

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.⁽¹⁾ 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 95th percentile.⁽²⁾

Pathophysiology: Obesity is a complex disease that involves interactions between societal, environmental, metabolic and genetic factors.⁽³⁾ 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.⁽⁴⁾ 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.⁽⁵⁾ 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
- Sulfonyleureas
- 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) †
 - 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 ⁽⁶⁾.

† 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. ⁽¹⁵⁻¹⁸⁾ – 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. ⁽¹⁹⁻⁴⁰⁾ – Strong recommendation, moderate quality evidence
- Support for weight loss maintenance for at least two years after successful completion of weight loss interventions. ⁽⁴¹⁻⁴⁴⁾ – Strong recommendation, moderate quality evidence
- The utilization of technology to support interventions for weight loss maintenance. ⁽⁴⁵⁻⁴⁹⁾ – 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 ^(50-64,76.77) – Strong recommendation, moderate quality evidence
- To consider referral of adolescents to the bariatric surgery program who are suffering from severe obesity (BMI≥40 kg/m²) and severe comorbidity or who are extremely obese (BMI≥50 kg/m²) 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). ⁽⁶⁵⁻⁷⁰⁾ – Strong recommendation, high quality evidence

Evidence Against

- The use of pharmacological interventions in children younger than 12 years of age. ⁽⁵⁰⁻⁶⁴⁾ – 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. ⁽⁶⁵⁻⁷⁰⁾ – 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 TH %ile	Underweight
5 th - 84 th %ile	Healthy Weight
85 th -<95 th %ile	Overweight
≥95 th %ile	Obese
≥120% of 95 th %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 ≥ 85th 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:	Family History Risks (1st and 2nd degree relatives unless otherwise stated):
<ul style="list-style-type: none"> 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) 	<ul style="list-style-type: none"> 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= 5th to 84th percentile (healthy weight)
OR
BMI= 85th to <95th percentile (overweight) with no risks

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

- Prevention**
- Target behavior**
- Identify problem behaviors
 - If none, reinforce healthy habits
- Patient/Family Counselling:**
- Review risks
 - Use motivational interviewing to encourage behavior change

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 ≥ 85th %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 ≥85th %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



TEXAS CHILDREN'S HOSPITAL EVIDENCE BASED OUTCOMES CENTER

Management and Treatment of Pediatric Overweight and Obesity

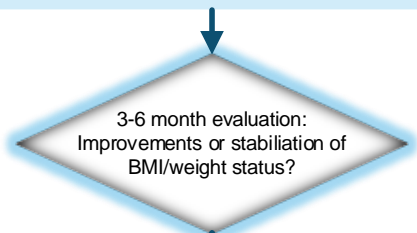
BMI= 85th to <95th percentile (overweight) with medical risks,
BMI > 95th percentile (obese or severely obese)

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



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



LEVEL 3

Management and Treatment Strategies

- Refer adolescents for bariatric surgery program who are:
 - Suffering from severe obesity (BMI≥40 kg/m²) and severe comorbidity **OR** who are extremely obese (BMI≥50 kg/m²) 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

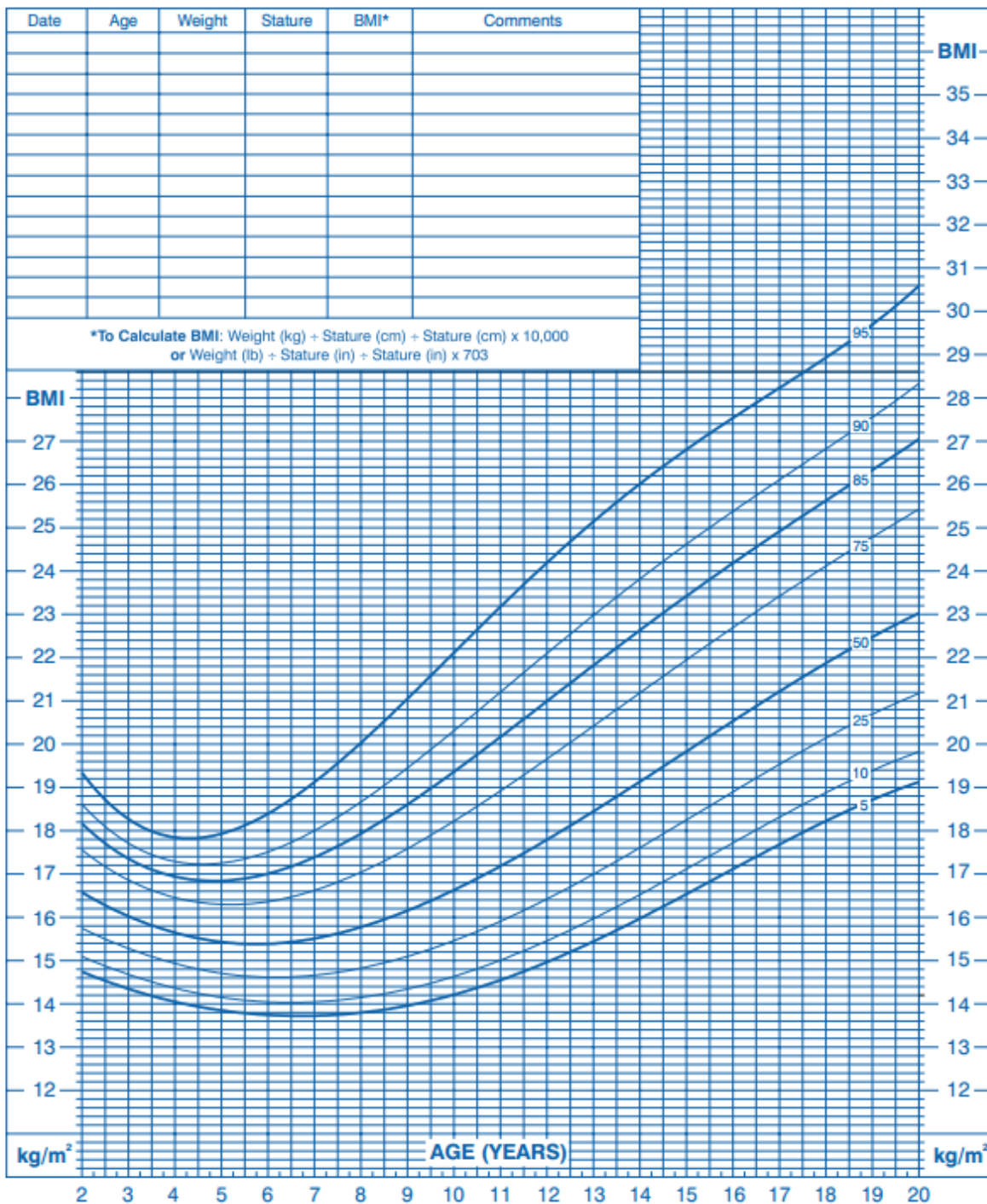
Updated 4/5/2023

Appendix A: Boys- CDC Body mass index for age percentiles

2 to 20 years: Boys Body mass index-for-age percentiles

NAME _____

RECORD # _____



Published May 30, 2000 (modified 10/16/00).
 SOURCE: Developed by the National Center for Health Statistics in collaboration with the National Center for Chronic Disease Prevention and Health Promotion (2000).
<http://www.cdc.gov/growthcharts>



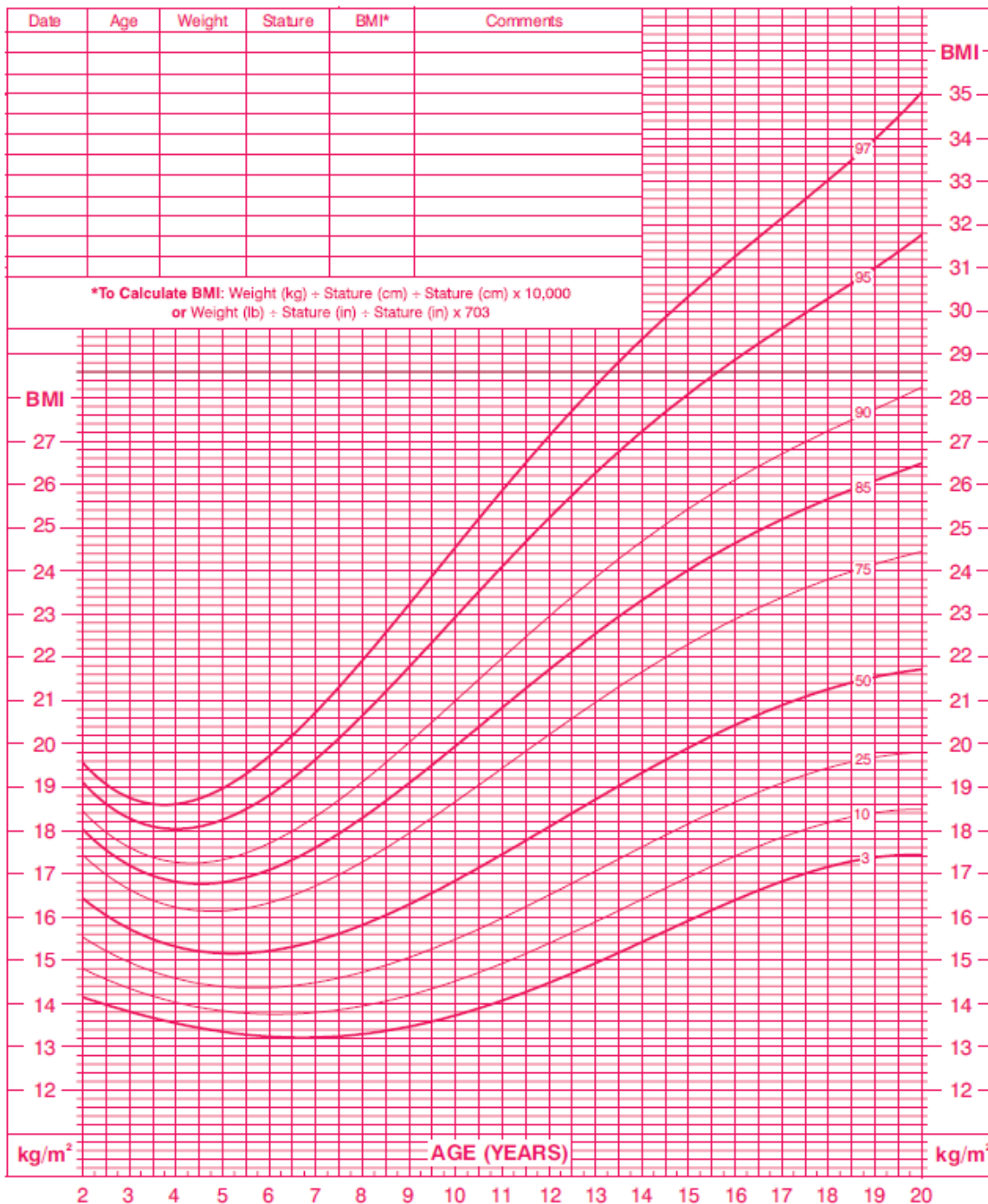
Appendix B: Girls- CDC Body mass index for age percentiles

2 to 20 years: Girls

NAME _____

Body mass index-for-age percentiles

RECORD # _____



Published May 30, 2000 (modified 10/16/00).
SOURCE: Developed by the National Center for Health Statistics in collaboration with
the National Center for Chronic Disease Prevention and Health Promotion (2000).
<http://www.cdc.gov/growthcharts>



Appendix C: BMI, Laboratory, and Diagnostic Tests

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

Body Mass Index at the 95 th Percentile and 120% of the 95 th percentile, by Age and Gender				
Age (years)	Males		Females	
	BMI @ 95 th %ile	120% of 95 th %ile	BMI @ 95 th %ile	120% of 95 th %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 ≥ 85th %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 ≥ 85th %ile + ≥ 1 of the following: maternal history of diabetes or gestational diabetes during child's gestation, family history of 1st or 2nd 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 95th 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^(72,73,74)			
Laboratory Test	Normal Value	Values to consider Specialist Referral	Values for Definitive Specialist Referral
Pre-Diabetes/Diabetes (Referral to Endocrinology)			
Fasting glucose	< 100 mg/dL	100 – 125 mg/dL	≥126 mg/dL
Hemoglobin A_{1c}	< 5.7%	5.7 - 6.4 %	≥ 6.5 %
Non-alcoholic Steatohepatitis (Referral to Gastroenterology – Fatty Liver Clinic)			
ALT	≤22 mg/dL girls ≤ 26 mg/dL boys	≥44 U/L girls ≥52 U/L boys	≥ 80 U/L
Fasting Lipid (Referral to Cardiology – Preventative Clinic, lipids)			
Total cholesterol	< 170 mg/dL	≥ 180 mg/dL < 120 mg/dL	≥ 200 mg/dL
LDL cholesterol	< 110 mg/dL	≥ 130 mg/dL	> 160 mg/dL (fasting on 2 different occasions)
Non-HDL cholesterol	< 120 mg/dL		≥ 145 mg/dL
HDL cholesterol	> 45 mg/dL		< 30 mg/dL Or if + CV events: >80 mg/dL girls > 70 mg/dL boys
Apolipoprotein A-I	> 120 mg/dL	< 115 mg/dL	< 110 mg/dL
Apolipoprotein B	< 90 mg/dL	≥ 110 mg/dL	> 120 mg/dL
Triglycerides (fasting) • 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)
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)			
Blood pressure (all % are references to systolic or diastolic blood pressure percentile for age/height/gender)	1-12 yo: <90 th %ile ≥13 yo: <120/80 mm Hg	Elevated blood pressure 3 separate visits (0, 6 mo, 12 mo) 1-12 yo: ≥90 th % but < 95 th % ≥13yo: 120/80-139-89 Stage 1 Hypertension 3 separate visits (0, 2 wk, 3 mo) 1-12 yo: ≥ 95% - 95 th % + 12 mm Hg ≥13 yo: 130/80 to 139/89 mm Hg Stage 2 Hypertension on initial visit 1-12 yo: ≥ 95 th % + 12 mm Hg ≥13 yo: ≥140/90 mm Hg	Stage 2 Hypertension after 2 separate visits (0, 1 wk) 1-12 yo: ≥ 95 th % + 12 mm Hg ≥13yo: ≥140/90 mm Hg Immediate referral to Emergency room ≥ 140/90 and symptoms (ie headache) or 1-12 yo: 95 th % + > 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 (75)**

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
TCH Resources								
Adolescent / Teen WOW	12-18	>95th %ile	Medical, nutrition, and behavioral interventions	Yes	Insurance/Self	Wallace Tower		EPIC*("referral to Adol Med")/832-822-4887
Bariatric Surgery	15-18	≥40 kg/m ²	Evaluation and preparation for surgery or alternate treatments	Yes	Insurance/Self	Woodlands		EPIC* ("referral to pediatric surgery")/832-822-4868
Non-TCH Resources								
Weight Management Clinic – Harris Health	1-18	≥85th %ile	Medical, nutrition, and psychology	Yes	Insurance/Self	3925 Fairmont parkway, Pasadena 77504	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
Non-TCH Resources								
Weight Watchers	≥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
TCH Resources								
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	http://www.houstontx.gov/parks/youthsports.html
Marathon Kids Running Clubs	pre K-12 grade	any	Running clubs at various schools running for 10-30 minutes	n/a	\$15	multiple		www.marathonkids.org
Girls on the Run Greater Houston	3rd-8th grade	any	Running clubs at various schools for 10 weeks each Fall/Spring	n/a	\$30-155	multiple	varies; 2x/wk for 90 minutes	http://gotrgreaterhouston.org/
BakerRipley	any	any	some offer nutrition and physical fitness classes	n/a	\$150/family/yr	multiple		https://www.bakerripley.org/services
YMCA		any	group and individual fitness options	n/a	varies	multiple		https://www.ymcahouston.org
CDC.gov	any	any	guideline for physical activity	n/a	Free			https://www.cdc.gov/healthyschools/physicalactivity/toolkit/factsheet_pa_guidelines_families.pdf
Healthy children.org (American Academy of Pediatrics)	any	any	online collection of articles on physical fitness for families	n/a	Free			https://www.healthychildren.org/English/healthy-living/fitness/Pages/default.aspx

Camps

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

Nutrition Resources

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

References

1. Centers for Disease Control and Prevention. (2015). Defining childhood obesity. *CDC web site*.
2. Kelly, A. S., Barlow, S. E., Rao, G., Inge, T. H., Hayman, L. L., Steinberger, J., ... & Daniels, S. R. (2013). Severe obesity in children and adolescents: identification, associated health risks, and treatment approaches: a scientific statement from the American Heart Association. *Circulation*, CIR-0b013e3182a5cfb3.
3. Mohamed, S. M. (2015). Childhood obesity: epidemiology, determinants, and prevention. *J Nutrition Disorders & Therapy*, 5(156), 2161-0509.
4. Parker, L., Burns, A. C., & Nyberg, K. (Eds.). (2010). *Childhood obesity prevention in Texas: Workshop summary*. National Academies Press.
5. Combs, S. (2011). Gaining costs, losing time-The obesity crisis in Texas-worksites wellness programs. *Austin, TX: Texas Comptroller of Public Accounts*.
6. Paruthi, S., Brooks, L. J., D'Ambrosio, C., Hall, W. A., Kotagal, S., Lloyd, R. M. ... & Rosen, C. L. (2016). Recommended amount of sleep for pediatric populations: a consensus statement of the American Academy of Sleep Medicine. *Journal of Clinical Sleep Medicine*, 12(06), 785-786.
7. Ogden CL, Carroll MD, Kit BK, Flegal KM. Prevalence of obesity and trends in body mass index among us children and adolescents, 1999-2010. *JAMA*. 2012;307(5):483-490.
8. Armstrong S, Lazoric S, Hampl S, et al. Physical Examination Findings Among Children and Adolescents With Obesity: An Evidence-Based Review. *Pediatrics*. 2016;137(2).
9. Spear, B. A., Barlow, S. E., Ervin, C., Ludwig, D. S., Saelens, B. E., Schetzina, K. E., & Taveras, E. M. (2008). Recommendations for treatment of child and adolescent overweight and obesity. *Pediatrics*, 120(Supplement 4), S254-S288.
10. Kuczumski, R. J. (2000). CDC growth charts; United States.
11. Styne, D. M., Arslanian, S. A., Connor, E. L., Farooqi, I. S., Murad, M. H., Silverstein, J. H., & Yanovski, J. A. (2017). Pediatric obesity—assessment, treatment, and prevention: an Endocrine Society Clinical Practice guideline. *The Journal of Clinical Endocrinology & Metabolism*, 102(3), 709-757.
12. Centre for Public Health Excellence at NICE (UK, & National Collaborating Centre for Primary Care (UK). (2014). Obesity: the prevention, identification, assessment and management of overweight and obesity in adults and children.
13. The Spanish National Healthcare System Ministry for Health and Social Policy (2009). Clinical Practice Guideline for the Prevention and Treatment of Childhood and Juvenile Obesity.
14. US Preventive Services Task Force. (2017). Screening for Obesity & Intervention for Weight Management in Children and Adolescents *Pediatrics*, peds-2009.
15. Javed, A., Jumean, M., Murad, M. H., Okorodudu, D., Kumar, S., Somers, V. K., & Lopez-Jimenez, F. (2015). Diagnostic performance of body mass index to identify obesity as defined by body adiposity in children and adolescents: a systematic review and meta-analysis. *Pediatric obesity*, 10(3), 234-244.
16. Ma, C., Wang, R., Liu, Y., Lu, Q., Liu, X., & Yin, F. (2016). Diagnostic performance of neck circumference to identify overweight and obesity as defined by body mass index in children and adolescents: systematic review and meta-analysis. *Annals of Human Biology*, 44(3), 223-229.
17. Simmonds, M., Llewellyn, A., Owen, C. G., & Woolcott, N. (2016). Simple tests for the diagnosis of childhood obesity: a systematic review and meta-analysis. *Obesity Reviews*, 17(12), 1301-1315.
18. Vanderwall, C., Clark, R. R., Eickhoff, J., & Carrel, A. L. (2017). BMI is a poor predictor of adiposity in young overweight and obese children. *BMC pediatrics*, 17(1), 135.
19. Al-Khudairy, L., Loveman, E., Colquitt, J. L., Mead, E., Johnson, R. E., Fraser, H., ... & Azevedo, L. B. (2017). Diet, physical activity and behavioural interventions for the treatment of overweight or obese adolescents aged 12 to 17 years. *The Cochrane Library*.
20. Janicke, D. M., Steele, R. G., Gayes, L. A., Lim, C. S., Clifford, L. M., Schneider, E. M., ... & Westen, S. (2014). Systematic review and meta-analysis of comprehensive behavioral family lifestyle interventions addressing pediatric obesity. *Journal of pediatric psychology*, 39(8), 809-825.
21. Kamath, C. C., Vickers, K. S., Ehrlich, A., McGovern, L., Johnson, J., Singhal, V., & Montori, V. M. (2008). Behavioral interventions to prevent childhood obesity: a systematic review and metaanalyses of randomized trials. *The Journal of Clinical Endocrinology & Metabolism*, 93(12), 4606-4615.
22. Mead, E., Brown, T., Rees, K., Azevedo, L. B., Whittaker, V., Jones, D., & Beardsmore, E. (2017). Diet, physical activity and behavioural interventions for the treatment of overweight or obese children from the age of 6 to 11 years. *The Cochrane Library*.
23. O'connor, E. A., Evans, C. V., Burda, B. U., Walsh, E. S., Eder, M., & Lozano, P. (2017). Screening for obesity and intervention for weight management in children and adolescents: evidence report and systematic review for the US Preventive Services Task Force. *Jama*, 317(23), 2427-2444.
24. Peirson, L., Fitzpatrick-Lewis, D., Morrison, K., Warren, R., Ali, M. U., & Raina, P. (2015). Treatment of overweight and obesity in children and youth: a systematic review and meta-analysis. *CMAJ open*, 3(1), E35.
25. Whitlock, E. P., O'Connor, E. A., Williams, S. B., Beil, T. L., & Lutz, K. W. (2010). Effectiveness of weight management interventions in children: a targeted systematic review for the USPSTF. *Pediatrics*, peds-2009.
26. Bean, M. K., Powell, P., Quinoy, A., Ingersoll, K., Wickham, E. P., & Mazzeo, S. E. (2015). Motivational interviewing targeting diet and physical activity improves adherence to paediatric obesity treatment: results from the MI Values randomized controlled trial. *Pediatric obesity*, 10(2), 118-125.
27. Chahal, N., Rush, J., Manlhiot, C., Boydell, K. M., Jelen, A., & McCrindle, B. W. (2017). Dyslipidemia management in overweight or obese adolescents: A mixed-methods clinical trial of motivational interviewing. *SAGE open medicine*, 5, 2050312117707152.
28. Danielsen, Y. S., Nordhus, I. H., Júlíusson, P. B., Mæhle, M., & Pallesen, S. (2013). Effect of a family-based cognitive behavioural intervention on body mass index, self-esteem and symptoms of depression in children with obesity (aged 7–13): A randomised waiting list controlled trial. *Obesity Research & Clinical Practice*, 7(2), e116-e128.
29. Draxten, M., Flattum, C., & Fulkerson, J. (2016). An example of how to supplement goal setting to promote behavior change for families using motivational interviewing. *Health communication*, 31(10), 1276-1283.
30. Freira, S., Lemos, M. S., Williams, G., Ribeiro, M., Pena, F., & do Céu Machado, M. (2017). Effect of Motivational Interviewing on depression scale scores of adolescents with obesity and overweight. *Psychiatry research*, 252, 340-345.
31. Dreyer Gillette, M. L., Odar Stough, C., Best, C. M., Beck, A. R., & Hampl, S. E. (2014). Comparison of a condensed 12-week version and a 24-week version of a family-based pediatric weight management program. *Childhood Obesity*, 10(5), 375-382.
32. Resnicow, K., McMaster, F., Bocian, A., Harris, D., Zhou, Y., Snetselaar, L., ... & Hollinger, D. (2015). Motivational interviewing and dietary counseling for obesity in primary care: an RCT. *Pediatrics*, 135(4), 649-657.
33. Savoye, M., Caprio, S., Dziura, J., Camp, A., Germain, G., Summers, C., ... & DePourcq, F. (2014). Reversal of early abnormalities in glucose metabolism in obese youth: results of an intensive lifestyle randomized controlled trial. *Diabetes care*, 37(2), 317-324.
34. Schwartz, R. P., Hamre, R., Dietz, W. H., Wasserman, R. C., Slora, E. J., Myers, E. F., ... & Resnicow, K. A. (2007). Office-based motivational interviewing to prevent childhood obesity: a feasibility study. *Archives of pediatrics & adolescent medicine*, 161(5), 495-501.

35. Blüher, S., Petroff, D., Wagner, A., Warich, K., Gausche, R., Klemm, T., ... & Keller, A. (2014). The one year exercise and lifestyle intervention program KLAKS: Effects on anthropometric parameters, cardiometabolic risk factors and glycemic control in childhood obesity. *Metabolism-Clinical and Experimental*, 63(3), 422-430.
36. Christison, A. L., Daley, B. M., Asche, C. V., Ren, J., Aldag, J. C., Ariza, A. J., & Lowry, K. W. (2014). Pairing motivational interviewing with a nutrition and physical activity assessment and counseling tool in pediatric clinical practice: a pilot study. *Childhood Obesity*, 10(5), 432-441.
37. Danielsson, P., Kowalski, J., Ekblom, Ö., & Marcus, C. (2012). Response of severely obese children and adolescents to behavioral treatment. *Archives of pediatrics & adolescent medicine*, 166(12), 1103-1108.
38. Danielsson, P., Bohlin, A., Bendito, A., Svensson, A., & Klaesson, S. (2016). Five-year outpatient programme that provided children with continuous behavioural obesity treatment enjoyed high success rate. *Acta Paediatrica*, 105(10), 1181-1190.
39. Holm, J. C., Gamborg, M., Neland, M., Ward, L., Gammeltoft, S., Heitmann, B. L., ... & Ibsen, K. K. (2012). Longitudinal changes in blood pressure during weight loss and regain of weight in obese boys and girls. *Journal of hypertension*, 30(2), 368-374.
40. Koot, B. G. P., Van Der Baan-slootweg, O. H., Vinke, S., Bohte, A. E., Tammenga-Smeulders, C. L. J., Jansen, P. L. M., ... & Benninga, M. A. (2016). Intensive lifestyle treatment for non-alcoholic fatty liver disease in children with severe obesity: inpatient versus ambulatory treatment. *International journal of obesity*, 40(1), 51.
41. Garipağaoğlu, M., Sahip, Y., Darendeliler, F., Akdikmen, Ö., Kopuz, S., & Sut, N. (2009). Family-based group treatment versus individual treatment in the management of childhood obesity: randomized, prospective clinical trial. *European journal of pediatrics*, 168(9), 1091-1099.
42. Kalavainen, M. P., Korppi, M. O., & Nuutinen, O. M. (2007). Clinical efficacy of group-based treatment for childhood obesity compared with routinely given individual counseling. *International journal of obesity*, 31(10), 1500.
43. Kalavainen, M., Korppi, M., & Nuutinen, O. (2011). Long-term efficacy of group-based treatment for childhood obesity compared with routinely given individual counselling. *International Journal of Obesity*, 35(4), 530.
44. Steele, R. G., Aylward, B. S., Jensen, C. D., Cushing, C. C., Davis, A. M., & Bovaird, J. A. (2011). Comparison of a family-based group intervention for youths with obesity to a brief individual family intervention: A practical clinical trial of positively fit. *Journal of pediatric psychology*, 37(1), 53-63.
45. Anderson, J. W., Konz, E. C., Frederich, R. C., & Wood, C. L. (2001). Long-term weight-loss maintenance: a meta-analysis of US studies. *The American journal of clinical nutrition*, 74(5), 579-584.
46. Goldschmidt, A. B., Best, J. R., Stein, R. I., Saelens, B. E., Epstein, L. H., & Wilfley, D. E. (2014). Predictors of child weight loss and maintenance among family-based treatment completers. *Journal of consulting and clinical psychology*, 82(6), 1140.
47. Svetkey, L. P., Stevens, V. J., Brantley, P. J., Appel, L. J., Hollis, J. F., Loria, C. M., ... & Samuel-Hodge, C. (2008). Comparison of strategies for sustaining weight loss: the weight loss maintenance randomized controlled trial. *Jama*, 299(10), 1139-1148.
48. Wilfley, D. E., Stein, R. I., Saelens, B. E., Mockus, D. S., Matt, G. E., Hayden-Wade, H. A., ... & Epstein, L. H. (2007). Efficacy of maintenance treatment approaches for childhood overweight: a randomized controlled trial. *Jama*, 298(14), 1661-1673.
49. Voils, C. I., Olsen, M. K., Gierisch, J. M., McVay, M. A., Grubber, J. M., Gaillard, L., ... & Yancy, W. S. (2017). Maintenance of weight loss after initiation of nutrition training: a randomized trial. *Annals of internal medicine*, 166(7), 463-471. Armstrong, 2017
50. Armstrong, S., Mendelsohn, A., Bennett, G., Taveras, E. M., Kimberg, A., & Kemper, A. R. (2018). Texting Motivational Interviewing: A Randomized Controlled Trial of Motivational Interviewing Text Messages Designed to Augment Childhood Obesity Treatment. *Childhood Obesity*, 14(1), 4-10.
51. De Niet, J., Timman, R., Bauer, S., van den Akker, E., de Klerk, C., Kordy, H., & Passchier, J. (2012). Short message service reduces dropout in childhood obesity treatment: A randomized controlled trial. *Health Psychology*, 31(6), 797.
52. Chin, S. O., Keum, C., Woo, J., Park, J., Choi, H. J., Woo, J. T., & Rhee, S. Y. (2016). Successful weight reduction and maintenance by using a smartphone application in those with overweight and obesity. *Scientific reports*, 6, 34563.
53. Pbert, L., Druker, S., Barton, B., Olendzki, B., Andersen, V., Persuitte, G., ... & Geller, A. C. (2016). Use of a FITLINE to support families of overweight and obese children in pediatric practices. *Childhood Obesity*, 12(1), 33-43.
54. Woolford, S. J., Clark, S. J., Strecher, V. J., & Resnicow, K. (2010). Tailored mobile phone text messages as an adjunct to obesity treatment for adolescents. *Journal of telemedicine and telecare*, 16(8), 458-461.
55. Bouza, C., López-Cuadrado, T., Gutierrez-Torres, L. F., & Amate, J. (2012). Efficacy and safety of metformin for treatment of overweight and obesity in adolescents: an updated systematic review and meta-analysis. *Obesity facts*, 5(5), 753-765.
56. McDonagh, M. S., Selph, S., Ozpinar, A., & Foley, C. (2014). Systematic review of the benefits and risks of metformin in treating obesity in children aged 18 years and younger. *JAMA pediatrics*, 168(2), 178-184.
57. Mead, E., Atkinson, G., Richter, B., Metzendorf, M. I., Baur, L., Finer, N., ... & Ells, L. J. (2016). Drug interventions for the treatment of obesity in children and adolescents. *The Cochrane Library*.
58. Glaser Pediatric Research Network Obesity Study Group. (2010). Metformin extended release treatment of adolescent obesity: a 48-week randomized, double-blind, placebo-controlled trial with 48-week follow-up. *Archives of pediatrics & adolescent medicine*, 164(2), 116.
59. Kendall, D., Vail, A., Amin, R., Barrett, T., Dimitri, P., Ivison, F., ... & Stirling, H. (2013). Metformin in obese children and adolescents: the MOCA trial. *The Journal of Clinical Endocrinology & Metabolism*, 98(1), 322-329.
60. Pastor-Villaescusa, B., Cañete, M. D., Caballero-Villarraso, J., Hoyos, R., Latorre, M., Vázquez-Cobela, R., ... & Gil, Á. (2017). Metformin for obesity in prepubertal and pubertal children: a randomized controlled trial. *Pediatrics*, 140(1), e20164285.
61. van der Aa, M. P., Hoving, V., van de Garde, E. M., de Boer, A., Knibbe, C. A., & van der Vorst, M. M. (2016). The Effect of Eighteen-Month Metformin Treatment in Obese Adolescents: Comparison of Results Obtained in Daily Practice with Results from a Clinical Trial. *Journal of obesity*, 2016.
62. Marques, P., Limbert, C., Oliveira, L., Santos, M. I., & Lopes, L. (2016). Metformin effectiveness and safety in the management of overweight/obese nondiabetic children and adolescents: metabolic benefits of the continuous exposure to metformin at 12 and 24 months. *International journal of adolescent medicine and health*, 29(5).
63. Maahs, D., Serna, D. G. D., Kolotkin, R. L., Ralston, S., Sandate, J., Qualls, C., & Schade, D. S. (2006). Randomized, double-blind, placebo-controlled trial of orlistat for weight loss in adolescents. *Endocrine Practice*, 12(1), 18-28.
64. Ryder, J. R., Kaizer, A., Rudser, K. D., Gross, A., Kelly, A. S., & Fox, C. K. (2017). Effect of phentermine on weight reduction in a pediatric weight management clinic. *International Journal of Obesity*, 41(1), 90.
65. Ells, L. J., Mead, E., Atkinson, G., Corpeleijn, E., Roberts, K., Viner, R., ... & Richter, B. (2015). Surgery for the treatment of obesity in children and adolescents. *The Cochrane Library*.
66. Pedrosa F., Angriman F., Endo A., Dasenbrock H3, et al. (2017). Weight loss after bariatric surgery in obese adolescents: a systematic review and meta-analysis. *Surg Obes Relat Dis*. 2017 Oct 10.
67. Qi, L., Guo, Y., Liu, C., Huang, Z., Sheng, Y., & Zou, D (2017). Effects of bariatric surgery on glycemic and lipid metabolism, surgical complication and quality of life in adolescents with obesity: a systematic review and meta-analysis. *Surg Obes Relat Dis*. 2017 Dec; 13(12):2037-2055
68. Alqahtani, A. R., Elahmedi, M., & Alqahtani, Y. A. (2014, February). Bariatric surgery in monogenic and syndromic forms of obesity. In *Seminars in pediatric surgery* (Vol. 23, No. 1, pp. 37-42). Elsevier.

69. Nobili, V., Carpino, G., De Peppo, F., Caccamo, R., Mosca, A., Romito, I., ... & Gaudio, E. (2017). Laparoscopic Sleeve Gastrectomy Improves Nonalcoholic Fatty Liver Disease–Related Liver Damage in Adolescents by Reshaping Cellular Interactions and Hepatic Adipocytokine Production. *The Journal of pediatrics*.
70. Speer, A. L., Parekh, J., Qureshi, F. G., & Nadler, E. P. (2017). Thirty-day outcomes for children and adolescents undergoing laparoscopic sleeve gastrectomy at a free-standing children's hospital. *Clinical obesity*, 7(2), 86-91.
71. American Academy of Pediatrics. (2007). Assessment of Child and Adolescent Overweight and Obesity: A Supplement to. *Pediatrics*, 120(Supplement 4).
72. Flynn, J. T., Kaelber, D. C., Baker-Smith, C. M., Blowey, D., Carroll, A. E., Daniels, S. R., ... & Gidding, S. S. (2017). Clinical practice guideline for screening and management of high blood pressure in children and adolescents. *Pediatrics*, e20171904.
73. Vos, M. B., Abrams, S. H., Barlow, S. E., Caprio, S., Daniels, S. R., Kohli, R., ... & Xanthakos, S. A. (2017). NASPGHAN clinical practice guideline for the diagnosis and treatment of nonalcoholic fatty liver disease in children: recommendations from the Expert Committee on NAFLD (ECON) and the North American Society of Pediatric Gastroenterology, Hepatology and Nutrition (NASPGHAN). *Journal of pediatric gastroenterology and nutrition*, 64(2), 319-334.
74. Berglund, L., Brunzell, J. D., Goldberg, A. C., Goldberg, I. J., Sacks, F., Murad, M. H., & Stalenhoef, A. F. (2012). Evaluation and treatment of hypertriglyceridemia: an Endocrine Society clinical practice guideline. *The Journal of Clinical Endocrinology & Metabolism*, 97(9), 2969-2989.
75. Estrada, E., Eneli, I., Hampl, S., Mietus-Snyder, M., Mirza, N., Rhodes, E., ... & Pont, S. J. (2014). Children's Hospital Association consensus statements for comorbidities of childhood obesity. *Childhood Obesity*, 10(4), 304-317.
76. Weghuber, D., Barrett, T., Barrientos-Pérez, M., Gies, I., Hesse, D., Jeppesen, O. K., ... & Arslanian, S. (2022). Once-weekly semaglutide in adolescents with obesity. *New England Journal of Medicine*, 387(24), 2245-2257.
77. Hampl, S. E., Hassink, S. G., Skinner, A. C., Armstrong, S. C., Barlow, S. E., Bolling, C. F., ... & Okechukwu, K. (2023). Clinical Practice Guideline for the Evaluation and Treatment of Children and Adolescents With Obesity. *Pediatrics*.

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	
STRONG	Desirable effects clearly outweigh undesirable effects or vice versa
WEAK	Desirable effects closely balanced with undesirable effects
Quality	Type of Evidence
High	Consistent evidence from well-performed RCTs or exceptionally strong evidence from unbiased observational studies
Moderate	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
Low	Evidence for at least 1 critical outcome from observational studies, RCTs with serious flaws or indirect evidence
Very Low	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 must 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.

Version History

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