity.
    - Patinkin ZW, Feinn R, Santos M. Metabolic consequences of obstructive sleep apnea in adolescents with obesity: a systematic literature review and meta-analysis. Child Obes. 2017;13:102–10

Slipped Capital Femoral Epiphysis (SCFE)

Slipped Capital Femoral Epiphysis	
History	Knee or hip pain
Review of systems	Knee or hip pain, limp
Physical examination	Limp, pain in knee or hip
Laboratory/imaging	Hip and knee films
Treatment	Immediate non weight bearing and referral to pediatric orthopedist

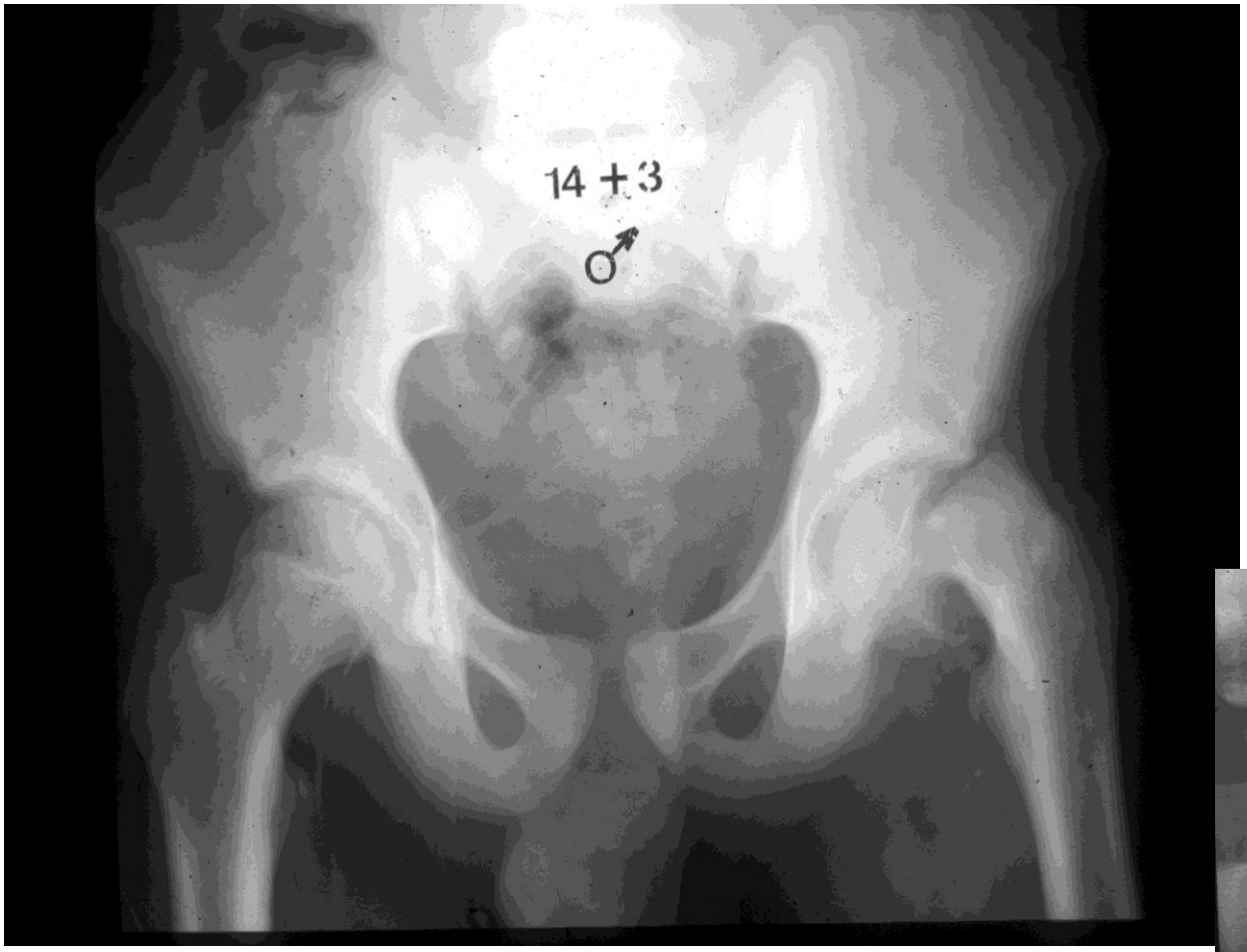
Slipped Capital Femoral Epiphysis

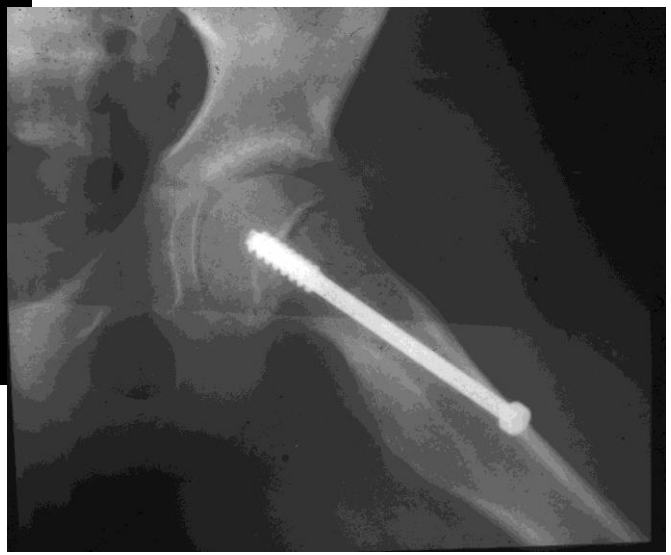
- Suspect and immediately evaluate in a patient with obesity who presents with limp
- Can also present with complaints of groin, thigh, or knee pain referred by obturator nerve
  - 50%-70% patients with SCFE have obesity
    - Wilcox J Pediatr Orthop 1988:8:196-200.
- Physical
  - Motion of the hip in abduction and internal rotation is limited on examination.
- X- ray
  - Anteroposterior view of the pelvis and frog leg that includes both hips.
  - Comparison of the hips
    - Bilateral disease occurs in up to 20% of patients.
- Intervention

  Requires immediate non weight bearing and surgical correction and weight loss.

  - Peck DM, Voss LM, Voss TT. Slipped Capital Femoral Epiphysis: Diagnosis and Management. Am Fam Physician. 2017 Jun 15;95(12):779-784. PMID: 28671425.

Slipped Capital Femoral Epiphysis

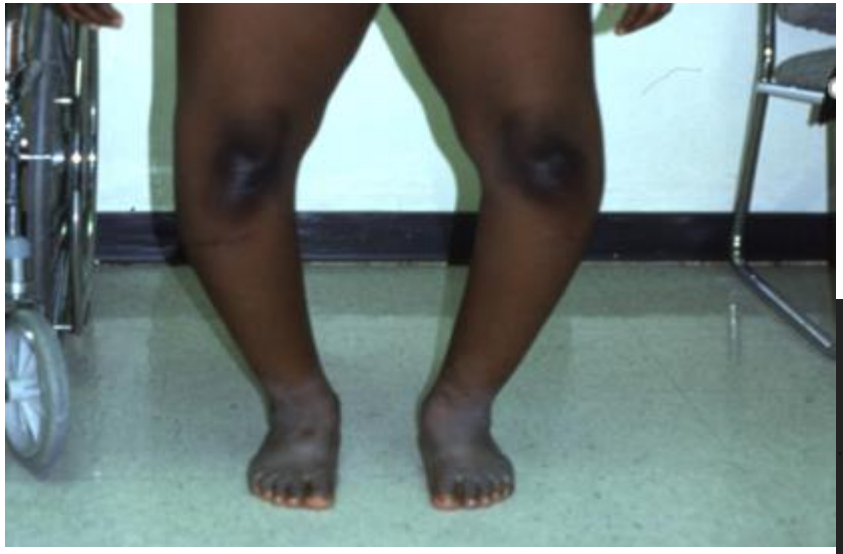


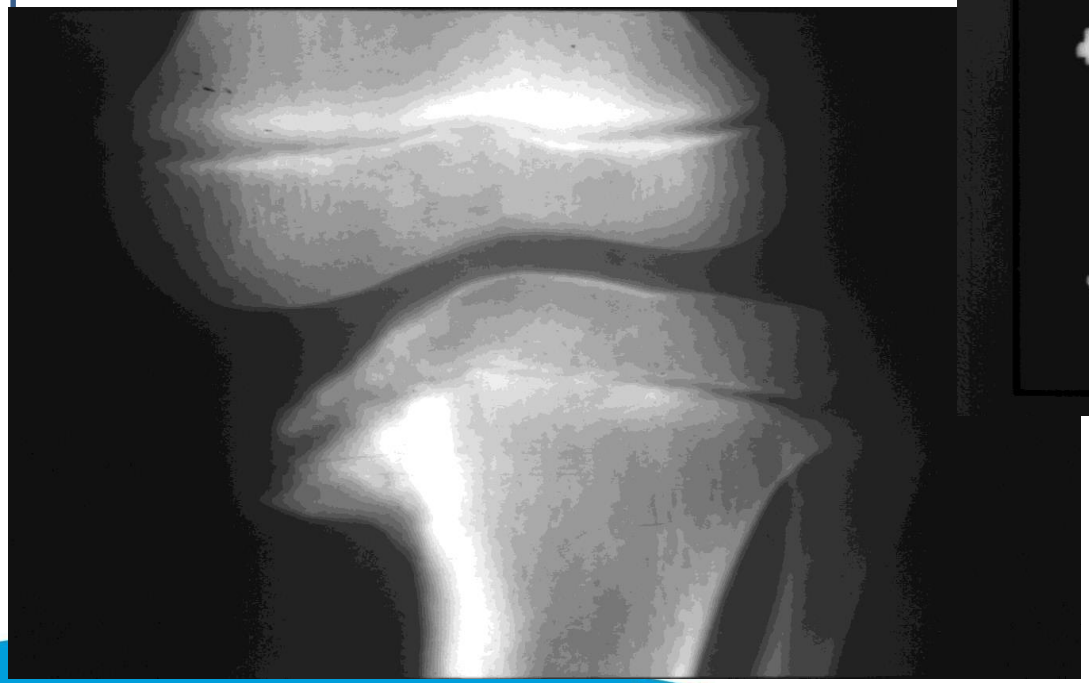


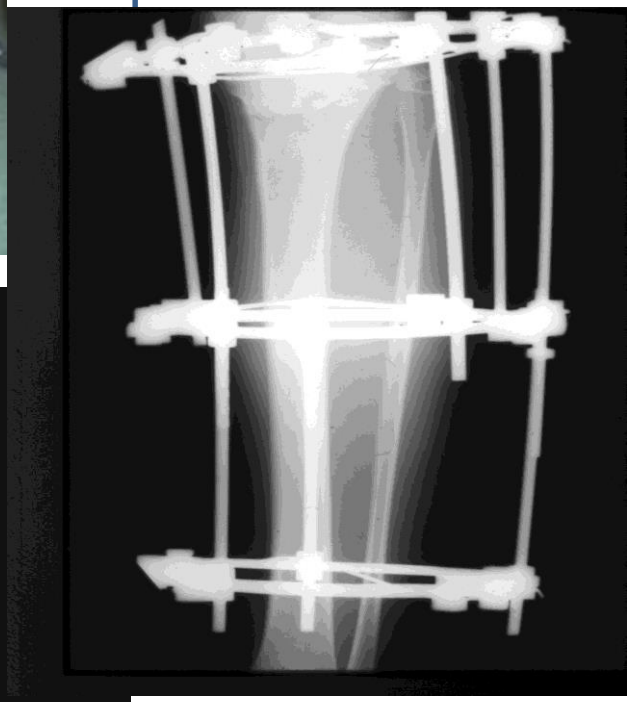
Blount Disease

Blount Disease	
History	Bowing
Review of systems	Bowing (tibia vera), knee pain, limp
Physical examination	Bowing, knee pain, limp
Laboratory/imaging	Knee films
Treatment	Referral to pediatric orthopedist

Blount Disease







Polycystic Ovary Syndrome (PCOS)

Polycystic Ovarian Syndrome	
History	Premature adrenarche, irregular menses
Review of systems	Glucose intolerance, prediabetes, type 2 DM
Physical examination	Hirsutism, acne, obesity, acanthosis nigricans
Laboratory/imaging	FSH, LH, estradiol, total or free testosterone ,Sex Hormone Binding Globulin (SHBG) Androstenedione (A4),Dehydroepiandrosterone Sulfate (DHEAS), obesity related metabolic labs
Treatment	Lifestyle, anti androgens, oral contraceptives

Clinical Diagnosis PCOS in Adolescents

Pediatric Endocrine Society criteria (2015)

- Abnormal uterine bleeding pattern
  - a. Abnormal for age or gynecologic age
  - b. Persistent symptoms for 1 - 2 years
- Evidence of hyperandrogenism
  - a. Persistent testosterone elevation
  - b. Moderate-severe hirsutism
  - c. Moderate-severe inflammatory acne vulgaris
    - Legro RS, Arslanian SA, Ehrmann DA, Hoeger KM, Murad MH, Pasquali R, et al. Diagnosis and treatment of polycystic ovary syndrome: An Endocrine Society clinical practice guideline. J Clin Endocrinol Metab. 2013;98(12):4565–92.
- PCOS can be associated with a wide range of cardiometabolic disorders, including obesity, type 2 diabetes mellitus, dyslipidemia, metabolic syndrome, hypertension, and risk factors for cardiovascular disease
    - Behboudi-Gandevani S, Amiri M, Bidhendi Yarandi R, NoroozzadehM, Farahmand M, Rostami Dovom M, et al. The risk of metabolic syndrome in polycystic ovary syndrome: A systematic review and metaanalysis. Clin Endocrinol (Oxf). 2018;88(2):169–84.

Diagnosis in Adolescence

- Rule out other causes of irregular or absent menses including pregnancy
- Ultrasound is not a first-line investigation in adolescents
- Ovarian dysfunction detected based on oligomenorrhea and/or biochemical evidence of oligo/anovulation
  - FSH, LH, estradiol
  - Total or free testosterone
  - Sex Hormone Binding Globulin (SHBG)
  - Androstenedione (A4) and Dehydroepiandrosterone Sulfate (DHEAS)
- Differential diagnosis
  - Prolactin
  - Serum cortisol
  - FT4 and TSH
  - 17 hydroxyprogesterone
- Labs associated with metabolic obesity comorbidities

- Ramezani Tehrani F, Amiri M. Polycystic Ovary Syndrome in Adolescents: Challenges in Diagnosis and Treatment. Int J Endocrinol Metab. 2019 Jul 27;17(3):e91554.

Common Therapeutic Options Used in Adolescents with PCOS

Options
Lifestyles interventions
Weight loss
Physical exercise
Nutrition modifications
Combination of weight loss, physical exercise, and nutrition modifications
Local therapies
Laser
Electrolysis
Other methods
Metformin
Antiandrogens
Spironolactone
Flotamid
Finasteride
Oral contraceptives

Ramezani Tehrani F, Amiri M. Polycystic Ovary Syndrome in Adolescents: Challenges in Diagnosis and Treatment. Int J Endocrinol Metab. 2019 Jul 27;17(3):e91554.

Depression

Depression	
History	Family history of depression, history of abuse, psychological trauma, teasing, low self-esteem
Review of systems	Loss of interest, anger, irritability, sadness, suicidal ideation
Physical examination	No signs; may have sad, irritable appearance with lack of self-care
Laboratory/imaging	None
Treatment	Mental health referral for counseling or pharmacologic treatment

Psychological Morbidity

Obesity Associated Psychological Conditions

- Depression
- Anxiety
- Low self esteem
- Teasing/Bullying
- Binge eating disorder

Pregnancy Risk for Patients with Obesity

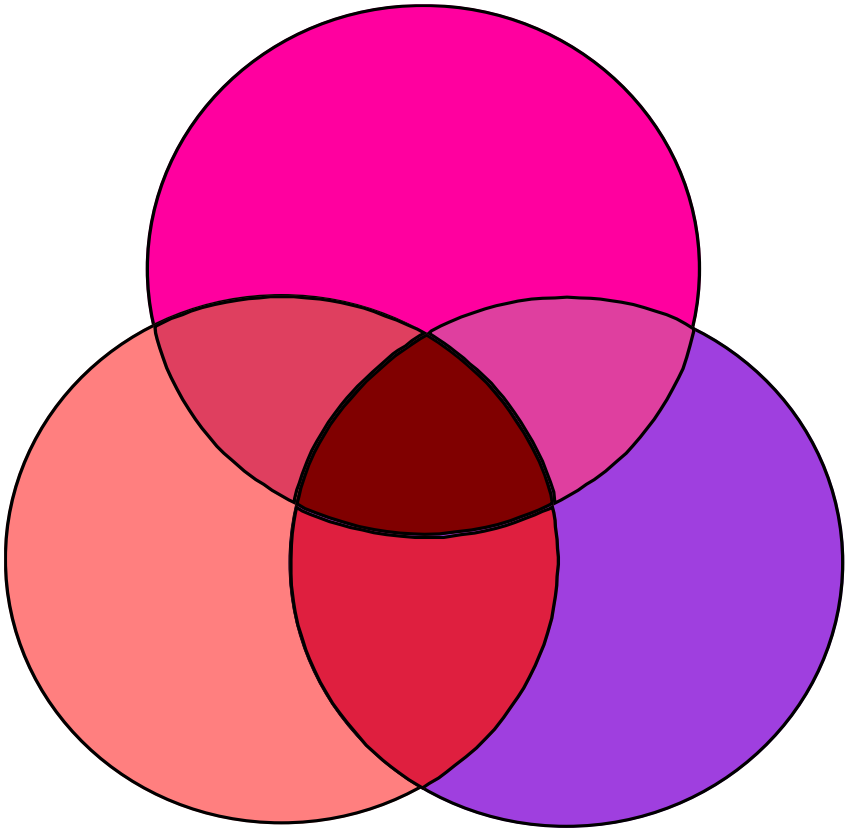
Adjusted Predicted Absolute Risk (%) of Selected Adverse Fetal and Maternal Outcomes According to Maternal Prepregnancy BMI

BMI (kg per m^2)	Macrosomia*	Shoulder dystocia	Stillbirth	In-hospital newborn mortality	Preeclampsia	Gestational diabetes mellitus	Preterm birth†
25	1.9	3.8	0.3	0.4	8.0	6.9	1.8
30	2.7	4.0	0.4	0.5	13.1	11.0	2.3
35	3.5	4.1	0.4	0.6	17.2	13.9	2.8
40	4.3	4.2	0.5	0.6	21.4	16.9	3.4

- Spontaneous and recurrent miscarriages
- Suboptimal ultrasound screening for fetal anomalies
- Congenital heart and neural tube defects
- Wound infections,
- Maternal thromboembolic and anesthesia complications
- Depression
- Breastfeeding problems

Riley L, Wertz M, McDowell I. Obesity in Pregnancy: Risks and Management. Am Fam Physician. 2018 May 1;97(9):559-561. PMID: 29763261.

Severe Obesity Related Emergencies



Hyperglycemic Hyperosmolar state
DKA
Pulmonary embolism
Cardiomyopathy of obesity
Pseudotumor Cerebri
SCFE
Complications of Bariatric Surgery

American Academy of Pediatrics
Institute for Healthy Childhood Weight

WHERE LIFELONG RESULTS BEGIN

Vision

The Institute serves as a translational engine for pediatric obesity prevention, assessment, management and treatment; and moves policy and research from theory into practice in American healthcare, communities, and homes.

https://ihcw.aap.org/

MaineHealth

LET'S GO!

5-2-1-0

Case Presentation

The Barbara Bush Children's Hospital At Maine Medical Center

Project ECHO

Some possible next steps for you….

1. Are there a few key take aways you can put into practice next week?
2. View a few of the supplemental learning options
3. Think about any bias you have that might get in the way with your patients
   - Bias screening test – https://implicit.harvard.edu/implicit/takeatest.html
4. Do you have a Team to help you?
   - Internal team
   - Community partners
   - Referring physicians
5. Do you need to develop new Workflows for Well Visits and Follow Up Visits?
6. Think about taking an MI course - ask us, we know of a few good ones

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Supplemental Learning CME Modules & Resources

- CME Modules
  - Introduction to the Pathophysiology of Obesity
  - Bias and Stigma Associated with Obesity
  - Introduction to Motivational Interviewing
  - Talking with Patients and Families about Nutrition
  - Physical Literacy and Physical Activity - coming soon!

- Monthly Session recordings, resources, articles, etc.

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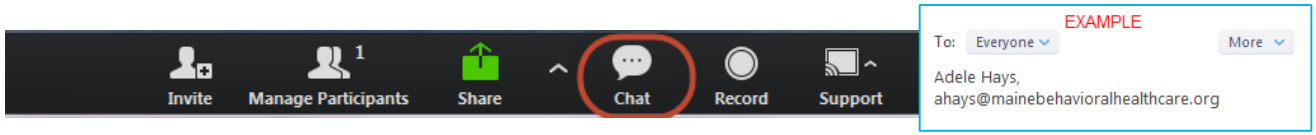
Evaluation and CMEs

If you haven't already done so, please enter your name and email address in the Chat



- After each ECHO session, you will receive an email with a link to a brief evaluation survey and Post-Test.
  - Please complete within 1 week.
- Upon completion, a link to the CME credit will be sent to you.

What's Next

- Office Hours
  - Feb 17 from 12-1pm
  - Opportunity to talk with Carrie and Tory about cases, workflows, labs, etc

- Monthly ECHO session: March 3 12-1 PM
  - Talking with Patients and Families about Nutrition – Jen Montague – Weight and Wellness Dietician

Thank you

- Feel free to reach out to us at:
  - ObesityECHO@mainehealth.org

  or
  - Tory – rogerv@mmc.org
  - Carrie – gordoc@mmc.org

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