# DEVELOPMENT OF AN ALGORITHM FOR ADOLSECENT BARIATRIC SURGERY

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**Title**

Development of an Algorithm for Adolescent Bariatric Surgery

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## ABSTRACT

Childhood obesity has become a national epidemic and children are diagnosed with co-morbidities once only associated with adults. Despite current interventions, children continue to exude poor diet and physical activity outcomes. The final project is an adolescent weight management algorithm to include bariatric surgery for select adolescents who meet the criteria. The algorithm developed was in congruence with a regional healthcare facility mission and goals. A literature review was conducted by searching databases EBSCO, CINAHL, Bing, Google Scholar and Academic Search Premier. The algorithm was developed by reviewing current literature and evidence on adolescent bariatric surgery. Experts in the field of adolescent bariatric surgery were contacted to evaluate the proposed algorithm. The development of an adolescent bariatric surgery program poses many challenges as it remains a relatively new process. The screening adolescents undergo before surgery is extensive and takes several months to complete. The algorithm may be helpful in the development of an adolescent bariatric surgery program and in the primary care setting as it can guide providers in the adolescent weight management process. The algorithm and the recommendations may be used as a starting point for program development and adolescent weight management, but the ultimate decision on which adolescents have surgery should be based on expert medical and surgical personnel judgment.

## TABLE OF CONTENTS

## LIST OF TABLES

## LIST OF FIGURES

Figure Page

## LIST OF APPENDIX TABLES

## LIST OF APPENDIX FIGURES

# CHAPTER 1. INTRODUCTION

According to the Center for Disease Control and Prevention (CDC), the number of overweight and obese children has tripled in the past thirty years (2013). Nationally, 18 % of children between six and eleven years old and 18% of children between 12-19 years old are obese, whereas in 1980 only 7% of children in these age ranges were determined to be obese. If this statistic doesn't cause distress, then the fact that 15.9 % of this population is considered morbidly obese ought to cause alarm (Abington Memorial Hospital, 2013). Childhood obesity has become a national epidemic and if not reversed, is estimated that by 2030, 50.1% of adults and 30% of children and adolescents will be classified as obese (Montoya & Lobo, 2011).

The consequences of obesity affect children physically, psychologically, and socially. However, the impact of the physical consequences could potentially be chronic and eventually fatal if left untreated. Obese children are diagnosed with co-morbidities which are usually associated with adults such as type 2 diabetes, hypertension, hyperlipidemia, metabolic syndrome, sleep disorders, asthma, non-alcoholic fatty liver disease, gallbladder disease, Blount's disease, and pseudotumor cerebri (Montoya & Lobo, 2011). Healthcare costs related to treating children for obesity related problems has increased more than three fold in the past two decades (Shaya, Fores, Gbarayor, & Wang, 2008). Obesity has known detrimental effects on a child's psychological state of mind. According to the CDC, obese children are at an increased risk for depression and social stigmatization (2013). "Studies have shown a relationship between childhood obesity, lowered self-esteem, discrimination, stigmatization, and peer rejection particularly in educational settings" (Shaya et al., 2008, p. 190).

The purpose of this project is to develop an algorithm to help guide providers in the treatment of overweight and obese adolescents in order to prevent morbid obesity. The barriers in the prevention of childhood obesity in school-age children (ages 6-18) will be evaluated with the intent to help guide future interventional practice in effective management of childhood obesity. All current weight loss management recommendations will be reviewed, to include bariatric surgery. The developed adolescent weight loss algorithm will include bariatric surgery and the criteria adolescents must meet prior to surgery. The desired outcome of this project is healthier children who have overcome barriers and have the potential to live long and fulfilling lives.

## Background and Significance

### *Familial Barriers to Prevention*

Parents are the role models of the home; therefore, the choices made regarding physical activity and diet are modeled by their children. Children with parents who are obese have up to a 70% chance of becoming obese themselves, especially if their mother is obese (Montoya & Lobo, 2011). Some reports cite genetics as the cause of obesity, but a child has a greater chance of becoming obese if they reside in an environment where being sedentary is acceptable and a lack of healthy food choices are offered (Elder et al., 2010). At a young age, children equate foods that are good for you as being "yummy", but once children reach second grade, they start believing that the reverse is true. As children get older, they are able to discriminate between what is healthy and what is not, but prefer to eat sweet treats and other foods that provide energy or the sense of feeling good. Mealtime is important to children from a nutritional standpoint by providing them with structure and allowing for family discussion on healthy food options; however, the number of times a week families eat together at home is decreasing and the number of times they eat at fast food restaurants is increasing (Howard, 2007).

Parents often fail to recognize that their child is overweight or obese, and healthcare providers often under-diagnose children with obesity due to informal diagnostic measures like observation (Reilly, 2010). Parents may not perceive their child as being overweight or obese because they are overweight or obese themselves. They may be oblivious to the fact because in certain cultures, being overweight and obese is accepted. The Body Mass Index (BMI) is a number determined based on a child's weight and height and correlates to the measure of body fat. BMI is plotted on a growth chart and converted into a percentile ranking. The index is age and sex specific and is the accepted method for determining overweight and obesity in children and teens (Centers for Disease Control and Prevention, 2011). However, some parents don't believe that it is an accurate tool and use alternative methods such as:

> a) when the child grew out of his or her clothing too quickly, b) the child was teased at school, or c) the child was experiencing physical limitations to his or her activity. These mothers believed their child's weight to be a function of heredity and tended to describe their children as 'thick, solid, strong or big boned'. (Howard, 2007, p. 75)

Even if parents recognize that their child is overweight or obese, they may not enforce changes if they are not ready to correct their own unhealthy behaviors. Unfortunately, if parents don't view obesity as a problem or aren't at a stage where they are ready to make changes, then the unhealthy habits won't be altered (Sealy & Farmer, 2011).

There is a strong correlation between low socio-economic status (SES) and parental education in regards to childhood obesity. Families with higher incomes and higher levels of education tend to eat healthier foods, where as those with lower incomes and lower levels of education consume less healthy foods. Research has indicated that children's eating patterns up to the age of seven are more affected by the maternal level of education than older children

(Craig et al., 2009). Balisteri and Van Hook suggested that girls are more likely to become overweight if they are a part of low SES family with parents who have low levels of education, whereas boys are mostly affected by the level of parental education (Balistreri & Van Hook, 2010). The correlation between low education levels and child and adolescent obesity indicates that this population is at higher risk to become overweight and/or obese, but the data is not consistent among racial and ethnic groups (Ogden, Lamb, Carroll, & Flegal, 2010). Families classified as low-income have less access to healthy foods as do families with higher incomes. According to Walsh (2008) "Many obese children live in what are called nutritional deserts, where there are few nearby supermarkets offering the produce nutritionists recommend" (The Front Lines section, para. 4).

Cultural considerations are also a barrier to prevention, as African American, Latino American, and Native American children are at greater risk of becoming obese. Obesity in minorities is less stigmatizing than in the Caucasian population (Stevens, 2010). Latino Americans believe the standard the U.S. has determined to be overweight or obese is actually underweight. They also consider children who are heavier to be healthier and encourage children to eat more (Elder et al., 2010). African Americans view thinness being linked with drug addiction and poverty (Stevens, 2010). Native American families who reside on reservations have little access to supermarkets with fresh fruits and vegetables, as produce is a scarcity. However, when fruits and vegetables are available, many are unable to afford fresh produce, as many Native Americans have incomes that fall below the poverty line (Walsh, 2008).

*School Based Barriers to Prevention*

"Health and success in school are interrelated. Schools cannot achieve their primary mission of education if students and staff are not healthy and fit physically, mentally, and socially" (Wechsler et al., 2004, p. 4). Schools play a vital role in the prevention of childhood obesity and when effective programs are in place, then staff have the means to encourage physical activity and healthy behaviors (Temple University School of Medicine, 2010). However, many school systems are faced with several obstacles in the battle against childhood obesity.

Schools are facing dilemmas in regards to appropriation of funds and budget cuts. Physical education classes, after school sports, and playground equipment aren't a top priority and therefore, may not be available to children attending school (Shaya et al., 2008). Schools participating in breakfast and lunch programs must have wellness policies in place enforcing increased access of healthy foods to children. Offsetting this strategy is the issue of schools allowing agencies to place vending machines on school grounds, which sell sugary foods and soft drinks (Dartmouth-Hitchcock Norris Cotton Cancer Center, 2013) Additionally, some cash strapped schools have opted to have "fast-food" kitchens due to its cost efficiency (Shaya et al., 2008).

School nurses are a key component in the prevention of obesity, but many feel "a sense of futility in being able to treat the problem successfully" (Moyers, Bugle, & Jackson, 2005, p. 87). Some school nurses report certain barriers exist such as "lack of support from principals (school boards), parental involvement, lack of patient motivation and lack of support services…" (Melin & Lenner, 2008, p. 498). Other nurses feel incompetent in providing a weight loss plan for children due to lack of guidelines for their role in treating obese children. Additionally, some school nurses believe parents often are a barrier due to lack of support (Bunting, 2011). "My

main problem with counseling obese students is their parents. They are overweight themselves and do not recognize their child has an obesity problem nor do they want me to counsel their child" (Moyers et al., 2005, p. 92).

*Environmental Barriers to Prevention*

Energy expended must be greater than energy consumed in order to lose weight. Children today are spending more time watching television and playing video games than ever before, which contributes to the development of obesity. Children perceive sedentary activities, like reading as boring, but believe watching television and playing video games are enjoyable (Meininger et al., 2010). In a home environment where unlimited video game playing and television watching is allowed and physical activity isn't enforced, then children will be less able to maintain a healthy weight. Additionally, during the time children watch television, they are bombarded with advertisements promoting fast foods. Yu reports children view approximately 40,000 advertisements per year and those individuals with frequent exposure to advertisements promoting fast foods have an increased risk in becoming obese (2011).

The lack of parks, fields, and other places for physical activity is a major barrier (Shaya et al., 2008). Communities may lack the funds to build facilities promoting physical activity, which only fuels the problem. Obesity tends to follow the geography of poverty, with the poorest neighborhoods hardest hit. In some communities, such as inner city neighborhoods, parents won't allow their children to play outside because of danger and safety concerns (Walsh, 2008). The director of the Center for Human Nutrition at the University of Colorado Health Sciences Center, James Hill, encompasses environmental barriers as a whole by stating, "We have to realize that we're not going to get anywhere in getting people to eat healthy and be more

physically active until we create an environment that supports that" (as cited in Walsh, 2008, Fighting the Fight section, para. 1).

*Medical Barriers*

An additional barrier to prevention and treatment is the lack of primary care providers who identify and treat obesity in children. According to the American Heart Association, the absence of identification of obesity "may be due to the lack of well-defined, validated preventive and therapeutic interventions that could be given to children, adolescents, and their families" (as cited in Daniels, Jacobson, McCrindle, Eckel, & Sanner, 2009, p. 2117). Many providers feel inadequate in their knowledge on how to address the issue of obesity in children and adolescents, as well as treatment methods. A major barrier in the primary care setting is time constraints averting providers from addressing obesity. Providers do not have enough time to assess the problem, the patient, or even to monitor changes needing to be made in the patient's behavior, diet, or exercise habits. Furthermore, many experts have the belief that current treatment regimens for obesity, specifically morbid obesity, are inadequate to treat the problem (Ingelfinger, 2011). Adding to the problem is the fact that treatment for obesity is often times not reimbursable by insurance companies (Spear et al., 2007).

Obesity is not a health problem that only affects children. Many adults are also obese, including healthcare providers, and consider themselves poor role models for overweight/obese children. If healthcare providers are overweight or obese, it affects how they treat patients in the same situation, as they don't feel comfortable providing counseling and education (Daniels et al., 2009).

Provider bias against obese people, known as "weight stigma", can affect the care given in a healthcare setting. "Stigma and bias generally refer to negative attitudes that affect our

interpersonal interactions and activities in a detrimental way" (The Obese Society, 2010, What is Weight Stigma section, para. 1). Weight stigma can occur in a variety of settings and by many professionals, including medical professionals. Biased individuals have the perception that obese patients are "unintelligent, unsuccessful, weak-willed, unpleasant, overindulgent, and lazy" (The Obese Society, 2010, Where Does Weight Stigma Occur section, para. 3). Due to these negative beliefs, many obese individuals cancel medical appointments, avoid annual health preventative services, and delay necessary treatment. Children who are targets of weight stigma often view themselves in a negative light and engage in self-blame. Adolescents teased because of their weight often have low self-esteem, depression, and cut themselves off from their peers. Recent reports indicate a positive correlation between obesity in adolescents and suicide attempts (The Obese Society, 2010).

## Significance of Proposed Project

Children and adolescents face many barriers in the prevention of obesity, to include obstacles at home, school, and environment. Over the years, intervention programs have focused on the school setting, but children continue to exude poor diet and physical activity outcomes. In the article, School-Based Obesity Interventions: A Literature Review, the authors state "…there is a lack of understanding of the sustainability and efficacy of different types of interventions across the board" (Shaya et al., 2008, p. 190). Several articles were reviewed to determine what barriers exist that prevents childhood obesity and why current interventions utilized are not effective. Obesity in children cannot be prevented or treated if changes aren't made at home, in school, and throughout the community. Obesity is not a product of one of these factors, it is a consequence of all combined. The prevalence of childhood obesity continues to escalate and is due to multiple factors as is evidenced by the above section on background.

Obesity by itself isn't the concern; the concern is the associated co-morbid conditions that are concerning. Obese children are often diagnosed with medical problems once only associated with adults, putting them at increased risk for lifelong health problems and premature death. Despite current efforts to prevent obesity and reverse existing damage, more children continue to become severely obese.

Evidence from research and studies indicate bariatric surgery for certain adolescents may be the necessary course of action since the weight lost leads to a reduction or elimination of life threatening co-morbid conditions. Improvements adolescents receive from bariatric surgery may outweigh risks because of the positive impact the procedure has on their body at a young age. If the procedure isn't completed until adolescents reach adulthood, the medical problems that have occurred may be irreversible (Inge, Xanthakos, & Zeller, 2007).

Due to the current obesity trends, an increasing number of adolescents may be in need of bariatric surgery. However, many bariatric surgery programs do not have a protocol, as adolescent bariatric surgery has previously been unwarranted. An algorithm will be a useful tool in assisting bariatric centers in instituting practice guidelines and surgery protocols. Additionally, many primary care providers are unsure of how to treat obesity in children and adolescents. The developed algorithm will provide them with instructions from the initial assessment of the individual and to the last phase, which is the evaluation for bariatric surgery and follow-up care after surgery.

# CHAPTER 2. LITERATURE REVIEW AND THEORETICAL FRAMEWORK

## Literature Review

The purpose of the literature review is to examine the barriers in prevention of childhood obesity in school-age children (6-18) with the intent to guide future interventional practice in effective management and treatment of childhood obesity. Previous intervention programs have focused on childhood obesity prevention in the school setting, but children continue to exhibit poor diet and physical activity outcomes. In the article, School-Based Obesity Interventions: A Literature Review, Shaya et al state "…there is a lack of understanding of the sustainability and efficacy of different types of interventions across the board" (2008, p. 190).

Information for this literature review was retrieved by searching for keywords such as "childhood obesity", "school-age children and obesity", "childhood obesity risk factors", "childhood obesity and genetics", "adolescent bariatric surgery", "weight loss medications and adolescents", "adolescent bariatric surgery program development", and "adolescent bariatric surgery algorithm". The time frame of articles ranged from 2004-2014 and the databases EBSCO, CINAHL, Bing, PubMed, and Google Scholar were the foremost sites used for collection of publications. Other publications were received from experts who reviewed the algorithm. Specific terms used to yield results were *childhood obesity, barriers to prevention of childhood obesity, obesity prevention in schools, interventions for childhood obesity, readiness for change and obesity, adolescents and weight loss medications, adolescent bariatric surgery, adolescent bariatric surgery protocol, and adolescent weight loss algorithm.* The information was scrutinized to ensure studies examined the barriers in preventing and treating childhood obesity and that the ages studied are school-age children between six and eighteen years old.

## Literature Search

An integrative literature review was completed using literature published from 2004-2014 to address the following questions:

- What is the etiology and risk factors associated with childhood obesity?
- What interventions have been used previously to prevent childhood obesity?
- What tools are available to assist providers in preventing/treating overweight/obesity in school age children?

Specific inclusion criteria:

- The published articles are written in the English language.
- The subjects are school age children.
- The subjects are overweight or obese.
- The risk factors and etiology of obesity.
- Interventions focused on prevention and treatment strategies.

Specific exclusion criteria:

- Articles published greater than ten years ago
- Studies not including school age children
- Studies not including risk factors or etiology of obesity
- Study not including intervention strategies

## Analysis of Literature Search Results

From the aforementioned questions additional analysis is needed in order to enhance what has been developed. Data from the literature review is used to further expand upon the original query.

1. What is the etiology and risk factors associated with childhood obesity?
    a) What puts racial and ethnical minorities at risk for childhood obesity?
    b) Why do lower levels of parental education put children at greater risk for obesity?
    c) Why do children whose parents fall into the low socioeconomic level have higher incidence of obesity?
    d) What factors at school can attribute to obesity in school age children?
    e) What community factors hinder childhood obesity prevention?
    f) What parental characteristics put children at risk for obesity?
    g) What dietary factors lead to obesity?
2. What interventions have been used previously to prevent and treat childhood obesity?
    a) What teaching methods are useful in assisting children and parents interventional methods?
    b) What changes can schools make to implement healthy eating and activity behaviors?
    c) What can community members do to provide children and families with adequate recreational areas for play?
    d) How can healthcare professionals promote weight loss and prevent weight gain (changes made for greater than six months)?
    e) How can healthcare professionals increase self-efficacy in obesity intervention and prevention?

3. What tools are available to assist providers in preventing/treating overweight/obesity in school age children?
    a) How can practitioners use available tools and stay within appointment time constraints?
    b) How can providers accurately measure overweight and obesity in an individual?
    c) How do providers determine risks for co-morbidities of overweight and obesity?
    d) How can parental and family readiness for change be assessed by the provider?
    e) How can providers advocate for prevention of obesity?

*Etiology and Risk Factors*

The first question posed in the review is "What is the etiology and risk factors of childhood obesity". Many research articles were evaluated and contained information pertaining to the causes and risk factors associated with obesity. Geographic location, ethnicity, socioeconomic factors, and level of education are the most common risk factors that increase the prevalence of childhood obesity (Howard, 2007; Walsh, 2010). Balistreri used the Early Childhood Longitudinal Study-Kindergarten Cohort (ECLS-K) as a tool to identify weight gain in children from Kindergarten through eighth grade. The researchers included study limitations and stated further research was needed (Balistreri & Van Hook, 2010). Elder et al utilized a randomized community trial focusing on environment and weight gain in school age children. Researchers used the body mass index or BMI as the primary outcome variable and tested what effect environment has on children obesity. The researchers concluded microenvironmental effects in a child's day to day life has a greater impact on weight gain than does macroenvironmental elements (Elder et al., 2010). Moyers et al (2009) focused on the role of school nurses and their perceptions on the causes and risk factors of childhood obesity. They

used a descriptive design survey similar to what had been created by Price and colleagues in 1987 and analyzed what school nurses believe are the causes of childhood obesity. Most respondents believe major causes of obesity in children are poor eating habits, high caloric intake, and a sedentary lifestyle (Moyers, Bugle, & Jackson, 2005).

*Interventions*

The second question presented in the review is "What interventions have been used previously to prevent and treat childhood obesity?" Research evaluated indicates various interventions can be used in obesity prevention (Taylor et al., 2007). Each study equips healthcare providers and community members with many useful interventions. The etiology of childhood obesity is multifaceted and those employing interventions should address the complex nature of the disease (Cleveland Clinic, 2013).

Melin and colleagues (2008) screened the height and weight of 7 year olds in 32 schools. Families with children who are overweight or obese were invited to participate in a year-long intervention which included a once per month meeting with a dietician and school nurse. The dietician and school nurse counseled families and provided advice pertaining to nutrition and physical activity. The intervention results were positive for a reduction of the mean BMI. Parents were eager to learn what foods were "safe" and believed the intervention was helpful in making lifestyle changes. School nurses were satisfied with the program because they felt adequately prepared on how to address obesity in children. The study results indicate weight loss in children can occur by increasing awareness of obesity, as well as a family's food intake and physical activity. Researchers concluded that this study though successful in a small group, may not be replicated in a larger group, and needs further evaluation over a longer period of time (2008).

Shaya, Flores, Gbarayor, and Wang (2008) performed a literature review of interventions useful in prevention of obesity in school age children. They analyzed interventions ranging from four weeks to eight years in duration. The interventions examined included physical activity programs, educational curricula focusing on fitness, health, and nutrition and behavior modification, and a mixture of all types. Results of applied interventions did not result in preventing or reducing obesity in school age children.

Sliwa and colleagues (2011) used the Community Readiness Model (CRM), a structured interview guide and scoring system, to assess community readiness in preventing obesity in children. Interviews of four key members of the community were conducted. These individuals were from different communities similar in size and socioeconomic status. The use of the CRM allows researchers to compare communities and select future locations in order to replicate the study. Assessing a community's readiness to implement interventions helps determine a community's success in fighting the obesity epidemic.

Taylor et al. (2007) conducted a two year community study including a control group and an intervention group containing randomly selected 5-12 year old children. The focus of the study was to develop a program educating children on healthy eating and provided encouragement to participate in non-curricular physical activity, such as walking, household chores, gardening, hiking, and outdoor games. The program successfully reduced BMI and weight circumference in the intervention group. However, the percentage of overweight children in both groups remained the same. Children in the intervention group drank less carbonated beverages and fruit juices and consumed more fruit. The researcher concluded that educating children on healthy eating habits while encouraging and providing them with ideas for physical

activity, reduces weight gain. However, results may be restricted to those not originally overweight.

*Available Tools*

The third question presented in the review is "What tools are available to assist primary care providers in preventing/treating overweight/obesity in school age children?" Rao (2008) discussed the recommendations made by the American Medical Association Expert Committee on the Assessment, Prevention, and Treatment of Child and Adolescent Overweight and Obesity. The committee stressed the importance of providers discussing dietary habits, physical activity, readiness to make lifestyle changes, family history of obesity and related illnesses with patients and families at least once per year. Specific laboratory tests are recommended depending on the child's BMI percentile and associated risk factors. Assessment of a fasting cholesterol, glucose level, and liver enzymes are indicated in overweight and obese children (Nationwide Children's Hospital, n.d.). The Expert Committee advises children with a BMI between 5$^{th}$ and 84$^{th}$ percentiles be counseled on obesity prevention, while those overweight or obese should be treated by using a staged technique. The first stage focuses on dietary changes and increasing physical activity. The second step includes a structured physical activity plan, a menu incorporating a balanced diet, and completion of logs documenting progress or setbacks. This step may use a multi-disciplinary approach to treatment. Step three includes more intense interventions supervised by specialized teams trained in childhood obesity treatment. The time and training for stage three is beyond the scope of practice for a family practice provider (2008).

Passehl and colleagues (2004) recognized the time constraints providers often face in educating patients and families. Their "Take Charge" project includes five modules promoting behavioral changes. Each ten minute module encourages changes for the whole family.

Providers were interviewed and reported using this model on a daily or weekly basis. They also felt the information was clearly presented and easy for families to understand. The National Institute for Children's HealthCare Quality developed an implementation guide suggesting providers use a 5 point childhood obesity prevention model (B-B-2-1-0) starting with conception of a fetus. By initiating the program at conception, parents will be given the education and tools needed for healthy development of their child throughout their youth. The model advocates for breastfeeding, regular assessment of BMI, limiting screen time to less than two hours per day, eliminating televisions in children's rooms, incorporating more than one hour of physical activity per day, and prohibits children from having sweetened beverages. The institute recognizes many intervention models may work, but successful interventions are dependent on the target population and provider preference. The institute encourages providers to find a model that works for them to utilize in practice (2007).

*Pharmacological Therapy*

When lifestyle changes, such as diet and exercise, are not having the desired effect for weight loss, then in certain cases medications can be prescribed. Pharmacological advances have been made and work physiologically to decrease appetite, control food cravings, and increase energy use. The recommended treatment intervention depends on the child's age and degree of obesity. Medications for weight loss are considered in obese children when lifestyle modifications fail and when comorbidities or risk factors cotinine despite recommended diet and exercise changes. Pharmacological therapy should only be prescribed by providers who have experience initiating and monitoring treatment and understand potential adverse effects (Iughetti, China, Berri, & Predieri, 2011). Patients are required to continue making lifestyle changes while

taking medications due to the likelihood of weight gain after the medication has been discontinued (Spear et al., 2007).

*Bariatric Surgery*

As adolescent obesity rises, so does their risk for obesity related health problems. Adolescents with a BMI greater than or equal to the 99$^{th}$ percentile are more likely to become obese adults with decreased life expectancy due to co-morbid conditions linked with obesity (Xanthakos & Inge, 2014). Despite the abovementioned treatment options, a select population of adolescents continues to remain morbidly obese, as weight loss with these methods is minimal. Due to poor outcomes of conservative methods, more adolescents are turning to bariatric surgery. With the increase of bariatric surgery performed in adolescents, there is a need for pertinent assessment criteria preoperatively and postoperatively. Bariatric surgery in adolescents is a fairly new procedure with little to no data from long-term outcome studies indicting efficacy and safety. At this point, bariatric surgery is only indicated in morbidly obese adolescents who have failed previous weight loss endeavors (Xanthakos & Inge, 2014).

## Theoretical Framework

The Health Promotion Model (HPM) will guide this dissertation. Approval for use of this model has been granted by Dr. Nola Pender PhD, RN, FAAN at the University of Michigan, School of Nursing. The HPM, developed by Dr. Nola Pender, emphasizes individuals have certain personality traits and past experiences leading them to the actions taken in their life. This model defines health as "a positive dynamic state not merely the absence of disease" (Nursing Planet, 2012, Introduction section, para. 1). The goal of the HPM model is health promoting behavior which increases well-being, health, and functional capacity in all aspects of an individual's life. This theory postulates that individuals are more likely to follow health

promoting behaviors when others around them are doing the same. Furthermore, when the individual is motivated to make necessary changes, then those changes are more likely to endure over a long period of time (Pender et al., 2011). The Health Promotion Model theorizes that health fluctuates and may change as the person develops throughout the lifespan. The state of health of an individual is also affected by the surrounding environment. The health status of a person is often situational. Health status can be affected by a positive or negative influence and can lead to a decreased commitment to health promoting behaviors (Pender et al., 2011). This is key for adolescents undergoing bariatric surgery as they will be required live by strict guidelines in order to maintain their health and will be influenced by. Outside influences will be a factor in how well an individual adheres to necessary rules and successful in their weight loss endeavors. Pender's model proposes that a person can "modify cognitions, affect, and the interpersonal and physical environment to create incentives for health actions" (Nursing Planet, 2012, Theoretical Propositions of the HPM Section, para. 1). When a person is highly committed to a plan and has a positive support system, then success will be likely.

The major concepts of the HPM are health promotion, individual characteristics or experiences, behavior specific cognitions and affect, and behavioral outcomes. Health promotion is the willingness to make healthy changes and focus on wellness through health promoting actions. Individual characteristics or experiences are defined as past occurrences which shape who we are and what we become. Behavior specific cognitions and affect are what the individual believes is a barrier or promoter and may be an environmental, personal, or situational influence. Behavioral outcomes are the person's ensuing plan of action and is affected by immediate and competing requirements. The HPM includes a sub-category, labeled personal factors. Personal factors are influenced by biological, psychological, and socio-cultural factors

(Pender et al., 2011). "These factors are predictive of a given behavior and shaped by the nature of the target behavior being considered" (Gonzalo, 2011, Personal Factors section, para. 1). Other categories of the HPM include Perceived Benefits of Action and Perceived Barriers to Action. These are important in adolescent weight loss, as what is thought to be beneficial can motivate and what is a barrier will may cause an individual to fall short of their goal. Addressing what is a benefit and barrier will assist in weight loss and management.

The HPM can serve as a guide in prevention and managing obesity in adolescents. Pender believes an individual will achieve weight loss success if they have a supportive family, friends, and healthcare providers. A supportive team has the potential to help an individual fully commit to a health changing activity (Houston, 2012). The HPM can provide a framework for providers and patients at Sanford Health, particularly the Eating Disorders Unit, in creating a successful plan to prevent, manage, and treat obesity in children. This model is easy to use, understand, and can be applied to various settings, making the HPM an ideal model to use for this project.

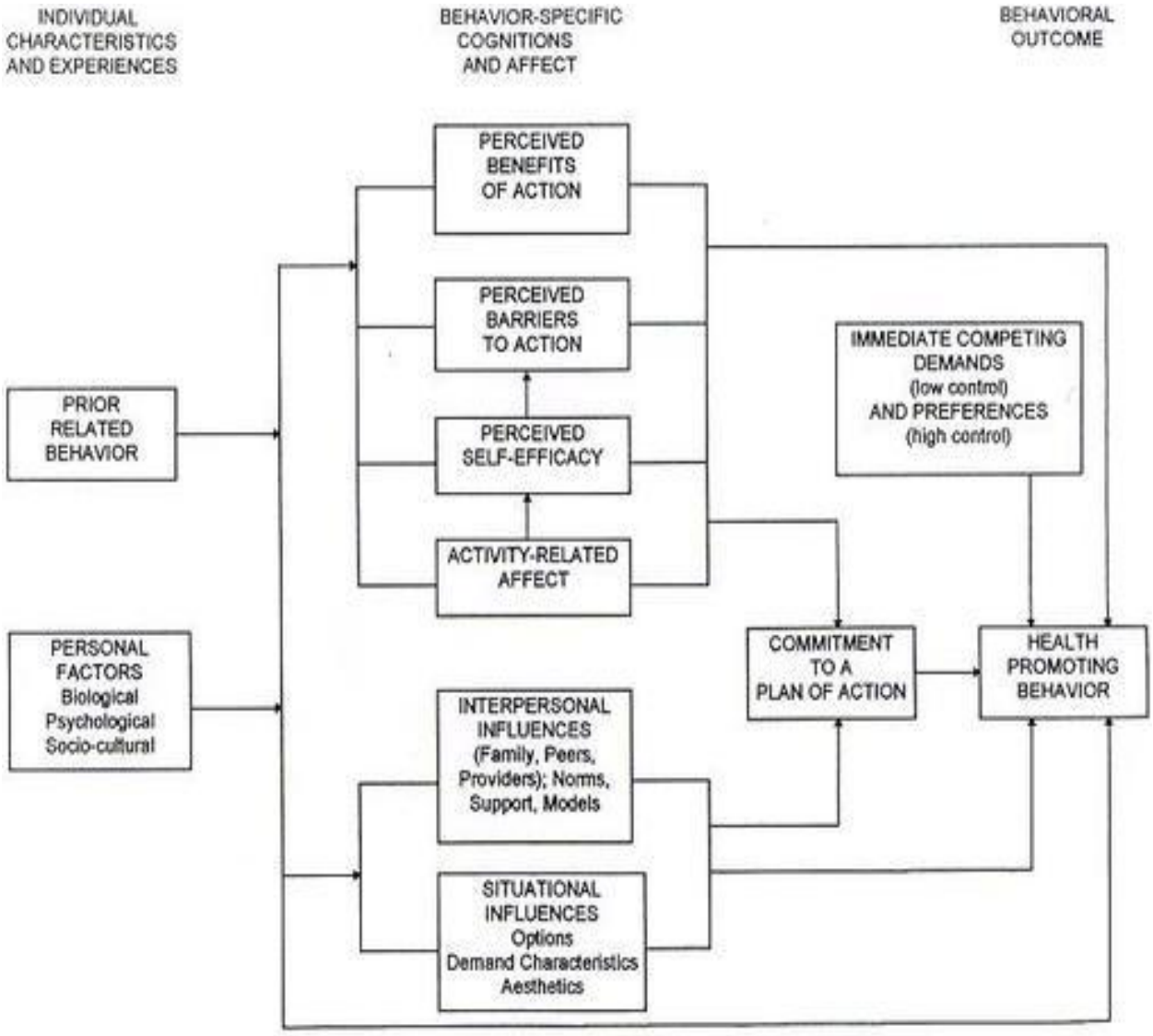


*Figure 1.* Health promotion model (Gonzalo, 2011).

## Congruence of Project to Needs of a Regional Healthcare Facility

The mission of the Eating Disorders Unit at a regional healthcare facility is to provide treatment for adolescents and adults with eating disorders, to include binge eating disorder. The Eating Disorders Unit utilizes many resources available to assist overweight and obese adolescents make necessary lifestyle changes and lose weight, while supporting their psychological needs. Family members are also included in the treatment process. The unit values coincide with the goals of this practice improvement project: to treat obesity in adolescents in an effective and efficient manner and incorporate bariatric surgery for eligible participants. Just as in the HPM, this project is aimed at incorporating "steps in which a person can pursue better health or ideal health" (Health Promotion Model, n.d.). The way the project will achieve this goal is by creating an algorithm to guide institutions developing adolescent bariatric surgery programs and assist primary care providers in treating obesity in children and adolescents.

## CHAPTER 3. PROJECT OBJECTIVES AND DESIGN

### Project Description with Purpose and Objectives

The significance of childhood obesity has been extensively reviewed and can lead to many co-morbid conditions to include premature death. The most effective way to reduce associated risk of obesity related complications is to prevent occurrence of the health risk. Despite long term efforts, current interventions have not improved obesity rates in adolescents. Lifestyle changes, to include diet modifications and increasing daily physical exercise, is supported by the literature, but has minimal effect on morbidly obese adolescents. Nominal research is available in regards to weight loss in adolescents with pharmacological therapy, but the weight loss results are not substantial (Iughetti, China, Berri, & Predieri, 2010). Bariatric surgery is used for weight loss in adults and has shown to be a successful method for weight loss and improving obesity associated co-morbidities. However, marginal research is available documenting outcomes of bariatric surgery in adolescents. Currently, this procedure is only considered for morbidly obese adolescents. The initial results have been positive for weight loss, but there are no studies to report on long term effects of bariatric surgery in adolescents. Due to the initial outcomes promoting weight loss, it can be presumed that more adolescents will be seeking bariatric surgery as a treatment option for morbid obesity. This demand may compel hospitals to develop adolescent bariatric surgery programs and will require a multi-disciplinary team to provide appropriate care and treatment. Using the HPM and a team approach in developing an adolescent weight management protocol for treating morbid obesity in select individuals can prove to be a very successful (Inge, Xanthakos, & Zeller, 2007).

The project focused on designing a step-by-step algorithm for adolescent weight loss for a regional healthcare facility. Currently, there is no protocol in place for bariatric surgery in

adolescents at this facility and an algorithm would be valuable in developing a program. The literature review of childhood and adolescent obesity was taken into consideration when designing the algorithm. Meeting with the Eating Disorders Unit and bariatric surgery staff at this regional healthcare facility was an integral part of the planning process. The information included in the algorithm was based on current evidence, staff input, and the recommended process for weight loss as instructed by national pediatric specialists. Project design and timeline can be found in the Appendix, labeled Appendix A.

The purpose: To enhance current weight loss management program at a regional healthcare facility. To create an algorithm that guides treatment of overweight and obese adolescent patients to include bariatric surgery. The objectives:

1. Consider implementation of an adolescent bariatric surgery program.
2. Describe the benefits of a bariatric surgery program for adolescents.
3. Identify barriers and limitations of an adolescent bariatric surgery program.
4. Describe the ethical considerations of implementing an adolescent bariatric surgery program.
5. Design an algorithm to guide implementation of an adolescent bariatric surgery program by using current literature.

# CHAPTER 4. EVALUATED ALGORITHM

The project aimed at enhancing the lives of children by developing a weight loss algorithm that includes all available resources. Many facilities have a program in place for adult bariatric surgery, but not adolescent bariatric surgery. An evaluation of the algorithm and determining if the algorithm was useful in assisting organizations implement an adolescent bariatric surgery program was completed.

The evaluation of the project and objective five was based on the Eating Disorders Unit decision to use the designed algorithm for the implementation of an adolescent bariatric surgery program. Two individuals from the committee working on implementing the adolescent weight loss program at the regional healthcare facility were contacted via e-mail to provide an evaluation on the algorithm. Several bariatric centers of excellence were contacted via email in regards to evaluating the proposed weight loss algorithm as they indicated a vested interest in the project. Contacted staff received the proposed algorithm and were asked to fill out a brief survey. One expert in the field of adolescent bariatric surgery responded out of the several that were contacted. The expert was asked to assess the functionality of the algorithm for use in a primary care setting and if any changes should be made before disseminating the algorithm. The algorithm was then reviewed by selected primary care providers to further evaluate its potential usefulness as a tool for primary care providers in treating obesity in the adolescent population. They were given a survey containing questions which had the examiner provide feedback on the usefulness of the algorithm in the primary care setting, if the algorithm was a tool they would use in practice, and if they felt any changes should be made. The information was assessed and revisions to the algorithm were made in regards to the recommendations.

# CHAPTER 5. RESULTS

## Project Objectives

*Consider Implementation*

Several meetings were conducted with members of the Eating Disorder Unit and bariatric surgery members at a regional healthcare facility to discuss the need to implement an adolescent bariatric surgery program. Many concerns were raised, as there was no guide for program development since this type of surgery is only done at a select few bariatric centers in the nation. The American Society for Metabolic and Bariatric Surgery (ASMBS) recommends bariatric surgery for weight loss in morbidly obese adolescents who failed previous weight loss attempts. The ASMBS released best practice guidelines 2011, but has not presented a guide for program development (Michalsky, Reichard, Inge, Pratt, & Lenders, 2011). The Eating Disorder Unit and bariatric surgery committee at a regional healthcare facility desired an algorithm be developed to include initial assessment of an obese adolescent, conservative weight loss methods, pharmacological weight loss options, and bariatric surgery with a time frame for each step. Team members were also interested in screening criteria needed pre-operatively, contraindications for surgery, risks of the surgery, necessary team members, types of bariatric surgery used in adolescents, and follow-up care. The committee requested contact with the adolescent bariatric surgery program at Cleveland Clinic in order to find out how their program was set-up. An initial plan consisted of setting up a site visit at the Cleveland Clinic to learn first-hand how their adolescent bariatric surgery program functions.

*Describe the Benefits*

No intervention is or will be perfect to assist with weight loss in children and adolescents, but obesity-related health problems will only rise if obesity is left untreated, which may make it

necessary to perform bariatric surgery during the adolescent years. The benefits of bariatric surgery in adolescents include: weight loss, resolution of co-morbid conditions such as hypertension, obstructive sleep apnea, Type 2 Diabetes, chronic pain, gastroesophageal reflux, dyslipidemia, irregular menstrual cycles, polycystic ovarian syndrome, and asthma. Other benefits of bariatric surgery are: decreased use of medications, increased energy, improved self-esteem, and improved quality of life to include social, emotional, physical, and health (Nationwide Children's Hospital, n.d.). "Reported weight loss in adolescents undergoing weight loss surgery ranges from 52 to 70 percent of excess body weight" (Xanthakos & Inge, 2013, Efficacy and Complications section, para. 2).

Successful outcomes are based on adherence to strict dietary guidelines and follow-up care. Patients who have bariatric surgery need to advance to regular foods slowly, but when tolerating solids, should eat three to four times per day and consume foods high in protein. Vitamin and mineral supplementation is necessary before and after surgery to prevent micro and macro nutrition deficiency (Inge et al., 2007). In order to attain best results, individuals should stay away from foods with a high fat content and carbohydrate food as they may cause malabsorption or dumping side effects. Sixty-four to ninety-two ounces of fluids are recommended to prevent dehydration and should not contain sugar or carbonation. Drinking fluids during meals is not advised as nausea and vomiting can occur (Xanthakos & Inge, 2014). Persons who have had bariatric surgery should exercise 30-60 minutes per day to assist with their weight loss goals. Follow-up care should be tailored to the individual depending upon degree of weight loss or gain.

A requirement for adolescent bariatric surgery programs is to have an organized and supervised support group available for patients. Such groups can be in person or via electronic

devices. Individuals contemplating surgery and those who have undergone surgery are encouraged to attend these meetings. All activities should be documented and include the location, meeting time, supervising individual, topics discussed, and all who attended the meeting. Adolescents undergoing bariatric surgery also need extensive support from family and peers. Supportive family and friends willing to assist the individual in weight loss endeavors will increase their chance for success (Michalsky et al., 2011).

*Identify the Barriers and Limitations*

Several barriers and limitations to the implementation of an adolescent bariatric surgery program at the regional healthcare facility were discussed. One question that arose was, "is there a need for this type of surgery at the facility" and committee members decided a need was present. The regional healthcare facility provides services to people in North Dakota, Minnesota, and South Dakota and committee members believed there would be a select number of adolescent who would meet the criteria for bariatric surgery and may choose to have surgery. A potential barrier preventing successful outcomes is that many areas served the organization are rural locations and those electing to have bariatric surgery, may not be able to afford the travel required for pre-operative evaluations and necessary follow-up care. Through researching the literature, an example was found which may assist in overcoming this obstacle. The University of Iowa established a network of outreach clinics throughout the state and > 75% of its tertiary care patients receive treatment at outreach locations via use of telemedicine and electronic communication (e-mail, telephone, video chat programs) extending the reach of specialty care experts associated with tertiary care centers. The technology allows specialists to coordinate care through the patient's primary care provider. Two research studies reported individuals who use this method of care lose an equivalent amount of weight as those who travel to tertiary care

facilities. A limitation to these findings is that the study is based on adults and not the pediatric population. Saelens et al. 2007 developed a weight management intervention using computer-based diet and activity education. Routine visits with the patients' primary care provider and counseling through e-mail and telephone was incorporated into care. Results indicate adolescents using this program lost slightly more weight and report a higher sense of satisfaction (as cited in Spear et al., 2007).

Another potential barrier of successful implementation of an adolescent bariatric surgery program at the regional healthcare facility is the financial cost to the family. Historically, most insurance companies do not reimburse providers when providing weight loss services (Spear et al., 2007). The concern among the eating disorders unit and bariatric surgery committee members was deciding on what coding to apply to the appointments pre and post-operatively in order to receive reimbursement. "Despite the above minimum BMI criteria, many insurance companies will not cover bariatric surgical procedures for adolescents under the age of 18 years, or they may have different criteria or only cover a certain specific procedure or procedures" (American Society for Metabolic & Bariatric Surgery, 2014). The American Society for Metabolic & Bariatric Surgery recommends parents contact their insurers prior to having their adolescent screened for bariatric surgery so they will know what will or won't be covered by their policy (2014).

*Ethical Considerations*

Despite the myriad of benefits bariatric surgery has in adolescents, there are ethical issues to consider. One consideration to address is the question, "can a determination be made that an adolescent is competent to decide to have bariatric surgery?" The prospective candidate may have reached physical maturation and is allowed to proceed with surgery, but they may not have

reached an age of mental maturity and fully understand the long-term impact bariatric surgery may have on them physically, socially, and mentally. Adolescents are required to have psychiatric screening prior to surgery, but there is no evaluation that can give a definitive answer. Current best practice guidelines recommend a broad evaluation of mental health in adolescents to include screening for binging or purging behaviors and depression before and after surgery. However, there is no standardization of the mental health screening process and interpretation of the results can be varied and inconsistent.

Another ethical question to consider is "can adolescents comply with the nutritional guidelines and follow-up care post-surgery"? Adolescents who have had bariatric surgery are required to follow a strict diet and follow-up program; however, compliance in this population is dependent upon influential psychological factors. "Limited data are currently available to evaluate factors influencing post-surgery follow-up among adolescents receiving bariatric surgery, and to our knowledge, there is no studies examining the relationship between psychopathology and post-weight loss surgery adherence among adolescents" (Sysko et al., 2013).

Underlying motivational factors need to be assessed as they can enhance or hinder the outcomes of surgery and the question, "what is the adolescents motivation for having surgery" should be evaluated during the psychological screening process. The motivational factors of the adolescent is important, but parental desires are also a concern, as they may influence the adolescents' decision to have surgery, as well as their ability to follow necessary lifestyle changes post-surgery. Problems found prior to surgery may require further education and intervention.

Screening the adolescent for psychiatric conditions should be performed prior to surgery as other psychological problems may be intensified after surgery. The question, "does the individual have a psychological condition that may be amplified by surgery" should be addressed in a psychological evaluation as these individuals are at higher risk for relapse. However, if the individual is deemed stable and is undergoing treatment by a mental health provider, then bariatric surgery can be performed (Sysko et al., 2013).

Poor family functioning can hinder the success of surgery and needs to be assessed before surgery. The question "will family functioning lead to a poor outcome" should be asked by evaluators. Studies have shown adolescents who have stressful home environments lose less weight following bariatric surgery. Another study has shown BMI one year post surgery is greater in adolescents with family conflict compared to adolescents without family conflict. Evaluation of the adolescent and their family should include assessment questions pertaining to history or presence of stressors, physical, emotional, and sexual abuse, and involvement with social services as conflict amongst family members can negatively affect adolescents (Sysko et al., 2013).

The ability of an adolescent to provide informed consent for surgery has also raised concerns. The question "is the individual competent to provide consent for surgery" is recommended to be discussed among those evaluating the adolescent. Knowledge pertaining to informed consent should be discussed with the individual and their family. Risks of surgery need to be examined in length and carefully considered by the adolescent. The risk of becoming a morbidly obese adult with potential life threatening co-morbid conditions needs to be weighed against the risks of bariatric surgery. Issues typically occur when the parents and adolescent do not agree on using bariatric surgery as a weight loss method. Oftentimes parents understand the

consequence obesity has on their child's life more than the individual comprehends. The bariatric team needs to ensure the adolescent agrees to surgery because they want the procedure and there is no coercion by their parents. Adolescents undergoing bariatric surgery are required to sign the consent for surgery and understand the risks and benefits, but there is no "empirically valid method of assessing the capacity of an adolescent to make an informed decision about bariatric surgery" (Michalsky et al., 2011, p. 66). This leads to the ethical dilemma of adolescents consenting for surgery when there is no definitive way to know if they truly understand the risks and benefits of the procedure. Prior to signing the consent form, bariatric team members need to ensure cognitive and emotional maturation of the adolescent and their ability to make an informed decision (Michalsky et al., 2011).

*Design an Algorithm*

Developing an adolescent weight loss algorithm to include bariatric surgery was completed using current and available research. There are several requirements for adolescents to meet before an individual can consider and be screened for bariatric surgery.

The algorithm is broken down into three categories: Assess and Diagnose, Education and Change Encouragement, and Bariatric Surgical Screening. Each section of the algorithm will be discussed in detail.

Assess and Diagnose

The first step is to assess for obesity by obtaining height and weight to determine the BMI percentile. Normal weight is less than the 85$^{th}$ percentile, overweight is 85-95$^{th}$ percentile, obese is greater than the 95$^{th}$ percentile, and severe/morbid obesity is greater than the 120$^{th}$ percentile (Klish, 2014). Adolescents with a normal BMI should be instructed to continue with healthy behaviors and providers should observe for rapid weight gain (Institute for Clinical

Systems Improvement, 2013). Overweight individuals should be given educational materials on lifestyle changes, such as diet and exercise and encouraged to schedule a follow up appointment with their primary care provider in four weeks. Follow-up visits should include: weight, BP measurement, and patient and family reinforcement on diet and exercise. Providers may refer an individual to organized weight loss program if follow-up visits prove to be successful (Klish, 2014). Weight loss goals for the first six months depends on the degree of obesity and the severity of the co-morbid conditions present. Lifestyle changes made by the adolescent should be monitored for at least six months before moving to more intense therapy (Institute for Clinical Systems Improvement, 2013). Adolescents with a BMI indicating obesity or morbid obesity are at risk for co-morbidities and should have a fasting blood sugar, alanine aminotransferase, and a lipid panel drawn and proceed to the next phase of the algorithm (Klish, 2014).

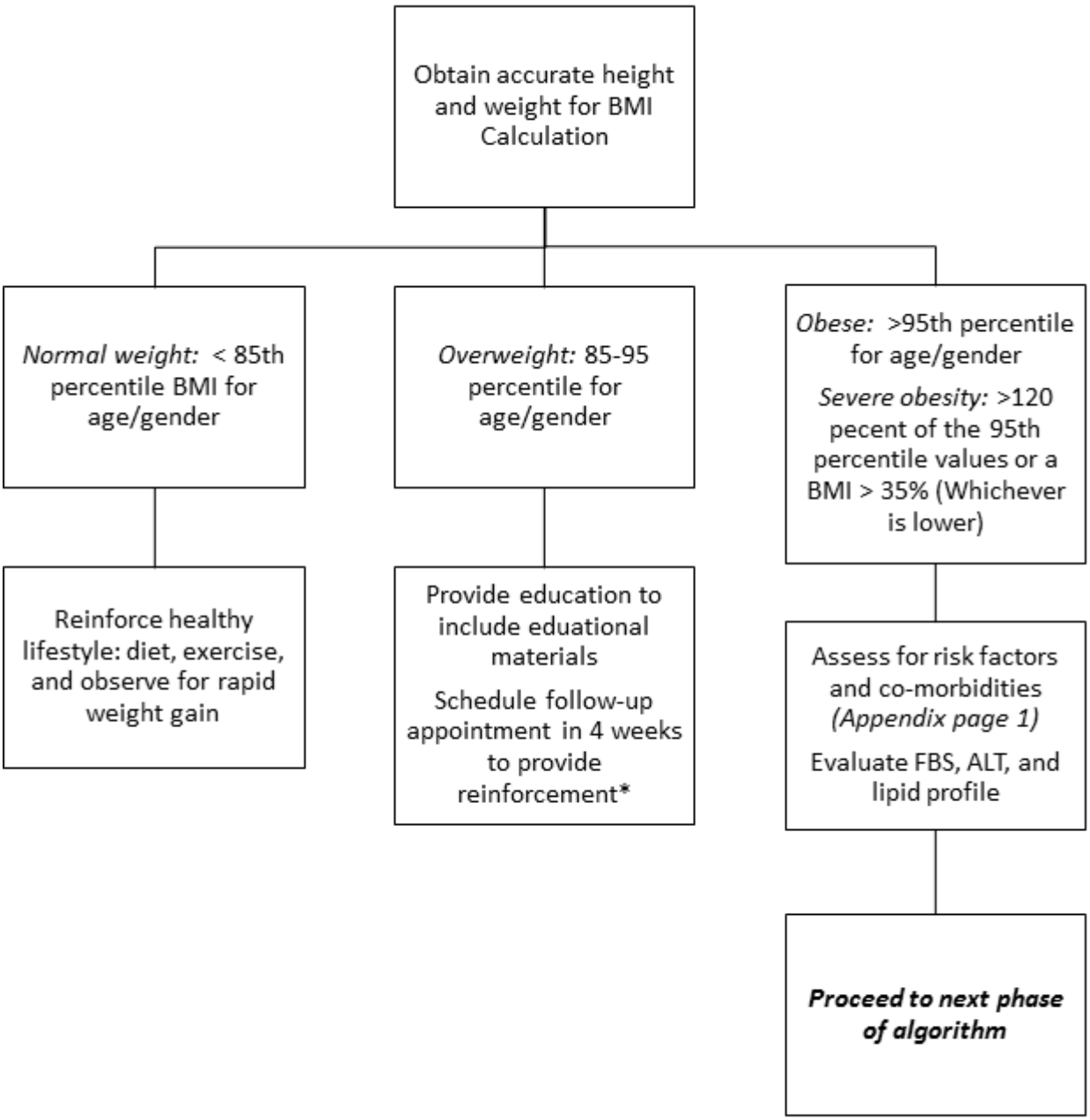


*Figure 2.* Assess and diagnose.

Educate and Change Encouragement

After a diagnosis of obesity or morbid obesity is given, the provider should offer medically supervised weight loss treatment. The next step of the algorithm relies on the patient and family's motivation to make changes. If the patient and family are motivated to make changes, then the provider incorporates education on nutrition, increased physical activity, behavior modification, and family counselling. Follow-up visits should be every four weeks for six or more months. Depending on the progress and weight lost, the adolescent should continue with the lifestyle changes and follow-up with their primary care provider as needed (Institute for Clinical Systems Improvement, 2013). Goals should be assessed and if they are not achieved but the individual remains motivated, the next step is to refer them to an endocrinologist at an adolescent weight loss center to discuss initiation of pharmacologic therapy. Pharmacological therapy may be considered if the individual is obese with co-morbidities or is morbidly obese with a BMI > 99$^{th}$ percentile (Institute for Clinical Systems Improvement, 2013).

Currently Orlistat, Metformin, and Phentermine are medications indicated for use in adolescents for weight loss. Orlistat decreases the absorption of fatty acids by 30 percent in people who ingest a 30 percent fat diet. Side effects of this medication are abdominal cramping, flatus, and oily bowel movements. However, with continued use, the side effects decrease. Orlistat may interfere with absorption of fat-soluble vitamins, so a daily multi-vitamin containing vitamins A, D, E, and K should be taken to prevent deficiencies (Iughetti et al., 2010). In a study done of 17 adolescents, average weight loss when taking this medication was approximately 5.4 percent with a decrease in BMI and waist circumference. Orlistat medication may be used in individuals 12 years or older (Spear et al., 2007). Metformin is an oral antihyperglycemic agent. As a treatment option for pediatric obesity, the medication is safe and shown to induce minimal

weight loss after 6-12 months of use; however, Metformin has multiple cardiac and metabolic benefits (Kelly, et al., 2013). There is no correlation of weight loss and dose prescribed. Best results have been obtained by prescribing 1000 mg daily (Brufani et al., 2013). Potential side effects of this medication are diarrhea, bloating, stomach pain, gas, indigestion, constipation, metallic taste in mouth, heartburn, flushing, nail changes, muscle pain, chest pain, and rash (National Institute for Health, 2014). Phentermine is a stimulant and appetite suppressant and approved for use in adolescents who are sixteen years old and/or are older, but should not be used for more than twelve months (Institute for Clinical Systems Improvement, 2013). Common side effects from this medication include dry mouth, unpleasant taste, diarrhea, vomiting. Serious side effects can include increased blood pressure, heart palpitations, restlessness, dizziness, tremor, insomnia, shortness of breath, chest pain, lower extremity edema, and difficulty performing physical exercise an individual is normally able to perform (National Institute of Health, 2013). Effectiveness of these medications may be reduced after six months to one year of use. The regain of weight after discontinuation is common. After six or more months of treatment and goals have not been achieved, the next phase of the algorithm is necessary.

Adolescents and whose families are not motivated to make changes should be educated by their provider on risks of obesity and related comorbidities. A follow-up appointment should be made periodically to asses for patient and family motivation in making lifestyle changes (Institute for Clinical Systems Improvement, 2013).

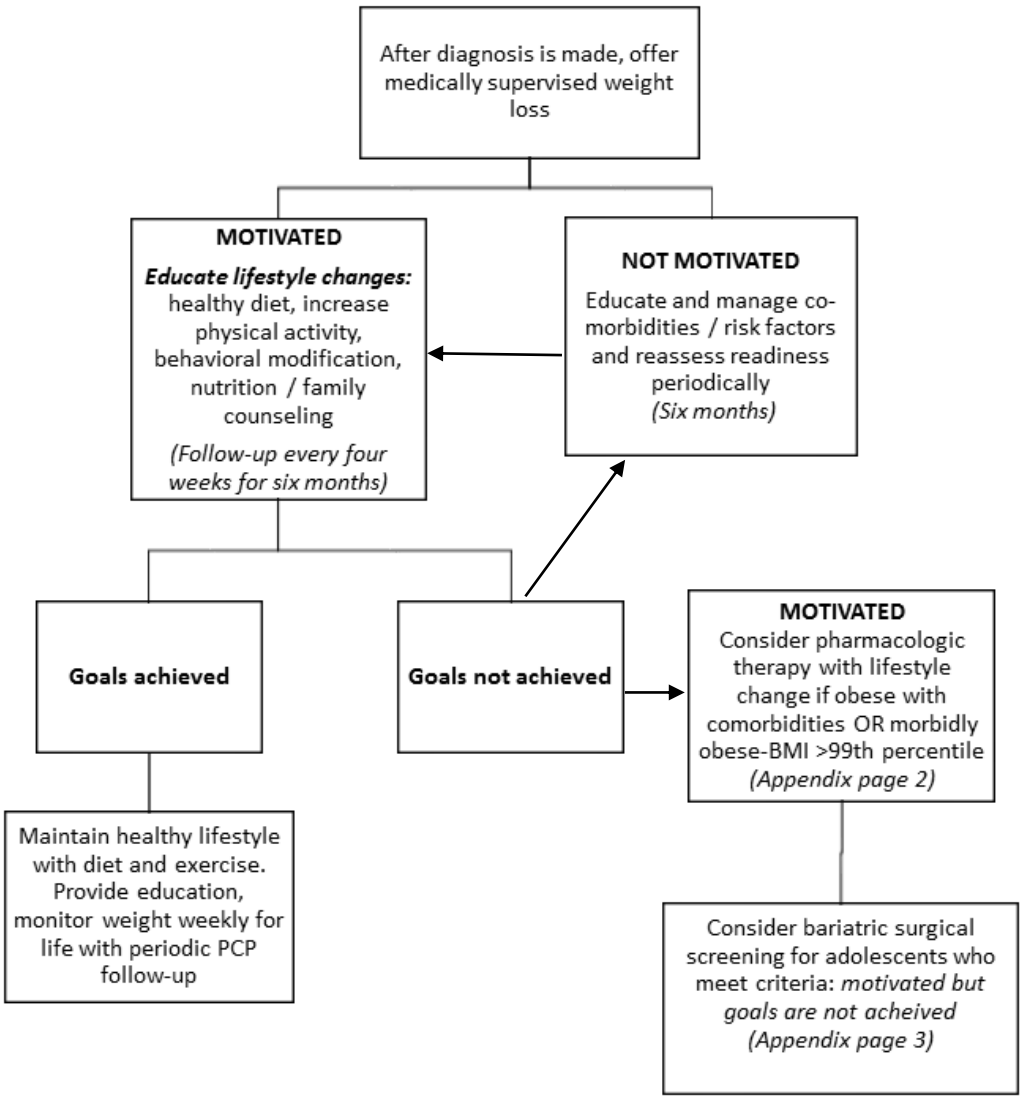


*Figure 3.* Educate and change encouragement.

Bariatric Surgical Screening

The first step of this phase of the algorithm is to determine if the adolescent meets the criteria for bariatric surgery. Evaluation is performed by a multi-disciplinary team at a facility specializing in adolescent bariatric surgery. The facility must have staff and administration personnel dedicated to the excellence of care provided to the adolescent population. Staff members must be able to provide morbidly obese adolescents with compassion and understand the medical and psychosocial co-morbidities associated with the disease. Staff must be skilled at providing pre and post-operative care of patients undergoing bariatric surgery. The facility must have an age appropriate intensive care unit staffed with a physician skilled in Advanced Cardiac Life Support and who is available twenty-four hours per day. A facility offering adolescent bariatric surgery is required to have specialized bariatric equipment designed for the care of patients who are morbidly obese. The medical director of this program must be a pediatric expert in order to "evaluate and manage the developmentally unique aspects of pediatric patients and their families" (Michalsky et al., 2011, p. 67). During the course of evaluation and treatment, bariatric surgery team members must keep the patients primary provider informed of their medical status (Michalsky et al., 2011).

The American Society for Metabolic and Bariatric Surgery recommends facilities have a multidisciplinary team in place for adolescents undergoing bariatric surgery, but there is no compelling evidence to support this recommendation (Michalsky et al., 2011). Disciplines chosen to be a part of the team are based on each facility and available resources. Below is a basic list of disciplines that can be combined to form a multidisciplinary team (Michalsky et al., 2011).

1. A surgeon who is skilled in bariatric surgery.
2. A pediatric specialist, does not have to be a medical doctor or an expert in bariatric surgery.
3. A registered dietician who is skilled in caring for obese pediatric patients and their families.
4. A mental health specialist who has previous experience working with families, children, and adolescents. The mental health specialist should have a background in eating disorders and evaluating patients for bariatric surgery.
5. A team member willing to be a coordinator of care for the adolescent. This person will ensure there is compliance of the patient and follow-up appointments.
6. An exercise specialist to educate the adolescent on safe and effective activities for obese adolescents.

The screening criteria adolescents have to meet to undergo bariatric surgery is extensive. An adolescent must have a BMI greater than or equal to 35 with one or more serious obesity related co-morbidities, or a BMI greater than or equal to 40 with less serious complications. If a patient presents for surgery with a BMI greater than 55 kg/m^2, then further weight reduction should occur prior to surgical intervention in order for the adolescent to achieve a non-obese stature (Inge & Kollar, 2011). The adolescent must have participated in six consecutive months of medically supervised weight loss attempts (Cleveland Clinic, 2011). The individual must have attained physical maturity, which determined by assessing bone age. The adolescent must have completed 95% of predicted adult stature based on bone age or have reached Tanner Stage IV (Xanthakos & Inge, 2014). They must demonstrate commitment to comprehensive medical and psychological evaluations before and after surgery. All females must avoid pregnancy for

twelve to eighteen months post operatively and cannot be pregnant at the time of surgery. Individuals must adhere to nutritional guidelines post operatively. The adolescent undergoing surgery must be able to provide informed consent prior to surgery, demonstrate mature decision making, and understand the risks/benefits of surgery. To achieve optimal outcomes, it is important that the individual receive family support available pre and post operatively (Cleveland Clinic, 2011).

Before an adolescent undergoes bariatric surgery, potential medical causes of obesity must be ruled out. Such causes can be from medications or medical illness. Medical conditions that can cause obesity are Cushing Syndrome and Prader-Willi Syndrome (Xanthakos & Inge, 2014). Contraindications may prevent the individual from having bariatric surgery and include: substance abuse problem within past year, medical, psychiatric, psychosocial, or cognitive condition preventing patient from abiding to post-operative dietary and medication regimens or impediment in their decision making ability**,** current or planned pregnancy within 18 months of procedure**,** and inability of the patient or parent to understand risks of surgical treatment and need for lifelong postoperative medical and nutritional management (Inge & Kollar, 2011).

The next step of the screening process includes a variety of laboratory and radiographic tests. Further evaluation by specialists may be indicated given results of the tests and certain results may disqualify the adolescent from surgery. Adolescents who do not qualify for surgery should follow-up with their primary care provider periodically and reassess changes that could qualify them for surgery and/or to continue with weight loss management. Below is Table 1 documenting the recommended tests necessary prior to surgery (Cleveland Clinic, 2011; Inge & Kollar, 2011; Inge et al., 2004). The entire screening process may take several months to complete.

Table 1

*Recommended Bariatric Surgery Screening*

| Recommended Bariatric Surgery Screening | |
|---|---|
| • Comprehensive history and physical exam<br>• Waist circumference, height, weight, BMI<br>• Systolic and diastolic blood pressure<br>• Fasting lipid profile<br>• Oral glucose tolerance test (elevated fasting blood sugar)<br>• Liver function tests<br>• Echocardiogram<br>• Electrocardiogram (including exercise stress test if present prolonged QT)<br>• Chest radiograph<br>• Urea breath test or endoscopy (excluding Helicobacter pylori infection if patient exhibits unexplained anemia or abdominal pain/ulcers history<br>• Bone age (If there is a need to assess patient maturity as surgery causes rapid weight loss. Concern exists that this procedure may cause inhibition of structural growth if adolescent is not near anticipated adult height. Radiograph of hand and wrist can be completed to accurately determine achieved adult stature percentage.) | • Chemistry profile<br>• Complete blood count<br>• Hemoglobin A1C<br>• Psychological adjustment disorders<br>• Thyroid stimulating hormone<br>• Urinalysis<br>• Pregnancy tests (female or beta HCG)<br>• Polysomnography (sleep apnea symptoms)<br>• Abdominal ultrasound (chronically elevated liver enzymes or gallstone concern)<br>• Specialist evaluation (if preliminary results indicate need)<br>• Primary care provider documentation of continued weight loss attempts through lifestyle changes and medical use (most insurance companies require documentation show at least six months of attempted weight loss regardless of weight loss or gain. Some insurance companies will not cover surgical procedure if patient is less than 18 years old.) |

(Cleveland Clinic, 2011; Inge & Kollar; 2011; Inge et al., 2004)

Choosing a weight loss procedure is the next step of the algorithm for an adolescent qualifying for bariatric surgery. Two choices are available, the Roux-en-Y bypass and the Lap-Band. The Roux-en-Y procedure creates a small pouch out of the stomach which will decrease an individual's appetite. The Y portion is part of the small intestine attaching to the stomach in order to pass the duodenum (Cleveland Clinic, 2011). The Lap-Band procedure is an adjustable

band placed at the upper portion of the stomach creating a small stomach pouch. The band can be tightened and loosened depending on the needs of the patient. Unlike bypass, this procedure is completely reversible and is only performed in patients eighteen years and older (Inge & Kollar, 2011). Before adolescents and their families can make a decision, it is imperative they understand risks of the procedures. Once risks and benefits have been outlined and the adolescent comprehends the potential outcomes of weight loss surgery, the individual undergoing surgery has to sign a consent form. Below is a table that lists the risks of both procedures.

Table 2

*Short-Term Risks of Gastric Bypass Surgery*

| **Short-Term Risks of Gastric Bypass Surgery** | |
|---|---|
| **Roux-en-Y†** | **Lap Band (Age 18 and Older)** |
| • Infection at point of incision<br>• Blood flow blockage in lungs<br>• Pulmonary embolism<br>• Stomach leak into other parts of body<br>• Loosened staples<br>• Narrowing link between stomach and intestines<br>• Small bowel obstruction<br>• Dumping Syndrome (group of symptoms includes nausea, bloating, vomiting, cramps, diarrhea occurs when food moves through body to quickly.) | • Bleeding<br>• Infection<br>• Leak at incision site<br>• Band slippage with continuous vomiting if behavioral changes do not occur in moderate food intake<br>• Band erosion into stomach<br>• Stoma blockage<br>• Esophageal or gastric pouch dilatation<br>• Severe nausea 1st month after surgery |

**† Other risks include nausea, vomiting, sweating, faintness, general weakness, diarrhea, hiccups, bloating, hernia, ulcers, gallstones, nutritional deficiencies (iron, calcium, and other vitamins and minerals which can lead to anemia or brittle bone disease osteoporosis if left untreated, and death (always a possibility with surgery)**

(Cleveland Clinic, 2011; Xanthakos & Inge, 2013)

The last step of this phase is follow-up care. "Compliance with long-term post-operative follow-up care is critical for appropriate monitoring of weight-loss velocity and to provide

anticipatory guidance and goal-setting for both patient and his or her family" (Michalsky et al., 2011, p. 69). Postoperatively, patients will be seen by the surgeon, psychologist, and dietician two weeks after surgery, then 1, 3, 6, 9, and 12 months post-operatively. After the first year, annual follow-up is recommended (Xanthakos & Inge, 2014). Laboratory checks are done at three months, twelve months, and yearly (Inge et al., 2004). Annual follow-up visits are recommended for monitoring of anthropometric measurements, nutritional status, residual comorbidities, and general health. CBC with differential, serum iron and ferritin, folate, B12, serum homocysteine, serum thiamine (B1), albumin, total protein, alkaline phosphatase, calcium, 25-hydroxy vitamin D, and parathyroid should be assessed annually. Adolescents may have post-prandial hypoglycemia after surgery, so questions pertaining to hypoglycemia need to be asked at each follow-up visit. Patients who chose the Lap-Band procedure will have more frequent follow-up visits due to the need for band adjustments (Xanthakos & Inge, 2014).

Xanthakos and Inge (2014, p. Nutritional Monitring section, para. 1) report "Dual energy X-ray absorptiometry (DEXA) scan, to monitor lean and fat-free mass, and bone density" should be done annually in patients who do not have adequate nutritional intake; however, annual Dexa scans do not have to be performed if the adolescent has good nutritional status. Advancement of regular food is a slow process and should occur over the first six months after surgery. Nutritional monitoring is important during this time as is adequate protein for maintenance of lean muscle during the rapid weight loss period (Inge et al., 2004). Adequate protein intake is required for maintenance of lean muscle during the rapid weight loss period (Inge et al., 2004). Patients need to consume a variety of nutritional supplements in to prevent complications of malnutrition (Xanthakos & Inge, 2014). Ursodiol and ranitidine are prescribed for the first six months (Inge et al., 2004). A daily multivitamin containing folate and iron (or a prenatal vitamin

in females), 1200 to 1500 mg of calcium with 800 to 1000 international units of vitamin D, and 1000 micrograms of oral vitamin B12 supplements or 1000 microgram injection every month (patients with stable vitamin B12 may receive one 3000 microgram injection at their annual visit) are needed for the remainder of life of the patient who has had the Roux-en-Y procedure. Patients who had the Lap Band procedure need to take a daily multivitamin, but if iron deficiency occurs, should be prescribed supplemental iron (Xanthakos & Inge, 2014).

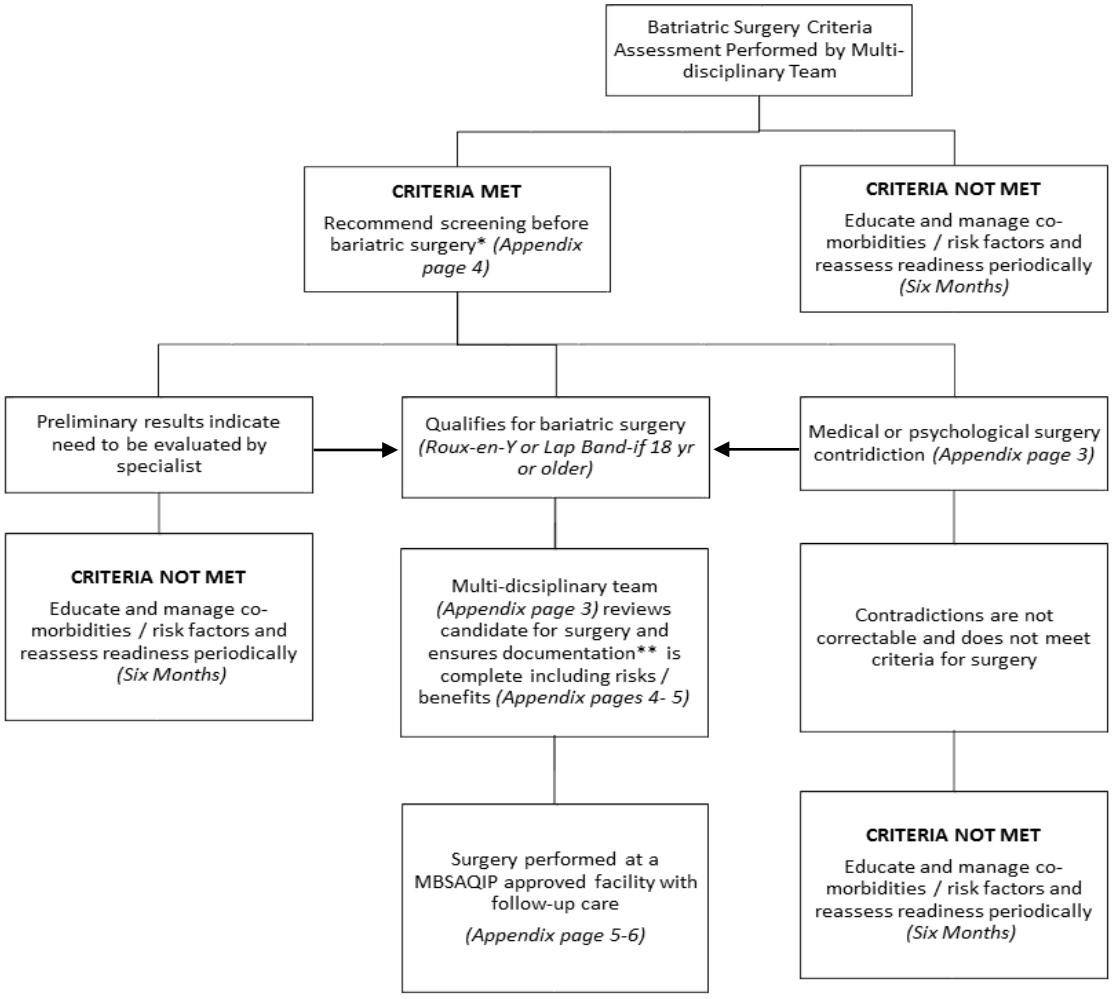


*Figure 4.* Bariatric surgical screening.

## Unintended Consequences

Bariatric surgery in adolescents is a relatively new procedure and long term effects are unknown. Unintended consequences can be speculated by reviewing cases of adults who have had bariatric surgery, but it cannot be certain what occurs in adults will happen in adolescents. Adolescents are still growing and may be negatively affected by bariatric surgery as they may not consume or absorb adequate nutrients to sustain their growth (Inge et al., 2004).

Prior to bariatric surgery, many obese females have polycystic ovarian syndrome, which makes becoming pregnant difficult. After bariatric surgery, females may resume normal ovulation and become more fertile than they were before the surgery. The recommendation is for females to avoid pregnancy up to eighteen months after the procedure because rapid weight loss and possible nutritional deficiencies may have negative effects on the fetus and mother (Xanthakos & Inge, 2014). The body has difficulty absorbing food and essential nutrients after bariatric surgery, as well as orally ingested medications. Oral contraception is a very popular choice of birth control in young women and because of altered absorption, puts them at higher risk for pregnancy if taken after bariatric surgery. A study done Roehrig et al. (2007) found that female adolescents had a higher rate of pregnancy after bariatric surgery than expected. Risk factors which may have contributed to the higher rates are unclear, but speculated factors include poor adherence to prescribed contraception, as well as a psychological component. Providers need to educate female patients and their parents on potential risk factors and determine what barriers exist that may prevent compliance. Ultimately, providers need to encourage the patient to postpone plans for pregnancy until after the surgical procedure. Aside from abstinence, the best choice of contraception is a non-oral route, such as Depo-Provera or an IUD. Women

should be advised to avoid contraception containing estrogen at least up to four weeks after surgery as estrogen puts them at an increased risk for developing blood clots (Gunter, 2009).

Bariatric surgery has the potential to be an excellent procedure to reduce weight in morbidly obese adolescents, but like any invasive procedure, comes with the possible risk of developing complications. Initial outcomes are positive as the procedure has eliminated or markedly decreased co-morbid conditions associated with the disease. Unfortunately, no data is available on long term safety and efficacy of this procedure in adolescents. Additionally, minimal research has been conducted on the psychosocial effects of bariatric surgery in adolescents and information published is based on short term monitoring. In most cases, individuals who had bariatric surgery report psychological improvements of their self-esteem and self-image due to weight lost, but there is a chance that surgical outcomes may not be as expected. Post-operatively, some patients still struggle with weight loss and regaining weight, which leads to continued negative feelings towards themselves and increased depression (Kubik, Gill, Laffin, & Karmali, 2013). When this occurs, adolescents tend to feel guilt and shame because of their continued obesity. "Some studies indicate significant rates of high depression scores and negative self-acceptance in adolescents after laparoscopic adjustable gastric banding" (Hofmann, 2013, p. 3).

> Preoperative patient expectations that life will dramatically change after bariatric surgery may have negative impact on psychological health if these results are not met, even if significant weight loss is achieved. Moreover, some patients realize that certain presurgical problems persist after surgery, which may disappoint them because they cannot attribute underlying emotional disturbance to their weight. Furthermore, patients may have difficulty coping with negative life events that they were previously able to

contribute to their obesity. (Kubik, Gill, Laffin, & Karmali, 2013, Postoperative Psychological Health section, para. 3)

Policies pertaining to bariatric surgery have been enacted by the Centers for Medicare and Medicaid (CMS) and in 2006, the CMS mandated that individuals undergoing bariatric surgery have the procedure done at a Center of Excellence (COE). The COE's were instructed to become accredited by a professional surgical organization and required other measures of care were implanted at the facilities. Creation of this policy was to increase the quality of care and decrease complications related to bariatric surgery. However, in a study conducted from 2004-2009 on outcomes of surgery at these facilities, there was no difference in Medicare patients and non-Medicare patients. An increase in the outcomes was reported of all individuals undergoing surgery since changes were already being made to the procedure to ensure safety and better outcomes. Restrictions placed by CMS has made the process more difficult for individuals desperately needing surgery, as many have to travel increased distances for surgery at a COE (Dimick, Nicholas, Ryan, Thumma, & Birkmeyer, 2013).

## Health Promotion Model and Algorithm Development

The HPM was helpful in developing an adolescent weight management algorithm as all three phases incorporate health promotion, such as promoting healthy dietary choices and increasing physical activity. Information in the algorithm emphasizes the importance of providing individuals with educational materials and follow-up care which encourages healthy behaviors. The HPM theorizes that individuals will be successful in making changes if others around them are doing the same and many of the changes necessary to treat obesity, need to be done as a family in order for outcomes to be successful (Pender et al., 2011). Screening of family environment and outside influences is part of the psychological evaluation an adolescent

undergoes prior to surgery and may determine how well an adolescent will be able to follow necessary post-surgery guidelines.

Providers need to be aware of potential barriers that may prevent an individual from being successful, to include lack of familial and peer support, personal ideations, or environmental obstacles as they may interfere with the treatment process. Motivational factors that are the driving force for the adolescent to have surgery are assessed as part of the psychological evaluation. Identifying these factors will potentially allow for long-term success. Biological factors of obesity, such as medical causes, is incorporated into the algorithm and must be ruled out prior to the adolescent having surgery. Laboratory and radiographic tests are done prior to and after surgery to ensure the individual is medically stable.

The goal of the HPM model is health promoting behavior which increases well-being, health, and functional capacity in all aspects of an individual's life (Pender et al., 2011). The benefits an adolescent receives from bariatric surgery will improve their well-being, overall health, and allow them to live to the fullest extent possible. The HPM model was a useful tool in the development of the algorithm and would be helpful in guiding providers when treating obesity in adolescents.

# CHAPTER 6. RECOMMENDATIONS

Implementation of an adolescent bariatric surgery program at the regional healthcare facility should be continued. As the population of obese and morbidly obese adolescents rise, so will the need for bariatric surgery. The implementation process poses many challenges as adolescent bariatric surgery has not been evaluated over long periods of time and outcomes can be projected, but are not certain. Requirements of developing an adolescent bariatric surgery program is more conservative than the adult program and screening is more extensive. The developed algorithm and recommendations provide a starting point for program development, but the ultimate decision on which adolescents have surgery is based on expert medical and surgical personnel judgment (Inge & Kollar, 2011).

Developing a tool or tools to guide the multi-disciplinary team in psychological evaluation of an adolescent, as well as determining if they are mature and competent in consenting for surgery, is an important issue requiring inquiry. The regional healthcare organization needs to ensure the facility is equipped with the necessary equipment and staff to properly care for morbidly obese adolescent's pre and post-operatively. The majority of the area served by the regional healthcare facility is rural and necessary appointments needed throughout the process may be too expensive for a family to afford, which poses a challenge in achieving a successful program. Additionally, insurance may not cover the surgery for the adolescent, which means a great majority of the cost is out of pocket and potentially not affordable for most families.

The committee developing the program at the regional healthcare facility had intended to make an on-site visit to Cleveland Clinic to assess how their program was conducted; however, due to unforeseen problems, had to change direction and contacted Texas Children's Hospital via

phone and discussed adolescent bariatric surgery program development. The team determined the phone conversations were sufficient in assisting with the development of their program. Evaluation of the discussions the regional healthcare facility had with Texas Children's Hospital was outside the scope of this project.

Due to lack of knowledge of long-term effects bariatric surgery has on adolescents, recommendations have been made for institutions engaging in adolescent bariatric surgery to enroll their participants in a long-term outcome study. The National Institute of Health has developed an on-going investigation termed Teen-Longitudinal Assessment of Bariatric Surgery (LABS). This study tracks information from adolescents who have had bariatric surgery and information gained used to guide the future of bariatric surgery in adolescents (Inge & Kollar, 2011).

> All centers involved in adolescent bariatric care should be encouraged to participate in a national longitudinal database in an effort to objectively refine the criteria for adolescent bariatric surgery specialty programs. The goals of creating such criteria include standardization of practices and process that promote quality care and ensure measurement and reporting of outcomes. (Michalsky et al., 2011, p. 66)

However, children and adolescents are a special population and considered to be a vulnerable group. Conducting research on these individuals is challenging as they need to understand the potential risks and benefits and give consent (Hofmann, 2013).

## Evaluation by Experts

The completed algorithm was given to Stephen Wonderlich, Ph.D., Director of Clinical Research at the Neuropsychiatric Institute and Luis Garcia, MD, FACS, Chair of Bariatric Surgery at the regional healthcare facility to evaluate the algorithm. Dr. Wonderlich and Dr.

Garcia both felt the information provided in the algorithm was critical in identifying key information for program protocol. The information provided in the algorithm has been used by the regional healthcare facility in the development of an adolescent bariatric surgery program and the final protocol created will contain essential portions of the algorithm (L. Garcia & S. Wonderlich, personal communication, March 24, 2014).

The algorithm was evaluated by William Gourash, a certified nurse practitioner at the University of Pittsburgh. He has worked for 30 years in general surgery, but the last fifteen years has focused on minimally invasive bariatric surgery. His place of employment is a member of the LABS study and Mr. Gourash acts as coordinator. He also manages ten adolescents who have undergone bariatric surgery and has been involved in their pre, peri, and postoperative care. Mr. Gourash consented to evaluate the developed algorithm due to his expertise in the field. He believes an algorithm to guide primary care providers in managing adolescent weight loss is needed, as it will be helpful in treating weight related metabolic disorders and in determining when to initiate screening in adolescents for bariatric surgery (W. Gourash, personal communication, February 10th, 2014). All recommendations made by Mr. Gourash were included in the final algorithm, which can be found in the Appendix and is labeled Appendix B.

Many primary care providers manage and treat obesity in adolescents and having a step by step algorithm to include screening for bariatric surgery may help guide them in the process. Follow-up information contained in the algorithm is useful to decide which tests need to be ordered and at what time interval.

Three primary care providers were asked to review the algorithm and report the usefulness in a primary care setting. Two out of three providers provided responses to the requested feedback. The questions included:

1. Would you find the algorithm is useful in a primary care setting?
2. Would you recommend any changes?

Both providers cited that the algorithm would be useful in a primary care setting and neither recommended any changes (R. Lenzmeier, K. Polcher, personal communication, February 25, 2014). Currently, the algorithm is only available as a word or pdf document, but may be a better asset to a provider as a smart phrase contained within an electronic medical record. More data needs to be collected to validate the reported information.

## Attainment of Personal Leadership Goals

For as long as I can remember, I have had a desire to make a difference in the lives of children. I believe this feeling has stemmed from my mother's aspiration to recognize children for the joy they bring to this world. This desire started many years ago when my mother initiated "Kid's Day" with my siblings and me. Kid's Day was going to be a day focused on celebrating her love for us and turned into an annual tradition for our family. My mother didn't want this tradition to stay just within our family, but rather she wanted other families within our community to recognize it as well. She petitioned to local leaders and on June 1st, 1993 it was proclaimed by the city of Dickinson, ND to be Kid's Day. My mother decided to take the proposal further and lobbied to the state to pass a Kid's Day proclamation. In the mid-1990's, Governor Schaffer passed the proclamation. My mother was ecstatic at the news, but she wasn't done yet. She yearned for Kid's Day to pass nationally and conversed with national representatives. Unfortunately, a similar proclamation had already passed through the legislature

and my mother's dream fell short. She was disappointed, but never stopped spreading her message of celebrating children. Since her death eleven years ago, I have wanted to carry on her legacy. Through the development of my Doctor of Nursing Practice project, I have had the opportunity to find a way to follow in her footsteps. Over the years, I have seen the prevalence of childhood obesity rise dramatically and have wanted to be a part of a change process to reverse the trend. As a cardiac nurse, I have witnessed the physical and emotional effects obesity can have on a person, as well as the unfortunate circumstance of premature death. In conjunction with local healthcare leaders, I have had the opportunity to develop an algorithm that may assist in adolescent bariatric surgery program development and aid primary care providers in successfully managing obesity in children. Through this algorithm, I hope to better the lives of children, which will allow them to celebrate a brighter future.

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## APPENDIX A. PROJECT DESIGN AND TIMELINE

A portion of the regional healthcare facilities Eating Disorders Unit patient population may be overweight or obese despite the efforts to prevent or treat the growing crisis. After meeting with Eating Disorder Unit staff and bariatric surgery members, it was proposed to develop an algorithm to aid in the process of adding bariatric surgery as a weight loss option for their adolescent population. Timeline:

1. Literature Review: research non-surgical and surgical options for weight loss in adolescents. Projected time allotted: one month
2. Assess national bariatric surgery programs that perform adolescent bariatric surgery. Projected time allotted: one month
3. Design an algorithm for treatment of adolescent weight loss to include bariatric surgery. Projected time allotted: 2 months

   The project improvement proposal will include:

   a. Briefly review non-surgical and surgical weight loss management options for the adolescent population.
   b. Review current bariatric surgery procedures for adolescents.
   c. Review screening procedures for adolescents before bariatric surgery.
   d. Review contraindications for adolescent bariatric surgery.
   e. Review risks of bariatric surgery for the adolescent population
   f. Clarify the multi-disciplinary staff needed to institute an adolescent bariatric surgery program.
   g. Review follow-up care of the adolescent to include duration time-line

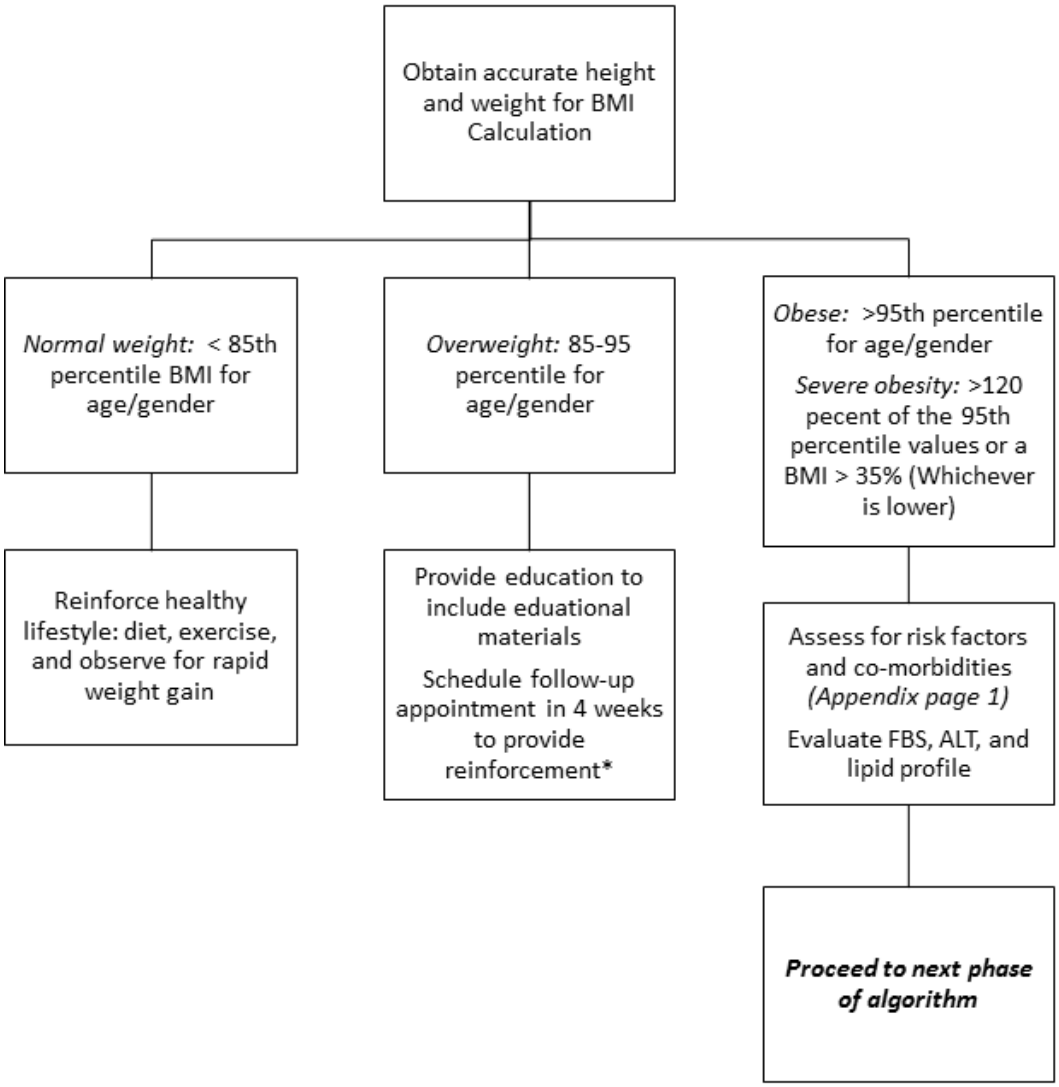
h. Design algorithm for treatment of adolescent weight loss to include bariatric surgery

4. Present proposed algorithm to regional healthcare facility eating disorders unit staff and bariatric surgery members. Projected time allotted: 2 months

**Resources**

1. Technology: computers with internet capabilities; email communications, and Microsoft word application.
2. Personnel: Eating Disorder Unit and bariatric surgery staff at regional healthcare facility willing to answer questions and address problems that may arise; other health care agency staff to answer questions about current adolescent bariatric surgery programs and weight loss treatment already instituted; staff for evaluation of project improvement algorithm.
3. Budget: staff of Eating Disorders Unit and members of the bariatric surgery unit at regional healthcare facility may need to travel to other healthcare facilities to evaluate other programs similar to what may be instituted at regional organization. The information that would be brought back may be integrated into the project improvement plan. The money for the trip would come from the budget set by the regional healthcare facility, but would need approval before scheduling.

## APPENDIX B. ADOLESCENT WEIGHT MANAGEMENT ALGORITHM




***Follow-up visits should include: weight, BP measurement, and patient and family reinforcement on diet and exercise. If follow-up reinforcement is successful, may refer to organized weight loss program.**

*Figure B1.* Assess and diagnose.

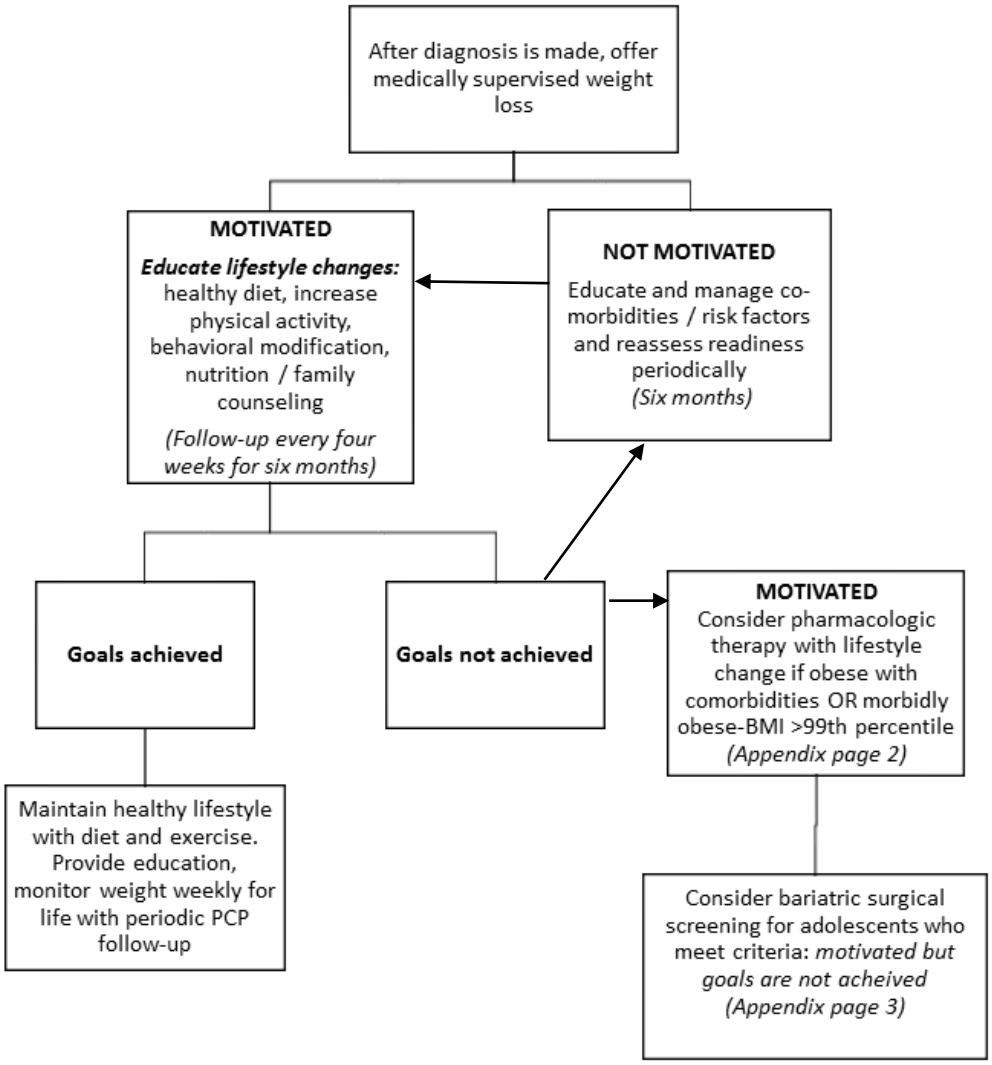
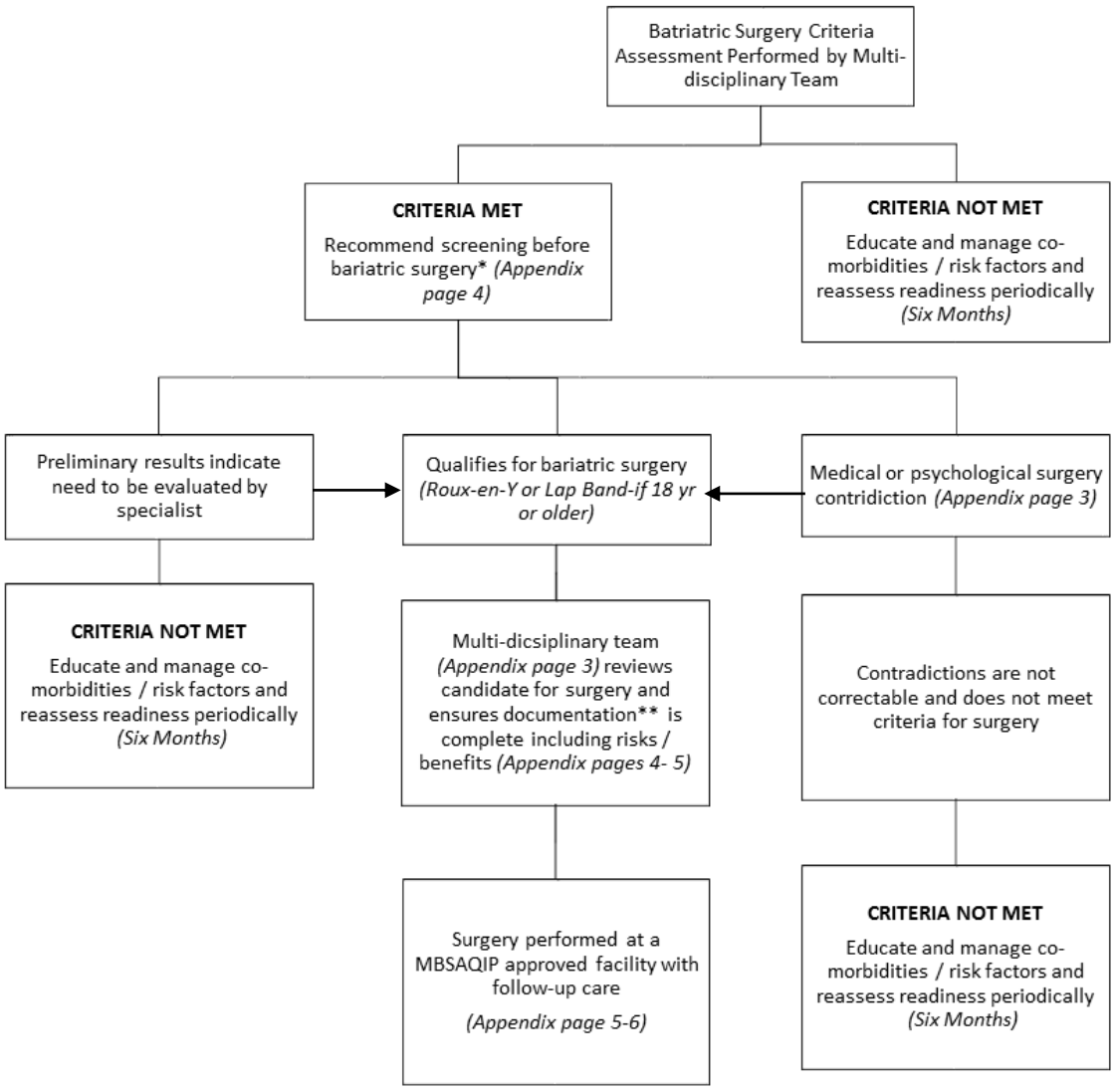



*Figure B2.* Educate and change encouragement.




*** Process may take several months**

****Ensure patient fully understands risks and benefits before signing consent form**

*Figure B3.* Bariatric surgical screening.

Table B1

*Weight Loss Goals*

**Weight Loss Goals*** (1st Six Months)

- >95th Percentile BMI for age and gender
- >85th Percentile BMI with co-morbidities
    - Pubertal = 10% body weight loss
    - Pre-pubertal : age 7 and above = 1-2 lbs per month weight loss
    - Pre-pubertal: age 7 and below = weight maintenance or modest weight loss

***Degree of weight loss should depend on the severity of the co-morbidity**

Table B2

*Co-morbidities Associated with Obesity*

**Co-morbidities Associated with Obesity**

- Sleep Apnea
- Dyslipidemia (elevated LDL –C and / or TG; low HDL-C)
- Non-Alcoholic Fatty Liver Disease (NAFLD)
- Weight bearing joint pain
- Polycystic Ovarian Disease (PCOS) / hyperandrogenism
- Acanthosis Nigricas (AN)
- Pseudotumor cerebri
- Hypertension
- Gastroesophageal Reflux Disease (GERD)
- Psychological adjustment disorders
- Type 2 diabetes (fasting blood glucose is greater than or equal to 126 mg/dL or post-prandial blood glucose is greater than or equal to 200 mg/dl)

Table B3

*Risk Factors and/or Contributing Factors Associated with Obesity*

| **Risk Factors and / or Contributing Factors Associated with Obesity** | |
|---|---|
| • Medications (See below)<br>• Hypothyroidism<br>• Small for Gestational Age (SGA) | • Low birth weight<br>• Post malignancy treatment |

Table B4

*Medications Associated with Insulin Sensitivity and/or Weight Gain*

| **Medications Associated with Insulin Sensitivity and / or Weight Gain** | | |
|---|---|---|
| **Inhaled Steroids** | **Oral Steroids** | **Others** |
| Fluticasone (Flovent) 1000mcg per day | Cyclosporine (neural / Sandimmune) | Valporic Acid (Depakote/Depakene/Depacon) |
| All others 2000mcg per day | L-asparaginase | Risperidone (Risperdal) |
| | FK506 (Tacrolimus) | Clozapine (Clozaril) |
| | Niacin | Ziprasidone (Geodon) |
| | | Tricyclic Antidepresants |
| | | Olanzapine (Zyprexa) |
| | | Quetiapine (Seroquel) |
| | | Carbamazepine (Tegretol) |

## Pharmacological Therapy for Obesity

These medications should be prescribed by an endocrinologist at an adolescent obesity clinic-effectiveness of medications decrease after 6 months of use.

Orlistat decreases the absorption of fatty acids by 30 percent in those who ingest a 30 percent fat diet. Side effects of this medication are abdominal cramping, flatus, and oily bowel movements. However, with continued use, the side effects tend to decrease. This medication may interfere with fat-soluble vitamins, so a daily supplement needs to be taken. In a study done of 17 adolescents, the average weight loss when using this medication was approximately 5.4 percent with a decrease in BMI and waist circumference. This medication may be used in individuals 12 years or older.

Metformin is an oral antihyperglycemic agent. In the treatment for pediatric obesity, it is safe and has been effective in those using it for minimal weight loss after 6-12 months of use; however, it has multiple cardiac and metabolic benefits. There is no correlation of weight loss and dose prescribed. Best results have been obtained by prescribing 1000 mg daily.

Phentermine is a stimulant and appetite suppressant. This medication has been approved by the FDA for use in adolescents 16 years and older. Adolescents taking this medication should use it for no more than 12 weeks.

Table B5

*Multidisciplinary Team Members*

| **Multidisciplinary Team Members** | |
|---|---|
| • Medical Director<br>• Surgeon<br>• Registered Dietician<br>• Mental Health Specialist | • Coordinator<br>• Exercise Specialist<br>• Social Worker |

Table B6

*Bariatric Surgery Adolescent Patient Criteria*

**Bariatric Surgery Adolescent Patient Criteria**

BMI greater than or equal to 35 with one or more serious obesity related co-morbidity, or BMI greater than or equal to 40 with less serious complications. Participated in six consecutive months of medically supervised weight loss attempts. . If the BMI is greater than 55 kg/m^2, then further weight reduction should occur prior to surgical intervention in order for the adolescent to achieve a non-obese stature.

- Attained physical maturity (completing 95% of predicted adult stature based on bone age or reaching Tanner Stage IV)
- Demonstrates commitment to comprehensive medical and psychological evaluations before and after surgery
- Avoid pregnancy for at least 12 to 18 months post operatively
- Adhere to nutritional guidelines post operatively
- Provide informed consent prior to surgery
- Demonstrates mature decision making and understand the risks/benefits of surgery
- Receive family support available pre and post operatively

Table B7

*Bariatric Surgery Contraindications and/or Relative Contraindications*

**Bariatric Surgery Contraindications and/or Relative Contraindications**

- Cushing Syndrome
- Prader-Willi Syndrome
- Medically correctible cause of obesity
- Substance abuse problem within past year
- Medical, psychiatric, psychosocial, or cognitive condition preventing patient from abiding to post-operative dietary and medication regimens or impediment in their decision making ability
- Current or planned pregnancy within 18 months of procedure
- Inability of the patient or part to understand risks of surgical treatment and the need for lifelong postoperative medical and nutritional management

Table B8

*Recommended Bariatric Surgery Screening*

**Recommended Bariatric Surgery Screening**

- Comprehensive history and physical exam
- Waist circumference, height, weight, BMI
- Systolic and diastolic blood pressure
- Fasting lipid profile
- Oral glucose tolerance test (elevated fasting blood sugar)
- Liver function tests
- Echocardiogram
- Electrocardiogram (including exercise stress test if present prolonged QT)
- Chest radiograph
- Urea breath test or endoscopy (excluding Helicobacter pylori infection if patient exhibits unexplained anemia or abdominal pain/ulcers history)
- Bone age (If there is a need to assess patient maturity as surgery causes rapid weight loss. Concern exists that this procedure may cause inhibition of structural growth if adolescent is not near anticipated adult height. Radiograph of hand and wrist can be completed to accurately determine achieved adult stature percentage)
- Chemistry profile
- Complete blood count
- Hemoglobin A1C
- Psychological adjustment disorders
- Thyroid stimulating hormone
- Urinalysis
- Pregnancy tests (female or beta HCG)
- Polysomnography (sleep apnea symptoms)
- Abdominal ultrasound (chronically elevated liver enzymes or gallstone concern)
- Specialist evaluation (if preliminary results indicate need)
- Primary care provider documentation of continued weight loss attempts through lifestyle changes and medical use (most insurance companies require documentation show at least six months of attempted weight loss regardless of weight loss or gain. Some insurance companies will not cover surgical procedure if patient is less than 18 years old).

**Key Information**

Patients must be able to provide informed consent. Ensure patient and family fully understand risks and benefits associated with bariatric surgery; especially younger patient correlated risks. Decisions must be voluntary, well informed, and rational.

Most adolescent obesity continues into adulthood with increasing risk factors with age, BMI, and parental obesity. Bariatric surgery is more effective than lifestyle changes, behavioral modifications, and family therapy.

Certain diet behaviors and untreated obesity can lead to mortality. These are usually long term risks; however, should be considered when weighing risks and benefits of bariatric surgery.

Table B9

*Short-Term Risks of Gastric Bypass Surgery*

| Short-Term Risks of Gastric Bypass Surgery | |
|---|---|
| **Roux-en-Y†** | **Lap Band (Age 18 and Older)** |
| • Infection at point of incision<br>• Pulmonary embolism<br>• Stomach leak into other parts of body<br>• Loosened staples<br>• Narrowing link between stomach and intestines<br>• Small bowel obstruction<br>• Dumping Syndrome (group of symptoms includes nausea, bloating, vomiting, cramps, diarrhea occurs when food moves through body to quickly) | • Bleeding<br>• Infection<br>• Leak at incision site<br>• Band slippage with continuous vomiting if behavioral changes do not occur in moderate food intake<br>• Band erosion into stomach<br>• Stoma blockage<br>• Esophageal or gastric pouch dilatation<br>• Severe nausea 1st month after surgery |

**† Other risks include nausea, vomiting, sweating, faintness, general weakness, diarrhea, hiccups, bloating, hernia, ulcers, gallstones, nutritional deficiencies (iron, calcium, and other vitamins and minerals which can lead to anemia or brittle bone disease osteoporosis if left untreated, and death (always a possibility with surgery)**

## Follow Up Care

Postoperatively, patients should be seen by the surgeon, psychologist, and dietician two weeks after surgery, then 1, 3, 6, 9, and 12 months post-operatively. After the first year, annual follow-up is recommended. Laboratory checks are done at three months, twelve months, and yearly. Afterwards, annual follow-up is recommended for monitoring of anthropometric measurements, nutritional status, residual comorbidities, and general health. CBC with differential, serum iron and ferritin, folate, B12, serum homocysteine, serum thiamine (B1), albumin, total protein, alkaline phosphatase, calcium, 25-hydroxy vitamin D, and parathyroid should be assessed annually. There may be a potential for adolescents to have post-prandial hypoglycemia, so questions need to be asked in association with this at each follow-up visit. Follow-up for AGB patients is more frequent due to the need for band adjustments. Band adjustments may be done every 4-6 weeks for up to two years.

DEXA scans should be conducted at three, six, nine, and twelve months to assess the amount of lean muscle to fat mass lost and ensure the prescribed 60 to 70 grams of protein per day intake is adequate for maintenance of lean muscle during the rapid weight loss period. After 12 months, DEXA scan is optional and can be done annually if patient does not have good nutritional status.

Advancement of regular food is slow over first six months after surgery. Patients should consume 8-12 ounces of sugar free fluids per day. Avoidance of liquids during meals is recommended to prevent nausea and vomiting. Eat protein first at each meal. Protein ratio should be 1 gm/kg of ideal body weight. Patients should have three to four meals per day with minimal snacks. Avoid high fat and carbohydrate diet. 30 to 60 minutes of daily exercise is also recommended.

Ursodiol and ranitidine are prescribed for the first six months. Chewable multivitamin (to include folate and iron or prenatal vitamin for females. Prescribed once or twice daily), calcium (1200-1500 mg daily, with 800 to 1000 IU Vitamin D), and vitamin B12 (1000 micrograms of oral vitamin B12 supplements or 1000 microgram injection every month; patients with stable vitamin B12 may receive one 3000 microgram injection at their annual visit) supplements are needed for the remainder of life of the patient having had Roux-en-Y. Patients who have the Lap Band only need a multi-vitamin if a well-balanced diet is consumed. If iron deficiency presents, supplemental iron should be prescribed.

Monthly adolescent support groups meetings should be attended.

## APPENDIX C. EXECUTIVE SUMMARY

### Project Summary

The proposed project is the development of an adolescent weight management algorithm to include bariatric surgery for select adolescents who meet the criteria. The algorithm was developed in congruence with regional healthcare organization mission and goals. The project is necessary as childhood obesity has become a national epidemic and children are being diagnosed with co-morbidities once only associated with adults. Despite current interventions children continue to exude poor diet and physical activity outcomes.

### Background

Children and adolescents are facing many barriers in the prevention of obesity, which include obstacles at home, school, and their environment. Over the years, intervention programs have focused on the school setting, but children continue to exude poor diet and physical activity outcomes. In the article, School-Based Obesity Interventions: A Literature Review, the authors state "…there is a lack of understanding of the sustainability and efficacy of different types of interventions across the board" (Shaya et al., 2008, p. 190). Several articles were reviewed to determine the existing barriers preventing childhood obesity and why current interventions are not effective morbidly obese children. Obesity in children cannot be prevented or treated if changes aren't made at home, in school, and throughout the community. Obesity is not a product of one of these factors, it is a consequence of all them combined. The prevalence of childhood obesity continues to escalate and is due to multiple factors.

Obesity by itself isn't the concern; it is the associated co-morbid conditions that concerning. Children are diagnosed with medical problems once only associated with adults, putting them at increased risk for lifelong health problems and even premature death. Despite

current efforts to prevent obesity and reverse damage that has been done, more children continue to become severely obese.

Evidence from research and studies indicate bariatric surgery for certain adolescents may be necessary since weight that is lost leads to a reduction or elimination of life threatening co-morbid conditions. Improvements adolescents receive from bariatric surgery may outweigh the risks of the procedure due to the positive impact it has on their body at a young age. If the procedure isn't done until the child reaches adulthood, the medical problems they have occurred may be irreversible.

Due to current obesity trends, an increasing number of adolescents may be in need of bariatric surgery. However, many bariatric surgery programs do not have a protocol for adolescent bariatric surgery as it has been unwarranted. Bariatric centers may need a guide in program development. Additionally, many primary care providers are unsure of how to treat obesity in children and adolescents. The developed algorithm will provide them with instructions though the process starting with the initial assessment of the individual and to the last phase, evaluation for bariatric surgery and follow-up care after surgery.

## Process

The project focuses on designing a step-by-step algorithm for adolescent weight loss for regional healthcare facility. Currently, there is no protocol in place for bariatric surgery in adolescents at this facility and an algorithm is a valuable tool in the development of a program. A literature review was conducted by searching databases EBSCO, CINAHL, Bing, Google Scholar and Academic Search Premier by searching for keywords such as "childhood obesity", "school-age children and obesity", "childhood obesity risk factors", and "childhood obesity and

genetics". The time it took to for data collection to the creation of the algorithm was several months.

Meeting with the Eating Disorders Unit and bariatric surgery staff was an integral part of the planning process. The information included in the algorithm is based on current evidence, expert opinion, and the recommended process for weight loss as instructed by national pediatric specialists.

## Findings and Conclusion

The implementation of an adolescent bariatric surgery program at regional healthcare facility should be continued. As the population of obese and morbidly obese adolescents rise, so will the need for bariatric surgery. The implementation process poses many challenges as bariatric surgery in adolescents has not been evaluated over a long period of time and outcomes can be projected, but are not certain. The requirements of developing an adolescent bariatric surgery program are more conservative than with the adult program and the screening needs are more extensive. The developed algorithm should be used as a starting point for program development, but the ultimate decision on which adolescents have surgery is based on expert medical and surgical personnel judgment.

## Recommendations for Further Action

Development of a tool to guide the multi-disciplinary team in the psychological evaluation of the adolescent, as well as determining if they are mature and competent in consenting for surgery, is an important issue needing to be addressed. The regional healthcare organization needs a facility equipped with the necessary equipment and staff to properly care for morbidly obese adolescent's pre and post-operatively. The majority of the area served by this organization is rural and necessary appointments needed throughout the process may potentially

be too expensive for a family to afford, which poses a challenge in achieving a successful program. Additionally, the surgery may not be covered by insurance, which means a great majority of the cost will be out of pocket and not affordable for most families.

The committee developing the program at the regional healthcare facility had intended to make an on-site visit to Cleveland Clinic to assess how their program was conducted; however, due to unforeseen problems, had to change direction and were planning a visit to Texas Children's Hospital. An on-site visit would be recommended as more detailed questions on program implementation can be answered by experts who have initiated a successful program.

Recommendations have been made for institutions engaging in adolescent bariatric to enroll its participants in a long-term outcome study. The National Institute of Health has developed an on-going investigation termed Teen-Longitudinal Assessment of Bariatric Surgery (LABS). This study tracks information from adolescents who have had bariatric surgery and information gained will be used to guide the future of bariatric surgery in adolescents.

The algorithm has been evaluated by William Gourash, a certified nurse practitioner at the University of Pittsburgh. He has worked for 30 years in general surgery, but the last fifteen years has focused on minimally invasive bariatric surgery. His place of employment is a member of the LABS study and Mr. Gourash acts as coordinator. He also manages ten adolescents who have undergone bariatric surgery and has been involved in their pre, peri, and postoperative care. Mr. Gourash was asked to evaluate the developed algorithm due to his expertise in the field. All recommendations made by Mr. Gourash were included in the final algorithm.

The developed algorithm for adolescent weight loss management has been proposed to be used in a primary care setting. Many primary care providers manage and treat obesity in

adolescents and having a step by step algorithm to include screening for bariatric surgery will help guide them in the process. Follow-up information contained in the algorithm is useful in determining which tests need to be ordered and at what time interval. Currently, the algorithm is only available as a word or pdf document, but may be more beneficial if it were a smart phrase contained within an electronic medical record.

Three primary care providers were asked to review the algorithm and report its usefulness in a primary care setting. Two out of three providers returned completed the requested feedback. The questions that were asked are as follows:

1. Would you find the algorithm is useful in a primary care setting?
2. Would you recommend any changes?

Both providers cited that the algorithm would be useful in a primary care setting and neither recommended any changes. More data needs to be collected to validate the reported information.