Table 4: Signs and Symptoms of Conditions Associated with Obesity, Diagnosis and Referral Recommendations

Symptoms or Signs	Suspected Diagnosis	Appropriate Studies	Referral
Polydipsia, polyuria, weight loss, acanthosis nigricans	Type 2 Diabetes	Random glucose, fasting glucose, 2 hour GTT, urine ketones, HbA1c	Endocrine
Small stature (decreasing height velocity), goiter	Hypothyroidism	Free T4, TSH	Endocrine
Small stature (decreasing height velocity), purple striae, Cushingoid facies	Cushing's Syndrome	Serum cortisol, 24 hour urine free cortisol	Endocrine
Hirsutism, excessive acne, menstrual irregularity	Polycystic Ovary Syndrome	Free testosterone	Adolescent medicine or Endocrine
Abdominal pain	GE Reflux, Constipation, Gall Bladder Disease	Medication trial for suspected reflux or constipation, ultrasound for GB disease	Gastroenterology
Hepatomegaly, increased LFTs (ALT or AST >60 for ≥6 months)	Nonalcoholic Fatty Liver Disease	ALT, AST, bilirubin, alkaline phosphatase (also see Table 5)	Gastroenterology
Snoring, daytime somnolence, tonsillar hypertrophy, enuresis, headaches, elevated BP	Sleep Apnea, Hypoventilation Syndrome	Sleep Study	ENT or Pulmonology
Hip or knee pain, limp, limited hip range of motion, pain walking	Slipped Capital Femoral Epiphysis	X-rays of hip	Orthopedics
Lower leg bowing	Blount Disease	X-ray of lower extremities and knees	Orthopedics
Severe headaches, papilledema	Pseudotumor Cerebri	Head CT Scan	Neurology or Neurosurgery
Depression, school avoidance, social isolation, sleep disturbances	Depression	Validated depression screen (PSC, MFQ)	Psychiatry or Psychology
Binge eating, vomiting	Bulimia	Validated screen for eating disorder	Psychiatry, psychology, eating disorders center
Dysmorphic features, small hands and feet, small genitalia, no menses, undescended testes	Prader-Willi Syndrome	Chromosomes for Prader Willi Syndrome	Genetics

Table 5: Results Guide for Overweight and Obese Pediatric Patients

Test	Result	Action Plan
Fasting Glucose	<100	Recheck every 2 years.
	≥100, <126	Pre-diabetes. Provide counseling. Consider oral glucose tolerance test, HbA1c. Recheck yearly.
	≥126	Diabetes. Refer to endocrine.
Oral GTT (2-hour)	<140	Recheck every 2 years, more frequently if weight gain continues/accelerates.
	≥140, <200	Pre-diabetes. Provide counseling. Consider referral to endocrine if risks present. Recheck every 2 years, more frequently if weight gain continues/accelerates.
	≥200	Diabetes. Refer to endocrine.
Random Glucose	≥200	Diabetes. Refer to endocrine.
Hemoglobin A1c	≥7	Refer to endocrine. Note that this test is not routinely recommended.
Fasting LDL	<110	Repeat every 5 years.
	≥110, <130	Repeat in 1 year.
	≥130, <160	Obtain complete family history. Provide low cholesterol diet (AHA "Step 1" Diet). Recheck 1 year.
	≥160 w/risks, or any LDL ≥190	Refer to cardiology.
Fasting HDL	≥40	Routine care. Recheck every 2 years, more frequently if weight gain continues/accelerates.
	<40	Increase activity and omega-3 fats (flax/fish oil). Stop smoking. Decrease sugar intake. Recheck 1 year.
Fasting Triglycerides	<200	Routine care. Recheck every 2 years, more frequently if weight gain continues/accelerates.
	≥200, <500	Increase omega-3 intake. Decrease saturated fat, sugar. Recheck 1 year.
	≥500	Refer to cardiology.
BP, ages 3-19 • Plot percentile from BP table • Must confirm with 3 separate measures	<90th%ile	Routine care. Recheck annually.
	≥90th, <95th%ile, ≥120/80 any age (pre-htn)	Increase physical activity. Smoking cessation. DASH diet. If other risks or symptoms, consider BUN/Cr, UA and culture, renal u/s, ECG, fundoscopic exam. Recheck every 6 months.
	≥95th%ile, <99th%ile + 5 mm Hg (Stage 1 htn)	As above, + CBC, electrolytes (include BUN/Cr), UA and culture, ECG. Consider renal u/s, fundoscopic exam, renin. Refer to cardiology or nephrology (esp. if pre-pubertal). Consider pharmacotherapy. Recheck 1 month.
	≥99th%ile + 5 mm Hg (Stage 2 htn)	As above. Refer to cardiology or nephrology. Recheck within 1 week.
Always elicit sleep history and consider sleep study to r/o OSA as cause of HTN		
Liver function tests	ALT or AST ≥60, <200	Lifestyle modification. Recheck every 3 months.
	ALT or AST ≥60 x 6 months or ≥200 at any time	Refer to GI.

Eat Smart Move More NORTH CAROLINA™

Pediatric Obesity

1. Assess Body Mass Index (BMI) in children ages 2-18 annually.
2. Plot BMI on gender-specific BMI-for-age chart to determine percentile.
3. Diagnose weight category (Table 1).
4. Identify risk (Table 2) and comorbidities (Table 4).
5. History and physical exam, blood pressure, appropriate laboratory tests and referrals (Tables 3, 5).
6. Share prevention messages (**5-3-2-1-Almost None**).

Assessment and Counseling Tips

Assess current behaviors (consider using questionnaires).

— Eating behaviors
- *Fruit and vegetable consumption*
- *Breakfast consumption (frequency and quality)*
- *Frequency of family meals prepared at home*
- *Sugar-sweetened beverage consumption (soda, tea, energy drinks)*
- *Excess juice consumption (>4-6 oz/day for age 1-6 yrs, >8-12 oz/day for age 7+ yrs)*
- *Frequency of eating food bought away from home (esp. fast food)*
- *Portion sizes of meals and snacks*
- *Atypical eating/nutrition behaviors*

— Physical activity behaviors
- *Amount of TV and other screen time and sedentary activities*
- *Amount of daily physical activity*
- *Role of environmental barriers and accessibility*

Assess motivation and attitudes.
- *Are you concerned about your/your child's weight?*
- *On a scale of 0 to 10, how important is it for you/child/family to change [specific behavior] or to lose weight?*
- *On a scale of 0 to 10, how confident are you that you/he/she could succeed?*

Summarize and probe possible changes.

Prevention Messages: 5-3-2-1-Almost None

5 or more servings of fruits and vegetables daily

3 structured meals daily—eat breakfast, less fast food, and more meals prepared at home

2 hours or less of TV or video games daily

1 hour or more of moderate to vigorous physical activity daily

Almost None: Limit sugar-sweetened beverages to "almost none"

Adapted from the 5-2-1-0 message promoted by the National Initiative for Children's Healthcare Quality (www.nichq.org)

Pediatric Obesity Prevention and Treatment Algorithm

BMI 5th to <85th percentile | **BMI 85th to <95th percentile *without* risk factors**

Prevention Counseling: Primary Care Office

- Assessment and counseling
- Reinforce healthy behaviors
- Identify problem behaviors and elicit solutions from family
- Assess motivation and attitudes
- Deliver consistent evidence-based messages regardless of weight (e.g. **5-3-2-1-Almost None**)
- Actively engage whole family
- Encourage authoritative parenting style (not restrictive)

Re-evaluate annually

BMI 85th to <95th percentile *with* risk factors | **BMI 95th to <99th percentile** | **BMI ≥99th percentile (age 6+, consider starting at Step 2-3)**

Step 1 Treatment: Primary Care Office

- Assessment and counseling*
- Explore/acknowledge possible roles of negative body image, low self esteem, and social isolation
- Motivational Interviewing
- Family visits with clinician—recommend every 1-3 months
- **5-3-2-1-Almost None** messages
- Actively engage whole family in lifestyle changes
- Weight goal: initially weight maintenance, then reduce BMI to <85th percentile

*Consider limitations and accommodations due to disabilities (physical, intellectual, and cognitive) and special health care needs in some children.

No improvement or stabilization from Step 1 Treatment in 3-6 months

Step 2 Treatment: Primary Care Office with Support

- Assessment and counseling*
- Explore/acknowledge possible roles of negative body image, low self esteem, and social isolation
- Motivational Interviewing
- Family visits with clinician trained in weight management—recommend monthly
- **5-3-2-1-Almost None** messages
- Monitor behaviors through diet and activity logs
- Meal plans created by Registered Dietitian or clinician with nutrition training
- Actively engage whole family in lifestyle changes
- Community-based programs
  —County contacts listed at www.EatSmartMoveMoreNC.com
  —Parent support groups
  —Individual or family cognitive behavior therapy
- Weight goal: weight maintenance, with lower BMI as age and height increase

*Consider limitations and accommodations due to disabilities (physical, intellectual, and cognitive) and special health care needs in some children.

No improvement or stabilization from Step 2 Treatment in 3-6 months

Step 3 Treatment: Comprehensive, Multidisciplinary Program *or* Tertiary Care Center

- Evaluation and follow-up with multidisciplinary team experienced in pediatric weight management
- Weekly visits for 8-12 weeks
- Weight goal: weight maintenance or gradual weight loss
- Other treatment options: medication, very low calorie diet (under direct medical supervision), bariatric surgery

ADDITIONAL RESOURCES

- BMI Calculator: http://apps.nccd.cdc.gov/dnpabmi/Calculator.aspx
- Patient Education Materials: www.EatSmartMoveMoreNC.com
- BP Norms for Age: www.nhlbi.nih.gov/guidelines/hypertension/child_tbl.pdf
- Additional Recommendations and Tools: National Initiative for Children's Healthcare Quality, www.nichq.org

Table 1: Weight Category by BMI* Percentile

BMI Percentile Range	Weight Category
<5th percentile	Underweight
5th percentile to <85th percentile	Healthy Weight
85th percentile to <95th percentile	Overweight
95th percentile to <99th percentile (or BMI >30)	Obese
≥99th percentile	Obese with Increased Risk

*Accurate BMI assessment depends on accurate height and weight measurements, which may be difficult to obtain in some children with disabilities and special health care needs.

Table 2: Risk Factors for Comorbidities and Future Obesity

Personal Risk Factors	Risk Factors from Family History
• Elevated blood pressure • Ethnicity: African American, Mexican-American, Native American, Pacific Islander • Puberty • Medications associated with weight gain (steroids, anti-psychotics, antiepileptics) • Acanthosis Nigricans • Birth history of SGA or LGA • Disabilities	• Type 2 Diabetes • Hypertension • High cholesterol • Obese parent(s) • Mother with Gestational Diabetes • Family member with early death from heart disease or stroke

Table 3: Laboratory Evaluation Recommendations

Age	BMI	Risk Factors	Action Plan
<10 years	≥85th %ile	N/A	Consider fasting lipids
≥10 years	85th to <95th %ile	No risk factors or symptoms	Consider fasting lipids
		≥2 risk factors	Biannually: fasting lipid profile, fasting glucose, consider ALT and AST
	≥95th %ile	N/A	Biannually: fasting lipid profile, fasting glucose, ALT and AST, other tests indicated by history and physical

References

An Implementation Guide from the Childhood Obesity Action Network, available at http://www.nichq.org/NR/rdonlyres/7CF2C1F3-4DA3-4A00-AE15-4E35967F3571/5316/COANImplementationGuide62607FINAL.pdf, accessed 3/19/08

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