REVIEW ARTICLE

An Interdisciplinary Approach to Adolescent Weight Management

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INTRODUCTION

Rates of obesity have more than doubled in children and quadrupled in adolescents over the past 30 years.[1] Obesity is now the most prevalent chronic health problem among adolescents in many developed countries.[2] Although the prevalence of childhood obesity seems to be stabilizing to some extent[3], rates of severe obesity in children are still increasing.[2] Severe obesity is defined as a body mass index (BMI) greater than or equal to 120% of the 95th percentile BMI for age and gender, or a BMI of 35 kg/m^2 or higher.[4]

There are significant racial, ethnic, and socioeconomic disparities in the prevalence of childhood obesity, with non-hispanic black and hispanic children having higher rates of obesity compared to non-hispanic Asian and white children.[3] Children and adolescents with Medicaid insurance have rates of obesity 6 times higher than those with private insurance.[2] Limited finances and transportation along with other barriers to healthy food choices and safe, affordable physical activity options are all factors which contribute to the disparities.[2]

Without intervention, obese children and adolescents are at higher risk of a multitude of medical conditions, once thought of as adult-onset illnesses, in addition to social and emotional issues. Adolescents with obesity are at increased risk for cardiovascular disease, due to hypertension or dyslipidemia, insulin resistance or type 2 diabetes mellitus, menstrual irregularities including polycystic ovarian syndrome, obstructive sleep apnea, non-alcoholic fatty liver disease, orthopedic problems such as slipped capital femoral epiphysis or Blount's disease, and pseudotumor cerebri.[5] Obesity is the most stigmatizing and least socially acceptable condition of childhood, leading to poor self-esteem, distorted body image, depression, anxiety, and difficulty

engaging with peers.[5] Obese children are frequently the victims of bullying or ridicule, and are 4 times more likely to report academic difficulties compared to their normal-weight peers.[5] Eighty percent of overweight and obese youth in the United States go on to become obese adults, and current rates of obesity with their long-term effects raise concerns not only for the overall health of our nation but also the economic burden on our healthcare system.[2]

RATIONALE FOR THE INTERDISCIPLINARY APPROACH

The connection between the human mind and body has been shown repeatedly in scientific literature and everyday practice. It is no different when looking at obesity. However, obesity is often treated simply looking at energy expenditure—energy in and energy out. If it were truly that simple for adolescents to be mindful of calories they intake versus calories they expend, then treatment of obesity would be easy. Unfortunately, as we have seen time and time again, it is not just those basic variables that need to be considered for successful weight management in patients with obesity. A myriad of variables has been identified as playing an impactful role in adolescents who struggle with their weight. Looking at how each of these variables impact obesity as a disease helps us to better understand the complex etiology of obesity in each patient and how to help. The variables that have been seen as contributors to obesity can be categorized into: individual psychology, social psychology, individual activity, activity environment, food consumption, food production, individual physiology, and general physiology (Figure 1)[24]. Thus, treating obesity as a multifactorial disease requires an interdisciplinary approach to help address as many factors as possible.

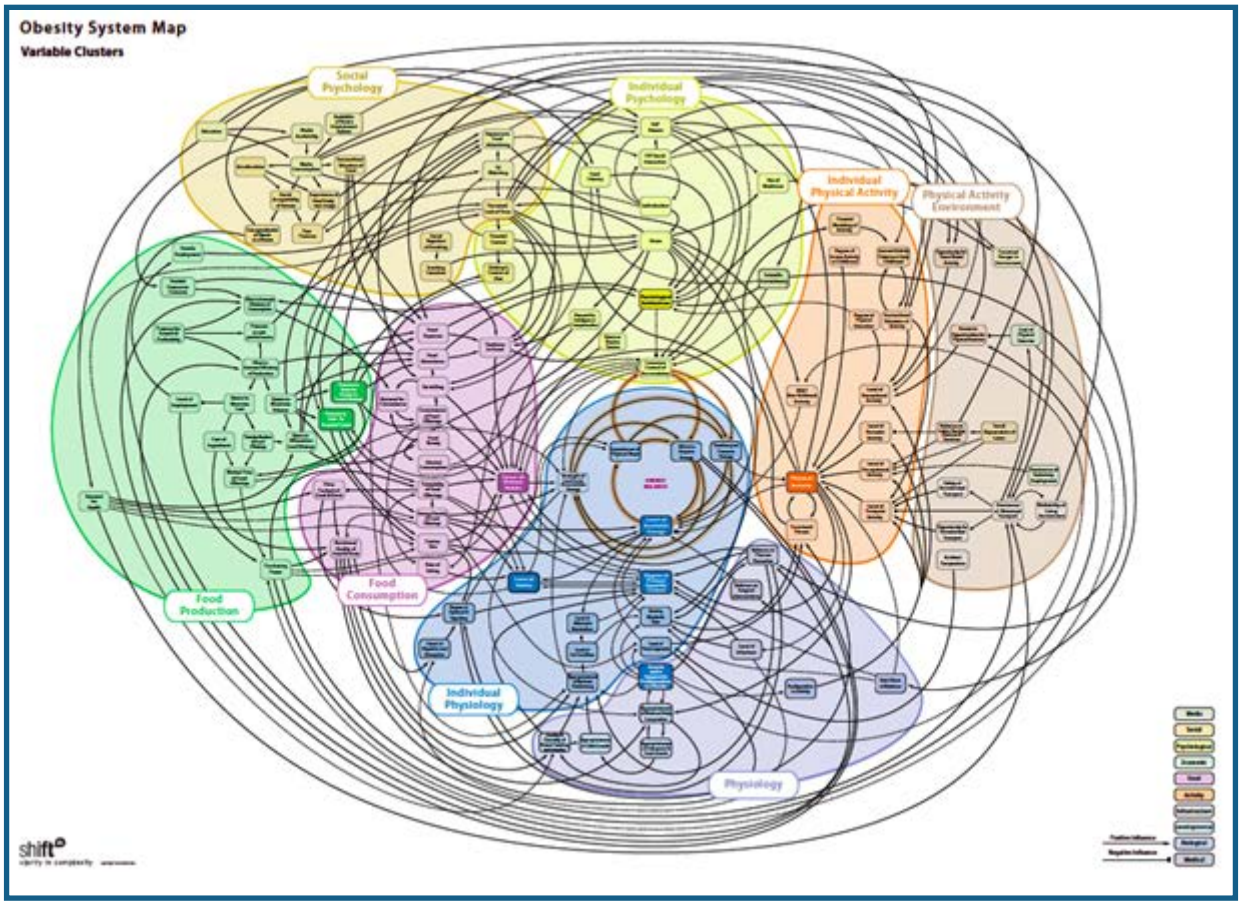

Figure 1: Obesity System Map, Variable Clusters

MEDICAL PROVIDER'S ROLE:

The medical provider on the team can be a general pediatrician or a specialist such as an adolescent medicine physician, gastroenterologist, or endocrinologist. The role of the medical provider in the interdisciplinary team is to assess medical and psychiatric comorbidities that may contribute to obesity. Some patients may have already been evaluated at length and bring outside records for review, while other patients may have received little prior weight-related medical care. In addition to basic labs including CBC, CMP, lipids, HbA1C, thyroid function, other nutritional labs such as vitamin D, B12, and folate levels as well as iron studies are obtained. Sleep hygiene must be addressed for all adolescent patients.[6] A sleep study is routinely used

to assess for obstructive sleep apnea, and positive airway pressure (PAP) therapy is initiated for those with obstructive sleep apnea. Many teenagers do not get adequate sleep each night, and many spend time on screens or electronic devices late at night, which is highly disruptive to both quality and quantity of sleep.

Other medical conditions that are present or discovered during the work-up, such as hypertension or diabetes, need to be addressed. For patients who are on medications that may contribute to weight gain, such as steroids for asthma or antipsychotics for mental health issues, discussion of ways to minimize these medications or find alternatives is essential. [6]

Many overweight and obese adolescents struggle with depression or anxiety. For those who are not already actively in treatment for mental health conditions, it may be appropriate to start a selective serotonin reuptake inhibitor (SSRI) to help with mood and anxiety. As part of the diet history, each patient should be assessed for eating disorders, particularly binge eating disorder and bulimia nervosa as well as other disordered eating behavior. If binge eating disorder is present, initiation of treatment with Vyvanse is often helpful. [6]

A comprehensive assessment of menstruation is an integral part of each evaluation for adolescent girls and young adult women. Many obese young women have irregular menstrual cycles which is often the result of polycystic ovarian syndrome (PCOS). Short-term oral contraceptive pills are an option for the initial regulation of menses. Long-term contraceptive options, such as intrauterine devices (IUDs) and implants, should be discussed and encouraged for adolescent young women pursuing weight loss surgery. Hormonal IUDs in particular seem to be the most helpful in minimization of menstrual blood loss after surgery.

Other aspects of the medical provider's role include assessing for contraindications to weight loss surgery, if surgery is desired, and ensuring that the patient has the ability to be successful following surgery. Contraindications to surgery include a medically correctable cause of obesity, untreated psychosis, active substance abuse, or an inability to understand or adhere to the long-term treatment recommendations. Since these patients are adolescents or young adults who frequently still live at home, an assessment of family support is essential.

PSYCHOLOGIST'S ROLE:

Mental health providers such as Licensed Clinical Psychologists or Licensed Mental Health Counselors with specific health psychology training play an integral role on the adolescent obesity treatment team, addressing the psycho-socio-cultural factors that may impact an adolescent's struggle with obesity. Starting with a semi-structured interview with both the adolescent and their caretaker(s), it is important to assess the impact of the adolescent's eating behavior and relationship with food/weight, potential food insecurity or access, physical activity, family dynamics, role of peers and social media, mood disorders, trauma or abuse, sleep hygiene, substance use, cognitive functioning, and cultural influence.[7,8,9,10] Identifying these variables in conjunction with evaluating motivation and insight from the patient and their family can help to determine a starting point and readiness for change. Furthermore, working collaboratively with the adolescent to identify their motivators and health values allows the patient to provide meaning to their health goals. Mental health providers can utilize a variety of evidence-based interventions such as motivational interviewing, cognitive behavioral therapy, and acceptance and commitment therapy to address related disordered eating behaviors, sleep hygiene, mood symptoms, and self-esteem.[10] One example of interdisciplinary treatment involves addressing maladaptive eating patterns and food relationships as a core component of psychological intervention, alongside nutrition education from the dietitian and medical intervention for impulsive or binge eating. It is also useful to collaboratively problem solve any roadblocks the adolescent encounters that may be impacting their weight management success, such as working on stress and time management strategies.

When considering bariatric surgery, psychologists have a unique role in determining if each variable listed above can be appropriately addressed within a reasonable time frame or if, in fact, the variables deem the adolescent to be a poor candidate for bariatric surgery. Psychologists need to determine the adolescent's capacity for understanding the life-long requirements of surgery maintenance, risks, potential complications associated with bariatric surgery, and post-operative guidelines and expectations.[8] Having the adolescent understand that bariatric surgery is not a "quick fix," but rather a tool in aiding in long-term significant weight loss is important, while medical and dietary regimen compliance and adequate support at home can be key contributors in determining success after surgery.

DIETITIAN'S ROLE:

Registered dietitian nutritionists (RDNs) are a critical members of the adolescent weight management interdisciplinary team. RDNs, unlike nutritionists or unlicensed nutrition coaches, must possess a 4-year bachelors of science degree, complete a 1200-hour supervised internship, pass a national accreditation examination, and complete 75 hours of continuing education credits every 5 years.[11] Training covers a wide variety of nutrition settings including clinical, school food programs, and WIC

counseling. As part of the adolescent interdisciplinary team, the RDN will have experience in all relevant areas of the patient's nutrition-related barriers to health.

Nutrition plays a key role in the weight management treatment plan. Diets containing calorically dense foods that lack nutrient density are associated with increased risk of obesity/overweight, hypertension, type 2 diabetes mellitus, depression, fatty liver disease, and cardiovascular disease. Over the past 10 years, there has been a significant increase in average caloric intake amongst Americans. This increased calorie intake can be connected to a similar increase in fast-food establishments per square capita, "food deserts," and increased cost or unavailability of fresh produce, milk, eggs, and lean proteins.[12,13,14]

A trained nutrition professional must first complete a formal nutrition assessment before prescribing a nutrition intervention. This involves identifying the patient's relevant medical history, family influence on health behaviors, access to food, food allergies/intolerances, and personal preferences. Other areas of assessment should include food/nutrition knowledge, meal timing, social eating behaviors, and participation in sports.[15] One must not assume that the patient knows how to read a nutrition label or understands macronutrients and food groups. These topics are not a required part of the school curriculum, may not be taught in school or even understood by the parent or guardian at home.

Adolescent patients often engage in social activities at fast food/fast casual food locations.[16] Examples may include local corner stores, shopping center food courts, and fast food establishments. Verbiage that demonizes these environments must be avoided, since they may be one of the few safe locations for socialization, especially for those with limited access to transportation. Instead, one should help patient understand the more health-promoting options available at those locations. If the patient currently participates, or desires to participate, in sports, then the patient's understanding of pre- and post-activity nutrition considerations should also be evaluated. Key considerations include hydration status, carbohydrate intake, and antioxidant load. Interventions for this population should be introduced in small, incremental steps. The conversation should not center around the patient's weight, instead focusing on health-behaviors (poor eating habits, limited physical activity, etc.) leading to poor health outcomes. Adolescents tend to respond best when presented with motivators such as athletic or academic performance, energy levels, and other short-term goals.

If patients desire surgical intervention, the RDN will need to educate the patient on the pre- and postoperative dietary guidelines. Prior to undergoing a bariatric procedure, patients will need to demonstrate understanding of the lifelong nutritional implications of the procedure, demonstrate commitment to more health-promoting behaviors, and implement protein and vitamin supplements. As determined by the clinic performing the procedure, the patient may also be required to complete a minimum number of consecutive nutrition counseling visits and receive nutrition clearance within 1 year or 6 months of surgery.

EXERCISE PHYSIOLOGIST'S ROLE:

The role of the exercise physiologist on the team is to minimize non-academic sedentary time, such as time spent playing video games, watching videos, or on screens for other reasons. The exercise physiologist must consider what the patient is willing and able to do, and help to set realistic movement goals. The exercise physiologist encourages structured movement, such as going to the gym to work out, as well as promoting active living and hobbies, such as walking or biking to and from school, playing sports, or swimming.

THE FAMILY'S ROLE:

Adolescents' family and caretakers hold a crucial role in the success and sustainable management of obesity. Obesity is often carried down from generations due to epigenetics, genetics, environment, nutrition education, access to nutritious food, value of physical activity, cultural impact, intergenerational trauma, and dynamics within the home.[7,17,18] The first goal is to obtain caretaker support and 'buy-in' to weight management intervention and acknowledgement of the need to be involved in the treatment. Oftentimes, caretakers of adolescents parentify or falsely believe that the adolescent makes all their own choices and should take sole responsibility for their health and weight-related behaviors. Teaching caretakers about how their own behaviors, eating habits, and thoughts about weight can influence their child is helpful.[9] It has been shown that boundaries and rules are effective for parenting children, while modeling and support are more effective for adolescents.[7,19] Ways that families can get involved in the adolescent's care are setting boundaries in the home regarding sedentary activity or screen time, sitting together for meals, teaching the adolescent to be more actively involved in the grocery shopping and cooking, encouraging more active hobbies, utilizing effective communication strategies within the home, and being actively involved with the adolescent's treatment and doctor appointments. Specifically when thinking about surgical intervention, the caretakers must understand their role in pre and post-operative care.

BARIATRIC SURGERY AMONG ADOLESCENTS:

Rates of bariatric or weight loss surgery among adolescents have been increasing rapidly. One estimate showed that rates increased 5-fold from 1997 to 2003[19], and another showed a tripling in adolescent bariatric surgeries from 2000 to 2009.[20] Long term data show that bariatric surgery produces significant and sustained weight loss among morbidly obese adults along with resolution or significant improvement in weight-related comorbid diseases .[19,20] There are increasing data on the safety and efficacy of bariatric surgery in adolescents.[21,22] Yet it still remains underutilized. Potential reasons include reluctance on the part of pediatric providers to suggest or recommend bariatric surgery. Pediatric providers may have concerns about the risks or long-term effects of surgery or may think that non-surgical management remains superior. There are also relatively few comprehensive, interdisciplinary, adolescent-focused bariatric programs compared to adult resources. Bariatric surgery should be considered for obese adolescents with significant medical or psychosocial impairment.

Bariatric surgery, regardless of procedure type, is indicated for adolescents with a BMI>35 kg/m^2 with a severe comorbidity, such as type 2 diabetes mellitus, moderate to severe obstructive sleep apnea, hypertension, pseudotumor cerebri, severe steatohepatitis, or for adolescents with a BMI>40 kg/m^2 with mild comorbid illness, including mild obstructive sleep apnea, glucose intolerance or prediabetes, dyslipidemia, or impaired quality of life (Table 1). Additional requirements include skeletal maturity (>95% estimated growth), advanced pubertal development (Tanner stage IV or V), and psychosocial maturity. There is no firm recommendation for a younger age limit as long as the other surgical indications are met. At our center, the youngest adolescents undergoing bariatric surgery have been 14-years-old. The adolescent must be prepared to make the necessary lifelong changes and must have failed 6 months of medical weight management. Contraindications to surgery include, 1) a medically correctable causes of obesity; 2) active substance abuse; 3) current pregnancy; 4) a medical, psychiatric, or cognitive disability that impairs ability for adherence; 5) an inability or unwillingness of the patient or family to understand the procedure or consequences and the need for long term follow-up and vitamin and mineral supplementation.

BMI≥35 kg/m2	BMI≥40 kg/m2
PLUS at least one major comorbidity:	PLUS other comorbidities:
1. Type 2 diabetes mellitus	1. Insulin resistance or glucose intolerance
2. Moderate to severe obstructive sleep apnea	2. Mild obstructive sleep apnea
3. Pseudotumor cerebri	3. Hypertension
4. Severe steatohepatitis	4. Hyperlipidemia
	5. Impaired weight-related quality of life
Recommended for all adolescent surgical candidates:	
1. Sexual maturity rating Tanner IV or V OR Bone age ≥13 years in girls and ≥15 years in boys	
2. Ability to understand and adhere to lifestyle changes required postoperatively (dietary needs, physical activity, vitamin supplementation, medical follow up)	
3. Ability to provide informed assent	

Table 1. Indications for Adolescent Bariatric Surgery

Currently the two most commonly performed bariatric surgeries are the Roux-en-Y gastric bypass (RYGB) and vertical sleeve gastrectomy (VSG) (Figure 2), both of which result in 70-85% excess weight loss at 12 months post-operatively.[23]. The RYGB and VSG are both considered to be safe operations with low rates of complications in the perioperative and postoperative period for both adolescents and adults.[21] Major complications, such as the need for reoperation or bleeding requiring transfusion, occur very rarely.[21] The trend over the past 10-15 years has been a decrease in RYGB and an increase in VSG among adolescents.[22] VSG is now performed most commonly in adolescents due to it being a simpler surgery allowing for a faster recovery time with lower long-term risk of malnutrition and vitamin deficiencies. VSG in our center has been

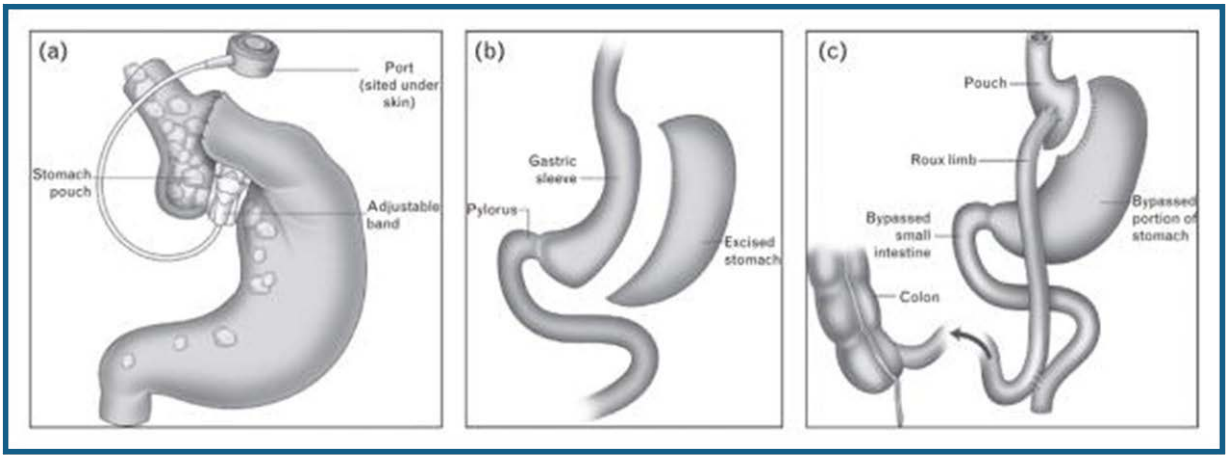

Figure 2: Three commonly performed bariatric procedures

performed for nearly all our adolescent patients. Our adolescent patients typically plan 2 weeks off from school and/or work for recovery following surgery. The laparoscopic adjustable gastric band (LAGB), which used to be performed commonly, is now rarely utilized in either adults or adolescents due to failure to lose weight or weight regain, dysmotility and worsened reflux, and band erosion or slippage, resulting in subsequent need for band removal.[22]

All patients should receive extensive education on the postoperative diet, which starts with clear fluids and gradually advances to protein shakes and sugar-free liquids, eventually progressing to include other foods. Education on proper fluid and protein intake to prevent dehydration and malnutrition as well as the need for lifelong vitamin supplementation to prevent vitamin deficiencies is essential. Patients are followed closely in the first year after surgery by the interdisciplinary team and surgeon in order to ensure proper protein and vitamin intake as well as appropriate weight loss. Lab screening for vitamin deficiencies should be performed regularly in the first 2 years following surgery, then annually thereafter.

Weight loss surgery seems to be very safe in adolescents with low rates of perioperative and postoperative complications.[21] These surgeries are all performed laparoscopically, and adolescents at our institution typically require only a 1 to 2 nights hospital stay following surgery. Large databases of adolescents show on average a 30% decrease in weight and BMI in the 12 months following surgery.[22] The majority of the weight loss is sustained out to 3 years post-operatively.[22] Medical comorbidities, such as type 2 diabetes mellitus or prediabetes, dyslipidemia, and elevated blood pressure show high rates of remission or improvement at the 3-year postoperative mark.[23] Additionally, adolescents report improvement in a variety of questionnaires in areas of quality of life, depression, self-esteem, physical functioning, and overall health anywhere from 6 months to 3 years post-operatively.[23]

CONCLUSION:

Obesity is a common problem in children and adolescents which can continue into adulthood with substantial morbidity. Medical treatment of obesity requires significant time and persistence, and results can be disappointing. It is important to consider various individual and environmental factors when helping adolescents with weight management, and utilization of an interdisciplinary team has proven to be most effective. Medical intervention alone is often not enough to achieve sustainable results when tackling obesity in adolescents. Incorporating other disciplines such as dietitians and mental health providers can be helpful. Bariatric surgery should be considered in adolescents with a long-standing history of excess weight, medical or psychological comorbidities, limited success with previous weight management efforts, and/or a significant family history of weight-related health problems. Whether the adolescent pursues medical weight management or bariatric surgery, they can significantly reduce risk of developing the complications of obesity and attain improvements in co-morbid diseases, mood, sleep, relationships, and overall quality of life.

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