

**TEXAS CHILDREN'S HOSPITAL**  
**EVIDENCE-BASED OUTCOMES CENTER**  
**Care Pathway for the Management of Pediatric Overweight and Obesity**  
 Evidence-Based Guideline

**Definition:** Pediatric obesity is defined in categories of overweight, obese and severely obese. Although there are limitations to various methods for determining the amount of excess fat, we recommend the use of BMI as an inexpensive and reproducible method. In patients with significantly developed muscle mass, other options such as body composition may be better alternatives. For this guideline, however, overweight is defined as a BMI at or above the 85th percentile and below the 95th percentile for children and teens of the same age and sex.<sup>(1)</sup> Obesity is defined as a BMI at or above the 95th percentile for children and teens of the same age and sex. Severe obesity is defined as a BMI  $\geq$  120% of the 95<sup>th</sup> percentile.<sup>(2)</sup>

**Pathophysiology:** Obesity is a complex disease that involves interactions between societal, environmental, metabolic and genetic factors.<sup>(3)</sup> Excess adipose tissue mass can be seen as a disruption in the balance between energy intake and expenditure. Although 70% of an obese phenotype is related to genetic factors, genetic-environment interactions are key to the promotion of obesity within an individual. Some of these environmental factors include: a sedentary lifestyle (e.g. excessive television viewing, excessive computer use, and insufficient physical activity), increased sugar-sweetened beverages, various unhealthy eating behaviors, and poor sleep. Additionally, excess weight gain causes hormonal and neurochemical alterations that reset the homeostatic "set point". This results in increased hunger hormones and decreased energy expenditure during weight loss, which likely leads to decreased efficacy of treatments over the long-term.

**Epidemiology:** Pediatric obesity affects 32% of children in the United States.<sup>(4)</sup> According to the National Survey of Children's Health, 33% of children in Texas are overweight or obese. Obesity is more likely in low-income and food insecure families and/or in racial/ethnic minorities. One in three children will suffer lifelong health and productivity consequences, and two-thirds will remain obese by the age of 35. As of 2005, obese adults cost Texas businesses \$3.3 billion per year.<sup>(5)</sup> It is predicted that the childhood obesity epidemic will triple Texas' adult obesity rate by 2040, and obesity-related expenses are projected to skyrocket accordingly.

**Inclusion Criteria**

- Children and adolescents age 6 to 18 years of age

**Exclusion Criteria**

- Children less than 6 years of age
- Children/adolescents with genetic or hormonal syndromes associated with childhood obesity:
  - Genetic syndromes associated with childhood obesity include the following:
    - Prader-Willi syndrome
    - Pseudohypoparathyroidism
    - Laurence-Moon-Biedl (Bardet-Biedl) syndrome
    - Cohen syndrome
    - Down syndrome
    - Turner syndrome

- Children/adolescents who currently take medications which cause overweight/obesity (not meant to be an all-inclusive list):
  - Cortisol and other glucocorticoids
  - Megace
  - Sulfonylureas
  - Tricyclic antidepressants (TCAs)
  - Monoamine oxidase inhibitors (MAOIs), such as phenelzine
  - Injectable contraceptives
  - Insulin (in excessive doses)
  - Thiazolidinediones
  - Risperidone
  - Clozapine

**Differential Diagnosis of Pathogenic Causes of Obesity (not an inclusive list)**

- Obesity with impaired linear growth should prompt investigation of :
  - Growth Hormone Deficiency
  - Hypothyroidism
  - Cushing Syndrome
- Obesity with very early onset or mental/developmental delays should prompt consideration of:
  - Genetic causes (Melanocortin 4 Receptor deficiency, Prader-Willi Syndrome, pseudohypoparathyroidism, leptin deficiency)
- Iatrogenic (medication-induced) obesity

**Diagnostic Evaluation**

**History: Assess for**

- History and ROS for comorbidities (see Appendix D)
  - Age < 5 years old at onset of excess weight
  - Increasing weight trajectory (crossing over 2 percentile lines)<sup>†</sup>
  - Bullying
- Dietary habits:
  - sugary beverages  $\geq$  1 four ounce serving per day
  - fast food/restaurant meals
  - large portions
  - skipping meals
  - < 5 fruit/vegetable servings per day
- Screen time: TV, computer, tablet, phone, video games  $\geq$  2 hours per day
- Physical activity: PE, recess, sports, outside play  $\leq$  1 hour per day
  - Safety and accessibility of outdoor play
- Sleep history
  - Hours per night
    - < 9 Hours per night (6-12 year olds) or < 8 hours per night (13-18 year olds)\*
  - Difficulty falling or staying asleep
- Family history
  - Parental/sibling obesity
  - Type 2 diabetes mellitus
  - Early cardiovascular disease (stroke, MI, death in M<55yo or F<65yo) (1st and 2nd degree relatives)
  - Dyslipidemia (1st and 2nd degree relatives)

- Hypertension
- Hyperlipidemia
- Liver or gallbladder disease
- Respiratory insufficiency or sleep apnea

### Physical Examination

- Vitals:
  - Body mass index (BMI) (see Appendix A, B, C)
  - Blood pressure (see Appendix C)
  - Height velocity
- Exam (in italics are items that would normally not prompt additional workup/referral unless severe or in conjunction with other features):
  - Otolaryngology – papilledema, dental caries, *enlarged tonsils*
  - Chest: wheezing, gynecomastia
  - Back: *cervicodorsal hump*
  - Gastrointestinal– enlarged liver
  - Genitourinary – *buried penis*, micropenis
  - Musculoskeletal– gait, scoliosis, hip ROM, genu varum/valgum
  - Skin – acanthosis, hirsutism, acne, *striae*, *intertrigo*, edema

### Laboratory Tests

See Appendix C for Laboratory and Diagnostic Tests

\* Children 6-12 years old may need between 9-12 hours and adolescents 13-18 years old may need 8-10 hours of sleep. Thus, this should be assessed in relation to the needs of the patient <sup>(6)</sup>.

† There is no clear definition of the amount of weight gain that increases medical risks in obesity. Crossing over 2 percentile lines is the standard definition for height/weight issues related to other diseases.

### Critical Points of Evidence\*

#### Evidence Supports

- Screening of children 6 years and older for obesity and offer services or referral to comprehensive, intensive behavioral intervention to promote improvement in weight status. <sup>(15-18)</sup> – Strong recommendation, high quality evidence
- Participation in a ≥ 26-hour, family-based interventions with the following components: dietary, physical activity and reduction of sedentary behaviors, and behavioral modifications has been shown to be effective in the short term (< 2 years) in a research setting. The use of this approach in real world settings is not well described. <sup>(19-40)</sup> – Strong recommendation, moderate quality evidence
- Support for weight loss maintenance for at least two years after successful completion of weight loss interventions. <sup>(41-44)</sup> – Strong recommendation, moderate quality evidence
- The utilization of technology to support interventions for weight loss maintenance. <sup>(45-49)</sup> – Weak recommendation, moderate quality evidence
- To consider pharmacological intervention after family-based, behavioral interventions are unsuccessful and BMI is greater than 120% of the 95th percentile. Orlistat should be considered in children ages 12 and older. Phentermine should be considered for adolescents 17 years and older. Liraglutide 3 mg or once weekly Semaglutide 2.4 mg can be considered for adolescents aged 12 to 17 years with a body weight of at least 60 kg and an initial BMI corresponding to 30 kg/m <sup>(50-64,76.77)</sup> – Strong recommendation, moderate quality evidence
- To consider referral of adolescents to the bariatric surgery program who are suffering from severe obesity (BMI≥40 kg/m<sup>2</sup>) and severe comorbidity or who are extremely obese (BMI≥50 kg/m<sup>2</sup>) and who despite attempts to lose weight after at least 6 months of organized weight loss, are Tanner Stage IV or V; are committed to medical and psychological evaluation before and after surgery; are committed to avoid pregnancy for 1 year after surgery; are capable and willing to adhere to post-operative nutritional guidelines; live in a supportive family environment; and are able to provide informed assent (patient) and consent (family). <sup>(65-70)</sup> – Strong recommendation, high quality evidence

#### Evidence Against

- The use of pharmacological interventions in children younger than 12 years of age. <sup>(50-64)</sup> – Strong recommendation, moderate quality evidence
- Bariatric surgery for overweight or obese children and/or who have not attempted weight loss through appropriate family-based, behavioral interventions, dietary changes, increased physical activity and reduction of sedentary behaviors. <sup>(65-70)</sup> – Strong recommendation, high quality evidence

#### Evidence Lacking/Inconclusive

- The off-label use of pharmacologic interventions in children
- The appropriate timing between repeat screening labs for comorbidities especially with regard to increased weight gain

\*NOTE: The references cited represent the entire body of evidence reviewed to make each recommendation.

## ***Use of This Guideline***

The Texas Children's Hospital Childhood Obesity content expert team acknowledges the vast scope and complexity surrounding the care of obese patients. This guideline is meant to serve as both a resource for the care of these children and also as overall guidance for where resources are needed to improve care within our system. Obesity is a multi-factorial problem whose management cannot be solely focused in a health care system (e.g. clinic or hospital). Societal commitment to the problem in the context of local, state and federal government supports, school system involvement and family commitment are critical for an effective preventative approach to this problem. We recognize that Texas Children's Hospital does not have a family-based intervention which utilizes > 26 hours of face-to-face contact time for all children ages 6-18. Given the significant number of children with obesity in our system and the mild beneficial effects seen in research settings, we are not advocating for such a program to be implemented system wide at this time (although implementing one for a subset of the population may be indicated). Unfortunately, there is very clear evidence that small scale interventions have limited effects on their own. Thus, in order to deliver high-level care to these patients with the necessary frequency to see lasting results, we encourage support for innovative care models. These models would likely include involvement of neighborhoods, families, schools and governments as well as Texas Children's Hospital. Additionally, we have included an appendix of resources in the community (as well as through Texas Children's Hospital) to help with engaging families in healthy behaviors/eating/activity (see Appendix E). These resources are also listed on the Texas Children's Weight Management website under "Provider Resources". As this guideline is a living document, we will continue to update it with the most recent evidence-based interventions to improve care of the obese child at Texas Children's Hospital.

### **Condition-Specific Elements of Clinical Management**

#### **Treatment Recommendations:**

##### **Consults/Referrals**

- Individualized referral to specialists

##### **Follow-Up Care**

- Support for weight loss maintenance for at least 2 years

##### **Measures**

###### **Structure**

- Guideline utilization
- Cost efficiency from reduced treatment of obesity-related comorbidities

###### **Process**

- Attrition
- Adherence

###### **Outcome**

- BMI reduction
- Reduced incidence of comorbidities
- Quality of life

# TEXAS CHILDREN'S HOSPITAL EVIDENCE BASED OUTCOMES CENTER

## Screening for Pediatric Overweight and Obesity

BMI PERCENTILE	NUTRITIONAL STATUS
<5 <sup>TH</sup> %ile	Underweight
5 <sup>th</sup> - 84 <sup>th</sup> %ile	Healthy Weight
85 <sup>th</sup> - <95 <sup>th</sup> %ile	Overweight
≥95 <sup>th</sup> %ile	Obese
≥120% of 95 <sup>th</sup> %ile (see Appendix C)	Severely Obese

### Physical Examination

- Otolaryngology: papilledema, dental caries, enlarged tonsils
- Chest: wheezing, gynecomastia
- Back: cervicodorsal hump
- Gastrointestinal: enlarged liver
- Genitourinary: buried penis, micropenis
- Musculoskeletal: gait, scoliosis, hip ROM, genu varum/valgum
- Skin: acanthosis, hirsutism, acne, striae, intertrigo, edema

**Well Child Exam  
Ages 5-18 y**  
Assess all children for obesity

### Identification

- Calculate BMI based on height and weight
- Determine percentile by plotting BMI on growth chart
- Assess height velocity
- Diagnose nutritional status

### Assessment

- Physical examination
- Blood pressure (see Appendix C)
- Assess risks (see table below)
- Review Medications for obesogenic drugs
- Labs for those with BMI ≥ 85<sup>th</sup> percentile (see Routine Care below)
- Assess behaviors and attitudes

### Behaviors

- Sedentary time < 2 hours per day
- Sugary beverages ≤ 1 four-ounce serving per day
- Meals at home
- Eating 3 meals per day
- Normal portion sizes
- ≥ 5 fruit/vegetable servings per day
- >1 hour of moderate activity per day
- At least 9 Hours per night (6-12 year olds) or 8 hours per night (13-18 year olds)

### Attitudes

- Family and patient concerns
- Motivation

### Medical History Risks:

- Any mental health diagnosis
- Age < 5 years old at onset of excess weight-Increasing weight trajectory (crossing over 2 percentile lines)
- Any disorder listed in Appendix D
- Presence of Bullying (if present, consider referral to psychology)

### Family History Risks (1st and 2nd degree relatives unless otherwise stated):

- Obesity (1st degree relatives)
- Stroke, MI, death in Male <55yo or Female <65yo
- Dyslipidemia; hypertension; diabetes mellitus type II; and/or liver or gallbladder disease
- Respiratory insufficiencies or sleep apnea

BMI= 5<sup>th</sup> to 84<sup>th</sup> percentile (healthy weight)  
OR  
BMI= 85<sup>th</sup> to <95<sup>th</sup> percentile (overweight) with no risks

### Prevention

#### Target behavior

- Identify problem behaviors
- If none, reinforce healthy habits

#### Patient/Family Counselling:

- Review risks
- Use motivational interviewing to encourage behavior change

BMI= 85<sup>th</sup> to <95<sup>th</sup> percentile (overweight) with medical risks  
OR  
BMI > 95<sup>th</sup> percentile (obese or severely obese)

### Intervention

Exit screening algorithm  
& go to management & treatment algorithm

### Routine care

- Provide ongoing positive reinforcement for healthy behaviors
- Follow weight and BMI at every well child visit
- For patients with BMI ≥ 85<sup>th</sup> %ile, draw the following labs: HgbA1c, ALT, non-fasting lipid panel. If the lipid panel is abnormal, perform a fasting lipid panel and also obtain a fasting glucose
- If labs are normal, repeat every 2 years as long as BMI ≥85<sup>th</sup> %ile or sooner if patient gains excessive weight or if symptoms arise specific to a comorbidity
- If labs are abnormal, move to treatment algorithm and consider referral to subspecialist (refer to Appendix C for guidelines)

Reinforce 5-2-1-0 teaching



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**Management and Treatment of Pediatric Overweight and Obesity**

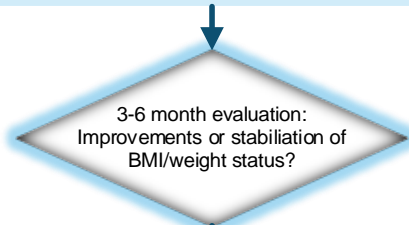
BMI= 85<sup>th</sup> to <95<sup>th</sup> percentile (overweight) with medical risks,  
 BMI > 95<sup>th</sup> percentile (obese or severely obese)

**LEVEL 1**

**Management and Treatment Strategies (see Appendix E)**

Implement family-based, behavioral interventions with the following components:

- Assessment for readiness for change for family and patient
- Motivational interviewing to promote healthy behaviors
- Family-based counseling sessions targeting both the parent and child
- Individual sessions (both family and group, as needed)
- Education and information on healthy eating, safe exercise, and reading food labels (reinforce 5-2-1-0 teaching)
- Encourage the use of stimulus control (e.g., limiting access to tempting foods and screen time)
- Goal setting, self-monitoring (e.g., maintenance of food diary), contingent rewards for success, and problem solving
- Supervised physical activity sessions (recommend at least 60 minutes of physical activity daily)
- Consider referral to specialist for management of comorbidities



YES

NO

Support successful weight loss with at least 2 years of maintenance weight loss support

**LEVEL 2**

**Management and Treatment Strategies**

- Continue interventions from Level 1
- Consider referral to weight management program
- Consider referral to specialist for management of comorbidities
- Consider pharmacological intervention:
  - Orlistat can be considered for children ages 12 and older
  - Phentermine can be considered for adolescents ages 17 and older
  - Liraglutide 3 mg or once weekly Semaglutide 2.4 mg can be considered for adolescents aged 12 to 17 years with a body weight of at least 60kg and an initial BMI corresponding to 30 kg/m



YES

NO

**LEVEL 3**

**Management and Treatment Strategies**

- Refer adolescents for bariatric surgery program who are:
  - Suffering from severe obesity (BMI≥40 kg/m<sup>2</sup>) and severe comorbidity **OR** who are extremely obese (BMI≥50 kg/m<sup>2</sup>) and who failed to lose weight despite persistent compliance to lose weight after at least 6 months of organized weight loss
  - Tanner Stage IV or V
  - Committed to medical and psychological evaluation before and after surgery
  - Committed to avoidance of pregnancy for 1 year after surgery
  - Are capable and willing to adhere to post-operative nutritional guidelines
  - Live in a supportive family environment
  - Are able to provide informed assent (patient) and consent (family)
- Continue interventions from Level 1 and 2

Updated 4/5/2023







## Appendix C: BMI, Laboratory, and Diagnostic Tests

BMI Percentile and Definitional Categories of Childhood Weight <sup>(1)</sup>	
Underweight	< 10 <sup>th</sup> percentile
Normal	10 <sup>th</sup> to 84 <sup>th</sup> percentile
Overweight	85 <sup>th</sup> to 94 <sup>th</sup> percentile
Obese	≥ 95 <sup>th</sup> percentile
Severe obesity	≥ 120% of the 95 <sup>th</sup> percentile

Body Mass Index at the 95 <sup>th</sup> Percentile and 120% of the 95 <sup>th</sup> percentile, by Age and Gender				
Age (years)	Males		Females	
	BMI @ 95 <sup>th</sup> %ile	120% of 95 <sup>th</sup> %ile	BMI @ 95 <sup>th</sup> %ile	120% of 95 <sup>th</sup> %ile
6	18.39	22.07	18.81	22.57
7	19.12	22.94	19.64	23.57
8	20.03	24.03	20.65	24.78
9	21.05	25.25	21.77	26.12
10	22.09	26.5	22.93	27.52
11	23.17	27.8	24.09	28.91
12	24.2	29.04	25.25	30.3
13	25.18	30.22	26.3	31.56
14	26.04	31.25	27.26	32.71
15	26.84	32.21	28.012	33.74
16	27.56	33.07	28.91	34.69
17	28.26	33.91	29.63	35.56
18	29.96	34.75	30.32	36.38

### Laboratory testing

Apart from guidelines on obtaining initial screening labs, there are no clear guidelines on when to repeat labs, how weight gain affects the screening schedule, or how to interpret abnormal labs. Below is guidance on screening labs from our combined expert opinion as well as taking into account referral patterns/requirements by different subspecialty services.

- **Tests to draw:** While fasting labs are diagnostic, we understand that obtaining a fasting sample is sometimes difficult. Thus, we agree a provider could either (1) perform a fasting glucose, fasting lipid panel, ALT, and hemoglobin A1c or (2) perform ALT, hemoglobin A1c, and non-fasting lipid panel with a repeat fasting lipid panel if the non-fasting lipid panel was abnormal (and recommend adding a fasting blood glucose level as hemoglobin A1c has variable predictive value for diabetes in children).
- **Effect of age:** Some obesity algorithms call for testing all children for comorbidities as young as age 6 (and younger for some). However, practice guidelines on each comorbidity recommend screening at different ages. Since lipids can be drawn as early as 2 years of age in an overweight patient, blood work is likely indicated in the entire population this guideline is targeting (patients ≥ 6 yo with BMI ≥ 85<sup>th</sup> %ile). For simplicity sake, we recommend drawing all labs in an overweight/obese patient. However, listed below are the recommendations for screening according to the appropriate clinical practice guideline per comorbidity:
  - Diabetes: HgbA1c, fasting glucose, or oral glucose tolerance test at age ≥ 10 yo or at the start of puberty, whichever is sooner, in those who have a BMI ≥ 85<sup>th</sup> %ile + ≥ 1 of the following: maternal history of diabetes or gestational diabetes during child's gestation, family history of 1<sup>st</sup> or 2<sup>nd</sup> degree relative with T2D, Race/ethnicity (Native American, African American, Latino, Asian American, Pacific Islander), acanthosis nigricans, dyslipidemia, PCOS, or small-for-gestational-age birth weight
  - NAFL: ALT at age ≥ 9 yo
  - Dyslipidemia: lipid panel beginning between 2-10 yo
  - Hypertension: Blood pressures in all children ≥ 3 yo.
- **Testing interval:** Many guidelines recommend repeating normal labs between 2-3 years. For simplicity, we recommend repeating normal labs every 2 years in an overweight/obese child who is not crossing over percentiles (ie 85, 95, 97, 99 or > 10%-ile change when calculated as a percent of the 95<sup>th</sup> percentile) or developing symptoms. If a patient is moving up percentiles in BMI, we recommend yearly screening.
- **Specialist referral:** For many comorbidities, mildly abnormal labs do not necessarily require specialist intervention. Thus, in the following table, we have listed when to consider referral to a specialist vs. when to definitely refer (though this does not necessarily mean it is an urgent referral).



**\*Screening Laboratory and Diagnostic Tests  
for Overweight and Obese Children<sup>(72,73,74)</sup>**

Laboratory Test	Normal Value	Values to consider Specialist Referral	Values for Definitive Specialist Referral
<b>Pre-Diabetes/Diabetes (Referral to Endocrinology)</b>			
<b>Fasting glucose</b>	< 100 mg/dL	100 – 125 mg/dL	≥126 mg/dL
<b>Hemoglobin A<sub>1c</sub></b>	< 5.7%	5.7 - 6.4 %	≥ 6.5 %
<b>Non-alcoholic Steatohepatitis (Referral to Gastroenterology – Fatty Liver Clinic)</b>			
<b>ALT</b>	≤22 mg/dL girls ≤ 26 mg/dL boys	≥44 U/L girls ≥52 U/L boys	≥ 80 U/L
<b>Fasting Lipid (Referral to Cardiology – Preventative Clinic, lipids)</b>			
<b>Total cholesterol</b>	< 170 mg/dL	≥ 180 mg/dL < 120 mg/dL	≥ 200 mg/dL
<b>LDL cholesterol</b>	< 110 mg/dL	≥ 130 mg/dL	> 160 mg/dL (fasting on 2 different occasions)
<b>Non-HDL cholesterol</b>	< 120 mg/dL		≥ 145 mg/dL
<b>HDL cholesterol</b>	> 45 mg/dL		< 30 mg/dL Or if + CV events: >80 mg/dL girls > 70 mg/dL boys
<b>Apolipoprotein A-I</b>	> 120 mg/dL	< 115 mg/dL	< 110 mg/dL
<b>Apolipoprotein B</b>	< 90 mg/dL	≥ 110 mg/dL	> 120 mg/dL
<b>Triglycerides (fasting)</b> • 0-9 years • 10-14 years • 15-19 years	• 30 - 104 mg/dL • 33 - 129 mg/dL • 38 - 152 mg/dL	≥ 200 mg/dL	> 400 mg/dL (on 2 different occasions)
<b>Hypertension (Referral to Cardiology – Preventative Clinic, hypertension) (referral to Cardiology for hypertensive patients who are obese will default to the Multidisciplinary Clinic which is staffed by both Cardiology and Nephrology)</b>			
<b>Blood pressure</b> (all % are references to systolic or diastolic blood pressure percentile for age/height/gender)	<b>1-12 yo:</b> <90 <sup>th</sup> %ile <b>≥13 yo:</b> <120/80 mm Hg	<b>Elevated blood pressure</b> 3 separate visits (0, 6 mo, 12 mo) <b>1-12 yo:</b> ≥90 <sup>th</sup> % but < 95 <sup>th</sup> % <b>≥13yo:</b> 120/80-139-89  <b>Stage 1 Hypertension</b> 3 separate visits (0, 2 wk, 3 mo) <b>1-12 yo:</b> ≥ 95% - 95 <sup>th</sup> % + 12 mm Hg <b>≥13 yo:</b> 130/80 to 139/89 mm Hg  <b>Stage 2 Hypertension on initial visit</b> <b>1-12 yo:</b> ≥ 95 <sup>th</sup> % + 12 mm Hg <b>≥13 yo:</b> ≥140/90 mm Hg	<b>Stage 2 Hypertension</b> after 2 separate visits (0, 1 wk) <b>1-12 yo:</b> ≥ 95 <sup>th</sup> % + 12 mm Hg <b>≥13yo:</b> ≥140/90 mm Hg  <b>Immediate referral to Emergency room</b> ≥ 140/90 and symptoms (ie headache) <b>or</b> 1-12 yo: 95 <sup>th</sup> % + > 30 mm Hg ≥13 yo >180/120 mm Hg
Notes on Hypertension Screening: Blood pressure (BP) should be taken with appropriate size cuff after sitting quietly for 10 minutes. If initial BP is elevated, repeat 2 more times at that visit and average the last 2 readings to stage the BP. If the repeat BP is done by oscillometry (machine), and the average of the 2 is still high, then it should be repeated again x 2 by auscultation. Together, these measurements are equal to one occasion of elevated blood pressure. To establish a diagnosis of hypertension, 3 separate occasions of elevated blood pressure must be noted.			
*Adapted from the AAP 2017 clinical practice guideline for screening and management of high blood pressure in children and adolescents, the NASPGHAN 2017 Guideline for the diagnosis and treatment of nonalcoholic fatty liver disease in children, the American Diabetes Association Standards of Medical Care in Diabetes – 2018, the 2011 Expert panel on integrated guidelines for cardiovascular health, and the 2012 Endocrine Society Clinical Practice Guideline on hypertriglyceridemia..			

## Appendix D: Obesity-Related Conditions & Comorbidities

### Obesity-Related Conditions & Comorbidities <sup>(75)</sup>

The following conditions are associated with obesity and should be considered for further work-up. Additional lab tests may be warranted if indicated by the patient's clinical condition.

#### Endocrine:

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

#### Dermatologic:

- Acanthosis nigricans
- Hirsutism
- Intertrigo
- Furunculosis
- Hidradenitis suppurative

#### Gastrointestinal:

- Cholelithiasis
- Pancreatitis
- Gastroesophageal reflux disease (GERD)
- Nonalcoholic fatty liver disease (NAFLD)

#### Genitourinary:

- Proteinuria
- Renal disease
- Incontinence

#### Cardiovascular:

- Hypertension
- Dyslipidemia

#### Neurological:

- Hearing loss
- Idiopathic intracranial hypertension
- Stroke

#### Orthopedic:

- Blount's disease (Tibia vara)
- Slipped capital femoral epiphysis (SCFE)
- Fractures
- Gout

#### Psychological/behavioral health:

- Anxiety
- Attention deficit/hyperactivity disorder (ADHD)
- Binge eating disorder
- Depression
- Distorted body image
- Peer dysfunction/alienation
- Teasing/bullying
- Poor self esteem

#### Respiratory:

- Obstructive sleep apnea (OSA)
- Hypoventilation syndrome
- Asthma

#### Miscellaneous:

- Vitamin D deficiency
- Iron deficiency
- Cancer

## Appendix E: Weight Management, Nutrition, and Community Resources

### Comprehensive Weight Management

Name	Age	BMI	Content	Referral required	Cost	Location	Days/Times	Enroll/Info
<b>TCH Resources</b>								
<a href="#">Adolescent / Teen WOW</a>	12-18	>95th %ile	Medical, nutrition, and behavioral interventions	Yes	Insurance/Self	Wallace Tower		EPIC* ("referral to Adol Med")/832-822-4887
<a href="#">Bariatric Surgery</a>	15-18	≥40 kg/m <sup>2</sup>	Evaluation and preparation for surgery or alternate treatments	Yes	Insurance/Self	Woodlands		EPIC* ("referral to pediatric surgery")/832-822-4868
<b>Non-TCH Resources</b>								
Weight Management Clinic – Harris Health	1-18	≥85th %ile	Medical, nutrition, and psychology	Yes	Insurance/Self	<a href="#">3925 Fairmont parkway, Pasadena 77504</a>	Monday PM	Families need to be ready to make changes

### Behavior Modification Programs

Name	Age	BMI	Content	Referral required	Cost	Location	Days/Times	Enroll/Info
<b>Non-TCH Resources</b>								
<a href="#">Weight Watchers</a>	≥13	any	Group behavior modification program	Yes - requires physician approval	Self (\$3-9/wk)	Multiple		For TCHP members, may be covered after case management supervision for at least 3 months (832-828-1197)

### Physical Activity Resources

Name	Age	BMI	Content	Referral required	Cost	Location	Days/Times	Enroll/Info
<b>TCH Resources</b>								
Physical Assessment Clinic	6-18y	any	Assessment of Physical Conditioning by a Physical Therapist	Yes	Insurance/Self	Wallace Tower	T, 1-4pm	EPIC (PT-evaluate and treat, Main campus, Evaluate and Treat, and Plan of Care to include "Education/Home Exercise Program" and put "Brandon Achane" in Comments")

**Non-TCH Resources**

Houston Parks and Recreation Instructional Sports Play	6-13y	any	Multiple offerings of sport teams and fitness	No	\$0-30	multiple	multiple	<a href="http://www.houstontx.gov/parks/youthsports.html">http://www.houstontx.gov/parks/youthsports.html</a>
Marathon Kids Running Clubs	pre K-12 grade	any	Running clubs at various schools running for 10-30 minutes	n/a	\$15	multiple		<a href="http://www.marathonkids.org">www.marathonkids.org</a>
Girls on the Run Greater Houston	3 <sup>rd</sup> -8 <sup>th</sup> grade	any	Running clubs at various schools for 10 weeks each Fall/Spring	n/a	\$30-155	multiple	varies; 2x/wk for 90 minutes	<a href="http://gotrgreaterhouston.org/">http://gotrgreaterhouston.org/</a>
BakerRipley	any	any	some offer nutrition and physical fitness classes	n/a	\$150/family/yr	multiple		<a href="https://www.bakerripley.org/services">https://www.bakerripley.org/services</a>
YMCA		any	group and individual fitness options	n/a	varies	multiple		<a href="https://www.ymcahouston.org">https://www.ymcahouston.org</a>
CDC.gov	any	any	guideline for physical activity	n/a	Free			<a href="https://www.cdc.gov/healthyschools/physicalactivity/toolkit/factsheet_pa_guidelines_families.pdf">https://www.cdc.gov/healthyschools/physicalactivity/toolkit/factsheet_pa_guidelines_families.pdf</a>
Healthy children.org (American Academy of Pediatrics)	any	any	online collection of articles on physical fitness for families	n/a	Free			<a href="https://www.healthychildren.org/English/healthy-living/fitness/Pages/default.aspx">https://www.healthychildren.org/English/healthy-living/fitness/Pages/default.aspx</a>

**Camps**

Name	Age	BMI	Content	Referral required?	Cost	Location	Enroll/Info
<b>Non-TCH Resources</b>							
<a href="#">BOUNCE</a>	9-14		4 week summer programs with nutrition, exercise, and counseling	No	varies	varies	<a href="http://www.uh.edu/education/bounce/">http://www.uh.edu/education/bounce/</a>

## Nutrition Resources

Name	Age	BMI	Content	Referral required	Cost	Location	Days/Times	Enroll/Info
<b>TCH Resources</b>								
Healthy Lifestyles Group Class	6-18	≥ 85 <sup>th</sup> %ile	1 hour group class with new topic every month	Yes	Insurance/Self	Telemed	Varies	832-227-2628
<b>Non-TCH Resources</b>								
ChopChop Cooking Club	any	n/a	Online cooking resource	No	Free			<a href="http://www.chopchopcookingclub.org">http://www.chopchopcookingclub.org</a>
BrighterBites	any	n/a	Online resource for recipes and helpful tips	No	Free			<a href="https://www.brighterbites.org/tips-tools/">https://www.brighterbites.org/tips-tools/</a>
ChooseMyPlate.gov	any	n/a	Online nutrition and physical activity facts	No	Free			<a href="http://www.choosemyplate.gov">www.choosemyplate.gov</a>
Calories Needed Parent Tips (NHLBI)	any	n/a	Online guideline for number of calories needed by age & gender	No	Free			<a href="https://www.nhlbi.nih.gov/health/educational/wecan/downloads/calreqtips.pdf">https://www.nhlbi.nih.gov/health/educational/wecan/downloads/calreqtips.pdf</a>
Healthy Children.org (American Academy of Pediatrics)	any	n/a	Online articles on nutrition	No	Free			<a href="https://www.healthychildren.org/English/healthy-living/nutrition/Pages/default.asp/">https://www.healthychildren.org/English/healthy-living/nutrition/Pages/default.asp/</a>
	0-5	<95%	Nutrition, PE, and parenting tips for infants through toddlers	No	Free			<a href="https://www.healthychildren.org/English/healthy-living/growing-healthy/Pages/default.aspx">https://www.healthychildren.org/English/healthy-living/growing-healthy/Pages/default.aspx</a>
SWAY nutrition videos (Stanford University)	any	n/a	Online nutrition video series	No	Free			<a href="https://www.youtube.com/playlist?list=PL61Cx01GKzUmt2vr3Pk5zQAix-1N_JP_R">https://www.youtube.com/playlist?list=PL61Cx01GKzUmt2vr3Pk5zQAix-1N_JP_R</a>



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### Clinical Standards Preparation

This clinical standard was prepared by the Evidence-Based Outcomes Center (EBOC) team in collaboration with content experts at Texas Children's Hospital. Development of this clinical standard supports the TCH Quality and Patient Safety Program initiative to promote clinical standards and outcomes that build a culture of quality and safety within the organization.

### **Care Pathway for the Management of Overweight and Obese Children Content Expert Team**

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No relevant financial or intellectual conflicts to report.

### Development Process

This clinical standard was developed using the process outlined in the EBOC Manual. The literature appraisal documents the following steps:

1. Review Preparation
  - PICO questions established
  - Evidence search confirmed with content experts
2. Review of Existing External Guidelines
  - Recommendations on The Assessment, Prevention, And Treatment Of Child And Adolescent Overweight And Obesity; Recommendations for Prevention of Childhood Obesity; Obesity Evaluation and Treatment
  - CDC Growth Charts
  - Pediatric Obesity- Assessment, Treatment, and Prevention
  - Obesity: identification, assessment and management
  - Clinical Practice Guideline for the Prevention and Treatment of Childhood and Juvenile Obesity
  - Screening for Obesity & Intervention for Weight Management in Children and Adolescents
3. Literature Review of Relevant Evidence
  - Searched: PubMed, Cochrane, CINAHL
4. Critically Analyze the Evidence
  - Systematic reviews / Meta-analyses, 15; randomized controlled trials, 28; nonrandomized studies, 15; professional organization guidelines, 6
5. Summarize the Evidence
  - Materials used in the development of the clinical standard, literature appraisal, and any order sets are maintained in a Care Pathway for the Management of Overweight and Obese Children evidence-based review manual within EBOC.

### Evaluating the Quality of the Evidence

Published clinical guidelines were evaluated for this review using the **AGREE II** criteria. The summary of these guidelines are included in the literature appraisal. AGREE II criteria evaluate Guideline Scope and Purpose, Stakeholder Involvement, Rigor of Development, Clarity and Presentation, Applicability, and Editorial Independence using a 4-point Likert scale. The higher the score, the more comprehensive the guideline.

This clinical standard specifically summarizes the evidence *in support of* or *against* specific interventions and identifies where evidence is *lacking/inconclusive*. The following categories describe how research findings provide support for treatment interventions. **"Evidence Supports"** provides evidence to support an intervention **"Evidence Against"** provides evidence against an intervention.

**"Evidence Lacking/Inconclusive"** indicates there is insufficient evidence to support or refute an intervention and no conclusion can be drawn *from the evidence*.

The **GRADE** criteria were utilized to evaluate the body of evidence used to make practice recommendations. The table below defines how the quality of the evidence is rated and how a strong versus weak recommendation is established. The literature appraisal reflects the critical points of evidence.

Recommendation	
<b>STRONG</b>	Desirable effects clearly outweigh undesirable effects or vice versa
<b>WEAK</b>	Desirable effects closely balanced with undesirable effects
Quality	Type of Evidence
<b>High</b>	Consistent evidence from well-performed RCTs or exceptionally strong evidence from unbiased observational studies
<b>Moderate</b>	Evidence from RCTs with important limitations (e.g., inconsistent results, methodological flaws, indirect evidence, or imprecise results) or unusually strong evidence from unbiased observational studies
<b>Low</b>	Evidence for at least 1 critical outcome from observational studies, RCTs with serious flaws or indirect evidence
<b>Very Low</b>	Evidence for at least 1 critical outcome from unsystematic clinical observations or very indirect evidence

### Recommendations

Practice recommendations were directed by the existing evidence and consensus amongst the content experts. Patient and family preferences were included when possible. The Content Expert Team and EBOC team remain aware of the controversies in the management of overweight and obese in children. When evidence is lacking, options in care are provided in the clinical standard and the accompanying order sets (if applicable).

### Approval Process

Clinical standards are reviewed and approved by hospital committees as deemed appropriate for its intended use. Clinical standards are reviewed as necessary within EBOC at Texas Children's Hospital. Content Expert Teams are involved with every review and update.

### Disclaimer

Practice recommendations are based upon the evidence available at the time the clinical standard was developed. Clinical standards (guidelines, summaries, or pathways) do not set out the standard of care and are not intended to be used to dictate a course of care. Each physician/practitioner should use his or her independent judgment in the management of any specific patient and is responsible, in consultation with the patient and/or the patient's family, to make the ultimate judgment regarding care.

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### Version History

Date	Action	Comments
8/2018	Created	
5/2022	Update	Liraglutide added
4/4023	Update	Semaglutide added; resources updated