



# Metabolic and Bariatric Surgery for Pediatric Patients With Severe Obesity

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Severe obesity affects the health and well-being of millions of children and adolescents in the United States and is widely considered to be an “epidemic within an epidemic” that poses a major public health crisis. Currently, few effective treatments for severe obesity exist. Metabolic and bariatric surgery are existing but underuse treatment options for pediatric patients with severe obesity. Roux-en-Y gastric bypass and vertical sleeve gastrectomy are the most commonly performed metabolic and bariatric procedures in the United States and have been shown to result in sustained short-, mid-, and long-term weight loss, with associated resolution of multiple obesity-related comorbid diseases. Substantial evidence supports the safety and effectiveness of surgical weight loss for children and adolescents, and robust best practice guidelines for these procedures exist.

## DEFINITION OF SEVERE OBESITY AND EPIDEMIOLOGY

This technical report uses the term “pediatric” in reference to a person under 18 years of age. Although the term “adolescent” may be defined differently in various studies and clinical settings, this technical report uses “adolescent” to refer to a person aged 13 to 18 years. Although BMI percentile for age and sex is widely used to define weight status in the pediatric population regarding underweight, normal weight, overweight, and obesity, the BMI percentile, BMI z score, and several other established methods of measurement have significant limitations when applied to populations at the highest and lowest ends of the obesity spectrum. In addition, these measures often do not change greatly even when significant weight loss occurs. For these reasons, the preferred method of reporting weight status in severe obesity is as a percentage over the 95th BMI percentile for age and sex.<sup>1</sup>

Although adults with class 2 obesity have an absolute BMI of 35 or higher, direct correlation within the pediatric population requires some additional consideration. Specifically, because BMI values increase over time from age 2 to 18 years, the use of absolute BMI is generally not considered an

## abstract

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The guidance in this report does not indicate an exclusive course of treatment or serve as a standard of medical care. Variations, taking into account individual circumstances, may be appropriate.

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accurate surrogate for adiposity and may either over- or underestimate associated health risks. For example, among younger children, a BMI at 120% of the 95th percentile (severe obesity) will still be well below an absolute BMI of 35. In addition, adolescents, who are often near adult heights, can have a BMI of 35, thereby meeting the adult definition of class 2 obesity, but this BMI may be below 120% of the 95th percentile. As a result, severe obesity in children and adolescents is defined as having a BMI  $\geq 35$  or a BMI that is  $\geq 120\%$  of the 95th percentile for age and sex, whichever is lower. This definition of "severe obesity," per the American Heart Association, is an appropriate point of reference for use in children and adolescents 2 years and older.<sup>1,2</sup> Cut points to define severe obesity are meant to identify patients at greatest risk for developing chronic and progressive disease states (ie, hypertension, impaired glucose metabolism, dyslipidemia, etc) because of their weight status.<sup>1</sup> The World Health Organization's classification of obesity in adults, which is helpful in discussing the likelihood of comorbidities, has prompted the use of obesity classifications in youth. Class 2 obesity is defined as having a BMI  $\geq 120\%$  of the 95th percentile or BMI  $\geq 35$ , and class 3 obesity is defined as having a BMI  $\geq 140\%$  of the 95th percentile or BMI  $\geq 40$ . As with many illnesses, patient populations of racial or ethnic minorities or with limited resources experience the majority of disease burden. African American and Hispanic populations have been shown to have 1.5 to 2 times the prevalence of severe obesity when compared with age-matched white counterparts.<sup>1</sup> American Indian youth are also at increased risk for severe obesity and especially weight-related type 2 diabetes mellitus.<sup>3</sup> In addition, when controlling for race and

ethnicity, lower socioeconomic status is associated with higher prevalence of severe obesity; this effect is most pronounced in girls and is present across all age groups.<sup>4</sup>

Prevalence of obesity remains well above historic norms and continues to increase in low-income populations and in certain racial and ethnic populations.<sup>5</sup> In addition, the prevalence of severe obesity is increasing at a greater rate among all groups and most significantly among adolescents.<sup>2</sup> Data from 2014 reveal that nearly 10% of adolescents were identified as having class 2 obesity (BMI  $\geq 120\%$  of the 95th percentile or BMI  $\geq 35$ ) and that 5% were identified as having class 3 obesity (BMI  $\geq 140\%$  of the 95th percentile or BMI  $\geq 40$ ). These results represent a dramatic increase from the estimated rate of class 2 obesity or higher in 1999 as 1.3%.<sup>6</sup> When combined with the high probability of corresponding obesity in adulthood<sup>7</sup> and the anticipated cumulative impact of related comorbid diseases, the prevalence of severe obesity has been appropriately described as an "epidemic within an epidemic."

The increase of severe obesity and its associated illnesses has resulted in a treatment crisis. Although behavioral and lifestyle interventions will be successful for certain individuals, the overall outcomes of behavioral and lifestyle interventions are discouraging when viewed as a solution for a larger number of patients with severe obesity.<sup>8-12</sup> Youth with severe obesity require effective intervention to prevent a lifetime of illness and poor quality of life.

### **CONSIDERATIONS FOR PURSUING METABOLIC AND BARIATRIC SURGERY**

Patient age as well as multiple variables related to developmental maturity factor into the decision and optimal timing for metabolic

and bariatric surgery. Recent data from the Teen-Longitudinal Assessment of Bariatric Surgery (Teen-LABS) study reveal that patients undergoing a weight loss procedure (ages 12–28 years, with a mean age of 17 years) demonstrate a direct correlation between increasing preoperative BMI and a higher probability of presenting with multiple comorbid conditions and/or associated cardiovascular risk factors.<sup>13,14</sup> Furthermore, evidence suggests that individuals who present with the highest BMI levels at the time of surgical intervention (ie, BMI  $> 50$ ) are less likely to achieve a nonobesity state (ie, BMI  $< 30$ ) after a successful operation.<sup>15,16</sup> Correspondingly, recent data from the Teen-LABS consortium have revealed that increased weight loss after bariatric surgery, female sex, and younger age at the time of surgical intervention serve to independently predict an increased likelihood of improvement in a number of cardiovascular risk factors (ie, elevated blood pressure, dyslipidemia, and abnormally elevated levels of high-sensitivity C-reactive protein).<sup>14</sup> Additionally, resolution of comorbid disease occurs before a normal weight is achieved. Collectively, such results suggest that optimal timing of metabolic and bariatric surgery for children and adolescents, designed to maximize long-term health benefits, warrants further research, clinical consideration, and potential refinements.

Barriers to insurance coverage occur for more than half of adolescents seeking treatment, which delay care.<sup>17</sup> These barriers are especially acute for patients from racial and ethnic minorities.<sup>18,19</sup> These barriers seem most related to economic disadvantage.<sup>20</sup> For a patient who meets criteria and whose family wishes to pursue

surgical treatment, the process would ideally begin as soon as possible. Clinicians can balance the child's psychological and developmental understanding of the procedure and the likelihood of successful weight loss through behavioral modifications with potential benefits for health and quality of life with surgical intervention.

Preparing a patient for metabolic and bariatric surgery starts with a realistic discussion of the available treatment options (ie, choosing a specific weight loss procedure) and likely expected outcomes with the patient and family. At present time, payers often require documentation of previous weight loss attempts and frequently require documentation of other related medical and behavioral evaluations. Although success rates are low, some youth with severe obesity will respond to behavioral interventions. Documentation of these interventions, even when unsuccessful, can assist in preparing a patient for surgical intervention. Understanding various payer-specific mandates for approval of insurance coverage of surgical weight loss can be both confusing and time consuming for health care providers and patients and their families. An equally important part of the initial conversation with a patient and family is the identification of a local or regional tertiary care facility that is equipped to provide ongoing bariatric surgical care to the pediatric population.

Ideally, early communication with a local or regional center may serve to streamline the process by establishing the need for various mandatory components of the preoperative evaluation. Although most centers rely on comprehensive multidisciplinary resources to conduct the necessary

preoperative evaluation, the development of a focused collaboration between a pediatric weight loss center and a pediatric or other primary care practice can serve to expedite the process. Whether conducted entirely by the referring practice, by the weight loss treatment center, or as an established collaborative effort, the preoperative evaluation may include evidence of regular visits with the multidisciplinary weight loss team and evidence that comorbid conditions have been screened for and appropriately managed. Additionally, a multidisciplinary weight loss team can screen for and treat genetic disorders (eg, Bardet-Biedl syndrome and Prader-Willi syndrome) and selective hormonal abnormalities (eg, proopiomelanocortin mutations and leptin deficiency) that can be medically managed. A comprehensive evaluation by a behavioral health clinician is essential early in the process to document the child's psychological well-being or to document an effective treatment plan, if indicated, for behavioral health concerns. In addition, a pediatric mental health clinician who has experience with obesity is able to document that the child has the necessary social and emotional support to follow through with required postoperative lifestyle modifications.

The patient's primary care pediatrician plays an important role in the perioperative period by monitoring progress and recognizing and reporting symptoms to the surgical program. Long-term follow-up requires monitoring the patient's progress, including weight regain and nutritional status. Adolescent girls undergoing metabolic and bariatric surgery have a higher risk for pregnancy than peers,<sup>21</sup> and

pediatricians can discuss this risk and develop a family-planning approach before surgery. Specific discussions related to reproductive health and various options for appropriate contraception can be a shared decision between the provider and patient as well as the family, as desired by the patient.

Studies reveal a small risk for anemia and bone mineral density loss among adolescents after metabolic and bariatric surgery.<sup>22</sup> Evidence on specific pre- and postoperative laboratory studies is lacking. Pediatricians or surgeons may obtain routine laboratory test results as indicated by the procedure and patient. Particular attention should be focused on the need to monitor and address potential long-term micronutrient deficiencies in the postoperative period. Although psychosocial functioning and health-related quality of life usually improve after metabolic and bariatric surgery,<sup>10</sup> pediatric patients with preexisting emotional concerns may require additional and ongoing evaluation postoperatively. In addition, adolescents may develop risk-taking behaviors, including increased use of alcohol, increased sexual activity, and suicide ideation, after surgery.<sup>21,23-25</sup>

## **COMMON WEIGHT LOSS PROCEDURES AND THEIR OUTCOMES**

### **Roux-en-Y Gastric Bypass**

Roux-en-Y gastric bypass (RYGB) has been considered the gold standard for the surgical management of severe obesity in adults<sup>26-28</sup> and adolescents.<sup>29-31</sup> Like all contemporary weight loss operations, RYGB is performed by using minimally invasive surgical techniques (ie, laparoscopic surgery) and results in significant and sustained weight loss from alterations in appetite, satiety, and

regulation of energy balance.<sup>32</sup> RYGB requires the creation a small proximal gastric pouch in combination with an accompanying roux limb of jejunum, which effectively excludes the remaining stomach (ie, gastric remnant), and proximal small bowel from the stream of ingested enteral content. The resulting anatomy creates a direct conduit between the newly established gastric pouch and jejunum, resulting in a “downstream” exposure of enteral content to the important biliopancreatic enzymes.

### Vertical Sleeve Gastrectomy

Vertical sleeve gastrectomy (VSG) emerged as an alternative weight loss procedure in both adults and youth in the mid-2000s and is currently the most common bariatric operation performed in the United States.<sup>27,33</sup> Current evidence suggests that altered gastric emptying and neurohormonal mechanisms may also be involved in achieving weight loss.<sup>34</sup> The VSG involves removal of ~80% of the stomach (consisting of the entire greater curve), resulting in a gastric sleeve (60–100 mL capacity). Creation of a uniformly fashioned sleeve is typically accomplished by using surgical dilators as a guide that range in size from 36F to 44F catheter diameter. Because the pylorus and distal antrum are anatomically preserved, gastric filling and emptying remain largely intact, resulting in enhanced postprandial satiety while avoiding the intestinal “dumping syndrome” that can occur after RYGB. Because VSG does not include creation of a gastrojejunostomy (ie, intestinal bypass), malabsorption and the complications stemming from more complex surgical anatomy are less frequent.<sup>35</sup> As is the case in adults,<sup>26</sup> major complications in adolescents after VSG are less common than after RYGB and include staple-line leak, stricture formation, and bleeding.<sup>36</sup>

Nutritional complications are also less common with VSG than with RYGB and include iron deficiency and vitamin B<sub>12</sub> deficiency, presumably related to decreased production of intrinsic factor resulting from the loss of the gastric fundus.<sup>36</sup>

### Laparoscopic Adjustable Gastric Band

The laparoscopic adjustable gastric band (LAGB) is an implantable device consisting of a silastic belt lined by a soft, low-pressure, adjustable balloon that is placed around the proximal portion of the stomach in a circumferential fashion (ie, immediately beneath the gastroesophageal junction). The creation of a “pseudo-pouch” at the proximal end of the stomach limits food intake and promotes early satiety because of its restrictive properties. The balloon is connected to a small subcutaneous fluid reservoir positioned on the abdominal wall. In an outpatient setting, the volume of the balloon lining the band may be adjusted by percutaneous infusion or aspiration of sterile water from the subcutaneous port. The ability to modulate the narrowness of the band limits food intake but does not affect physiologic pathways regulating energy balance, appetite, or satiety, as in RYGB or VSG. Although initially believed to be a desirable option for the adolescent population on the basis of several short-term safety and efficacy reports,<sup>27</sup> a relative paucity of longitudinal outcomes in combination with reports of weight regain and high device-explant rates in both adult<sup>37</sup> and adolescent<sup>38</sup> populations have dampened enthusiasm for this procedure. Complications associated with LAGB include port and catheter disruption, proximal gastric pouch dilatation, gastric erosion, and esophageal dysfunction. Explant rates may exceed 20%, and those procedures are associated with increased

morbidity.<sup>39</sup> To date, use of the adjustable gastric band has been restricted to individuals 18 years and older by the US Food and Drug Administration.

### Complications and Outcomes

Surgical complications after bariatric surgery in adolescents are infrequent, with the majority being defined as minor (15%) and occurring in the early postoperative period (eg, postoperative nausea and dehydration).<sup>35,36,40</sup> Major perioperative complications (30 days) occurred in 8% of Teen-LABS participants. In addition, reoperation before hospital discharge was required in 2.7%, which is similar to recent outcomes reported in a large adult series.<sup>41</sup> Micronutrient deficiencies are common after both RYGB (iron, 66%; vitamin B<sub>12</sub>, 8%; folate, 6%) and VSG (iron, 32%; folate, 10%).<sup>36</sup> Vitamin D deficiency is common preoperatively among teenagers with obesity and does not change significantly after surgery.<sup>36</sup> Folate deficiency is a concern for female patients of childbearing age.<sup>36</sup> However, most longitudinal studies of adolescent metabolic and bariatric surgery do not assess nutrient deficiency or follow a patient through subsequent pregnancy to assess for related complications.<sup>40</sup> In addition, although data related to psychosocial complications after weight loss surgery in adolescents are relatively sparse, recent data citing an increased risk of poor mental health in the postoperative time period among individuals with higher levels of anxiety, depression, and poor mental health highlights the need for long-term follow-up.<sup>25</sup> Although no perioperative deaths were reported in the Teen-LABS, Adolescent Morbid Obesity Surgery (AMOS), or Follow-up of Adolescent Bariatric Surgery at 5 Plus Years (FABS-5+) cohorts, 3 deaths (0.3%) occurred postoperatively at 9 months (related to infectious colitis),<sup>16</sup> 3.3 years (related to hypoglycemic

complications in a patient with type 1 diabetes),<sup>36</sup> and 6 years (unrelated), respectively, collectively representing a recently reported 0.3% mortality rate.<sup>40</sup>

Several recent prospective multi-institutional studies have helped to define weight loss and comorbidity outcomes for bariatric surgical procedures in adolescents. The Teen-LABS study consortium has published 3-year outcomes from the first large (242 subjects), prospective, observational study in patients younger than 19 years undergoing RYGB and VSG, with an overall follow-up rate of 89%.<sup>36</sup> Although the study was not specifically designed to detect between-group differences, total weight loss at 3 years was 27% in all patients and was similar for both procedures. Comorbidity resolution rates, including type 2 diabetes mellitus (95%), hypertension (80%), and dyslipidemia (66%), exceeded those reported in similar adult cohorts.<sup>25</sup> In a more recent analysis, researchers examined changes in overall prevalence of baseline cardiovascular disease risk factors in the same cohort as well as predictors of such change. There was an 85% reduction in the overall multiplicity of associated risk factors, whereby one-third (33%) of study participants had  $\geq 3$  risk factors at baseline (preoperatively), with only 5% demonstrating a similar degree by 3 years.<sup>14</sup> Improvements in certain variables (ie, dyslipidemia, elevated blood pressure, impaired glucose metabolism, and systemic inflammation) in association with increasing weight loss were not unexpected. Investigators also observed in postanalysis studies that after surgery, younger participants were more likely to experience improvements in dyslipidemia and elevated high-sensitivity C-reactive protein levels compared with older patients and that female patients were more likely than male patients

to experience significant improvements in blood pressure. These results are novel and offer new insights into long-term outcomes and support ongoing refinement in the evolving selection criteria and optimal timing of bariatric surgery in this age group.<sup>14</sup>

In the AMOS study, a prospective, controlled, and nonrandomized interventional study, researchers compared 80 adolescents undergoing RYGB with a matched cohort of adults of a parallel study after metabolic and bariatric surgery as well as a matched control group of adolescents undergoing conventional medical treatment of obesity in Sweden.<sup>42</sup> Recently reported outcomes from this comparative analysis revealed a significant reduction in both weight and BMI at 5 years among adolescents that was strikingly similar to results observed among the parallel adult subjects. In addition, the study authors reported substantial improvements in several comorbidities and cardiovascular risk factors. These results compared favorably with those of the adolescent nonsurgical control group. Furthermore, the AMOS study revealed a 92% resolution in elevated liver transaminase levels in patients after surgery versus an 18% resolution rate in control patients.<sup>39</sup> To date, the FABS-5+ study is the longest prospective longitudinal analysis of subjects undergoing adolescent metabolic and bariatric surgery, consisting of 58 adolescent patients undergoing RYGB (mean age, 17.1 years), with a mean follow-up of 8.0 years (range, 5.4–12.5 years). The FABS-5+ study revealed a 29% long-term reduction in preoperative BMI as well as a significant reduction in elevated blood pressure, type 2 diabetes mellitus, and dyslipidemia.<sup>16</sup> The effect on type 2 diabetes mellitus is especially striking. Surgical intervention results in better outcomes than medical management

in youth with severe obesity and type 2 diabetes mellitus.<sup>43,44</sup>

In no prospective studies is the efficacy of the various weight loss surgery procedures in pediatric patients directly compared, but a recent meta-analysis revealed that 1-year outcomes favored laparoscopic RYGB over LAGB, with intermediate results achieved in a small group of patients who underwent laparoscopic VSG.<sup>45</sup> In 1 single institutional retrospective comparison, adolescents undergoing laparoscopic VSG lost twice as much weight as those undergoing LAGB at 24 months.<sup>46</sup> Two smaller retrospective studies suggest similar weight loss in adults and adolescents after laparoscopic VSG (1 and 2 years) and LAGB (1 year).<sup>27</sup> Finally, in a single-institution longitudinal-outcome study of adolescents undergoing laparoscopic RYGB, the total weight loss percentage (37%) was independent of the baseline BMI, and patients with lower baseline BMIs were more likely to achieve normal weight at 1 year.<sup>15</sup> The results of this analysis raise the possibility of a therapeutic “ceiling effect” and may, if confirmed, support the need for changes in current referral patterns so that potential candidates may benefit from surgical consultation before reaching extremely high BMI levels (ie,  $\geq 50$ ).

Clear evidence pointing to “the best” or most appropriate weight loss procedure for pediatric patients with severe obesity remains elusive. RYGB was, by far, the most common weight loss surgical procedure used among adolescents in the early 2000s,<sup>47</sup> with LAGB gaining popularity later in the decade,<sup>48</sup> only to be followed quickly by the emergence of the VSG as a primary operation. Although an analysis of weight loss surgical procedural prevalence in the United States from the early 2010s reveals an equal proportion of VSGs and RYGBs, more recent data have suggested that VSG has become the

most commonly performed weight loss operation among adolescents, reflecting a pattern similar to the one observed in the adult population.<sup>33</sup> As in the adult population, the use of the LAGB in adolescents has dramatically declined in frequency.<sup>33,35</sup> Despite the presence of comparative results between RYGB and VSG that suggest similar surgical outcomes, there is still a need for prospective studies, controlling for confounding variables and potential selection bias.

## **THE CURRENT CLIMATE FOR PEDIATRIC METABOLIC AND BARIATRIC SURGERY**

### **Access to Care**

No unified reporting system tracks the overall procedural prevalence of pediatric metabolic and bariatric surgery in the United States. This paucity of data prevents the establishment of an accurate assessment of current access to bariatric surgical care. According to recent cross-sectional data, approximately 4 million adolescents have severe obesity.<sup>6</sup> In a recent analysis of discharge data obtained from the Healthcare Cost and Utilization Project Kids' Inpatient Database, Kelleher et al<sup>49</sup> showed an increase in procedural prevalence from 0.8 per 100 000 adolescents in 2000 to 2.3 per 100 000 in 2003, resulting in approximately 1000 cases per year. However, the investigators reported no subsequent change in the annual rate of adolescent weight loss procedures between 2003 and 2009.<sup>49</sup> In an additional report, Zwintscher et al<sup>48</sup> identified as many as 1600 adolescent patients from the same database, suggesting that procedural prevalence has likely continued to increase, albeit representing a fraction of the overall procedural prevalence when compared with the adult population. Low rates of metabolic and bariatric surgery in the adolescent population are likely to be multifactorial. Availability of surgical options,

physician attitudes regarding surgery, and individual assessment of likely patient outcome from surgery all appear to influence whether patients are referred for surgical evaluation.<sup>50,51</sup>

For example, recent reports from both the United States and the United Kingdom highlight the potential impact of differing attitudes toward the use of metabolic and bariatric surgery in the pediatric population (including the potential differences in associated referral patterns) among medical versus surgical health care providers.<sup>50,52</sup> In addition, recent data used to examine insurance coverage for adolescent metabolic and bariatric surgery in the United States reveal reduced approvals in comparison with those for adults seeking similar coverage.<sup>17</sup> In this multi-institutional review, Inge et al<sup>17</sup> showed that payers initially approved metabolic and bariatric surgery for less than half of adolescents who met the requirements. In contrast, payers initially approved 80% to 85% of adults who met similar criteria. Ultimately, 80% of adolescents received insurance approval, but it required patients, physicians, families, and support staff to engage in complex and time-consuming appeals processes. Adolescents seeking metabolic and bariatric surgery were required to appeal unfavorable coverage decisions as many as 5 times before obtaining the required authorization. The implications of such disparity in access to specialized health care compared with adults with severe obesity undergoing bariatric surgery, commonly during the fifth or sixth generation of life, becomes even more compelling considering the cumulative impact of numerous obesity-related disorders potentially leading to reduced quality of life and early mortality in younger patients. Limited studies indicate that the improvement in comorbidities may enhance the cost-effectiveness of

adolescent metabolic and bariatric surgery.<sup>53,54</sup>

## **Best Practice Guidelines and National Accreditation Standards**

Metabolic and bariatric surgery in the treatment of severe obesity was first described in the late 1950s and early 1960s in the adult population and led to the establishment of formalized clinical guidelines in the 1990s with the release of the National Institutes of Health consensus guidelines statement.<sup>55</sup> A corresponding framework for clinical eligibility in the pediatric population, however, has only emerged within the past 2 decades. Initial consensus-driven recommendations were predicated on the previously established adult clinical guidelines, including an overall assessment of related comorbid diseases in combination with the use of anthropomorphic criteria (ie, minimal BMI).<sup>56</sup> In contrast to the adult model, these initial recommendations called for a more conservative approach regarding minimal eligibility criteria (ie, BMI  $\geq 40$  in the presence of severe obesity-related comorbidities or BMI  $\geq 50$  with or without severe comorbid disease). The most recently updated guidelines from the American Society of Metabolic and Bariatric Surgery (ASMBS) follow evidence from several ongoing studies revealing favorable results.<sup>57-59</sup> In these updated guidelines, absolute age limits are eliminated, the World Health Organization weight classification is adopted, and the weight and comorbidity guidelines are brought into alignment with adult recommendations. Unlike clinical situations in which competing guidelines confuse care, the recommendations for weight loss surgery in children and adolescents are aligned and evidence based, yet they are not uniformly applied, creating barriers to accessing recommended care.

Consensus recommendations related to clinical criteria will likely continue to evolve in the decades to come. Best practice guidelines published by the ASMBS and pediatric-specific metabolic and bariatric surgery accreditation standards established by the joint ASMBS and American College of Surgeons Metabolic and Bariatric Surgery Quality Improvement Program establish a robust framework for the safe delivery of surgical weight management in the context of a multidisciplinary care model.<sup>60</sup> Clinical programs seeking pediatric accreditation within the Metabolic and Bariatric Surgery Quality Improvement Program are required to demonstrate access to child- and adolescent-specific clinical care resources designed to deliver optimal age-appropriate care. Such resources include incorporation of pediatric health care providers with expertise in general pediatric medicine, nutrition, anesthesia, and behavioral disciplines ([www.mbsaqip.org](http://www.mbsaqip.org)).

### **Multidisciplinary Care Model**

With recent interest in metabolic and bariatric surgery as safe and effective treatments of severe pediatric obesity, several important age-specific considerations have led to the development of child- and adolescent-specific clinical standards for perioperative evaluation, corresponding surgical care, and long-term follow-up. In expert recommendations established during the 2011 Children's Hospital Association multidisciplinary collaborative panel, FOCUS on a Fitter Future, which was commissioned to establish and disseminate expert recommendations pertaining to all aspects of childhood obesity prevention and treatment strategies, Michalsky et al<sup>61</sup> presented a consensus-driven road map for institutional development of age-appropriate weight loss surgical care.

As a primary goal of the expert panel report, the authors highlighted the importance of multidisciplinary care, which maximizes child- and adolescent-specific health care resources to deliver optimal care. The report emphasized the need for an institutional commitment to a culture of clinical excellence and safety during the delivery of age-appropriate weight loss surgical care. The report also offered a point-by-point set of recommendations, including establishment of a "medical home" (ie, including the need to establish routine communication among members of the multidisciplinary weight loss team and the patient's primary care provider). Key components of the medical home for pediatric patients with severe obesity include the establishment of a "medical leader," a qualified pediatric medical provider with experience in the screening and treatment of common obesity-related comorbid conditions. The team of medical home providers may also include an adolescent-specific behavioral health specialist, a dedicated registered dietitian familiar with the management of individuals undergoing metabolic and bariatric surgery, a licensed social worker, and medical subspecialists required on a case-by-case basis (ie, cardiology, nephrology, gastroenterology and hepatology, endocrinology, etc).

The ASMBS has published best practice guidelines that include contemporary and consensus-driven clinical inclusion criteria.<sup>57</sup> A joint ASMBS–American College of Surgeons national accreditation standard recommendation details specific requirements for the delivery of weight loss surgical care for individuals younger than 18 years. All groups strongly support the thoughtful delivery of complex care for an emerging and vulnerable population. The Teen-LABS consortium has also published

contemporary examples for implementation of this general framework for institutions considering the establishment of pediatric surgical weight management programs.<sup>62</sup> These works, along with the accompanying policy statement, "Pediatric Metabolic and Bariatric Surgery: Evidence, Barriers, and Best Practices,"<sup>63</sup> provide a coordinated and reinforcing view of the role of metabolic and bariatric surgery for youth with severe obesity.

### **CONCLUSIONS**

Severe obesity in children and adolescents is a worsening health crisis in the United States. Unfortunately, severe obesity has few effective treatments. The application of metabolic and bariatric surgery in the pediatric population provides evidence-based effective treatment of severe obesity and related comorbid diseases.<sup>14,16,36,42</sup> Improved access to metabolic and bariatric surgery for pediatric patients with severe obesity is urgently needed. American Academy of Pediatrics policy recommendations regarding metabolic and bariatric surgery in pediatric patients can be found in the accompanying policy statement, "Pediatric Metabolic and Bariatric Surgery: Evidence, Barriers, and Best Practices."<sup>63</sup>

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## ABBREVIATIONS

AMOS: Adolescent Morbid Obesity Surgery

ASMBS: American Society of Metabolic and Bariatric Surgery

FABS-5+: Follow-up of Adolescent Bariatric Surgery at 5 Plus Years

LAGB: laparoscopic adjustable gastricband

RYGB: Roux-en-Y gastric bypass

Teen-LABS: Teen-Longitudinal Assessment of Bariatric Surgery

VSG: vertical sleeve gastrectomy

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