

# Eating Disorders

Ellen S. Rome, MD, MPH,\* Sarah E. Strandjord, MD<sup>†</sup>

\*Department of General Pediatrics, Cleveland Clinic Children's Hospital, Cleveland, OH.

<sup>†</sup>Cleveland Clinic Lerner College of Medicine, Cleveland, OH.

## Educational Gap

For patients with moderate malnutrition, higher-calorie diets during refeeding may provide benefits, such as less initial weight loss, faster weight gain, and shorter hospitalization, without increasing the risk of refeeding syndrome. (1)(2)(3)

## Objectives After completing the article, the reader should be able to:

1. Understand the differences between *Diagnostic and Statistical Manual of Mental Disorders, 5th Edition* (DSM-5) and prior diagnostic criteria for eating disorders.
2. Recognize clinical presentations characteristic of anorexia nervosa, bulimia nervosa, and binge-eating disorder.
3. Plan appropriate management for anorexia nervosa, bulimia nervosa, and binge-eating disorder.
4. Distinguish avoidant/restrictive food intake disorder from other eating disorders.

## INTRODUCTION

Eating disorders are complex illnesses with profound psychosocial and physical consequences, including high rates of mortality. Despite growing recognition of their prevalence and severity, eating disorders remain underdiagnosed and undertreated. This review provides up-to-date information on eating disorder diagnosis, including tips for early recognition and evaluation, along with an overview of potential complications and evidence-based treatments. Pediatricians, in particular, play an important role in providing patients and their families with the care, resources, and guidance they need to reach and maintain recovery.

## EATING DISORDERS IN THE CONTEXT OF DSM-5

Eating disorder presentation and severity varies widely among individuals. In developing the fifth edition of the *Diagnostic and Statistical Manual of Mental Disorders* (DSM-5), (4) one of the primary goals of the Eating Disorder Work Group was to better describe the spectrum of patient behaviors. Previous editions of DSM only specified 2 eating disorders, anorexia nervosa and bulimia nervosa,

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with more than 50% of patients grouped into the category of Eating Disorders Not Otherwise Specified (EDNOS). The DSM-5 Feeding and Eating Disorders chapter includes 6 entities: anorexia nervosa, bulimia nervosa, binge-eating disorder, avoidant/restrictive food intake disorder (ARFID), rumination disorder, and pica. In addition, DSM-5 replaces EDNOS with the categories: 1) Other Specified Feeding or Eating Disorder, which specifies subcategories for patients who do not meet full criteria for other eating disorders; and 2) Unspecified Feeding or Eating Disorders, which encompasses any other concerning presentation suggestive of an eating disorder. This review focuses on anorexia nervosa, bulimia nervosa, and binge-eating disorder, along with a brief overview of ARFID. Please refer to the recent *Pediatrics in Review* article entitled “Managing Feeding Problems and Feeding Disorders” for additional information on ARFID, pica, and rumination disorder.

The case studies illustrate prototypical cases in our clinical practice. We have included these cases as educational examples. However, pediatric patients often do not present typically, and their diagnoses may evolve from 1 DSM category to another over time. Thus, their treatment may be more nuanced than what can be represented in this review. This set of challenges highlights the need for a trained therapy team partnering with the pediatrician to provide optimal care.

## ANOREXIA NERVOSA AND ATYPICAL ANOREXIA NERVOSA

### Case

A 14-year-old girl is admitted for severe bradycardia, with a resting heart rate of 39 beats per minute and QTc of 476 msec (normal QTc  $\leq$ 450 msec). Her weight has decreased from 61.2 kg to 50 kg in the last 6 months after adopting a vegan diet and increasing her running regimen. She has recently experienced worsening constipation and irregular menses. Her growth trajectory has been at the 25th percentile for height and 60th percentile for weight since 5 years of age, but in the past 6 months her height has stayed at the same percentile but weight has decreased to the 28th percentile. At her annual health supervision visit last year, her pediatrician had counseled her on the need for weight loss and a healthy lifestyle.

On physical examination, her body mass index (BMI) is 19.4 (33% of expected). Other findings on physical examination are normal, as are results of laboratory tests, with the exception of a serum magnesium measurement of 1.5 mEq/L (0.75 mmol/L) (normal, 1.7-2.6 mEq/L [0.85-1.3 mmol/L]).

On her first hospital day, the girl initially refuses her meal, expressing concerns over weight gain. She is offered

the options of 2 high-caloric nutritional supplements orally or by nasogastric tube. After one look at the NG tube, she chooses the oral supplements and finishes them within the specified 30-minute time period as per the hospital’s care path. She consumes all subsequent meals in their entirety. For the rest of her hospital stay, she experiences steady weight gain of approximately 0.2 kg per day, with QTc correcting to 434 msec on hospital day 5 and heart rate maintained above 50 beats per minute when awake and above 40 beats per minute when asleep by hospital day 5. She remains mildly orthostatic by pulse (64 beats per minute supine, 90 beats per minute standing). She is discharged that day to an outpatient family-based treatment (FBT) program.

### DSM-5 Characteristics

Anorexia nervosa is characterized by severe caloric restriction due to a fear of weight gain and a disordered body image, resulting in low body weight. DSM-5 retains these core characteristics but expands the diagnostic criteria to accommodate a wider range of individuals (Table 1). Unlike DSM-IV criteria, DSM-5 does not include a requirement for amenorrhea, increasing the applicability of the diagnosis in males, premenarchal females, and postmenopausal females. Other changes include alterations in wording, particularly the replacement of a specific weight criterion (<85% expected body weight) with a broader statement that allows clinicians to assess weight based on individual growth trajectory as well as numerical guidelines. In addition, the phrase “refusal to maintain weight” was removed and an alternative behavioral criterion (“persistent behavior that interferes with weight gain”) was added to avoid making assumptions about the patient’s intentions.

Anorexia nervosa most commonly occurs in adolescent and young adult females, although the disorder is also seen in males and other age groups. The prevalence of DSM-5 anorexia nervosa is approximately 1% among female adolescents, with no current estimates for males. Previous estimates using DSM-IV criteria suggested the male-to-female ratio as between 1:3 and 1:12, although additional studies are needed to determine how DSM-5 affects this ratio.

## CLINICAL APPROACH TO SUSPECTED EATING DISORDERS

Regardless of a patient’s physical appearance or weight, annual visits as well as any visit with a parental concern for weight loss or gain should include questions about diet and body image. When a clinician suspects an eating disorder, this discussion should be more in-depth (Table 2), including questions regarding specific disordered thoughts and behaviors as well as other aspects of the history, such as menstrual,

**TABLE 1. DSM-5 Diagnostic Criteria for Anorexia Nervosa (4)**

A. Restriction of energy intake relative to requirements, leading to a significantly low body weight in the context of age, sex, developmental trajectory, and physical health. <i>Significantly low weight</i> is defined as a weight that is less than minimally normal or, for children and adolescents, less than that minimally expected (e.g., falling off a previously followed growth curve).
B. Intense fear of gaining weight or of becoming fat or persistent behavior that interferes with weight gain, even though at a significantly low weight.
C. Disturbance in the way in which one's body weight or shape is experienced, undue influence of body weight or shape on self-evaluation, or persistent lack of recognition of the seriousness of the current low body weight.
Types:
Restricting type: During the last 3 months, the individual has not engaged in recurrent episodes of binge eating or purging behavior (i.e., self-induced vomiting or misuse of laxatives, diuretics, or enemas). This subtype describes presentations in which weight loss is accomplished primarily through dieting, fasting, and/or excessive exercise.
Binge-eating/purging type: During the last 3 months, the individual has engaged in recurrent episodes of binge eating or purging behavior (i.e., self-induced vomiting or the misuse of laxatives, diuretics, or enemas).

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psychiatric, and family history, that may provide further insight into patient risk factors. Of note, patients with eating disorders, particularly anorexia nervosa, may have anosognosia (a lack of self-awareness about their disordered behaviors) as well as alexithymia (a lack of ability to describe their emotions). Input from parents and other family members is, therefore, essential to clarify changes in patient behavior and emotional state. Several screening questionnaires are also widely used, including the SCOFF questionnaire, the Eating Disorders Examination-Questionnaire (EDE-Q), and the Female Athlete Screening Tool (FAST).

Some behaviors addressed in the interview may not have occurred to a child or adolescent, such as self-induced vomiting. When asking questions about these behaviors, motivational interviewing skills may help to avoid the development of new behaviors. For example, when asking about vomiting, the clinician can follow the question with an educational pearl such as, “Individuals who vomit intentionally may not realize that this behavior can actually result in long-term weight gain because your body thinks it has to ‘store up nuts for the winter’ to survive future episodes of vomiting.”

Clinical evaluations of adolescents should always include measurements of both weight and height, including assessments in the context of the growth curve to identify changes in growth trajectory. In some cases, an adolescent may withhold information during the history, and changes in weight or growth may provide the primary clue to a developing or established problem. Other physical findings suggestive of an eating disorder are summarized in Table 3, although many patients have no overt physical findings. Binge-eating disorder, in particular, rarely presents with physical findings other than possible weight gain.

Most laboratory tests yield normal results in patients with eating disorders, but they may provide insight into the severity of illness, current medical complications, or other possible ideologies. Conversely, normal laboratory values may falsely reassure families or clinicians; imminent decompensation (eg, cardiac ventricular tachydysrhythmias resulting in sudden cardiac death) can occur despite recent normal laboratory results. Initial laboratory evaluation should include a complete metabolic panel that includes serum electrolytes, magnesium, and phosphorus; liver function tests; blood urine nitrogen; creatinine; complete blood cell count; urinalysis; and thyrotropin assessment. For patients with amenorrhea, additional tests should include serum luteinizing hormone (LH), follicle-stimulating hormone (FSH), and prolactin and, if amenorrheic for more than 6 months, evaluation of bone mineral density. In patients with obesity, a fasting lipid panel, insulin measurement, and fasting glucose may help to detect chronic comorbidities.

Electrocardiography should be obtained when a patient presents with bradycardia (heart rate <50 beats per minute), abnormal rhythm, palpitations, and chest pain or when the clinician detects a high risk of electrolyte imbalance. When evaluating bradycardia, families or clinicians may confuse an “athlete’s heart” with an undernourished heart. On electrocardiography, an athlete’s heart produces a healthy voltage due to the large amount of muscle that depolarizes and repolarizes with each beat. An undernourished heart, on the other hand, produces a low voltage due to heart muscle loss during starvation. This visual display may provide concrete evidence of the medical challenges created by the disordered eating for patients and families.

**TABLE 2. Example Questions to Ask Adolescents with a Possible Eating Disorder**

<b>Weight History</b>	<ul style="list-style-type: none"> <li>• What was your highest weight? How tall were you? How old were you?</li> <li>• What was your lowest weight? How tall were you? How old were you?</li> <li>• What do you think your weight should be? What feels too high? What feels too low?</li> </ul>
<b>Body Image</b>	<ul style="list-style-type: none"> <li>• How much of your day is spent thinking about food or your body?</li> <li>• Are there body areas that cause you stress? Which areas? Do you do any body checking (ie., weighing, body pinching or checking, mirror checking)?</li> </ul>
<b>Diet History</b>	<ul style="list-style-type: none"> <li>• 24-hour diet history</li> <li>• Do you count calories/fat/carbohydrates? How much do you allow? What foods do you avoid?</li> <li>• Do you ever feel guilty about eating?</li> </ul>
<b>Exercise History</b>	<ul style="list-style-type: none"> <li>• Do you exercise? What activities? How often? How intense is your workout?</li> <li>• How stressed do you feel when you are unable to exercise?</li> </ul>
<b>Binge Eating and Purging</b>	<ul style="list-style-type: none"> <li>• Do you ever binge? On what foods? How much? How often? Any triggers?</li> <li>• Do you vomit? How often? How soon after eating?</li> <li>• Do you use laxatives/diuretics/diet pills/caffeine? What types? How many? How often?</li> </ul>
<b>Reproductive Health</b>	<p>Females:</p> <ul style="list-style-type: none"> <li>• When was your first period? Are they regular?</li> <li>• When was your last period? How much did you weigh?</li> </ul> <p>Males:</p> <ul style="list-style-type: none"> <li>• How is your libido?</li> <li>• Do you get morning erections? Has that changed?</li> </ul>
<b>Psychiatric History</b>	<ul style="list-style-type: none"> <li>• How is your mood? Any anxiety, panic attacks, obsessive-compulsive disorder, depression, self-injury?</li> <li>• Have you ever wished you didn't exist? When was that and how often? Any thoughts of suicide? What methods have you imagined? Past attempts?</li> <li>• Any prior therapy?</li> </ul>
<b>Substance Use</b>	<ul style="list-style-type: none"> <li>• Have you ever used tobacco, alcohol, or drugs? Which ones? How much? How often? Any blackouts or passouts?</li> <li>• Have you ever used steroids or stimulants? Caffeine consumption? Other substances?</li> </ul>
<b>Family History</b>	<ul style="list-style-type: none"> <li>• Does anyone in your family have a history of an eating disorder, obesity, or dieting?</li> <li>• Does anyone with a history of depression, anxiety, bipolar disorder, obsessive-compulsive disorder, substance abuse, or other psychiatric illness?</li> </ul>
<b>Review of Systems</b>	<ul style="list-style-type: none"> <li>• Dizziness, syncope, weakness, fatigue?</li> <li>• Pallor, easy bruising/bleeding, cold intolerance?</li> <li>• Hair loss, lanugo, dry skin?</li> <li>• Constipation, diarrhea, early fullness, bloating, abdominal pain, heartburn?</li> <li>• Palpitations, chest pain?</li> <li>• Muscle cramps, joint pains?</li> <li>• Excessive thirst and voiding?</li> </ul>
<b>HEADS Questions</b>	<ul style="list-style-type: none"> <li>• <b>H</b>ome: Who lives at home? What happens when there is an argument in the home?</li> <li>• <b>E</b>ducation: What grade are you in school? How are your grades?</li> <li>• <b>A</b>ctivities: What activities do you participate in?</li> <li>• <b>D</b>rugs: See Substance Use</li> <li>• <b>S</b>exual activity: Are you attracted to guys, girls, or both? Have you ever had sex? If yes, with guys, girls, or both? Oral, vaginal, anal? Condoms used sometimes, all the time, not at all? Second method of contraception used (for heterosexual sex)? History of sexually transmitted illnesses? Any unwanted sexual contact ever? Physical or emotional abuse?</li> <li>• <b>S</b>uicide/Depression: See Psychiatric History</li> <li>• <b>S</b>ocial media: How much/where do you spend time online?</li> </ul>

Other studies, such as radiographic imaging or gastrointestinal endoscopy, may be performed if the clinician is uncertain about the diagnosis, and considerable evidence supports their utility. For example, if the clinician strongly suspects gallbladder disease, imaging in a patient with an eating disorder is likely only to show an abundance of stool but no pathology. Table 4 lists other conditions that can lead

to weight loss, vomiting, or binge eating that should be considered when assessing an individual with these concerns.

### Medical Complications

In the starvation state, the body adapts by slowing metabolism and decreasing energy requirements wherever possible. As undernutrition persists, the body is unable to

**TABLE 3. Potential Physical Examination Findings in Eating Disorders**

SYSTEM	PHYSICAL FINDINGS
Vital signs	Bradycardia, hypotension, orthostatic hypotension, hypothermia
Weight and growth	Body mass index, body weight percentile, growth trajectory changes
Head	Parotid gland swelling; enamel erosion, especially of lingual and occlusal surfaces; dental caries
Chest	Arrhythmia
Abdomen	Palpable stool, bloating, abdominal pain
Extremities	Edema, muscle atrophy, weakness
Skin	Dry skin, hair loss, lanugo, acrocyanosis

maintain its regular functions, and complications develop in nearly every system, with increasing risk of death. Eating disorders have the highest mortality of any mental illness. Many of the medical complications of eating disorders improve and ultimately reverse with nutritional rehabilitation. Some complications, however, such as low bone mineral density, growth retardation, and structural brain changes, may not fully normalize after prolonged disease.

Cardiovascular changes, including severe bradycardia, hypotension, and orthostatic hypotension, occur frequently in patients with restrictive eating disorders, including anorexia nervosa and atypical anorexia nervosa. Bradycardia, QTc prolongation, and electrolyte abnormalities are the most common reasons for hospitalization. Patients, particularly those who vomit, often present with fluid and electrolyte abnormalities that may cause or contribute to cardiac complications. Gastrointestinal complaints occur commonly when the body tries to compensate for insufficient nutritional intake by slowing gastric motility, leading to increased constipation, bloating, and abdominal discomfort. Complications in the endocrine system may include euthyroid sick syndrome (low total and unbound triiodothyronine values with normal thyroxine and thyrotropin values), an adaptive response to starvation. Girls may have amenorrhea with decreased FSH, LH, and estradiol concentrations, and boys may have low testosterone concentrations. Prepubertal patients may experience delayed puberty and growth retardation, and older patients with suppressed hypothalamic-pituitary-gonadal axes may fail to deposit bone, leading to osteopenia and increased risk of stress fractures. Patients with restrictive eating disorders may develop pancytopenia, with white blood cell loss first, anemia second, and platelet suppression last. Closer examination of the bone marrow can reveal an increase in

fat deposition in the hypocellular matrix despite loss of fat elsewhere in the body during prolonged starvation. In the brain, weight loss is associated with decreased brain tissue (both white and gray matter), reduced brain activity, and mood changes. Psychomotor retardation, or slowing of speech, thought, and movement, may occur with prolonged starvation. Patients may have deficits in concentration, ability to focus, and memory. Although some patients may continue to perform exceptionally well in school, others may show declining academic performance with ongoing undernutrition.

Of note, patients with atypical anorexia nervosa can have a similar risk of sudden cardiac death due to prolonged QTc syndrome, bradycardia, and other arrhythmias as those who have a more classic picture of anorexia nervosa. Precipitous weight loss in an obese patient may be underrecognized or even celebrated by friends, family, and a medical team, not realizing the medical consequences caused by abnormal eating attitudes and behaviors. Medical risks are underrecognized in patients such as the girl in the case, especially in light of her normal BMI and seemingly reasonable weight for

**TABLE 4. Differential Diagnosis for Weight Loss, Vomiting, and Binge Eating**

Weight loss
• Celiac disease
• Inflammatory bowel disease
• Malabsorption
• Hyperthyroidism
• Addison disease
• Acquired immunodeficiency syndrome
• Occult malignancies
Vomiting
• Migraine
• Pseudotumor cerebri
• Hydrocephalus
• Central nervous system malignancy
• Gastrointestinal disease
• Cyclic vomiting
Binge eating
• Obesity
• Major depressive disorder
• Borderline personality disorder
• Prader Willi syndrome
• Kleine-Levin syndrome

height. Loss of heart muscle and life-threatening arrhythmias do not require the occurrence of an exceptionally low weight.

### Refeeding and Refeeding Syndrome

The foremost treatment for restrictive eating disorders is nutritional rehabilitation or “refeeding.” Refeeding can often take place in the outpatient setting, but when a patient is medically or psychologically unstable, initial refeeding should occur in the hospital setting to prevent additional complications. Table 5 provides guidelines for hospital admission for patients with eating disorders. One of the most feared complications of refeeding is “refeeding syndrome,” a life-threatening condition characterized by widespread organ dysfunction related to failure to make adequate adenosine triphosphate (ATP). Prior to refeeding, prolonged undernutrition decreases blood glucose concentrations, resulting in catabolism of fat and protein stores and depletion of intracellular electrolytes, including phosphorus. During refeeding, rising glucose concentrations stimulate insulin secretion, which causes phosphorus to move into cells to create more ATP for metabolism. Because phosphorus concentrations are already low from prolonged undernutrition, this process can lead to insufficient amounts within 12 to 72 hours of initiating refeeding. Without adequate ATP, every system in the body is prone to failure.

Traditional approaches to refeeding assume that a “start low, advance slow” approach to caloric replenishment can prevent refeeding syndrome. Increasing evidence, however, suggests that higher-calorie diets may have benefits without increasing the risk of refeeding syndrome. In 2010, Whitelaw et al (1) demonstrated the safety of initiating refeeding with diets of 1,900 kcal or higher. Two recent studies by Garber et al (2) and Golden et al (3) also demonstrated that higher-calorie interventions (approximately 1,400 to 2,400 kcal) decreased length of hospitalization compared to lower-calorie interventions (approximately 800 to 1,300 kcal) without increasing the incidence of hypophosphatemia in adolescents with moderate malnutrition. Clinical care paths have been used to standardize care in nutritionally depleted patients with eating disorders, with feeding initiated at 1,900 to 2,400 kcal daily. (6) Despite recent advances, an optimal approach to refeeding has yet to be established, and refeeding syndrome continues to be a risk. General guidelines recommend aiming for weight gain of 1.0 to 1.5 kg per week in inpatients (0.2 to 0.5 kg per week in outpatients) and regularly monitoring for and correcting electrolyte shifts.

### Therapeutic Approach

Options for care in medically stable patients range from long-term residential care to day treatment programs to

TABLE 5. **Criteria for Hospital Admission for Patients with Eating Disorders (5)**

- Heart rate <50 beats per minute while awake
- Heart rate <45 beats per minute while asleep
- Systolic pressure <90 mm Hg
- Temperature <35.6°C (96°F)
- Prolonged QTc or other arrhythmia
- Orthostatic changes in blood pressure (>10 mm Hg)
- Orthostatic changes in pulse (>20 beats per minute)
- Syncope
- Electrolyte abnormalities
- Esophageal tears or hematemesis
- Intractable vomiting
- Suicide risk
- Weight <75% of expected body weight or body fat <10%
- Ongoing weight loss despite intensive management
- Acute weight loss and food refusal
- Failure to respond to outpatient treatment

individual, group, or family therapies. Although site of care depends on multiple factors, including the patient’s physical condition, psychiatric stability, and social circumstances, treatment outcomes are generally superior in the outpatient setting. Treatment typically requires a multidisciplinary team, including physicians, registered dietitian nutritionists, and therapists, trained in the management of eating disorders. The pediatrician, as a member of the treatment team, is responsible for monitoring patients for medical complications that may require additional interventions and for signs of physical recovery or relapse, such as interval weight gain or loss. In addition, as a potential leader of the treatment team, the pediatrician is often responsible for educating patients and their families on available therapies, connecting patients with other team members, and encouraging regular communication within the team to ensure unified care. Failure to recognize disease or relapse can lead to a prolonged course of illness. Similarly, failure to gain weight in the first month of illness for patients with restrictive eating disorders corresponds with a lower likelihood of recovery at 1 year. The pediatrician can play a key role in ensuring that patients and families find the level of care appropriate to meet their needs.

Common psychotherapies used to treat patients with anorexia nervosa include cognitive behavioral therapy (CBT), which focuses on changing negative patterns of

thinking and behavior; dialectic behavioral therapy (DBT), which combines principles of CBT with insight plus techniques for emotional regulation; and FBT, which incorporates the family into treatment. Growing evidence suggests that FBT, also known as the Maudsley approach, is the most effective treatment for adolescents with anorexia nervosa. (7) This type of therapy involves 3 phases of treatment: giving the family complete control over the patient's food choices to facilitate weight restoration (Phase I), returning control gradually back to the patient (Phase II), and addressing other issues of adolescent development (Phase III). Weight gain in the first month is predictive of success with the Maudsley approach. Useful websites for parents include [www.maudsleyparents.org](http://www.maudsleyparents.org), Families Empowered and Supporting Treatment of Eating Disorders ([www.feast-ed.org](http://www.feast-ed.org)), and the National Eating Disorders Association ([www.nationaleatingdisorders.org](http://www.nationaleatingdisorders.org)) as well as the excellent article by Kaztman et al. (8)

Data on the therapeutic benefits of pharmacotherapy for patients with anorexia nervosa are limited, particularly for adolescents. The World Federation of Societies of Biological Psychiatry conducted a systematic review of studies on the pharmacologic treatment of eating disorders between 1977 and 2010. (9) Based on 20 randomized, controlled trials primarily in adult patients with anorexia nervosa, the authors concluded that Grade B evidence (ie, limited positive evidence from controlled studies) exists for the use of olanzapine for weight gain, with less evidence for other second-generation antipsychotics. No clear evidence supports the use of antidepressants to promote weight gain in patients with anorexia nervosa, although they may help with depressive symptoms, anxiety, or obsessive-compulsive tendencies. In general, when considering pharmacologic therapy, clinicians should weigh the adverse effects against the potential benefits of the medication on both eating disorder pathology and comorbid psychiatric symptoms.

### Prognosis

The prognosis for anorexia nervosa varies, based on the type of therapy. Approximately 33% of patients achieve recovery by 5 years with traditional treatments. With FBT, however, the rate of full recovery increases to 50% by 1 year. (10) Lock et al (10) defined recovery as normal weight ( $\geq 95\%$  of expected for sex, age, and height) and mean global Eating Disorder Examination score within 1 standard deviation of published means. Good outcomes are associated with shorter durations of illness and positive parent-child relationships, whereas poor outcomes are associated with greater weight loss, purging behaviors, and psychiatric comorbidity. Anorexia nervosa has the highest rate of mortality of any mental illness.

Patients with anorexia nervosa are 5 times more likely to die prematurely and 18 times more likely to die via suicide. (11) Adolescents generally have better outcomes than adults, emphasizing the importance of early recognition and treatment to promote recovery and prevent complications, including death.

## BULIMIA NERVOSA

### Case

A 16-year-old girl is brought to her pediatrician by her parents after they discovered her forcing herself to vomit in the bathroom. She has a history of alcohol use and self-harm (cutting). Physical examination findings include a BMI of 22 (111% of expected), mild parotitis, and mild erosion of her tooth enamel. Laboratory tests document hypokalemia with a potassium value of 3.3 mEq/L (3.3 mmol/L). Following potassium supplementation and a brief hospitalization, the patient is enrolled in a day treatment program that utilizes both CBT and DBT. She is prescribed fluoxetine along with psychotherapy but continues to struggle with daily binge eating and self-induced vomiting. Her behaviors decrease in frequency but she drops out of treatment before complete abstinence. After a 3-year hiatus, she returns after being forced to leave college due to her identified purging behaviors.

### DSM-5 Characteristics

Patients with bulimia nervosa engage in recurrent episodes of binge eating and compensatory behaviors, such as self-induced vomiting or laxative abuse, to prevent weight gain. Unlike patients with anorexia nervosa, who may also engage in binge eating and purging episodes, patients with bulimia nervosa may have normal or above-normal body weights. The primary change in the diagnostic criteria for bulimia nervosa in DSM-5 is a reduction in the frequency of binge-purge episodes from an average of twice a week to an average of once a week for 3 months (Table 6). The prevalence of bulimia nervosa, approximately 3% in female adolescents using DSM-5 criteria, peaks in late adolescence and young adulthood. Bulimia nervosa is far less common in males, with an estimated 1:3 to 1:18 male-to-female ratio using DSM-IV criteria.

### Medical Complications

Most medical complications associated with bulimia nervosa are due to purging behaviors. Electrolyte abnormalities are the most common reasons for hospitalization in patients with bulimia nervosa who vomit or abuse laxatives, diuretics, or other weight loss substances. Patients who vomit may present with metabolic alkalosis, hypochloremia, and/or hypokalemia, potentially resulting in life-threatening cardiac

**TABLE 6. DSM-5 Diagnostic Criteria for Bulimia Nervosa (4)**

- A. Recurrent episodes of binge eating. An episode of binge eating is characterized by both of the following:
1. Eating, in a discrete period of time (e.g., within any 2-hour period), an amount of food that is definitely larger than what most individuals would eat in a similar period of time under similar circumstances.
  2. A sense of lack of control over eating during the episode (e.g., a feeling that one cannot stop eating or control what or how much one is eating).
- B. Recurrent inappropriate compensatory behaviors in order to prevent weight gain, such as self-induced vomiting; misuse of laxatives, diuretics, or other medications; fasting; or excessive exercise.
- C. The binge eating and inappropriate compensatory behavior both occur, on average, at least once a week for 3 months.
- D. Self-evaluation is unduly influenced by body shape and weight.
- E. The disturbance does not occur exclusively during episodes of anorexia nervosa.

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arrhythmias. Laxative abuse may similarly lead to hypokalemia as well as metabolic acidosis. Persistent vomiting can also lead to Mallory-Weiss esophageal tears that present with either hematemesis or melena. Similar to patients with anorexia nervosa, those with bulimia nervosa may have vital sign abnormalities, especially orthostasis related to volume depletion. Reasons for hospitalization are summarized in Table 5. As with anorexia nervosa, inpatient medical stabilization focuses on initiating nutritional rehabilitation, replenishing electrolytes, preventing further medical or psychiatric complications, and providing resources for subsequent care.

### Therapeutic Approach

Outpatient treatment is recommended for bulimia nervosa, except when a patient experiences complications that require hospitalization or severe symptoms that do not respond to outpatient treatment. To break a pattern of binge-purge behaviors, a day treatment program is often required first, followed by intensive outpatient therapy, individual therapy, or FBT. CBT is generally considered the most effective intervention for bulimia nervosa, although FBT and DBT in bulimia nervosa appear promising and warrant further study. In a recent randomized clinical trial comparing CBT and FBT, for example, patients who participated in FBT achieved higher rates of abstinence from binge eating and purging at the end of treatment, although no difference was identified 12 months after treatment. (12)

Pharmacotherapy has more evidence-based support in bulimia nervosa than in anorexia nervosa, although studies primarily have been conducted in adults. According to a systematic review of 36 randomized, controlled trials, (9) Grade A evidence (ie, full evidence from controlled trials) supports the use of tricyclic antidepressants, fluoxetine, or topiramate to reduce binge eating and purging in patients with bulimia

nervosa. These therapies may provide additional benefit when combined with CBT, DBT, or FBT and may help manage comorbid psychiatric symptoms in addition to eating pathology.

### Prognosis

The rate of recovery from bulimia nervosa is similar to that for anorexia nervosa, with approximately 33% to 66% of patients achieving full recovery by 5 years, depending on severity of illness and type of treatment. Mortality is less common in bulimia nervosa than in anorexia nervosa, although patients are twice as likely to die prematurely compared to the general population, (13) with high rates of suicide. Poor outcomes are associated with older age at presentation, higher binge eating and purging frequency, and psychiatric comorbidity.

## BINGE-EATING DISORDER

### Case

A 19-year-old male visits his college health center for a routine physical. His weight is 114 kg, with a BMI of 35 (154% of expected). He states that he periodically feels out of control when he eats and often eats beyond fullness. Recently, these episodes have been occurring a few times a week, leading him to feel guilty and avoid eating around his friends. He has a history of obesity as a child and his mother frequently engages in dieting. Other than obesity, physical examination findings are unremarkable and laboratory testing suggests insulin resistance. The patient is referred for DBT and a weight loss program. His binge eating reduces substantially after 1 year of therapy and his weight declines by 4.5 kg, although he continues to be overweight.

### DSM-5 Characteristics

In binge-eating disorder, patients engage in recurrent episodes of binge eating, similar to bulimia nervosa, but do not

engage in compensatory behaviors. Binge-eating disorder was previously listed in the appendix of DSM-IV, with patients grouped under EDNOS. With DSM-5, binge-eating disorder was established as a separate diagnosis and the frequency of binge eating episodes was reduced to an average of once a week for 3 months (Table 7). Similar to bulimia nervosa and anorexia nervosa, binge-eating disorder often begins during late adolescence or early adulthood, although many patients do not present for treatment until later in life. The prevalence of binge-eating disorder ranges from 1% to 4% among female adolescents. The gender ratio for binge-eating disorder is less skewed than for bulimia nervosa or anorexia nervosa, with an estimated male-to-female ratio of 1:2 to 1:6.

### Medical Complications

Medical complications in patients with binge-eating disorder are similar to those in patients with obesity, although patients with binge-eating disorder may have increased medical morbidity compared to patients with the same BMI. Common conditions include hypertension, dyslipidemia, type 2 diabetes, coronary artery disease, osteoarthritis, and obstructive sleep apnea. Unlike patients who have anorexia nervosa or bulimia nervosa, patients with binge-eating disorder rarely require hospitalization for acute medical stabilization. Individuals may, however, require hospitalization for acute complications of chronic comorbidities, such as gallstones and the need for cholecystectomy.

### Therapeutic Approach

Psychotherapeutic approaches for patients with binge-eating disorders include CBT and DBT. Each of these interventions, including self-help approaches, can effectively reduce binge eating but may not substantially reduce BMI. Accordingly, psychotherapy, particularly in obese patients, should be coupled with weight loss treatment to target both the psychiatric and behavioral components as well as the physical and medical consequences of the disorder. Pharmacotherapy may also provide benefits in binge-eating disorder. A systematic review of 26 randomized, controlled trials concluded that Grade A evidence supports the use of imipramine, topiramate, or selective serotonin reuptake inhibitors, particularly sertraline or citalopram, to reduce binge eating. (9) For patients older than 18 years, lisdexamfetamine (30 mg daily, orally) was recently approved by the US Food and Drug Administration for treatment of binge-eating disorder. Patients should be assessed for cardiac disease before use and monitored for inadequate intake and any other adverse effects during use.

### Prognosis

Data on long-term outcomes in binge-eating disorder are scarce. Wide ranges of recovery, from around 30% to 80% of patients, have been reported for follow-up durations between 1 and 6 years. (13) Limited data suggest that mortality, including suicide, may not be significantly higher than in the general population.

TABLE 7. **DSM-5 Diagnostic Criteria for Binge-Eating Disorder (4)**

- A.** Recurrent episodes of binge eating. An episode of binge eating is characterized by both of the following:
  - 1. Eating, in a discrete period of time (e.g., within any 2-hour period), an amount of food that is definitely larger than what most individuals would eat in a similar period of time under similar circumstances.
  - 2. A sense of lack of control over eating during the episode (e.g., a feeling that one cannot stop eating or control what or how much one is eating).
- B.** The binge-eating episodes are associated with three (or more) of the following:
  - 1. Eating much more rapidly than normal.
  - 2. Eating until feeling uncomfortably full.
  - 3. Eating large amounts of food when not feeling physically hungry.
  - 4. Eating alone because of feeling embarrassed by how much one is eating.
  - 5. Feeling disgusted with oneself, depressed, or very guilty afterward.
- C.** Marked distress regarding binge eating is present.
- D.** The binge eating occurs, on average, at least once a week for 3 months.
- E.** The binge eating is not associated with the recurrent use of inappropriate compensatory behavior as in bulimia nervosa and does not occur exclusively during the course of bulimia nervosa or anorexia nervosa.

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## OTHER SPECIFIED FEEDING OR EATING DISORDER

Other specified feeding or eating disorder (OSFED) is a category added to DSM-5 that applies to patients whose presentations do not meet the full criteria for other eating or feeding disorders. This category, unlike EDNOS in DSM-IV, allows a clinician to subclassify a patient based on the reason that his or her presentation does not fit into other diagnoses. Such subclassification may help to identify similarities and differences between specific groups of patients, potentially leading to more effective interventions and further improvements in eating disorder classification. Table 8 provides examples of presentations that would be included in this category. If, on the other hand, a clinician does not choose to specify a diagnosis or if the presentation is insufficient to make a diagnosis, the clinician can use the category “Unspecified Feeding or Eating Disorder” (UFED). Changes made to DSM-5 effectively reduce the number of individuals in the “other category” (OSFED/UFED in DSM-5 and EDNOS in DSM-IV) by up to 50.

## AVOIDANT/RESTRICTIVE FOOD INTAKE DISORDER

### Case

While performing a school physical examination, a clinician notes that an 11-year-old boy’s weight and height, which previously followed the 25th percentile, have now dropped to the 3rd percentile and 15th percentile, respectively. He has always been a picky eater but recently refuses to eat any items that are not white. He has a set of food rules, including not having foods touch each other on the plate. He wants to gain weight and would like to grow taller. Further history confirms that he had

some challenges with the introduction of textured foods as a toddler and ate pureed foods well into his second year. Physical examination findings are normal other than a BMI of 13.4 (79% of expected). The parents are coached in FBT, starting with foods he deems safe, with a schedule of 3 meals and 3 snacks per day. A selective serotonin reuptake inhibitor is started as well as CBT with exposure-response prevention therapy. Over the next few months, various foods are reintroduced and he begins to increase in height. At 1 year after the initial diagnosis, his weight and height curves have normalized, although he continues to have some compulsive behaviors that are unrelated to food.

### Contrast to Other Eating Disorders

In DSM-5, ARFID replaces the DSM-IV diagnosis of feeding disorder of infancy or early childhood and removes the requirement of presentation before age 6 years. (4) This disorder is characterized by avoidance of food intake and may present similarly to anorexia nervosa, with significant weight loss or impaired growth. Unlike other eating disorders, however, food avoidance is not influenced by body image but rather by an aspect of the food (eg, its texture), a potential consequence of eating (eg, choking), or lack of interest (Table 9).

ARFID typically develops in childhood but may occur at any time or persist without full recognition into adulthood. Compared with other eating disorders, ARFID tends to occur at a higher frequency in males, with equal prevalence in males and females during early childhood. ARFID has also been found in patients with comorbid anxiety disorders as well as developmental disorders, such as autism spectrum disorders. The differential diagnosis for ARFID includes gastrointestinal diseases such as celiac disease,

TABLE 8. Examples of Diagnoses in the DSM-5 Other Specified Feeding or Eating Disorder Category (4)

<b>Atypical Anorexia Nervosa:</b> All of the criteria for anorexia nervosa are met, except that despite significant weight loss, the individual’s weight is within or above the normal range.
<b>Bulimia Nervosa (of low frequency and/or limited duration):</b> All of the criteria for bulimia nervosa are met, except that the binge eating and inappropriate compensatory behaviors occur, on average, less than once a week and/or for less than 3 months.
<b>Binge-Eating Disorder (of low frequency and/or limited duration):</b> All of the criteria for binge-eating disorder are met, except that binge eating occurs, on average, less than once a week and/or for less than 3 months.
<b>Purging Disorder:</b> Recurrent purging behavior to influence weight or shape (e.g., self-induced vomiting; misuse of laxatives, diuretics, or other medications) in the absence of binge eating.
<b>Night Eating Syndrome:</b> Recurrent episodes of night eating, as manifested by eating after awakening from sleep or by excessive food consumption after the evening meal. There is awareness and recall of the eating. The night eating is not better explained by external influences such as changes in the individual’s sleep-wake cycle or local social norms. The night eating causes significant distress and/or impairment in functioning. The disordered pattern of eating is not better explained by binge-eating disorder or another mental disorder, including substance use, and is not attributable to another medical disorder or to an effect of medication.

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**TABLE 9. DSM-5 Diagnostic Criteria for Avoidant/Restrictive Food Intake Disorder (4)**

- A. An eating or feeding disturbance (e.g., apparent lack of interest in eating or food; avoidance based on the sensory characteristics of food; concern about aversive consequences of eating) as manifested by persistent failure to meet appropriate nutritional and/or energy needs associated with one (or more) of the following:
1. Significant weight loss (or failure to achieve expected weight gain or faltering growth in children).
  2. Significant nutritional deficiency.
  3. Dependence on enteral feeding or oral nutritional supplements.
  4. Marked interference with psychosocial functioning.
- B. The disturbance is not better explained by lack of available food or by an associated culturally sanctioned practice.
- C. The eating disturbance does not occur exclusively during the course of anorexia nervosa or bulimia nervosa, and there is no evidence of a disturbance in the way in which one's body weight or shape is experienced.
- D. The eating disturbance is not attributable to a concurrent medical condition or not better explained by another mental disorder. When the eating disturbance occurs in the context of another condition or disorder, the severity of the eating disturbance exceeds that routinely associated with the condition or disorder and warrants additional clinical attention.

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occult malignancies, and neurological or congenital conditions associated with structural or functional abnormalities that affect feeding. Treatment varies, depending on the reasons for food avoidance and its impact on physical and social functioning. Further complicating the diagnosis of ARFID is the similarity in presentation to early-onset anorexia nervosa in patients who have not yet developed the vocabulary to discuss body image disturbance. Thus, the astute pediatrician must recognize that weight restoration remains paramount in the treatment of ARFID. If the child or adolescent fails to gain weight with appropriate treatment, the pediatrician should have a high index of suspicion for early-onset anorexia nervosa. For more information on the management of ARFID and other feeding disorders, please refer to the recent *Pediatrics in Review* article entitled “Managing Feeding Problems and Feeding Disorders.”

Underlying obsessive-compulsive disorder (OCD) can be found in patients with ARFID, as with patients with anorexia nervosa and other eating disorders. For patients with OCD, the rituals do not just involve food but cross into other realms of life, such as having crayons separated specifically by color in a certain order, counting rituals, or taking 20 hours on a homework assignment that should only take 30 minutes to get it “just right.” ARFID and other eating disorders may present with OCD behaviors, but as the brain is refed, such behaviors resolve. In the patient with underlying OCD, the eating and food behaviors may fade, but other rituals take their place over time. Similarly, anxiety disorder, depression, or other comorbid psychiatric diagnosis can be found in patients with

eating disorders. The pediatrician, in partnership with the multidisciplinary team, can help identify whether there is an underlying “iceberg” of psychiatric diagnosis, with the eating disorder serving as the tip rather than the iceberg itself.

#### **RISK FACTORS AND UNDERLYING INFLUENCES**

The etiology of eating disorders is unclear and likely multifactorial, including physiologic and sociocultural factors. Growing evidence supports a genetic contribution to eating disorder pathogenesis, particularly in anorexia nervosa and bulimia nervosa. Eating disorders can run in families, with about a 10-fold increased risk of an eating disorder in an individual with an affected first-degree relative. Twin studies demonstrate higher concordance rates among monozygotic compared to dizygotic twins. Alterations in brain chemistry may also play a role, particularly changes to the brain reward system and neurotransmitters, such as serotonin and dopamine, which can dysregulate appetite, mood, and impulse control. Whether these alterations predispose individuals to disease development or occur as a consequence of disease remains unknown.

Eating disorders have recently been recognized as “equal opportunity illnesses” found in all socioeconomic strata and in widely divergent cultures, including in developing countries. As with all mental health disorders, stressful life events, such as relationship conflicts, difficulties in school, or sexual assault, can play a role in triggering the onset of disordered eating in youth who are genetically or neurobiologically vulnerable. Eating disorders commonly occur in

patients with other psychiatric conditions, particularly anxiety, depression, bipolar disorder, or substance abuse.

## EARLY RECOGNITION IS KEY

The pediatrician, in partnership with the family, represents the front line for eating disorder detection. Warning signs, however, may be difficult to detect. Weight is not the only marker of clinically significant disease. As many as 66% of individuals with eating disorders are at normal weight and 33% are obese at the onset of disease. Both anorexia nervosa and bulimia nervosa frequently begin with dietary changes, such as adopting a vegetarian, low-fat, low-carbohydrate, or other “healthy” diet, along with changes in mealtime rituals, such as taking longer to complete meals, cutting food into small pieces, or shifting food around on the plate. Individuals who purge often make frequent trips to the bathroom, particularly during or after meals, and may adjust their schedules to accommodate both binge eating and purging. Many adolescents, including those with binge-eating disorder, begin to avoid social eating. Increases in physical activity may precede changes in diet and often become progressively obsessive throughout the course of illness. In general, suspicions from individuals close to the adolescent, such as a family member, friend, or coach, can correctly identify disordered eating and should be fully evaluated.

Several groups are at particular risk of delayed diagnosis. Younger children may present atypically, with failure to grow rather than precipitous weight loss and less focus on body image. Both anorexia nervosa and bulimia nervosa, however, have been seen in very young children. Weight loss in boys may also go undetected for a longer period of time due to the cultural perception of eating disorders as a female phenomenon. In addition, adolescents with chronic illnesses require close monitoring for abnormal eating attitudes and behaviors, particularly patients with type 1 diabetes (“diabulimia” in the layperson’s literature), corticosteroid-dependent illnesses, or those taking any other medications that affect appetite and eating habits.

In overweight adolescents, weight loss may initially draw praise rather than raise concerns, especially given the cultural focus on obesity prevention. How weight loss occurs, however, matters, and the pediatrician should assess methods of weight loss, including meal plans, exercise patterns, and body image. A child who declines from the 90th to the 50th percentile for BMI, for example, may have an illness as severe as a child who declines from the 30th to the 5th percentile, despite being in the normal range for age. Furthermore, natural differences in frame size and body composition affect individual growth patterns and, for some adolescents, following a

higher growth curve may be healthy. This understanding is important not only for identifying unhealthy weight loss, but also for determining individual treatment goals. Some clinicians may encourage all patients to aim for a BMI in the 50th percentile during recovery, but this goal may not correct eating disorder physiology or mindset in some patients. Research is currently underway to help determine optimal weight gain goals for both medical stability and emotional well-being, particularly in patients who were overweight before the onset of the eating disorder.

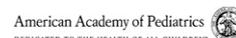
## Summary

- On the basis of some research evidence along with expert opinion, *Diagnostic and Statistical Manual of Mental Disorders, 5th Edition* diagnostic changes increase the number of patients who meet criteria for specific eating disorders.
- On the basis of primarily consensus, pediatricians should evaluate patients for signs and symptoms of eating disorders to promote recovery and prevent complications.
- On the basis of some research evidence, higher calories during initial refeeding may provide benefits without increasing the risk of refeeding syndrome in moderately malnourished adolescents with anorexia nervosa. (1)(2)(3)
- On the basis of strong research evidence, family-based treatment is helpful in the treatment of anorexia nervosa in adolescents. (7)
- On the basis of some research evidence, cognitive behavioral therapy and family-based treatment are helpful in the treatment of bulimia nervosa in adolescents. (5)
- On the basis of some research evidence, psychotherapy or pharmacotherapy coupled with a weight loss intervention is helpful in the treatment of binge-eating disorder. (9)

To view PowerPoint slides that accompany this article, visit <http://pedsinreview.aappublications.org> and click on the Supplemental tab for this article.

## Eating Disorders

Sarah E. Strandjord, BS  
Ellen S. Rome, MD, MPH



CME Quiz, References, and Suggested Readings for this article are at <http://pedsinreview.aappublications.org/content/37/8/323>.

## PIR Quiz

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1. A mother brings her 16-year-old daughter to your office with complaints that her daughter has a 6-month history of fatigue and weight loss. Until last week, she ran 4 miles daily. She has lost 25 lbs over the last 6 months. The girl admits she is scared of becoming fat and has limited herself to 1 meal per day. On review of systems, she complains of constipation for the past month and she has been amenorrheic for 3 months. Menarche was at age 13 years. She denies vomiting, which her mother confirms. Vital signs reveal heart rate of 50 beats per minute, respiratory rate of 12 breaths per minute, and blood pressure of 85/40 mm Hg. The mother raises the issue of an eating disorder. Which of the following eating disorders is the most likely diagnosis for this patient?
  - A. Anorexia nervosa.
  - B. Bulimia nervosa.
  - C. Binge-eating disorder.
  - D. Purging disorder.
  - E. Avoidant/restrictive food intake disorder.
2. The 16-year-old patient described in the previous question is admitted to the hospital and started on nutritional rehabilitation that provides 1,600 kcal per day. Which of the following complications is the patient most at risk of developing when nutritional rehabilitation is initiated?
  - A. Hyperglycemia.
  - B. Hyponatremia.
  - C. Hyperchloremia.
  - D. Hypophosphatemia.
  - E. Hypernatremia.
3. A mother brings her 15-year-old daughter to your office after witnessing her daughter force herself to vomit after eating a large meal. Upon questioning, the daughter admits to making herself vomit at least once a week for the past 2 months. Review of her growth chart demonstrates normal rate of weight gain. Vital signs are unremarkable. Physical examination reveals mild swelling of the parotid glands. The mother raises the issue of an eating disorder. Which of the following eating disorders is the most likely diagnosis for this patient?
  - A. Anorexia nervosa.
  - B. Bulimia nervosa.
  - C. Binge-eating disorder.
  - D. Purging disorder.
  - E. Avoidant/restrictive food intake disorder.
4. Outpatient management is arranged for the 15-year-old girl described in the previous question. Which of the following therapies is generally considered to be the most effective in treating binge eating and purging?
  - A. Olanzapine therapy.
  - B. Sertraline therapy.
  - C. Family behavioral therapy.
  - D. Dialectic behavioral therapy.
  - E. Cognitive behavioral therapy.

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This journal-based CME activity is available through Dec. 31, 2018, however, credit will be recorded in the year in which the learner completes the quiz.

5. A 15-year-old obese male is diagnosed as having a binge-eating disorder. In addition to starting cognitive behavioral therapy, which of the following therapies should be added to the patient's management?
- A. Olanzapine therapy.
  - B. Lisdexamfetamine therapy.
  - C. Weight loss treatment.
  - D. Family behavioral therapy.
  - E. No additional management is necessary.

## Parent Resources from the AAP at HealthyChildren.org

### Eating Disorders

- <https://www.healthychildren.org/English/health-issues/conditions/emotional-problems/Pages/Treating-Eating-Disorders.aspx>
- Spanish: <https://www.healthychildren.org/spanish/health-issues/conditions/emotional-problems/paginas/treating-eating-disorders.aspx>
- <https://www.healthychildren.org/English/health-issues/conditions/emotional-problems/Pages/Is-Your-Teen-at-Risk-for-Develop>
- Spanish: <https://www.healthychildren.org/spanish/health-issues/conditions/emotional-problems/paginas/is-your-teen-at-risk-for-developing-an-eating-disorder.aspx>
- <https://www.healthychildren.org/English/health-issues/conditions/emotional-problems/Pages/Eating-Disorders-in-Men-Boys.aspx> (English only)
- <https://www.healthychildren.org/English/health-issues/conditions/abdominal/Pages/Bowel-Function-in-Eating-Disorders.aspx> (English only)