NATIONAL GUIDELINE CLEARINGHOUSE™ (NGC) GUIDELINE SYNTHESIS

MANAGEMENT OF OVERWEIGHT AND OBESITY IN CHILDREN AND ADOLESCENTS

Guidelines

1. **American Heart Association (AHA)**. Overweight in children and adolescents: pathophysiology, consequences, prevention, and treatment. Circulation 2005 Apr 19;111(15):1999-2012. [103 references]
2. **Massachusetts Department of Public Health (MDPH)**. Expert panel on weight loss surgery. Boston (MA): Massachusetts Department of Public Health; 2007 Dec 12. 106 p. [77 references]
3. **The Endocrine Society (TES)**. Prevention and treatment of pediatric obesity: an Endocrine Society clinical practice guideline. J Clin Endocrinol Metab 2008 Dec;93(12):4576-99.

INTRODUCTION

A direct comparison of the American Heart Association (AHA), Massachusetts Department of Public Health (MDPH), and The Endocrine Society (TES) recommendations for management of overweight and obesity in children and adolescents is provided in the tables below.

- Table 1 provides a quick-view glance at the primary interventions considered by each group.
- Table 2 provides a comparison of the overall scope of the guidelines.
- Table 3 provides a more detailed comparison of the specific recommendations offered by each group for the topics under consideration in this synthesis, including:
    - General Recommendations
    - Dietary Interventions
    - Physical Activity
    - Pharmacological Treatment
    - Surgical Intervention
- Table 4 lists the potential benefits and harms associated with the implementation of each guideline as stated in the original guideline.
- Table 5 presents the rating schemes used by the guideline groups to rate the level of evidence and/or the strength of the recommendations.

Following the content and recommendation comparison tables, the areas of agreement and areas of differences among the guidelines are identified.

Abbreviations used in the text and table

- AGB, adjustable gastric band
- AHA, American Heart Association
- AHI, apnea hypopnea index
- BMI, body mass index
- BPD, biliopancreatic diversion
- CAD, coronary artery disease
- DS, duodenal switch
- DVT, deep venous thrombosis
- LAGB, laparoscopic adjustable gastric band
- LRYGB, laparoscopic Roux-en-Y Gastric Bypass
- MDPH, Massachusetts Department of Public Health
- NASH, nonalcoholic steatohepatitis
- OSA, obstructive sleep apnea
- PE, pulmonary embolism
- RYGB, Roux-en-Y Gastric Bypass
- TES, The Endocrine Society
- WLS, weight loss surgery

TABLE 1: COMPARISON OF INTERVENTIONS AND PRACTICES CONSIDERED
("✓" indicates topic is addressed)

	AHA (2005)	MDPH (2007)	TES (2008)
General Recommendations	✓		✓
Dietary Interventions	✓		✓
Physical Activity	✓		✓
Pharmacotherapy	✓		✓
Surgical Intervention	✓	✓	✓

TABLE 2: COMPARISON OF SCOPE AND CONTENT

	Objectives and Scope
AHA (2005)	• To examine the pathophysiology and epidemiology of overweight in children and adolescents • To present updated information on the adverse outcomes associated with childhood overweight and discuss approaches for the prevention and treatment of overweight in young individuals

MDPH (2007)	• To improve the safety of WLS in the state of Massachusetts and protect the well-being of patients who undergo it • To prevent medical errors with evidence-based standards of care

TES (2008)	• To provide practice guidelines for the treatment and prevention of pediatric obesity
	• To summarize information concerning:
	  • The seriousness of pediatric obesity and overweight
	  • The diagnostic criteria
	  • The available treatments and when to apply them
	  • The available measures to prevent overweight and obesity

Target Population	
AHA (2005)	• United States • Infants, children, and adolescents in the general population *(prevention)* • Overweight or obese children and adolescents with or without comorbidities *(prevention and treatment)*
MDPH (2007)	Patients in Massachusetts and nationwide, including children and adolescents, who are being considered for weight loss surgery
TES (2008)	Overweight and obese children and adolescents
Intended Users	
AHA (2005)	Health Care Providers Physicians
MDPH (2007)	Advanced Practice Nurses Allied Health Personnel Dietitians Health Care Providers Health Plans Hospitals Managed Care Organizations Nurses Patients Physician Assistants Physicians Psychologists/Non-physician Behavioral Health Clinicians Public Health Departments Social Workers Students Utilization Management

TES (2008)	Advanced Practice Nurses Dietitians Nurses Physician Assistants Physicians

TABLE 3: COMPARISON OF RECOMMENDATIONS	
General Recommendations	
AHA (2005)	The principal strategies for the treatment of overweight in children are similar to those for adults (dietary modification and increased physical activity), with treatment goals based on age, severity of obesity, and the results of risk factor assessment. **Guiding Principles** Five guiding principles are important for the treatment of overweight. These guiding principles can be summarized as follows: 1. Establish individual treatment goals and approaches based on the child's age, degree of overweight, and presence of comorbidities. 2. Involve the family or major caregivers in the treatment. 3. Provide assessment and monitoring frequently. 4. Consider behavioral, psychological, and social correlates of weight gain in the treatment plan. 5. Provide recommendations for dietary changes and increases in physical activity that can be implemented within the family environment and that foster optimal health, growth, and development. Treatment of overweight should rarely be instituted before 2 years of age because of the rapid growth and development that occurs during these early years and lower correlation with overweight in later years. Family involvement is critical in the treatment of childhood overweight. If treatment is initiated when a family is not ready to support the program, then success is unlikely. The treatment planned should also take into consideration long-term management with the continued assessment of the child for adequate growth and development because overweight is a long-term problem.
MDPH (2007)	No recommendations offered

TES (2008)	**<u>Lifestyle: General Considerations</u>** The Task Force recommends that clinicians prescribe and support intensive lifestyle (dietary, physical activity, and behavioral) modification to the entire family and to the patient, in an age-appropriate manner, and as the prerequisite for all overweight and obesity treatments for children and adolescents (**1 | +000**). <u>Evidence</u> Although good-quality pediatric and adolescent data are scarce, there is sufficient evidence that intensive lifestyle modification programs, as in adults, can be an effective tool for pediatric weight control. Furthermore, implementation of a formal maintenance program after the treatment phase is completed can be of added importance in maintaining achieved weight loss. This fits into a concept of obesity as a chronic disease. **Psychosocial Recommendations** The Task Force suggests that clinicians educate parents about the need for healthy rearing patterns related to diet and activity. Examples include parental modeling of healthy habits, avoidance of overly strict dieting, setting limits of acceptable behaviors, and avoidance of using food as a reward or punishment (**2 | +000**) The Task Force suggests that clinicians probe for and diagnose unhealthy intrafamily communication patterns and support rearing patterns that seek to enhance the child's self-esteem (**2 | +000**) <u>Remarks</u> It is important to remember that clinician interactions with the family and all educational materials should be culturally sensitive and in the language best understood by the family.
Dietary Interventions	
AHA (2005)	*Dietary Management* • Age-specific dietary modification is the cornerstone of treatment. The major goals in dietary management are to provide appropriate calorie intake, provide optimum nutrition for the maintenance of health and normal growth, and to help the child develop and sustain healthful eating habits. • Estimated energy requirements vary throughout childhood and reflect large increments with a range of 570 to 3,152 kilocalories/day for boys and 520 to 2,368 kcal for girls from age 3 months to 16 years. In addition, caloric needs may vary widely even for children of the same age because of normal differences in

	size. Thus, individualizing the calorie-intake recommendation and monitoring weight change are essential. Healthcare professionals must help parents or caregivers recognize and prevent overeating. • Because it is difficult for parents to judge calorie intake and energy expenditure on a regular basis, it is necessary to help parents guide the diet and physical activity patterns of their children. Counseling and recommendations must be made within the context of the family's culture, living environment, and socioeconomic status. Involving children in meal planning, shopping, gardening, and preparation of food has been promoted, along with including all caregivers (including grandparents) in helping the child to adhere to recommended consumption patterns and healthier food choices.
MDPH (2007)	No recommendations offered
TES (2008)	**Dietary Recommendations** The Task Force recommends that clinicians prescribe and support healthy eating habits such as: • Avoiding the consumption of calorie-dense, nutrient-poor foods (e.g., sweetened beverages, sports drinks, fruit drinks and juices, most "fast food," and calorie-dense snacks) (**1 | ++00**) The Task Force suggests that clinicians prescribe and support: • Controlling caloric intake through portion control in accordance with the Guidelines of the American Academy of Pediatrics (**2 | +000**). • Reducing saturated dietary fat intake for children older than 2 yrs of age (**2 | ++00**). • Increasing the intake of dietary fiber, fruits, and vegetables (**2 | +000**). • Eating timely, regular meals, particularly breakfast, and avoiding constant "grazing" during the day, especially after school (**2 | +000**). Remarks Many different diets have been proposed for weight loss. Currently there is debate about whether a low-fat (usually 30% of calories as fat) or a low-carbohydrate diet is more efficacious. At the present time, there is insufficient pediatric evidence to warrant recommending any one hypocaloric diet over another. But caution should be exercised when using unbalanced hypocaloric diets that may be deficient in essential vitamins and minerals.
Physical Activity	

AHA (2005)	*Physical Activity* • Regular physical activity is critical for the prevention of abnormal weight gain and weight maintenance. The current recommendation for the amount of physical activity is 30 to 60 minutes of regular exercise daily. "Working up a sweat" during the activity suggests adequate effort expended. These recommendations apply to children of normal weight as well as to children who are overweight. • Recommended activities must be enjoyable and congruent with the child's and family's lifestyle and be rewarding independent of the health benefit. • A complementary approach is to restrict sedentary free-time activities to <2 hours/day.
MDPH (2007)	No recommendations offered
TES (2008)	**Physical Activity Recommendations** The Task Force recommends that clinicians prescribe and support 60 min of daily moderate to vigorous physical activity (**1 | ++00**) The Task Force suggests that clinicians prescribe and support a decrease in time spent in sedentary activities, such as watching television, playing video games, or using computers for recreation. Screen time should be limited to 1-2 h per day, according to the American Academy of Pediatrics (**2 | +000**) <u>Evidence</u> In the absence of caloric restriction, moderate exercise does not generally cause weight loss. However, in combination with decreased caloric intake, exercise can achieve significant weight loss. The beneficial effects of both aerobic exercise and resistance training can be short-lived, and exercise must be sustained. Time spent in daily vigorous exercise in excess of 60 minutes per day provides additional reduction in cardiovascular risk factors.
Pharmacological Treatment	
AHA (2005)	*Pharmacological Treatment* • Data supporting the use of pharmacological therapy for pediatric overweight are limited and inconclusive. • Sibutramine has been studied in a randomized controlled trial of severe obesity. It has been shown to be efficacious as compared with behavior therapy alone, but it may be associated with side

	effects including increases in heart rate and blood pressure. • Orlistat is approved for use in adolescence. The efficacy of orlistat has not been tested extensively in young patients. Orlistat is associated with gastrointestinal side effects and requires fat-soluble vitamin supplementation and monitoring. • For rare genetic and metabolic disorders, pharmacological treatment may be useful. For example, recombinant leptin is useful in hereditary leptin deficiency. Octreotide may be useful in hypothalamic obesity. Metformin, used to treat type 2 diabetes mellitus, has been used in insulin-resistant children and adolescents who are overweight, but long-term efficacy and safety are unknown.
MDPH (2007)	No recommendations offered
TES (2008)	**<u>Pharmacotherapy Recommendations</u>** The Task Force suggests that pharmacotherapy (in combination with lifestyle modification) be considered if a formal program of intensive lifestyle modification has failed to limit weight gain or to mollify co-morbidities in **obese** children. **Overweight** children should not be treated with pharmacotherapeutic agents unless significant, severe co-morbidities persist despite intensive lifestyle modification. In these children, a strong family history of T2DM or cardiovascular risk factors strengthens the case for pharmacotherapy (**2 | +000**) The Task Force suggests that pharmacotherapy be offered only by clinicians who are experienced in the use of antiobesity agents and are aware of the potential for adverse reactions (**2 | +000**) <u>Evidence</u> The utility of pharmacotherapy in adolescents has been reviewed, and the use of medication to treat severe obesity can be an additional treatment modality. Several limitations preclude physicians from early implementation of drug therapies. These include: 1) the lack of U.S. FDA approval for use in preadolescents and younger adolescents; 2) reduced efficacy over time, with a plateau after 6 months of treatment due to reduced energy expenditure offsetting the decrease in energy intake—an effect also noted with hypocaloric diets; 3) the existence of a limited number of well-controlled studies of the safety and efficacy of pharmacological intervention in obese children; and 4) the need to weigh the relative risk of severe adverse events in children against the long-term potential for obesity-related morbidity and mortality. Despite these concerns, the negative health impact of childhood obesity may justify long-term medication, but only in combination with lifestyle modification.

Three pharmacotherapeutic agents—**sibutramine**, **orlistat**, and **metformin** (metformin is not FDA approved for the treatment of obesity)—are most commonly used at present. Although metformin reduces hepatic glucose production and plasma insulin, inhibits lipogenesis, increases peripheral insulin sensitivity, and may reduce appetite by increasing levels of glucagon-like peptide, its mechanism of action on weight is unresolved. Only sibutramine (for children > 16 yr of age) and orlistat (for children 12 yr of age) are FDA approved for the treatment of obesity in adolescents (see Table 2 in the original guideline document).

Table 2 in the original guideline document summarizes the dosage, efficacy, adverse effects, contraindications, and monitoring needs of some of the medications used for the treatment of obesity, including:

- Sibutramine
- Orlistat
- Metformin
- Octreotide
- Leptin
- Topiramate
- Growth hormone

Remarks

The assessment of drug efficacy presented in the original guideline document founded only on the ability of medications to reduce BMI or BMI z-score. It must be emphasized that "antiobesity" drugs may have differential effects on BMI and obesity-associated co-morbidities. For example, certain medications (e.g., sibutramine, orlistat) may be more effective for weight loss than for treatment of impaired glucose tolerance, whereas other medications (e.g., metformin) have more potent effects on insulin production and glucose tolerance than on body weight per se. Drug selection should be tailored to the individual patient, with strong attention paid to the family history. The primary objective is to prevent co-morbidities in the obese (BMI $\geq$ 95th percentile) patient. Most importantly, the benefits of any drug used to treat childhood obesity should clearly outweigh its risks.

In general, children with a BMI below the 95th percentile should not be treated with antiobesity drugs. Pharmacotherapy for overweight children (**BMI $\geq$ 85th but < 95th percentile**) should be reserved for those with significant, severe comorbidities who have not responded to lifestyle modification. Although data suggest that adult Asians (and Native-Americans) develop obesity-associated comorbidities at a lower BMI than do Europeans, similar data are not available for children and adolescents, and so we cannot recommend the use of pharmacotherapy at a BMI range differing from the above recommendations.

The use of pharmacotherapeutic agents not yet approved for the

	treatment of pediatric obesity should be restricted to participation in large, well-controlled clinical trials.
Surgical Interventions	
AHA (2005)	*Surgical Treatment* • Surgical approaches to treat severe adolescent obesity are being undertaken by several centers. Indications used include a BMI >40 kilogram/m^2 and severe associated comorbidities, such as OSA, T2DM, and pseudotumor cerebri. • More severe elevation of BMI (>50 kilogram/m^2) may be an indication for surgical treatment in the presence of less severe comorbidities such as hypertension and dyslipidemia, particularly if the degree of overweight hinders performing the activities of daily living. • An experienced team approach including comprehensive medical and psychological evaluation is critical both for selection of appropriate candidates and for postoperative care that is sophisticated and often intense. • Weight loss goals and reduction of morbidity are often achieved with gastric bypass surgery. The rates of short-term mortality appear to be low, but significant complications can occur. Intermediate and long-term outcomes, including information on malabsorption of critical nutrients, are unknown. • Overall, surgical therapy should be reserved for full-grown adolescents with the severest obesity-related morbidity, offered only by experienced multidisciplinary teams, and presented to families with appropriate informed consent procedures.
MDPH (2007)	**<u>Pediatric/Adolescent</u>** A. **Types of Surgery** RYGB or LRYGB are considered safe and effective options for extremely obese adolescents as long as appropriate long-term follow-up is provided (**Category B**). The LAGB has not been approved by the FDA for use in adolescents, and therefore, should be considered investigational. Off-label use can be considered, if done in an Institutional Review Board (IRB)-approved study (**Category C**). BPD and DS procedures cannot be recommended in adolescents. Current data suggest substantial risks of protein malnutrition, bone loss, and micronutrient deficiencies. These nutritional risks are of particular concern during pregnancy. In addition, several late maternal deaths have been reported (**Category C**). Sleeve gastrectomy should be considered investigational; existing

data are not sufficient to recommend widespread and general use in adolescents (**Category D**).

B. **Comorbidities**

Strong indications for WLS in adolescents include established type 2 diabetes (**Category B**), moderate to severe OSA with AHI $\geq$15 (**Category C**), severe and/or progressive NASH (**Category C**), and pseudotumor cerebri (**Category C**). Other indications for WLS in adolescents include mild OSA, mild NASH, hypertension, dyslipidemia, and significantly impaired quality of life (**Categories C and D**).

All adolescents with obesity should be formally assessed for depression. If found to be depressed, they should be treated prior to WLS (**Category B**). The presence of eating disturbances is not an exclusion criterion for WLS, but adolescents with such disorders should be treated prior to surgery (**Category B**).

C. **Patient Selection**

When combination procedures are used in adolescents, physical maturity (completion of 95% of adult stature based on radiographic study) should be documented. In most cases, this criterion will limit surgery to children over age 12 (**Category D**). Psychological maturity-demonstrated by understanding of the surgery, mature motivations for the operation, and compliance with preoperative therapy-should be assessed prior to WLS (**Category D**).

BMI cutpoints in children and adolescents who meet other criteria should be $\geq$35 with major comorbidities (i.e., type 2 diabetes mellitus, moderate to severe sleep apnea [AHI >15], pseudotumor cerebri, or severe NASH) and $\geq$40 with other comorbidities (e.g., hypertension, insulin resistance, glucose intolerance, substantially impaired quality of life or activities of daily living, dyslipidemia, sleep apnea with AHI >5) (**Categories B and C**).

There are no data available to suggest that prolonged preoperative weight management programs are of benefit to adolescents who undergo WLS. However, children and adolescents should demonstrate the ability to comply with treatment regimens and medical monitoring before WLS. In many cases, consistent attendance in a prolonged weight management program will provide important assurance of postoperative compliance (**Category D**).

Individuals with mental retardation vary in their capacity to demonstrate knowledge, motivation, and compliance; they should, therefore, be evaluated for WLS on a case-by-case basis. For these children, the authors suggest including an ethicist on the

multidisciplinary evaluation team (**Category D**).

Others who should be screened on a case-by-case basis include: patients with syndromic obesity, endocrine disorders, obesity that appears to be related to the use of weight-promoting medications, and those in whom obesity cannot be controlled through medical interventions and/or carefully designed environmental and behavioral management. Very limited information is available about the outcomes of WLS for such patients (**Category D**). Patients with uncontrolled psychosis (presence of hallucinations and delusions), bipolar disorder (extreme mood lability), or substance use disorders can be considered for WLS on a case-by-case basis after they have been in remission for one year (**Category C**).

D. **Team Member Qualifications**

Although few hospitals have sufficient volume for a stand-alone pediatric surgical center, the ideal WLS team should include a minimum of 4 or 5 professionals who are co-located and have at least one preoperative face-to-face meeting to prepare a treatment plan for each patient (**Category D**). Staff should include:

- Surgeon — experienced adult bariatric surgeon or pediatric surgeon with bariatric fellowship or the equivalent experience
- Pediatric specialist — internist or pediatrician with adolescent and obesity training and experience
- Registered dietician — with weight management certificate and experience in treating obesity and working with children and families
- Mental health professional — with specialty training in child, adolescent, and family treatment, and experience treating eating disorders and obesity
- Coordinator — Registered nurse (RN), social worker, or one of the other team members who has the responsibility of coordinating each child or adolescent's care and assuring compliance and follow-up

The ideal setting would be in an adult/pediatric hospital, with a pediatric program, partnered with an adult program that has full access to pediatric specialists (**Category D**). A comprehensive family-based evaluation should be provided to parents seeking surgery for their adolescent children (**Category D**).

E. **Risks and Outcome**

Early WLS may reduce obesity-related mortality and morbidity. However, early timing must be weighed against the patient's possible psychological immaturity and the risk of decreased compliance and long-term follow-up (**Category C**). All adolescents

	undergoing WLS should be included in prospective longitudinal data collection to improve the evidence base for evaluating the risks and benefits of WLS in this age group (**Category D**). Emphasis on compliance strategies, careful monitoring of vitamin and mineral intake, and periodic laboratory surveillance to detect deficiencies is crucial (**Category D**). Adolescent girls are particularly vulnerable to nutritional deficiencies; this group is at substantial risk of developing iron deficiency anemia and vitamin B deficiencies during menstruation and pregnancy (**Category C**), and should receive special attention. Risk of pregnancy increases after WLS. All female adolescents should be informed about increased fertility following weight loss, and possible risks associated with pregnancy during the first 18 months after surgery. They should be counseled to avoid pregnancy during this period, and offered contraception (**Category D**). In addition to risks for deficiencies of iron, calcium, and vitamin B12 after WLS, adolescents may also be at particular risk for osteopenia and thiamine deficiency (**Category C**). F. **Informed Consent** Informed assent by the adolescent should be obtained separately from the parents to avoid coercion (as in other pediatric chronic illnesses that require surgical intervention) (**Category D**). The patient's knowledge of the risks and benefits of the procedure and the importance of postoperative follow-up should be formally evaluated to ensure true informed assent (**Category C**). The parental permission process should include discussion of the risks of adult obesity (**Category C**), available medical treatments (**Category B**), surgical alternatives, and the specific risks and outcomes of the proposed WLS in the proposed institution.
TES (2008)	**<u>Bariatric Surgery Recommendations</u>** The Task Force suggests that bariatric surgery be considered only under the following conditions: 1. The child has attained Tanner 4 or 5 pubertal development and final or near-final adult height. 2. The child has a BMI greater than 50 kg/m^2 or has BMI above 40 kg/m^2 and significant, severe co-morbidities. 3. Severe obesity and co-morbidities persist despite a formal program of lifestyle modification, with or without a trial of pharmacotherapy. 4. Psychological evaluation confirms the stability and competence of the family unit. 5. There is access to an experienced surgeon in a medical center employing a team capable of longterm follow-up of the metabolic and psychosocial needs of the patient and family, and the

institution is either participating in a study of the outcome of bariatric surgery or sharing data.
6. The patient demonstrates the ability to adhere to the principles of healthy dietary and activity habits.

(2 | ++00)

The Task Force recommends against bariatric surgery for preadolescent children, for pregnant or breast-feeding adolescents, and for those planning to become pregnant within 2 yr of surgery; for any patient who has not mastered the principles of healthy dietary and activity habits; for any patient with an unresolved eating disorder, untreated psychiatric disorder, or Prader-Willi syndrome **(1 | ++00)**

Evidence

Although the LAGB procedure is considered safer than RYGB, the FDA has not yet approved LAGB for use in adolescents.

The Task Force agrees with the expert panels that suggest bariatric surgery for adolescents with obesity related comorbid conditions that threaten the adolescent's health-a BMI above 40 kg/m^2 and a severe comorbidity or a BMI above 50 kg/m^2 and less severe comorbidity. These cut-points are the ones generally accepted for adolescents. Others have suggested that we should consider using a BMI in at least the 99^{th} percentile-equivalent to an adult BMI of 35-40 kg/m^2-with severe co-morbidities as a cutpoint. There are insufficient data concerning the complication rates using the current cut-points to warrant suggesting any changes.

Remarks

Requirements for patients. It must be clear to the patient and the family that bariatric surgery is an adjunct to a sincere commitment to alteration of lifestyle and behavior rather than a cure. All obese children must first demonstrate their ability to adhere to a family-based dietary and lifestyle modification program.

Requirements for preoperative care. Bariatric surgery in adolescents should be performed in regional pediatric academic centers with programs equipped to handle the data acquisition, long-term follow-up, and multidisciplinary issues of these difficult patients. A multidisciplinary team with medical (including endocrine, gastrointestinal, cardiovascular, pulmonary, and otolaryngological expertise), surgical, nutritional, and psychological expertise should carefully select adolescents who are well informed and motivated as potential candidates for bariatric surgery and should provide preoperative care and counseling. Patients and families must be well informed as to the risks and complications of bariatric surgery.

	Requirements for postoperative care. Postoperative attention to the principles of growth, development, and compliance is essential to avoid adverse physical, cognitive, and psychosocial outcomes after bariatric surgery. Adolescents undergoing bariatric surgery require lifelong medical and nutritional surveillance postoperatively, especially to ensure adequate vitamin and mineral intake, as well as extensive counseling. Patients lacking such help tend to regain their weight over time.

TABLE 4: BENEFITS AND HARMS	
Benefits	
AHA (2005)	The short- and long-term association of obesity with morbid outcomes raises the level of importance for understanding overweight as a major public health concern for children and adolescents. Prevention and treatment of overweight and obesity in children and adolescents may help prevent these adverse outcomes.
MDPH (2007)	• Identification of credentials, tools, and procedures required for best practice in the care of weight loss surgery patients. • Enhanced public health policies and scientific research in the area of weight loss surgery. • Optimized patient safety and high quality care.
TES (2008)	Appropriate prevention and treatment of pediatric obesity
Harms	
AHA (2005)	• Sibutramine has been studied in a randomized controlled trial of severe obesity. It has been shown to be efficacious as compared with behavior therapy alone, but it may be associated with side effects including increases in heart rate and blood pressure. • Orlistat is associated with gastrointestinal side effects and requires fat-soluble vitamin supplementation and monitoring. • The rates of short-term mortality appear to be low, but significant complications can occur with surgical treatment of obesity. Intermediate and long-term outcomes, including information on malabsorption of critical nutrients, are unknown.
MDPH (2007)	The complications of commonly performed WLS procedures are well defined. They include:

	LRYGB Common causes of death include pulmonary embolism and anastomotic leaks. Nonfatal perioperative complications include venous thromboembolism, wound infections, small bowel obstruction, and bleeding. Postoperative gastrointestinal complications include nausea and vomiting, micronutrient deficiencies, and possible weight regain. *LAGB* Data link LAGB with intermediate and long-term complications (e.g., band erosion or slippage, failure to achieve or maintain weight loss) that require reoperation in up to 20% of patients. LAGB has been linked to intermediate and long-term complications. *BPD* BPD is capable of producing substantial and sustained weight loss, perhaps associated with markedly suppressed ghrelin levels. However, increased incidence of stomal ulceration, severe protein-energy malnutrition, diarrhea, and dumping has limited its broad acceptance. **Subgroups Most Likely to Experience Harms** • Higher BMI and medical comorbidities (e.g., obstructive sleep apnea and coronary heart disease risk factors) increase operative risk and postoperative complications. • Specific consideration should be given to WLS patients with a history of CAD or DVT/PE, those who are current smokers, and those with known or suspected abnormal liver function. Helicobacter pylori (*H. pylori*) testing and treatment may also be useful, but more evidence is needed to determine its importance. Other risk factors include postprandial hypoglycemia, chronic renal disease, and HIV.
TES (2008)	*Obesity Medications* • Potential side effects associated with anti-obesity medications. See Table 2 in the original guideline document for details on the side effects of medications proposed for the treatment of obesity. *Bariatric Procedures* • The Task Force suggests limited use of bariatric surgery that places a relatively higher value on avoiding anatomical and functional changes in developing children, on avoiding unforeseen complications associated with lifelong exposure to these changes, and on avoiding the costs and perioperative complications of these procedures.

	• Because of the high morbidity and mortality associated with jejunoileal bypass and the biliopancreatic diversion with duodenal switch, they cannot be recommended for use in children.

TABLE 5: EVIDENCE RATING SCHEMES AND REFERENCES	
MDPH (2007)	**Grading System for Evidence-Based Recommendations*** **Category A:** Evidence obtained from at least one well-conducted randomized clinical trial (RCT) or a systematic review of all relevant RCTs **Category B:** Evidence from well-conducted prospective cohort studies, registry or meta-analysis of cohort studies, or population-based case-control studies **Category C:** Evidence obtained from uncontrolled or poorly controlled clinical trials, or retrospective case-control analyses, cross-sectional studies, case series, or case reports **Category D:** Evidence consisting of opinion from expert panels or the clinical experience of acknowledged authorities *Adapted from the criteria used by the U.S. Preventive Services Task Force (USPSTF) and the American Diabetes Association.
TES (2008)	The Task Force used the Grading of Recommendations Assessment, Development, and Evaluation (GRADE) method. **Strength of Recommendations** **1** - Indicates a strong recommendation and is associated with the phrase "The Task Force recommends." **2** - Denotes a weak recommendation and is associated with the phrase "The Task Force suggests." **Quality of the Evidence** **+OOO** Denotes very low quality evidence **++OO** Denotes low quality evidence

	+++O Denotes moderate quality evidence **++++** Denotes high quality evidence

GUIDELINE CONTENT COMPARISON

Areas of Agreement

General Recommendations

AHA and TES agree that, as in adults, dietary, physical activity, and behavioral modification are the primary strategies for the treatment of obesity and overweight in children. The groups further agree that family involvement is critical to the success of the treatment plan. According to AHA, success is unlikely if treatment is initiated when a family is not ready to support the program. TES recommends that clinicians probe for and diagnose unhealthy intrafamily communication patterns and support rearing patterns that seek to enhance the child's self-esteem. The guidelines further agree that long-term management is necessary. According to TES, implementation of a formal maintenance program after the treatment phase is completed can be of added importance in maintaining achieved weight loss. AHA states that long-term management should include continued assessment of the child for adequate growth and development.

Physical Activity

The two groups that provide physical activity recommendations, AHA and TES, recommend vigorous daily activity. AHA states that the current recommendation is 30 to 60 minutes; TES recommends 60 minutes. The groups also agree that a complementary approach to physical activity is to limit sedentary activities (e.g., watching television, playing video games, or using computers for recreation) to less than two hours per day.

Dietary Interventions

The two groups that address dietary interventions, AHA and TES, agree that incorporation of healthy eating habits is the cornerstone of dietary management. AHA states that the major goals in dietary management are to provide appropriate caloric intake, provide optimum nutrition for the maintenance of health and normal growth, and to help the child develop and sustain healthful eating habits. They recommend that all caregivers be involved in helping the child to adhere to recommended consumption patterns and healthier food choices. TES recommends: reduction of saturated fat intake for children older than two; avoidance of calorie-dense, nutrient-poor foods; increase of fiber, fruit and vegetable intake; planning of timely, regular meals; and avoidance of "grazing" during the day. TES also suggests control of caloric intake through portion control in accordance with the guidelines of the American Academy of Pediatrics.

Pharmacotherapy

The two groups that address pharmacological treatment, AHA and TES, discuss sibutramine, orlistat, metformin, leptin, and octreotide. TES also addresses topiramate and growth hormone. Only sibutramine (for adolescents > 16 yr of age) and orlistat (for adolescents > than 12 years of age) are FDA approved for the treatment of obesity in adolescents. TES states that sibutramine, orlistat and metformin are most commonly used at present. The groups agree that, among other adverse effects, sibutramine is associated with cardiac side effects and orlistat with gastrointestinal side effects. There is also agreement that while not approved by the FDA for the treatment of obesity, leptin and octreotide are useful for leptin deficiency and hypothalamic obesity, respectively. AHA and TES agree that while metformin (approved for children $\geq$ 10 years of age for type 2 diabetes mellitus) has been used in insulin-resistant children and adolescents who are overweight, its mechanism of action on weight is unclear.

AHA provides no specific pharmacotherapy recommendations, stating that data supporting the use of pharmacological therapy for pediatric overweight are limited and inconclusive. TES provides explicit recommendations, suggesting that pharmacotherapy (in combination with lifestyle modification) be considered for **obese** children if a formal program of intensive lifestyle modification has failed to limit weight gain or to mollify co-morbidities. With regard to non-obese children, TES states that, in general, children with a BMI below the 95th percentile should not be treated with antiobesity drugs. They add that pharmacotherapy for **overweight** children (BMI $\geq$ 85th but < 95th percentile) should be reserved for those with significant, severe comorbidities who have not responded to lifestyle modification.

Surgical Intervention

According to MDPH, RYGB is considered a safe and effective option for extremely obese adolescents as long as appropriate long-term follow-up is provided. TES notes that although LAGB is considered safer than RYGB, the FDA has not yet approved LAGB for use in adolescents. MDPH similarly notes that AGB use in adolescents should be considered investigational for this reason. MDPH adds that BPD and DS procedures, as well as sleeve gastrectomy, cannot currently be recommended for use in adolescents.

All three groups emphasize that adolescents undergoing bariatric surgery should be physically mature. The groups define this in slightly different ways, with AHA stating that surgery should be reserved for "full-grown adolescents" with the severest obesity-related morbidity. According to MDPH, physical maturity is defined as "completion of 95% of adult stature based on radiographic study". Lastly, TES states that adolescents being considered should have attained "Tanner 4 or 5 pubertal development and final or near-final adult height".

There is also overall agreement that adolescents being considered for surgery should be assessed for psychological maturity and stability, as demonstrated by understanding of the surgery, mature motivations for the operation, compliance with preoperative therapy, and the ability to adhere to the principles of healthy dietary and activity habits. The guidelines emphasize the importance of the role of the family both pre- and post-operatively.

All three guidelines agree that surgery should only be managed by an experienced multidisciplinary team with medical, surgical, nutritional, mental health, and pediatric expertise. MDPH and TES agree that in an effort to improve the evidence base for evaluating the risks and benefits of surgery in this age group, the institution where the surgery is performed should either be participating in a study of the outcomes of bariatric surgery or sharing data.

Refer to Areas of Differences for recommendations regarding BMI cutpoints.

Areas of Differences

Surgical Intervention

AHA and TES agree that adolescents being considered for bariatric surgery should generally have a BMI > 40 kg/m^2 and severe co-morbidities, or a BMI > 50 kg/m^2 with less severe comorbidities. MDPH, in contrast to AHA and TES, states that BMI cutpoints in children and adolescents who meet other criteria should be $\geq$35 kg/m^2 with major comorbidities and $\geq$40 kg/m^2 with less severe comorbidities.

TES addresses the issue of discrepancies in BMI cutpoint recommendations between groups, noting that the cutpoints they recommend are the ones generally accepted for adolescents. They add that while other groups have suggested using a BMI in at least the 99th percentile—equivalent to an adult BMI of 35-40 kg/m^2—with severe co-morbidities as a cutpoint, they conclude that there are insufficient data concerning the complication rates using the current cut-points to warrant suggesting any changes to their current recommendation.

AHA and MDPH agree that comorbidities typically classified as severe include type 2 diabetes mellitus, moderate to severe OSA, and pseudotumor cerebri. Comorbidities considered less severe include conditions such as hypertension, dyslipidemia, interference with activities of daily living, and mild sleep apnea.

This synthesis was prepared by ECRI on March 2, 2005. The information was verified by SIGN on April 12, 2005. It was updated to include RNAO on June 21, 2005, and to include AHA and USPSTF on July 22, 2005. The information was verified by AHA on August 23, 2005 and by USPSTF on September 19, 2005. This Synthesis was revised in October 2008 to remove AAP and SIGN recommendations. This synthesis was revised most recently in March 2009 to remove SMOH, USPSTF and RNAO recommendations and to add MDPH and TES. The information was verified by TES on April 7, 2009 and by MDPH on April 17, 2009.

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