

Adolescents with Diet-Related Chronic Health Conditions (DRCHCs) and Unique Risk for Development of Eating Pathology

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Abstract

Diet-Related Chronic Health Conditions (DRCHCs) are a subset of chronic health illnesses, which presently includes Inflammatory Bowel Disease (IBD), Type 1 Diabetes (T1D), Cystic Fibrosis (CF), and Celiac Disease (CD). Food and diet play integral roles in the management and progression of each condition. The diversity of treatments for DRCHCs encompass therapies that impact diet, weight, and body shape, such as steroids, insulin, and special and/or restrictive diets. Often with efforts to control unwanted side effects of the myriad of treatments, there is poor adherence to prescribed therapies. Given the psychosocial burden of DRCHCs, and the high degree of focus on weight and diet involved in managing each disorder, it is not surprising that those living with DRCHCs may be at risk for developing body image concerns, including poor body image and weight concerns, which may increase the risk for the development of eating pathology. In addition to summarizing current eating pathology risk factors present in DRCHCs, the proposed article builds on previous research by recommending an expansion of the category of DRCHCs to include Type II Diabetes and serious/anaphylactic food allergies, and hypothesizes DRCHC-specific eating pathology risk factors, such as hyper focus on weight, medically-related food restriction, and societal acceptance of thinness despite health issues. The article concludes with clinical recommendations for pediatric medical providers to potentially minimize the negative impact of DRCHC on pediatric patients' medical and psychosocial outcomes.

Keywords: Chronic illness; Disordered eating; Pediatrics

Introduction

It is imperative to examine factors negatively affecting those with pediatric chronic health conditions, as the incidence and prevalence of chronic health conditions among children and adolescents has been rapidly increasing [1]. Chronic health conditions negatively impact not only a child's physical health, but also their psychosocial health, emotional functioning, social functioning, and school functioning [2]. Among pediatric patients, these conditions often wax and wane over time [1], indicating that children and adolescents may often have to cope with fluctuating levels of psychosocial health, emotional, social, and school functioning.

Diet-Related Chronic Health Conditions (DRCHCs) are a subset of chronic health conditions, which includes Inflammatory Bowel Disease (IBD), Type 1 Diabetes (T1D), Cystic Fibrosis (CF), and Celiac Disease (CD). IBD is an umbrella term for Crohn's Disease and ulcerative colitis. Both are chronic, autoimmune diseases that primarily affect the Gastrointestinal (GI) system and cause harmful inflammation, which disrupts the body's ability to absorb nutrients [3]. Symptoms of IBD include severe abdominal pain, weight loss, urgency with defecation, blood in stool, and loss of appetite. Crohn's disease affects the entirety of the GI system, while ulcerative colitis is largely confined to the colon. T1D is a metabolic disorder that occurs due to the destruction of the body's beta-cells, which typically produce and release insulin, a hormone necessary to metabolize carbohydrates, fats, and proteins [4]. CF is a disease in which mucus builds up in a person's lungs and digestive tract, blocking the pancreatic ducts, which in

result, decreases the pancreatic enzymes within the intestines causing poor digestion and poor absorption of nutrients [5]. Lastly, CD is an autoimmune condition where an individual cannot properly digest gluten. If ingested, pain and inflammation within the GI system occurs [6]. Classic CD symptoms include constipation, diarrhea, abdominal bloating, and failure to thrive in young children [7]. These conditions and their respective prevalence rates are summarized in Table 1.

While an oversimplification of each disorder, one can glean from these examples the integral role that food and diet play in the management of each condition. Children and adolescents with IBD are often underweight, thus weight becomes a proxy of success (i.e., moving from being underweight to being an appropriate weight for height and age) [8]. Treatment for IBD may include enteral and parenteral feeding, medications including acetylsalicylic acid (ASAs), antibiotics, steroids, immunosuppressants, biologics, and surgical intervention including resections and colectomies. Those with CF also often have difficulty maintaining a healthy weight, thus a calorically dense, high fat diet is often recommended [9]. To manage T1D, insulin is administered and special attention is paid to diet and physical activity [10]. If insulin is administered by injection, it must follow either a fixed dose regimen that corresponds to prescribed mealtimes and amount of carbohydrates, or a regimen that can be adjusted based on glucose levels and intended mealtimes [11]. Those with CD must pay close attention to ingredients in the foods they consume, as the primary treatment for CD is to eliminate all gluten from one's diet, and consequently remove the irritant [6]. Those with DRCHCs must adhere to these prescriptions to help manage current symptomatology and to protect against exacerbation of the disorder.

DRCHC	Definition	Prevalence
Cystic Fibrosis (CF)	Mucus builds up in a person's lungs and digestive tract, which blocks the pancreatic enzymes in the intestines, causing poor digestion and absorption of nutrients [5]	CF affects about 15,000 people under the age of 18 [71]
Type 1 Diabetes (T1D)	Metabolic disorder caused by the destruction of beta-cells, which produce and release insulin to properly metabolize carbohydrates, fats, and proteins [4]	In 2009, T1D affected 1.93 per 1000 children and adolescents [72]
Inflammatory Bowel Disease (IBD)	Umbrella term for Crohn's Disease and ulcerative colitis, which are chronic, autoimmune disorders that affect the GI system and causes inflammation, disrupting the absorption of nutrients [3]	10%-15% of those with IBD are diagnosed before of the age of 18 [33]
Celiac Disease (CD)	Autoimmune condition where an individual has difficulty digesting gluten, and if the individual does, it can cause pain and inflammation in the GI system [6]	Approximately 1 in 100 children is living with CD, while many cases may remain undiagnosed [45-47]

Table 1: Descriptions of DRCHCs and their respective prevalence rates.

Long-term psychosocial issues often present alongside DRCHCs. For instance, individuals with T1D often experience mood difficulties and anxiety associated with their disorder, which may result in non-adherence [12,13]. GI symptoms have been positively correlated with distress, which has been associated with decreased health-related quality of life among those with IBD [14]. Factors that may cause further distress among children and adolescents with IBD include explaining school absences to teachers and peers, a decreased ability to participate in activities (i.e., sports), and frequent trips to the bathroom [15]. Anxiety and depression are prevalent among those with CF [16]. Those with CF also often have less social support than their healthy peers, and are often unable to receive in-person social support from other children with CF, due to the health risks that would be incurred [16].

Given the psychosocial burden of DRCHCs, and the high degree of focus on weight and diet involved in managing each disorder, it is not surprising that those living with DRCHCs may be at risk for developing body image concerns, including poor body image and weight concerns, which may increase the risk for the development of an eating disorder [17]. Rohde et al. [18] conducted a longitudinal study of healthy children and adolescents aimed at assessing predictors of the onset of an eating disorder diagnosis. Findings indicated that body dissatisfaction was a predictor at ages 13, 14, 15, and 16 [18]. Negative affectivity was predictive at ages 14 and 15, while perceived pressure to be thin, thin-ideal internalization, and dieting were predictive at age 14 [18]. Similar risk factors appear among those with DRCHCs including variations in body mass index [19], thin ideal internalization [19], body dissatisfaction [19,20], negative affectivity [12] and dieting, although each risk factor may be expressed differently depending upon the specific DRCHC. Each DRCHC may also be associated with unique risk factors. Exploration of these risk factors and the impact they may have on children and adolescents with DRCHCs is crucial, as development of weight concerns and eating disorder symptomatology may negatively affect adherence to prescribed medical regimens and have long-term health consequences. Thus, the primary aim of this review is to describe the current state of the literature and to suggest future directions. More specifically this paper aims to review eating disorder risk factors present within CF, T1D, IBD, and CD. Clinical implications and future directions are also discussed.

Eating Pathology Risk Factors

Risk factors for eating pathology are described in Table 2.

DRCHCs

Cystic fibrosis

Over 70,000 children in the world are diagnosed with CF [9]. There are approximately 1,000 new cases of CF each year [9]. While there have been few studies examining CF and eating disorders, Pearson and colleagues [21], found that 16.4% of their participants, which was comprised of children and adolescents, had been diagnosed with an eating disorder. Similarly, Byron et al. [22] found that 53% of their sample displayed disturbed eating attitudes and 16% reported disturbed eating behaviors, according to the child version of the Eating Disorders Examination. These studies point to the importance of assessing for the presence of eating disorders and disturbed eating behaviors among those with CF.

ED risk factors associated with CF

While there is limited research on eating disorders among adolescents with CF, research shows there are eating difficulties among this population [23]. Risk factors associated with EDs, such as eating difficulties, low self-esteem, life stressors, body image disturbance, and somatization tend to appear within adolescents diagnosed with CF [23,24]. Shearer and Bryon [23] found that participants endorsed symptoms of AN and BN without meeting full diagnostic criteria, with the exception of one male participant who met criteria for a diagnosis of EDNOS. These results demonstrate that eating disturbance may be prevalent among adolescents with CF [23].

Children and adolescents with CF may also develop food avoidance [24], due to pulmonary infection. Pulmonary infections often include feeling nauseous, leading an individual to avoid eating; however, the avoidance of food may continue even after recovery from infection [24].

ED Risk Factor	Description	Citations
Body Mass (e.g., BMI)	An index created by calculating weight in kilograms divided by height in meters squared. An elevated BMI is a risk factor for body dissatisfaction while a low BMI is a risk factor for an eating pathology.	[73]
Thin Ideal Internalization	"Extent to which an individual cognitively "buys into" socially defined ideal of attractiveness and tries to achieve this ideal;" the acceptance of this thin ideal is a risk factor for developing eating pathology.	[63]
Body Dissatisfaction	Negative subjective evaluation of one's weight or body shape, which is a risk factor for eating pathology.	[73]
Dieting	Instituting a diet plan with the goal of losing weight; can be a rigid set of self-imposed food rules.	[63]
Negative Affect	A factor of subjective distress which can result in negative mood states and makes one vulnerable to eating pathology.	[63]

Table 2: Risk factors for the development of eating pathology.

Willis et al. [25] demonstrated that females with CF were happy with their weights and BMI because they were slender. Willis et al. [25] interviewed males and females who have CF on different domains such as the meaning of life, death, career, and body image. While discussing body image, the females were not concerned that they were thin and the females believed they were healthier and attractive being thin [25]. This shows that the thin-ideal play a role in young females with CF because they are content with their low weights and BMIs. Whereas adolescent males with CF have higher levels of body dissatisfaction due to having less muscle tone compared to their healthy counterparts [24].

Pumariega et al. [24] conducted a study which showed there were other risk factors related to children and adolescents with CF. These risk factors include sleep disturbances, social withdrawal and depression, and psychological stress due to denial of sexuality (especially girls starting their menstruation at an older age) and strained interpersonal relationships [24]. All CF-related risk factors for eating pathology are summarized in Table 3.

DRCHC	ED Risk Factor	Relevance	Citations
CF	Body Mass (e.g., BMI)	Females with CF were happy with their BMI because they were slender	[25]
	Thin Ideal Internalization	Adolescent females are content with their low weights and slenderness, which can play into the thin ideal	[25]
	Body Dissatisfaction	Male adolescents with CF have higher body dissatisfaction than female adolescents with CF	[24]
	Dieting	Children and adolescents with CF can develop food avoidance due to a pulmonary infection where they feel sick and do not want to eat	[24]
	Negative Affect	Sleep and emotional disorders, such as withdrawal and depression can occur in children and adolescents with CF	[24]
T1D	Body Mass (e.g., BMI)	Children and adolescents with T1D have higher BMIs than their healthy counterparts	[19,27]
	Thin Ideal Internalization	There may be a drive for thinness, for those with T1D, due to their body dissatisfaction	[19]
	Body Dissatisfaction	Adolescents with T1D, who have higher BMIs, also have increased body dissatisfaction	[19,20]
	Dieting	Eating a certain times, rather than as a response to internal cues, may disrupt interoceptive awareness	[26]
	Negative Affect	Individuals with T1D often experience mood difficulties, which are associated with more difficulty managing the disorder	[12]

Table 3: Summary of DRCHC-specific eating pathology risk factors.

Type 1 Diabetes

The emphasis placed on the monitoring of diet, eating patterns, and weight, which is necessary for the management of T1D, may place already vulnerable individuals at an increased risk for the development

of disordered eating behaviors and eating disorder pathology [26]. One of the largest studies comparing the prevalence rates of eating disorder diagnoses between adolescents with T1D and non-diabetic controls indicated that those with T1D were 2.4 times more likely to receive an eating disorder diagnosis (based on the Eating Disorders Examination)

when compared to age-matched controls [27]. Additionally, subthreshold eating disorders were more prevalent among those with T1D when compared to controls [27].

ED risk factors associated with T1D

Disturbed eating behaviors (DEBs), which include binge eating and compensatory behaviors (i.e., self-induced vomiting, laxative abuse) are often found among those with T1D [12]. It is crucial to assess for DEBs in this population, as they may further impair metabolic control and contribute to the development of complications such as diabetic retinopathy [28]. DEBs among those with T1D have been found to increase throughout adolescence, with approximately 33% of 14-16-year-old girls endorsing that they have engaged in these behaviors, while approximately 50% of 17 to 19 year olds reported engaging in DEBs [29,30]. DEBs may be less prevalent, yet still significant, among adolescent boys; approximately 7% of 14-16 year olds and 15% of 17-19 year olds with T1D reported engaging in DEBs [29,30].

Individuals with T1D who engage in DEBs may also use insulin omission as a form of weight control. Examination of this unique form of DEB, indicated that between 10.3-26.2% of girls and 1.4-4.5% of boys with diabetes have skipped doses of insulin to control weight, while 7.4-36.8% of girls and 1.4-9.4% of boys have administered lower doses of insulin than they were prescribed to control weight [29,30]. Jones and colleagues [27] found insulin omission to be the second most commonly utilized form of weight control among those with T1D, indicating that this behavior is common among those with T1D who are attempting to control weight. Thus, insulin administration may act as a unique risk factor. Individuals with T1D are also often prescribed eating patterns. It is thought that eating at certain times, rather than as a response to internal cues, may disrupt interoceptive awareness, which may place susceptible individuals at greater risk for eating pathology [26].

There are several additional factors often experienced by children and adolescents with T1D that may place them at risk for developing DEBs or an eating disorder. While findings have been mixed, some studies have demonstrated that children and adolescents with T1D have higher BMIs than their healthy counterparts [19,26]. Among adolescents with T1D, higher BMIs are often associated with increased body dissatisfaction [19,20]. Further, body dissatisfaction has been found to predict drive for thinness in this population [19]. Additional risk factors for the development of DEBs among those with T1D include low self-esteem and high disturbed maternal eating attitudes [31]. Taken together, children and adolescents with T1D, especially those with higher BMIs, may be at risk of developing an eating disorder. Additionally, certain aspects of treatment for T1D may increase risk for the development of eating pathology. All T1D-related risk factors for eating pathology are summarized in Table 3.

Inflammatory Bowel Disease

IBD is most commonly diagnosed between ages 13 and 25 years of age, although recent research has discovered an ever-increasing cohort of younger children being diagnosed with the disease and that pediatric-onset IBD tends to involve more extensive disease than their adult counterparts [32-35]. Adults with IBD have been found to have high body image dissatisfaction [36]. Adults with IBD were at greater risk for body image dissatisfaction if they were female, had overall greater disease activity, reported a higher symptom burden, had an

extended steroid treatment, and had extraintestinal manifestations [36].

Given the increasingly pediatric onset, the proclivity for weight loss and digestive malabsorption, the side effects of treatments, and highly comorbid psychosocial issues, it is hypothesized that children and adolescents with IBD are particularly vulnerable to body image concerns and eating pathology.

ED risk factors associated with IBD

There are multiple treatment-related risk factors that may increase an individual's vulnerability to poor body image and eating pathology, notably including Prednisone side effects, impact of surgery, appliance-related impact (e.g., NG tube), and external appraisal of weight loss as positive [37].

Prednisone, a largely effective and fast-acting steroid, is readily associated with various side effects, including idiosyncratic facial weight gain ("chipmunk cheeks"), overall weight gain, dramatic increase in appetite, increase in impulsivity, difficulty sleeping, and mood swings [37,38]. Although the side effects of Prednisone are temporary individuals experiencing them tend to report high distress, with females living with IBD reporting greater distress than males [37]. Further, current steroid use was found to increase body dissatisfaction amongst adults living with IBD [39].

While surgery is often delayed in pediatric IBD patients to avoid aggressive medical intervention, researchers have estimated rates of surgery in this population ranging between 20% to 34% at 3 and 5 years post-diagnosis, respectively [40]. Surgical interventions for IBD typically include resecting diseased portions of the GI tract, partial colectomy and ostomy (e.g., a temporary "resting" ostomy), or total colectomy and ostomy (e.g., a permanent ostomy) [40]. Research suggests that such surgeries have an immediate and enduring impact on body image and quality of life [37,41].

With the potential dramatic decrease in weight, resulting from uncontrollable, active disease that negates absorbing nutrition, individuals with IBD can experience external appraisal of disease-related weight loss as positive [37]. In this manner, an interaction between western societal thin ideal standards and disease-related weight loss manifests as a harmful, albeit misguided, compliment.

Adolescents living with IBD are known to have a higher incidence of psychosocial concerns, including internalizing and depressive disorders, low quality of life, and decreased social functioning [42-44]. This psychological vulnerability is thought to exacerbate one's risk of developing poor body image and, in turn, eating pathology given the risk factors outlined above.

Body image is considered to be a primary concern of individuals living with IBD [37]. As one review article articulates, the intersection of many adolescents being diagnosed with IBD and the onset of body image concerns is especially challenging [37]. Stated differently, the interaction between experiencing emerging adolescence and an individual living with IBD and enduring treatment appear to create a specific vulnerability to body image concerns and potentially disturbed eating behaviors. All IBD-related risk factors for eating pathology are summarized in Table 3.

Celiac Disease

Research suggests that CD is a relatively common diagnosis, with estimates approximating nearly 1 in 100 children living with CD, although many cases remain undiagnosed in part due to the heterogeneity of symptom presentation [45-47]. As previously noted, the primary treatment for the disorder is life-long adherence to a gluten-free diet. Compliance with such a stringent diet has been shown to be problematic and challenging to many children and adolescents with CD [7,47,48], and may put children and adolescents at an increased risk for the development of eating pathology.

ED risk factors associated with CD

Researchers have suggested that the cornerstone gluten-free diet has historically been conflated as a simple solution, and the burden of illness and psychosocial concerns remain largely unexplored [6,45]. Obesity has been demonstrated to be increasingly common in children with CD, and is evidently tied to additional obesity-related medical and psychological risk factors [49].

Given the difficulty in receiving an accurate CD diagnosis, many individuals remain undiagnosed [46]. Even within this subset of undiagnosed individuals with pathological CD, research has found altered eating behaviors [50]. In all, eating pathology has been demonstrated to be more common in young women living with CD compared to young men with CD and healthy controls [50].

In one study evaluating the psychiatric comorbidities of CD, researchers found that 22% of women living with CD reported disordered eating [6]. Further, 27% of women living with CD were found to meet clinical criteria for depression [6].

Adolescents with CD have an increased vulnerability to developing eating pathology, particularly bulimia nervosa [51]. Additionally, the subset of adolescents with CD exhibiting eating pathology were shown to have higher rates of non-adherence to the gluten-free diet [51]. It is suggested that chronic dietary restraint, preoccupation with food, growth and pubertal delay, weight gain during gluten-free diet adherence, and the generalized burden of chronic illness are risk factors for the development of eating pathology [51].

The ongoing and incessant focus on identifying and consuming 'safe' foods are believed to serve as a risk factor [51]. Furthermore, while the availability of gluten-free foods has steadily increased, gluten-free foods tend to be costly and of inferior palatability to regular foods; the limited access to gluten-free foods also evokes social pressures and isolation when an individual with CD engages in eating at a restaurant with peers [51]. Particularly for children from low socioeconomic backgrounds, obtaining expensive gluten-free food may pose as a risk for poor gluten-free diet adherence, increase in symptoms, and decreased psychological well-being [52,53]. Ongoing consultation and support from a multidisciplinary medical team is considered to be an ideal mechanism to improve gluten-free diet compliance [52]. All CD-related risk factors for eating pathology are summarized in Table 3.

Proposed Expansion of DRCHCs Category

The authors suggest that the expansion of the DRCHC category to include Type II Diabetes and serious/anaphylactic food allergies. The proposed additions to the DRCHC category are explained below.

Type II Diabetes

The increasing incidence of Type II Diabetes in children and adolescents has been classified as an epidemic and a public health crisis since the 1990s in the United States, particularly affecting youth of minority backgrounds [54-56]. In a report on the emergence of Type II Diabetes in children and youth by the American Diabetes Association [4], the authors estimated that the prevalence of Type II Diabetes increased from 1-2% to 8-45% of pediatric patients with diabetes. Lifestyle change, notably exercise and healthy eating habits, has long been thought to be a key ingredient in treating Type II Diabetes. Early onset Type II Diabetes, including during childhood and adolescence, is believed to be particularly challenging for individuals and clinicians and robust psychosocial support is recommended to accompany ongoing medical care [57-60]. It should be noted that recommendations to alter lifestyle are of particular relevance to the importance of food and weight apparent in current DRCHCs.

In a national study of over 670 adolescent girls with Type II Diabetes, researchers found that 26% of the sample reported binge eating [61-65]. Of the adolescents who endorsed binge eating, there were also significant correlations between ongoing binge eating behaviors, higher levels of obesity, psychological distress, and lower quality of life [66-71]. Children and adolescents with Type II Diabetes have also been found to have poor rates of adherence to medical treatments, which is believed to be a mechanism for weight control and suppression [72-76]. Further, individuals with Type II Diabetes are more likely to use 'unhealthy' efforts (e.g., using laxatives) to reduce weight than individuals with Type I Diabetes [76,77].

While body and weight dissatisfaction amongst individuals with Type II Diabetes has been identified as concern, a prospective study with adults found that chronic weight dissatisfaction increased the risk for developing Type II Diabetes [78]. This research suggests that enduring weight dissatisfaction may not only be a contributing factor to the development of Type II Diabetes, but also a maintenance factor for poor eating behaviors and psychosocial concerns following a Type II Diabetes diagnosis [78]. The stigma associated with both obesity and Type II Diabetes, particularly in childhood and adolescence, are posited to negatively affect the psychological functioning, coping, and positive self-care behaviors in this population [79]. In adults with Type II Diabetes, weight stigma was found to be strongly tied to poor care management such that individuals who strongly felt a weight stigma had poorer self-care behaviors [80].

The constellation of Type II Diabetes, eating pathology, and eating-related distress has been demonstrated to be of significant concern for individuals with the disease and clinicians caring for them [81]. Although this work was conducted with adults with Type II Diabetes, the relevance of disordered eating behaviors and distress specific to eating is important to consider for older children and adolescents with the disease. As outlined above, the finding of higher rates of binge eating behaviors in this population gives insight into the elevated risk for disordered eating, fitting with the current disorders identified as DRCHCs.

As such, the prevalence of eating pathology and psychological distress in pediatric Type II Diabetes is of great concern. The lack of early assessment of disordered eating, weight/shape concerns, and psychosocial issues in this population adds to the need to bolster screening and intervention tools [57]. Furthermore, the medical significance of food and weight in the prognosis and health status of adolescents with Type II Diabetes is a compelling reason to consider

the illness a DRCHC. The risk factors for Type II Diabetes are summarized in Table 4.

DRCHC	ED Risk Factor	Relevance	Citations
Type II Diabetes	Body Mass (e.g., BMI)	Individuals with Type II Diabetes often have higher BMIs than their healthy weight peers, thus, weight loss is often recommended; one study estimated that 81% of individuals with Type II Diabetes are overweight or obese	[4,81]
	Thin Ideal Internalization	Little research in this area, although overweight/obese individuals have been found to have high rates of thin ideal internalization	[80,87]
	Body Dissatisfaction	Little research in this area, while a study with overweight/obese individuals have been found to have high rates of body dissatisfaction	[80,87]
	Dieting	One study of adolescent females with Type II Diabetes found over one quarter reported binge eating behaviors, with binge eating and bulimia nervosa recognized as a notable issue in this population; exercise and healthy eating is highly encouraged in this population to reduce disease burden; individuals with Type II Diabetes have been found to skip treatment doses (e.g., insulin) as a means of weight control, as well as using laxatives, diet pills, or refusing to eat	[57,88]
	Negative Affect	For adolescent females who reported binge eating behaviors, there were significant correlations to psychological distress and lower quality of life	[57]

Table 4: Summary of DRCHC-specific eating pathology risk factors for proposed expansion of the diagnostic category.

Serious and/or Anaphylactic Food Allergies

Serious and/or anaphylactic food allergies - the atypical immunologic response to certain food protein(s) - have been demonstrated to affect a significant subset of children, with recent estimates ranging between 2 to 8% of the pediatric population [58]. Some research has noted an increased prevalence of food allergies as a result of more sensitive screening and diagnostic measures, as well as the introduction of new foods (and inherently new allergens) to the national diet [59]. Compared with other chronic health conditions, serious food allergies involve the threat of a fatal allergic reaction [60]. Given that the degree of allergic reaction potentially escalates from previous reaction(s) (i.e., a first reaction may be manageable while a second reaction could prove to be fatal), the uncertainty of the extent of the reaction is an additional troubling feature to serious food allergies [60].

Treatment for serious food allergies involves the quintessential lifestyle change of complete restriction of the allergen from the child's life and immediate access to rescue medication (e.g., epinephrine) [58,61]. Due to the necessary food restrictions that accompany serious food allergies, researchers have excluded individuals with such allergies from studies investigating eating pathology and in turn there is limited evidence to understand the connection between serious allergies and disordered eating behaviors [82,83]. Although the notion of removing an allergen from a child's - and often family's - diet appears relatively simplistic, the added barriers of subpar food labels, cross-contamination, multiple food allergies, poor control of the environment beyond the family home, and thorough familial education in choosing foods for a child with a serious food allergy create a plethora of challenges [58].

The relationship with serious food allergies and BMI is not well-understood, with some research in Asian countries finding that children with all types of allergies (i.e., not only food allergies) had higher BMIs in Taiwan and Vietnam, but not in Japan [83-85]. In one retrospective case-control study, 4.1% of children and adolescents with food allergies were found to meet criteria for an Avoidant/Restrictive Food Intake Disorder (ARFID) diagnosis [86-88]. The relevance of

AFRID for children and adolescents with DRCHCs is discussed later in this review.

Parents of children with serious food allergies have reported significant disturbance of daily activities and heightened parental distress [58]. In addition to familial distress, children have also been found to be psychosocially impacted by their serious food allergies, notably including lower quality of life than healthy siblings and food restrictions in social settings [61,62]. Research has demonstrated significant disturbance in daily activities, including field trips, parties, play dates, sleepovers, eating outside the home, and family social outings, with parents preferring complete avoidance of such activities to prevent potential allergic reactions [61]. As such, the persistent high-level vigilance evident in pediatric patients with serious and/or anaphylactic food allergies and their families highlights the pivotal role that food plays in the illness; it is argued that serious and/or anaphylactic food allergies should be considered a DRCHC. The summary of factors for serious food allergies can be found in Table 4.

Hypothesized DRCHC-Specific Risk Factors for Body Image Disturbance and Eating Pathology

While the authors have outlined the evidence relating to the risk factors born from the eating pathology literature, it is suggested that there are specific risk factors to DRCHCs. The proposed risk factors are defined and explained below.

Hyperfocus on weight

In addition to the overwhelming saturation of the thin ideal in Western societies, children and adolescents living with DRCHCs face a dramatic hyperfocus on weight by a variety of authority figures in their lives. Socialization agents, such as peers and the media, support and reinforce the thin ideal through actions and comments in regards to weight and dieting, as well as glorifying thin models [63]. Given that weight is often a proxy of health and remission for DRCHCs, it becomes a centerpiece of a pediatric patient's medical care and experiences. Beyond an individual's concentration on personal weight,

a pediatric patient with a DRCHC faces routine questioning, examination, and discussion surrounding food and weight with caregivers, nurses, doctors, and additional providers. While these conversations are allegedly based in medical necessity, it is evident that the psychosocial impact of such a hyper focus on weight may put pediatric patients at risk for body image concerns and eating pathology.

Medically-related food restriction

For a diversity of reasons, many individuals with DRCHCs restrict certain types of food to minimize symptoms and increase functionality. Although this food restriction engenders positive outcomes for individuals, the act of voluntary and often long-term restriction has the potential to create frustration, social differences, and an increased consciousness regarding having a chronic condition. Additionally, media outlets are inundated with food cues - between commercials selling food products or restaurants to food placement within television shows and movies - and this inescapable presence of food is believed to be particularly triggering for pediatric patients with DRCHCs as they are continuously primed to think about food despite their dietary restrictions. Individuals suffering with DRCHCs may have trouble with emotion regulation, as documented previously in regards to psychological distress. These individuals may not have the skills needed to cope with negative affect in regards to DRCHCs, which could also be viewed as a risk factor for eating pathology [64]. Thus, medically-related food restriction is hypothesized to be a risk factor for eating pathology in pediatric patients with DRCHCs.

Body image uncertainty

There can be a discrepancy in regards to actual body image and the ideal body image, which may contribute significantly to body dissatisfaction and eating pathology [65]. The self-discrepancy theory [66] states that dissatisfaction can lead to a negative emotional state, which in turn, can create low self-efficacy for bodily goals and negatively impact health behaviors, such as diet and physical activity [67]. Individuals hold themselves to ideals that impact their body satisfaction, which may impact disordered eating behaviors [65]. High levels of body dissatisfaction results in an increased drive for thinness, higher dietary restraint, and higher levels of binge eating [65]. The idea of self-discrepancy shows that the actual body image and the ideal body image differ, in part because higher body dissatisfaction can lead to a negative emotional state and engender increased eating and decreased dieting [65]. With the combination of disease pathology and treatment side effects, many individuals with DRCHCs experience dramatic fluctuation in regards to weight and shape, particularly during adolescence and puberty. This vacillation interferes with the development of an adolescent's body image and has the potential to put an adolescent at risk for body image disturbance and eating pathology.

Societal acceptance of thinness despite health issues

During times of flares (active disease), individuals with DRCHCs are often unable to absorb nutrition and gain weight. In such situations, individuals with DRCHCs may appear markedly thin. It is possible that this unintended weight loss coincides with the pervasive thin ideal, and in turn for individuals to receive compliments and acceptance of their low weight status. Exposure to thin ideal images (i.e., slender models) encourages the thin ideal internalization [68]. Typically, those who internalize the thin ideal have high body dissatisfaction and may be independently vulnerable to developing

eating pathology [68]; individuals with DRCHCs may already have disordered eating due to their conditions, and therefore attempting to maintain their lower weight aligns with the pursuit of thin ideal and receiving compliments from others. This positive societal appraisal may affect an adolescent's body image and consequently eating pathology.

Conclusion and Clinical Recommendations for Providers

This review has highlighted how DRCHCs may place children and adolescents at risk for body image disturbance and eating pathology. Examination of the risk factors unique to each condition yields information that may be pertinent for health care professionals, as this information may help to identify children and adolescents who have already begun engaging in disordered eating. Further, identification of at-risk individuals may help to protect children and adolescents from developing eating disorders.

To identify children and adolescents with DRCHCs who may have developed eating pathology, it may be necessary to use a combination of disease markers and assessment tools. For instance, Rodin et al. [26] recommended that individuals with T1D who present with repeated bouts of diabetic ketoacidosis or other markers of poor metabolic control be screened for the presence of disordered eating behaviors and eating disorders. More specifically, clinicians should assess concerns regarding weight and shape, behaviors such as insulin omission and daily eating patterns. Rodin et al. [26] also suggest assessing for the frequency of hypoglycemic episodes, as these may lead to binge eating. The Diabetes Eating Problem Survey-Revised (DEPS-R) is a diabetes-specific screening tool that may be useful in helping health-care professionals identify children and adolescents with diabetes who may be engaging in disordered eating behaviors.

Similar measures and clinical markers are needed for IBD, CF, and CD. While body image dissatisfaction has been described in adult populations, researchers have noted the absence of sensitive screening tools specific to body image dissatisfaction in individuals with IBD [36,39]. Researchers have worked to focus the scientific conversation on pediatric IBD to build an optimal and meaningful model of transitioning pediatric patients into adult medical institutions, with effective and positive health behaviors to maximize adherence and disease management, while also instilling psychological resilience, social competence, and coping strategies into chronic illness care [43]. Further, providers may consider utilizing clinical and diagnostic measures of adherence in identifying proxy assessments of body image disturbance and disordered eating; given the previously outlined side effects of medications like Prednisone, non-adherence to treatment protocols may be an effort to minimize weight gain out of body image disturbance. Similarly, it is necessary to conduct similar research to create screeners that are specific to CF and CD. Given the lack of valid, reliable measures unique to each of these disorders, clinicians may consider administering measures used within the general population to assess factors such as body image, drive for thinness, and eating disorder pathology.

To help protect individuals from the development of eating pathology, it may also be helpful for clinicians to consider the entire family of an individual with a DRCHC. It has been shown that having regular family meals may help to promote healthy eating behaviors and protect against the development of DEBs [69]. Parental modeling of healthy eating behaviors may also serve as a protective factor [69]. The

concept of expressed emotion - critical elements of interpersonal relationships including criticism, hostility, and over-protection - has been found to be connected to individuals with eating disorders and the often tense, high-stress familial environment [70]. To the authors' knowledge, the role of expressed emotion has not been identified in pediatric chronic illness, although it is hypothesized that families of a pediatric patient with a chronic illness may be vulnerable to high levels of expressed emotions alike families of an adolescent with an eating disorder. As such, it may be beneficial for clinicians to work with parents to refer to psychological services, and/or provide psychoeducation regarding family dynamics and eating in an effort to help protect a child or adolescent from developing disordered eating.

It should be noted that the assessment of eating pathology in those with DRCHCs should be conducted with caution. As reviewed, subclinical and clinical eating pathology is highly prevalent within this population. However, prudence is needed to ensure symptoms of eating pathology are carefully differentiated from symptoms of disease (i.e., weight loss due to restricting behaviors vs weight loss solely from the medical condition). This is especially pertinent when considering a diagnosis of ARFID, which includes symptoms such as significant weight loss or failure to achieve expected weight gain, nutritional deficiencies, and dependence on enteral feedings. To illustrate, a child or adolescent with IBD may present with these symptoms due to the underlying disease process, in which case a diagnosis of ARFID would not be warranted. Alternatively, a child or adolescent with IBD may begin avoiding food in an attempt to avoid some of the aversive symptoms of IBD, leading to the weight loss or nutritional deficiencies, which may indicate that ARFID is an appropriate diagnosis.

As outlined in this review, food and weight have been established to be critical elements of pediatric DRCHCs. While researchers continue to investigate body image disturbance and eating pathology in this population to develop screening assessments and interventions, providers should seek to immediately institute compassionate means of assessing and imparting medically-relevant information regarding food and weight. Below are the authors' recommendations for screening, employing sensitive methods of inquiring about, and delivering food and weight-related information.

- Any discussions relating to height and weight charts should include the visualization of such growth curves in order to educate pediatric patients on the normalcy of gaining height and weight throughout development. Additionally, conversations around height and weight charts should provide psychoeducation on healthy height/weight ranges. Given that the growth of a pediatric patient with a DRCHC may be stunted and/or occurring at a distinct pace from peers, it is believed to be important to express, explain, and demonstrate an individual's growth pattern. For example, a 12-year old pediatric patient with IBD concerned about her weight gain from Prednisone should have an understanding that height and weight gain are normal and necessary to her overall long-term health. Further, conversations about weight and shape should revolve around physical ability and not simply appearance to underscore the importance of healthy bodies to do meaningful activities (e.g., playing soccer).
- Any instruction and information regarding healthy food choices should be operationalized for pediatric patients and families, with resources such as recipes and reputable websites with additional information provided in paper-format (i.e., for the family to take home and reference). Additionally, such information should be positive and action-oriented - for example, involving and engaging

a pediatric patient in grocery shopping and food preparation allows for an element of control and an opportunity for learning and pride.

- Ask pediatric patients and their families about psychosocial concerns they may have. Encouraging pediatric patients and their families to discuss food and weight-related concerns with clinical providers will allow individuals to speak openly and for providers to identify any concerning features. Discuss strategies to deal with peers who may identify changes in a pediatric patient's appearance in order to equip pediatric patients with resilience to succeed in their familial, academic, and extracurricular social interactions.
- Assess for any body image concerns and eating patterns or behaviors that are significant changes from the individual's previous behaviors or expected behaviors on a given treatment (e.g., a pediatric patient being treated with NG feeds may only be taking clear fluids orally as directed by clinicians, but this restriction of taking in clear fluids is expected). Check in regularly with families about any psychological concerns and refer individuals with concerns for appropriate eating pathology screening.
- For pediatric patients with DRCHCs who need some degree of medically-related food restriction, model and encourage families to minimize focus on restricted food and incorporate conversations on activities those children and adolescents find meaningful to foster feelings of inclusion and pride instead of exclusion. Problem-solve strategies for family mealtimes to make such events comfortable for the pediatric patient with food restrictions.
- When possible, seek to pair inpatient roommates with DRCHCs on their eating status to minimize food-related cues that may cause distress. For example, pairing pediatric patients who are both NPO in the same room. Encourage inpatient staff and any visitors to be mindful of NPO or food restriction orders for the psychosocial benefit of pediatric inpatients.

Future Directions

While research has demonstrated that pediatric patients with DRCHCs have unique vulnerabilities to body image disturbance and eating pathology, the authors believe there is a significant amount of investigation needed to improve the pathological and psychosocial understanding of why this relationship exists. As outlined in this review, there is a pressing need to develop, validate, and institute routine screening methods to identify at risk children and adolescents with DRCHCs. Additionally, future research should seek to establish risk factors that are shared for all DRCHCs and ones that may be unique to a given condition.

In the realm of prevention and intervention, research is needed to understand mechanisms that may decrease risk (i.e., preventative interventions) and ones that may treat existing issues (i.e., treatment interventions). Again, the importance of understanding the summary of conditions as DRCHCs and as unique illnesses should be a factor in building and tailoring interventions.

The role of gender and ethnicities as it relates to body image disturbance and eating pathology in pediatric patients with DRCHCs should be considered and evaluated. Without the foundation of research to understand the impact on gender and ethnicities, screening and interventions may not be appropriately sensitive and may ultimately lack clinical utility.

As discussed in this review, the expansion of DRCHCs to include Type II Diabetes and serious food allergies should be considered. Additionally, the hypothesized DRCHC-specific body image and eating pathology risk factors could be evaluated, further operationalized, and appropriate measures should be developed. The integration of expanding DRCHCs and adding specific risk factors should seek to bolster research endeavors in order to isolate and identify the unique risk associated with these conditions.

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