INNOVATIONS IN RESEARCH AND PRACTICE OF FAMILY BASED TREATMENT FOR EATING DISORDERS

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INNOVATIONS IN RESEARCH AND PRACTICE OF FAMILY BASED TREATMENT FOR EATING DISORDERS

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EDITORIAL
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Editorial: Innovations in Research and Practice of Family Based Treatment for Eating Disorders

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Keywords: Family-based Treatment, research, clinical, eating disorders, anorexia nervosa, bulimia nervosa

Editorial on the Research Topic

Innovations in Research and Practice of Family Based Treatment for Eating Disorders

This special issue of *Frontiers in Psychiatry/Psychosomatic Medicine* is focused on innovations in research and treatment for eating disorders using Family-based Treatment (FBT). FBT is at this time the first line treatment recommended by most international treatment guidelines for Anorexia Nervosa (AN) and Bulimia Nervosa (BN) for adolescents (1). Nonetheless, there is still much to be learned about FBT and this special issue provides a broad view of the clinical and research directions that are taking place currently. There are 15 articles in this special issue covering a range of topics from neuroscience of FBT, research protocols of current ongoing studies, and novel clinical applications and adaptations. Contributions are from scientists and clinicians from around the world including Australia, New Zealand, the UK, Sweden, Canada and the US.

Starting first with novel clinical applications, Spettigue, Norris et al. in their article entitled "Feasibility of Implementing a Family-Based Inpatient Program for Adolescents With Anorexia Nervosa: A Retrospective Cohort Study" describe how the principles of FBT can be adapted to an inpatient setting. This is an important contribution because it highlights that although FBT is an outpatient treatment, many of the key aspects of the approach—most importantly parental involvement—can be helpful in more intensive programmatic settings. Loeb et al. report on a pilot study of adapted FBT for youth at risk AN. This study suggests that FBT as well as other interventions are potentially useful in treating eating disorder in children and adolescent before they become highly symptomatic. Early intervention for at risk youth is an important avenue of research and aims at secondary prevention. As such, this study adds to the body of prevention and related early intervention clinical and research endeavors. In a similar vein, Spettigue, Aldaqqaq et al. report outcomes of a small case series of children and adolescents with mild eating disorder symptoms in their article "A Brief Modified Family-based Treatment Intervention for Youth with Mild Eating Disorders: A Case Series." These authors found that a very brief FBT-like intervention led to symptomatic improvement in these sub-clinical cases. The brevity of the intervention adds to its potential as a secondary prevention approach as it likely increases feasibility and acceptability.

Several articles focus on broader overviews of how FBT might be helpful. Lock and Nicholls describe how implementing FBT necessarily involves recognizing that the initial narrow behavioral focus of FBT on weight restoration broadens over the course of treatment to include adolescent developmental issues as treatment progresses. This allows FBT to address broader clinical issues that often accompany adolescents with AN, including problems that might be understood as comorbidities. Adding a neuropsychiatric understanding about the underpinnings of exposure and response prevention—one way to conceptualize parental re-feeding efforts—is described as a critical aspect of FBT related to brain neuroscience in the contribution by Mysliwiec entitled

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"Neuroscience of Adolescent Anorexia Nervosa: Implications for Family-based Treatment." This theoretical description of how FBT interventions "change the brain" makes for provocative and inspiring reading. In addition, Lavender in her article "Rebooting 'failed' Family-based Treatment" describes how cases that appear not to have responded to standard FBT can be successfully treated by greater adherence and fidelity to the treatment approach and manual. This article serves as a kind of corrective to the notion that once FBT fails, it is not possible to re-visit the approach with motivated families.

Turning to contributions that describe new research protocols using FBT, Bohon et al. describe a study using fMRI to evaluate anatomical brain changes secondary to re-feeding as a possible mediator of outcome. These authors claim that understanding neural change during treatment with FBT, particularly in the early weeks, has the potential to improve outcome by enhancing motivation for rapid behavior change, while also examining possible mechanisms by which early treatment response leads to improved outcome. Another protocol currently being used in research is described by Wallin and Saha in their article "Implementation of Key Components of Evidence-based Family Therapy for Eating Disorders in Child and Adolescent Psychiatric Outpatient Care." Their research evaluates whether implementing key components of family therapy during the first month of treatment in child and adolescent psychiatric outpatient care will lead to decreased inpatient utilization. Readers will likely find the design of these studies of interest, as well as anticipate future research findings from them.

There are several contributions related to broad themes of dissemination and implementation of FBT. For example, Le Grange et al. compared weight outcomes for adolescents with AN who received FBT in a randomized clinical research trial or non-research specialty care. They found no differences in outcome between the groups, suggesting that implementation of FBT in non-research settings can achieve results similar to those found in clinical trials. This finding should give confidence to clinical programs wishing to improve outcomes for patients in non-research settings. Hughes et al. in their contribution entitled "Adolescent and Parent Experience of Care at a Family-based Treatment Service for Eating Disorders" describes how patients and families treated with FBT on their clinical service experienced care. Their results found that parent and patients reported overall positive experiences of FBT. These findings are important because they counter the contention by some therapists and clinical programs concerned about the burden on families who receive FBT and resistance by adolescents, who they worry will not be cooperative with the approach. To examine the impact of therapists' attitudes on the uptake of FBT, Accurso et al. in their contribution "Attitudes toward Family-based Treatment Impact Therapists' Intent to Change Their Therapeutic Practice for Adolescent with Eating Disorders" found that providers reported very positive attitudes toward evidence-based practices in general and moderately positive attitudes toward FBT. Because attitudes of providers about treatment correlate with adoption and fidelity, these findings may indicate that FBT can be disseminated best by therapists who are supportive of the model.

There were, in addition, contributions that add to our understanding of what to expect in treatment using FBT. For example, Matheson et al., in their study entitled "Investigating Early Response to Treatment in a Multi-site Study of Adolescent Bulimia Nervosa" found markers of early response—reduction in purging at session 2, and binge eating at session 4—were related to abstinence of symptoms at the end of treatment, regardless of treatment type. Early response is potentially important because those who fail to achieve these markers might benefit from an adapted form of FBT or other treatments. Rosania and Lock in their article "Family-based Treatment for a Preadolescent with Avoidant/Restrictive Food Intake Disorder (ARFID)" describe a novel application of FBT to a younger population with ARFID. FBT for ARFID relies upon the same key interventions as FBT for AN, but the author identifies critical differences in the application of these interventions given the unique challenges of ARFID, particularly when characterized by sensory sensitivity. At this stage, FBT for ARFID needs further investigation and this case report is helpful in describing what might be needed for the approach to be effective for ARFID. Finally, Kimber et al. describe how clinicians can manage the unusual, but serious problem of child maltreatment in the context of FBT treatment in their article "Recognizing and Responding to Child Maltreatment: Strategies to Apply When Using Family-based Treatment for Eating Disorders."

Taken together the collection of articles in this special issue offers clinicians and scientists an important opportunity to learn more about where things are with FBT and where they are going.

AUTHOR CONTRIBUTIONS

JL, DL, DN, and JC contributed to the composition of this editorial. All authors contributed to the article and approved the submitted version.

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ORIGINAL RESEARCH
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Feasibility of Implementing a Family-Based Inpatient Program for Adolescents With Anorexia Nervosa: A Retrospective Cohort Study

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Background: Manualized Family Based Therapy (FBT) is the treatment of choice for adolescent anorexia nervosa, but it is an outpatient treatment. Very little research has examined whether or how the principles of FBT might be successfully adapted to an inpatient setting, and there is little other evidence in the literature to guide us on how to best treat children and adolescents with eating disorders (EDs) while in hospital. This paper describes and provides treatment outcomes for an intensive inpatient program that was designed for the treatment of adolescents less than 18 years of age with severe anorexia nervosa, based on the principles of FBT. Each patient's family was provided with FBT adapted for an inpatient setting for the duration of the admission. Parents were encouraged to provide support for all meals in hospital and to plan meal passes out of hospital.

Methods: A retrospective cohort study was conducted that examined the outcomes of 153 female patients admitted over a 5-year period. Outcome data focused primarily on weight change as well as psychological indicators of health (i.e., depression, anxiety, ED psychopathology).

Results: Paired t-tests with Bonferroni corrections showed significant weight gain associated with a large effect size. In addition, patients showed improvements in scores of mood, anxiety, and ED psychopathology (associated with small to medium effect sizes), though they continued to display high rates of body dissatisfaction and some ongoing suicidality at the time of discharge.

Conclusion: This study shows that a specialized inpatient program for adolescents with severe EDs that was created using the principles of FBT results in positive short-term medical and psychological improvements as evidenced by improved weight gain and decreased markers of psychological distress.

Keywords: eating disorders, adolescents, Family Based Therapy, inpatient treatment, Maudsley model

INTRODUCTION

Eating disorders (EDs) are serious and potentially life-threatening conditions that typically have their peak age of onset in adolescence (1), with anorexia nervosa (AN) being the third most common chronic illness in adolescent females (2). EDs are associated with significant medical complications including cardiovascular dysfunction, growth retardation, pubertal delay, and low bone mineral density (3). Psychiatric co-morbidities are also common, including depression, anxiety disorders, and substance abuse, and there is a significantly increased risk of completed suicide in this population (4, 5).

Despite their prevalence and seriousness, there is debate about how best to treat these illnesses in young people. Manualized Family Based Therapy (FBT) (6) has the most evidence for weight restoration and long-term recovery in adolescent AN (6–13). This outpatient approach is designed to externalize the illness, lift blame, raise parental anxiety about the seriousness of the illness and the need for weight gain, and empower parents to support recovery at home by taking charge of their child's nutrition (14). Despite the established efficacy of FBT, as many as 50–65% of adolescent patients with AN may not successfully reach full remission with this approach (15), and the evidence is less clear about the most efficacious form of treatment for these patients. Also, since FBT is an outpatient treatment, little research has examined whether or how the principles of FBT might be successfully adapted to an inpatient setting, and there is little other evidence in the literature to guide us on how to best treat children and adolescents with EDs while in hospital. A recent article by Murray et al. (16) outlined a theoretical framework of how to adapt FBT to higher levels of care, including inpatient admissions. Suggestions included taking the opportunity to raise parental anxiety at the onset of admission, empowering parents to start making choices over their child's nutrition while in hospital, and using weight gain after weekend passes as indices of parental effectiveness prior to discharge (16). Rhodes and Madden (2) describe the changes they made to their pediatric ED inpatient program to make it more consistent with FBT, but they did not include any outcome data.

These conceptual reports are useful as practical guidelines about how a program might implement FBT in more intensive treatment settings. Our goal in the current study is to provide preliminary data related to the feasibility and outcome of FBT in such a program. As such, this study aims to describe and examine outcome data for 153 female patients admitted over a 5-year period to a specialized pediatric tertiary care inpatient ED program that was designed and adapted around principles of FBT. Patients who underwent a formal assessment by our team and were admitted to the ED inpatient unit were compared on weight and ED psychopathology outcomes from pre– to post–inpatient admission.

MATERIALS AND METHODS

Inpatient Program

Our specialized ED inpatient program is located in a tertiary children's hospital and contains six dedicated beds on a psychiatric unit for children and adolescents up to age 18 years with severe EDs. The program is staffed by a multidisciplinary team including psychiatrists, psychologists, adolescent health physicians, and dieticians, among other professionals with specialized training in EDs. Most patients live in the surrounding area or within a 150 km radius of the hospital, covering a catchment area of almost 1 million people. Generally, these adolescents are voluntary but are brought to hospital by their parents and are not motivated for treatment; they are admitted to the intensive inpatient program because they are medically unstable (low weight and/or with unstable vital signs, usually bradycardia), are highly symptomatic, and/or have failed outpatient treatment, and do not meet criteria for less intensive levels of the program's services such as day hospitalization.

The overall aim of our "FBT-informed" inpatient program is to empower parents to compassionately take charge of their child's nutrition (6, 17). This task is accomplished *via* the use of FBT-based treatment goals of lifting guilt and raising anxiety about the seriousness of the child's illness, in addition to educating parents regarding EDs and helping them to provide meal support to their child, first in hospital and then out of hospital on passes. The program empowers parents by asking them to be present as much as possible throughout the admission, starting FBT with an assigned therapist, including parents in nutritional planning sessions, and providing education around EDs and meal support using expert-endorsed books, videos, and, at times, a parent support group. Each family receives a family therapist (either a psychiatrist or a psychologist) specialized in the treatment of EDs. The therapist meets at least once a week with the family, and sometimes more often. The therapist may choose to see the parents alone, or with the child, or both. Family therapy sessions focus on lifting guilt and blame, raising anxiety about the dangers of starvation and the importance of renourishment, externalizing the illness, and empowering parents to "keep their child safe" from the ED, to "stand up to the bully that has taken over their daughter's brain," and to prevent the illness from "destroying" their child's mental and physical health and well-being. Passes begin as soon as medical stability occurs so that the patient can spend time with family at home, first between meals, then gradually for longer periods of time that include meals. Parents are encouraged to plan the passes, and attending physicians are flexible and supportive in encouraging decisions around such pass-planning. At home, parents practice food selection, preparation, and serving of meals while encouraging their children to take the necessary nutrition and compassionately containing symptoms (for example, if a patient has symptoms of exercising at night, the parents and siblings will work together in a family therapy session to decide how to keep the patient "safe" from these symptoms when on pass, including possibly choosing which family member will sleep with the patient). Patients work on nutrition goals using in-hospital experiences and out-of-hospital passes and are discharged after completion of at least one successful extended pass home (e.g., taking all nutrition over 2–3 days).

Most parents respond extremely well to FBT during the admission, and do an excellent job of supporting their child compassionately, taking control of nutrition, supervising meals in hospital, and planning passes. Some express fear of discharge, due to a fear that the ED will worsen after discharge and the patient will relapse, so therapists have to work hard to empower parents and help them to feel stronger than the ED and not dependent on the hospital. Admittedly, some parents use the "threat" of returning to hospital to try to get their child to eat. One area of contention is meal plans. Most patients are medically unwell and are put on non-selective menus at admission, followed eventually by selective menus with parents choosing the nutrition, plus choosing the nutrition on passes. However, many parents and patients feel "comforted" by the meal plan and choose to follow it after discharge, which can lead to a reliance on the hospital dietician for increases in nutrition, rather than parents feeling empowered to make the necessary changes. Other parents are able to use the meal plan as a guideline for in-hospital only, and are able to take charge of the type and amount of nutrition after discharge. Another challenge is when parents are unable to come to the hospital to support their child. This is especially problematic for single parents who work, or who don't drive a car and live far from the hospital. For example, a single mother who runs a home day care will have great difficulty getting to the hospital to supervise meals or attend family therapy sessions. Their children often end up eating meals with staff, and can be acutely aware that other patients are spending time with their families. Through no fault of the parent, the inpatient program is less helpful for these patients, who can end up enjoying the groups, bonding with the staff, doing poorly on passes home, and resisting discharge. Therapists must work hard to come up with innovative solutions for these families, including calling on help from their relatives and friends if possible, and using emails and phone calls to communicate with parents.

Patient Population

We included data from the charts of females with AN sequentially admitted to our inpatient EDs unit between April 2008 and October 2013. Outcomes from 153 patients between the ages of 13 and 18 years were retrospectively reviewed.

Diagnostic Categories

Patients were diagnosed (based on consensus diagnosis by an adolescent health physician and a psychiatrist or psychologist) using information gained from a clinical interview of the patient and the parents (interviewed separately), psychological measures [including the Eating Disorder Examination Questionnaire—Adolescent Version (EDEQ-A), Eating Disorder Inventory (EDI), Children's Depression Inventory (CDI), and Multidimensional Anxiety Scale for Children (MASC)], and medical history and data. Patients were then classified into one of two diagnostic categories: those with restrictive EDs, all of whom would now meet *DSM-5* criteria for AN—Restrictive subtype (AN-R); and low-weight patients with binge–purge behaviors, all of whom would now meet *DSM-5* criteria for Anorexia Nervosa—Binge/Purge subtype (AN-BP).The study was approved by the hospital's Research Ethics Board.

Measures

Well-validated self-report questionnaires were administered by a trained psychometrist. Demographic characteristics were collected using a self-report parent intake form, developed by members of the ED program. For the purposes of this study, parental employment, primary language spoken at home, and whether the child/adolescent has an identified learning disability or individualized education plan (IEP) were examined.

Weight Gain

A patient's height is taken at admission, and weight is taken daily, including at admission and discharge, by a nurse using a calibrated scale (patient is in a gown, post voiding, with back to the scale). Body mass index (BMI) is used as a marker of medical status and used to track weight gain and proximity to the patient's treatment goal weight (TGW) range. Using the publicly available World Health Organization's (18, 19) Child Health Growth References macros for the IBM Statistical Package for the Social Sciences (SPSS), BMI-for-age z-scores were calculated. Cutoff interpretations are as follows: normal ≤ +1 standard deviation (SD) to ≥ −2 SD; thinness < −2 SD; severe thinness < −3 SD (20).

Eating Behaviors and Attitudes

The EDEQ-A was used to measure ED psychopathology. As the EDEQ-A was only administered to patients 13 years of age or older due to developmental appropriateness, children <13 years were excluded from analyses. The EDEQ-A is a self-report questionnaire with 36 items, that produces a global score (average of the four subscales) and four subscale scores (Restraint, Eating Concern, Shape Concern, and Weight Concern) and has been found to have strong psychometric properties (21).

The Eating Disorder Inventory-3 (EDI-3) (22) was administered to measure ED attitudes and cognitions. The EDI-3 discriminates between samples (clinical versus nonclinical) and diagnoses [AN, bulimia nervosa (BN), partial AN/BN], and is documented to have good internal reliability for ED patients (α = 0.76–0.92) (23). The drive for thinness and body dissatisfaction subscales were used in this study.

Psychological Functioning

Depressive symptoms were measured using the CDI (24) and levels of anxiety with the MASC (22). The CDI total score is reported to have excellent internal consistency (Cronbach's α) in a clinical sample of females diagnosed with an ED (α = .93) (23). The MASC total score has high internal reliability in community samples (α = .90) and excellent internal consistency within clinical samples of children and youth with EDs (α = .92) (25). For the purposes of this study, only the total scores from the measures of depression and anxiety were used in our analyses. In addition, suicidality was assessed using a single item on the CDI (question #9) that asks respondents to indicate their level of suicidal ideation over the past 2 weeks.

STATISTICAL ANALYSES

Analyses were conducted using IBM SPSS Version 22. To examine psychological and weight change from admission to discharge, we performed Bonferroni-corrected paired-samples t-tests. Cohen's d (standardized mean difference) was the measure of effect size computed using Comprehensive Meta-Analysis (Version 3). As suggested by Cohen (26), d = .20 represents a small effect, d = .50 represents a moderate effect, and d = .80 represents a large effect.

Missing data analyses revealed that 67.7% (*n* = 109) of the original sample had self-report pre- and post- data available. The demographic and clinical characteristics of patients with missing data on all psychological measures at either time point (*n* = 52, 32.3%) were compared to patients included in the analysis of one or more psychological outcomes (*n* = 109, 67.7%). Bonferroni-corrected comparisons showed that included versus excluded patients did not differ on age or BMI at time of admission (*p* = .104 and *p* = .049, respectively), nor did they differ on some of the demographic characteristics listed in **Table 1** (range of *p* values:.071 to 1.00). Of note, patients with missing data on all psychological outcomes had a significantly shorter length of stay (LOS) (*M* = 33.06, *SD* = 26.06) than those who completed measures at pre- and post- on one or more self-report measures (*M* = 55.16, *SD* = 20.48, *p* < .001). Patients with missing data were dropped from analyses that included variables that they were missing.

RESULTS

Demographics and Clinical Characteristics

Demographics and clinical characteristics at admission can be found in **Table 1**.

Family Demographics

Parent self-report demographics are reported in **Table 1**. English was the most common primary language spoken at home (69.6%), and interestingly, only a minority of patients lived with married parents (47.8%). Most families reported having two working parents, full-time or part-time (55.9%). At assessment, 11.8% of parents reported their child as having an IEP and 7.5% of patients as having a recognized learning disability. Family lifetime prevalence of mental health disorders was collected *via* parent self-report at the time of admission. Family lifetime prevalence of depression was 55.3%, and lifetime family prevalence of any ED was 24.8%, with the most common self-reported ED within a family being AN (14.9%).

TABLE 1 | Parent (*n* = 133) Self-Report Demographics and Family Demographics at Inpatient Admission.

Demographic Characteristics	*n*	%
Primary language:		
English	112	69.6
French	11	6.8
Married parents	77	57.8
Working parents	90	55.9
Individualized education plan	19	11.8
Learning disability	12	7.5
Family history of:		
AN	24	14.9
BN	15	9.3
BED	7	4.3
Depression	89	55.3
Suicide attempts	33	20.5
Severe anxiety	50	31.1

Primary language = primary language spoken at home; working parents = both parents employed full- or part-time; AN, anorexia nervosa; BN, bulimia nervosa; BED, binge-eating disorder.

Demographics of the Diagnostic Categories

Patient clinical characteristics of the 153 females included in the study are presented in **Table 2**. Of the sample, 76.5% (*n* = 117) met criteria for *DSM-5* AN-R and 23.5% (*n* = 36) met criteria for AN-BP. Average age for the sample was 15.26 years of age (SD = 1.74), and mean LOS in hospital was 48.90 days (SD = 24.60). The average LOS was 48.22 days (SD = 24.37) for AN-Rs and 51.11 days (SD = 25.54) for AN-BPs. The AN-BPs were the oldest group (15.75 years of age) with the longest LOS (51.11 days).

Changes From Admission to Discharge

Weight Gain

Our findings show that both AN-R and AN-BP patients experienced significant increases in BMI for age z-scores (zBMI) from admission to discharge (*p* < .001; see **Table 2**). Patients with AN-R gained an average of 6.54 kg over 48.22 days (mean 0.95 kg/week), increasing the mean BMI from 16.49 (zBMI −1.70) to 19.0 (zBMI −0.51) at discharge. Patients with AN-BP gained an average of 6.42 kg during admission, increasing the mean BMI from 17.80 (zBMI −1.21) to 20.23 (zBMI −0.18). Weight gain was associated with a large effect size for both ED groups (*ds* = 1.08–1.11). Note that, given the low amount of nutrition prescribed in the initial days of the admission, as per standard protocol at the time of study inclusion, many patients did not start to gain weight until the second week, when the amount of nutrition started to increase beyond 2,000 kilocalories. (As per current recommendations, we now have a more aggressive renourishment protocol.)

Eating Behaviors and Attitudes

In terms of ED psychopathology, there was a significant decrease in ED symptoms as measured by the EDEQ-A in the AN-R cohort (*p* < .001; CI: 0.55, 1.30; see **Table 2**). There was a nonsignificant decrease in drive for thinness for the AN-R and the AN-BP groups, with a medium effect size for the AN-R group (*d* = 0.31) and a large effect size for the AN-BP group (*d* = 0.96). Those with AN-BP also had a nonsignificant improvement on the EDI-3 body dissatisfaction subscale (*p* = .098; CI: −1.06, 10.17; see **Table 2**) and a nonsignificant decrease in ED symptoms (*p* = .009; CI: 0.27, 1.69). Improvement in body dissatisfaction was associated with a small effect size (d = 0.32), and reduction in ED symptoms was associated with a medium effect size (*d* = .54). Lastly, there was a nonsignificant increase in body dissatisfaction in those with AN-R (*p* = .086; CI: −5.00, 0.35), with a small effect size (*d* = −0.18).

Psychological Functioning

Depression scores significantly decreased (*p* < .001; CI: 4.78, 11.77) from admission (*M* = 63.79, *SD* = 18.09) to discharge (*M* = 55.52, *SD* = 17.72) for those with AN-R (see **Table 2**). Those with

TABLE 2 | Paired-Samples t-Test Results for Inpatient Admission to Discharge by Subgroup.

Subsample	Outcome	Admission		Discharge		*n*	95% CI	*t*	*p*	*d*
		M	***SD***	***M***	***SD***					
AN-R										
	Age	15.11	1.84			117				
	BMI	16.49	2.19	19.0	2.08	117				
	zBMI	−1.70	1.15	−0.51	0.91	117	−1.33, −1.06	−17.43	.000*	1.11
	EDI: drive for thinness	19.0	9.25	16.02	9.88	43	0.39, 5.57	2.32	.025	0.31
	EDI: body dissatisfaction	24.07	12.57	26.40	13.17	43	−5.00, 0.35	−1.76	.086	−0.18
	CDI: total T score	63.79	18.09	55.52	17.72	73	4.78, 11.77	4.72	.000*	0.46
	MASC: total T score	59.87	10.15	54.62	12.65	71	3.17, 7.33	5.04	.000*	0.44
	EDEQ-A: total score	3.18	1.85	2.26	1.85	66	0.55, 1.30	4.90	.000*	0.50
AN-BP										
	Age	15.75	1.27			36				
	BMI	17.80	2.39	20.23	2.09	36				
	zBMI	−1.21	1.02	−0.18	0.72	36	−1.27, −0.80	−8.89	.000*	1.08
	EDI: drive for thinness	20.56	9.62	11.33	9.63	9	2.21, 16.23	3.03	.016	0.96
	EDI: body dissatisfaction	27.67	14.77	23.11	14.10	9	−1.06, 10.17	1.87	.098	0.32
	CDI: total T score	77.72	15.31	69.16	19.30	25	1.45, 15.68	2.48	.020	0.48
	MASC: total T score	62.04	10.69	57.04	14.89	24	0.67, 9.37	2.37	.027	0.36
	EDEQ-A: total score	4.35	1.57	3.37	1.99	22	0.27, 1.69	2.87	.009	0.54

*AN-R, Anorexia Nervosa—Restrictive; AN-BP, Anorexia Nervosa—Binge/Purge; BMI, body mass index in kg/m2; zBMI, body mass index for age z-scores; EDI, Eating Disorder Inventory; CDI, Children's Depression Inventory; MASC, Multidimensional Anxiety Scale for Children; EDEQ-A, Eating Disorder Examination Questionnaire—Adolescent Version; CI, confidence interval. * Significant at p < .003 (Bonferroni corrected).*

AN-R also showed a significant decrease in symptoms of anxiety ($p < .001$; CI: 3.17, 7.33; see **Table 2**). Decreases in symptoms of depression and anxiety were associated with small effect sizes (d = 0.44–0.46). In addition, there was a nonsignificant decrease in depression ($p = .02$; CI: 1.45, 15.68) and anxiety scores for the AN-BP cohort after Bonferroni adjustment ($p = .027$; CI: 0.67, 9.37), both associated with small effect sizes ($d = 0.36$–0.44).

At admission, 38.41% ($n = 58$) of those patients who completed the CDI ($n = 151$) endorsed suicidality (e.g., "I want to kill myself" or "I think about killing myself but would not do it"). Despite the improvement in depression scores, upon discharge, 34.55% ($n = 38$) of 110 patients still endorsed some degree of suicidality.

DISCUSSION

This study shows that a specialized inpatient program that combines medical treatment, nutritional rehabilitation, psychoeducation, and compassionate containment of symptoms with individual, family, and group therapy to treat adolescents with EDs is effective in achieving improvements in medical stabilization and weight gain, ED symptoms, and psychological functioning. Underweight patients experienced an improvement in medical status and an increase in BMI during the admission. Weight restoration and medical stabilization are of primary importance in the treatment of EDs (27, 28). Patients were able to gain weight adequately within this model of using parents and/or unit staff for meal support.

There is some limited literature looking at the effectiveness of inpatient treatment for adolescent AN. Some of these papers describe cognitive-behavior therapy-informed inpatient treatments, some look at predictors of outcome, and others compare inpatient treatment to day treatment program, or longer lengths of inpatient admission with shorter lengths of stay. Herpertz-Dahlmann et al. (29) compared a longer inpatient treatment for adolescent AN to a shorter inpatient stay (3 weeks) followed by treatment in a specialized EDs day program (29). Eighty-five adolescents were randomized to a longer inpatient stay, and 87 were allocated to day treatment. Results showed no significant differences in BMI at 12-month follow-up, suggesting that a specialized day treatment program for adolescents with AN may be effective and cost-saving compared to inpatient treatment (29). Madden et al. (30) assigned 82 adolescents with AN and medical stability to a short hospitalization, for medical stability (MS), or to a longer admission until they reached 90% of goal weight (WR), with both groups treated on a specialized pediatrics medical ward in one of two hospitals in Australia (30). Both groups were treated with 20 sessions of manualized FBT following discharge. Results at 12-month follow-up showed no difference in outcome between groups, (30% full remission for the MS group, 32.5% full remission for the WR group), but with obvious cost savings for those who had a shorter inpatient stay (30).

Schlegl et al. (31) examined predictors of outcome for 238 adolescents with severe AN treated in an inpatient setting in Prien, Germany (31). Overall, the patients gained weight, with BMI increasing from a mean of 14.8 to 17.3 kg/m^2; 45% of patients showed significant improvements on the EDI-2. They described their specialized ED inpatient treatment program for youth 14–17 years as one offering specialized individual and group manualized cognitive–behavioral therapy, along with some additional social skills training, art therapy, cooking training, and "sports therapy." They described parents as "actively involved in the therapy in the form of telephone consultations and family therapy sessions. There are at least three sessions with the nuclear family, one at the beginning of treatment, one in the middle of treatment and one at the end of treatment. Sessions include elements such as family diagnosis and family sculpture, role-playing techniques to clarify family interactions, homework and themes like detachment from family." They concluded that this program was effective in treating about two-thirds of adolescents with AN (31).

Salbach-Andrae et al. (32) examined outcomes from 57 female adolescents with AN treated at their specialized EDs inpatient unit in Berlin, Germany (32). The 12-week program was described as using a cognitive–behavioral approach including individual therapy, body-image and body-esteem group, expressive art, family therapy (once a week), recreation therapy, and nutritional education. Their results showed that at 1 year, 59.6% of the inpatients showed a poor outcome, and only 28.1% had recovered fully (32).

Hibbs et al. (33) studied an intervention for caregivers whose children were being treated in hospital for an ED, but in various non-specialized ED settings (33). The intervention consisted of providing a book, a DVD, and five coaching sessions to parents whose children were receiving inpatient treatment for an ED. They described "small improvements in symptoms and bed use" in the intervention use and suggested that providing parent support and psychoeducation may be helpful (33).

Halvorsen et al. (34) described an inpatient program in Oslo, Norway, that, like ours, is based on "Maudsley" principles of family-based treatment (34). Unlike our program, where patients may or may not have received previous outpatient treatment, their patients had all been unsuccessfully treated with previous inpatient or outpatient treatment, including family-based interventions. They describe their FBT-inspired inpatient program, in which parents stayed on the unit with the child, as "designed to help parents establish clear, predictable frameworks for meals with adequate amounts of food at the hospital and at home. The family ate all meals together in a designated family room or a designated table in the main dining room, receiving support from the staff as needed. Milieu therapy staff aimed to support the whole family in coping with the ED…. A weekly weight gain of approximately 1 kg was recommended. The family reviewed daily progress with the staff, attended joint family sessions once or twice a week, parental counselling and weekly group sessions for parents. Most patients were also offered weekly individual sessions. Weekend leaves were integrated into treatment to encourage families to practice and transfer skills to the home environment, with longer leaves granted toward the end of hospitalization" (34). The authors contacted 37 adolescents 1–7 years after discharge from their program and reported that only 36% (n = 12) were classified as fully recovered (as defined by BMI ≥18.5, EDEQ global ≤2.5, and no binge-eating/purging over past 3 months) (34).

The program described by Halvorsen et al. sounds very similar to ours, other than the fact that in our program, parents sleep at home or at a nearby "Rotel" beside the hospital and eat alone as a family, rather than in a group dining hall. Ours is thus the second study to evaluate an inpatient program for youth with EDs that has integrated FBT principles throughout programming, by having parents support a large proportion of meals while the adolescent is in hospital, having parents work closely with dietitians and plan nutrition on passes, and by offering weekly FBT-informed family therapy sessions with a psychologist or psychiatrist (i.e., FBT modified for an inpatient setting). Unlike the study by Halvorsen et al., which reports long-term outcomes for 37 adolescents, our study does not report long-term outcomes, but describes positive outcomes at discharge for 109 adolescent females (34).

Our results show an improvement in both depressive and anxiety symptoms during the course of the admission. This finding is in keeping with previous literature (35–38) showing that anxiety and depressive scores are highest in malnourished patients and that symptoms improve at least partially with weight restoration. Although weight gain likely contributed to improvements in mood, other factors including the intensive individual, group, and family therapy, in combination with the compassionate and informed therapeutic milieu, would likely have also impacted mood and anxiety scores. Despite significant improvements in mood, one-third of the sample expressed ongoing suicidality at the time of discharge. While we can only speculate, this could possibly be related to the stress of discharge and to ongoing body dissatisfaction. This study used the EDI-3 to assess changes in ED psychological functioning (attitudes and cognitions) pre- and post-admission, and focused on two subscales, drive for thinness and body dissatisfaction.

Our finding that body dissatisfaction did not decrease during admission in those with AN-R is in keeping with previous literature which has shown that physical symptoms tend to remit before psychological symptoms (39). Most patients who are admitted have severe distortions in how they see their body, along with a severe fear of weight gain. They are then required to increase nutrition to bring weight back into a healthy range, usually in a relatively short period of time. Therefore, it is not unusual for a patient's dissatisfaction with their body shape to increase with weight gain in the early stages of recovery. Surprisingly, drive for thinness showed a downward trend with treatment. It is also important to note that changes in ED cognitions in response to treatment are often delayed in adolescents with AN who are treated with FBT. Thus, given the short duration of treatment examined in the present study (average LOS being approximately 7 weeks), it may not be all that surprising that some observed changes were not significant or were associated with small effect sizes.

Limitations

One limitation of this study was missing data on some discharge measures (e.g., the EDI). While most pre-admission questionnaire packages are completed at the initial intake assessment successfully, administration of questionnaire packages at discharge was more frequently missed. This can be explained as a result of either patient unwillingness to complete questionnaires, unexpected discharges occurring during off hours (e.g., evening and weekends) when our psychometrist is not available, or sometimes due to busy clinicians neglecting to inform the psychometrist of upcoming discharges. Although missing data analyses revealed no significant differences on demographic and psychological measures at admission between those with and without discharge data, and as this type of missing data is not abnormal in clinical outcomes research settings, some caution is warranted when interpreting the generalizability of the results.

Other limitations include the exclusion of males and diagnoses other than AN (i.e., BN), use of self-report measures and lack of a standardized structured or semi-structured interview to obtain diagnoses, along with limited medical data, no pre- and post- measures of parent satisfaction and empowerment against the ED, lack of long-term follow-up, and the use of a single site which may limit generalizability to other ED programs. An additional limitation is the lack of a comparison group and a non-randomized design. Despite the noted limitations, this study provides initial treatment outcomes on an inpatient program for adolescents that was designed and implemented in the era of burgeoning FBT evidence.

Future Directions

The current study utilizes data collected between 2008 and 2013. Since that time, our inpatient program has undergone significant changes in an attempt to continue to align more closely with evidence-based FBT principles. As appropriate, lengths of stay are limited and patients are discharged at lower weights to continue treatment using outpatient FBT. Patients spend more time with families and less time in a group milieu, and individual therapy is limited. As well, renourishment protocols are now more "aggressive," in keeping with updated pediatric guidelines on the nutritional management of inpatient EDs (40). Moving forward, it will be critical to examine how inpatient programs that admit patients who have failed FBT or other traditional outpatient models can achieve success in helping to support a child's recovery, while taking into consideration indicators such as LOS, weight gain, changes in psychological measures, and most importantly, sustained markers of recovery including long-term outcomes.

CONCLUSION

This specialized intensive inpatient program for youth with severe EDs provided psychoeducation and medical and nutritional treatment, in combination with group, individual, and FBT-informed family therapy. Short-term outcomes show that an intensive inpatient program such as this one for youth with severe EDs is successful in restoring weight for patients, and in improving mood, anxiety, and ED symptomatology.

DATA AVAILABILITY STATEMENT

The datasets generated for this study are available on request to the corresponding author.

ETHICS STATEMENT

This study involving human participants was reviewed and approved by the Research Ethics Board, Children's Hospital of Eastern Ontario Research Institute. Written informed consent to participate in this study was provided by each participant and by their legal guardian/next of kin.

AUTHOR CONTRIBUTIONS

WS, KH, and AB proposed, sought funding for, and created the inpatient program described, and provided the individual, group, and family therapy to patients and families. NO created the database, and with WS, KH, and AB, chose the measures for evaluating outcomes of the program. NO collected the data and analyzed it. ID, WS, and MN wrote the manuscript for the paper. NO, NH, and DV helped to analyze the data and describe the results. DV helped with references and edited and formatted the manuscript. All authors have contributed to the writing of this manuscript, and have read and approved of this article's submission.

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STUDY PROTOCOL
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A Protocol for Integrating Neuroscience Into Studies of Family-Based Treatment for Anorexia Nervosa: An Approach to Research and Potential Benefits for Clinical Care

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Anorexia nervosa (AN) is a life-threatening disorder with peak onset during adolescence. Prior research supports the effectiveness of family-based treatment (FBT) for AN in adolescents, but studies do not regularly include neuroimaging to investigate the effects of FBT on the brain. This is important because we know that malnutrition has a detrimental impact on brain volume, cortical thickness, and function, which often recover with weight restoration. Additionally, early weight gain in FBT has emerged as a robust predictor of treatment outcome, yet it is unclear whether it is associated with neural change. Understanding neural change during treatment, particularly in the early weeks, has the potential to improve outcome by enhancing motivation for rapid behavior change, while also highlighting mechanisms by which early treatment response leads to improved outcome. This manuscript describes a study protocol and discusses both challenges and implications for this type of integrative research.

Keywords: neuroimaging, treatment, anorexia nervosa, family-based treatment, adolescents

INTRODUCTION

Background and Rationale for Studying Early Neural Change in Adolescent AN

Family-based treatment (FBT) for adolescent anorexia nervosa (AN) results in clinically significant improvement in about 75% of patients and remission in between 22%–49% by the end of treatment (EOT) (1). Despite this, these numbers demonstrate that a percentage of patients do not achieve optimal outcome. Prior research has identified early weight gain of 2.4 kg by session 4 in FBT as a surrogate early marker for full weight restoration [>94% expected body weight (EBW)] by end of treatment (EOT) (2–6). An improved understanding of the neural underpinnings of early weight gain could be helpful in identifying treatment mechanisms and developing novel ways to improve

FBT through behavioral reinforcement or support of refeeding effects, which will ultimately result in higher rates of recovery and decreased use of higher cost and potentially ineffective programs.

Existing randomized controlled trials (RCTs) have understandably focused attention on clinical outcomes such as weight gain and behavioral and attitudinal changes in the patients and their families (7). However, adding neuroimaging to an RCT would allow us to examine neural change over the course of treatment with particular emphasis on early neural changes. Determining neural correlates of the robust marker of early weight gain can potentially help us understand why it results in improved outcome and will allow us to further enhance treatment for those who do not show this early response. For example, the predictive effect of early treatment response may simply reflect that most change occurs early in treatment or it could be that early changes lead to neural changes that make further treatment more effective. Parents who understand the impact of their early efforts in refeeding on their children's brains may be more motivated to make necessary changes early in treatment. Given anecdotal evidence that many parents are resistant to pushing rapid weight gain to reduce conflict during meals or make meals easier, this could be especially helpful. Further, clinically, we see many parents concerned about a focus on feeding while seemingly ignoring cognitive symptoms. Providing evidence of brain effects of early refeeding efforts can assuage this concern and motivate parental feeding.

Prior Evidence of Change Neural Differences in AN With Recovery

There are currently no studies of brain changes over the course of FBT and no studies of brain change examining early weight change. Most studies that have investigated structural and functional brain changes with treatment have focused on weight restoration in hospital settings (8, 9). A recent study examined change in cortical thickness with short-term weight recovery and found significant change with improvements in nutrition (10). Because early weight gain in FBT is likely a consequence of consistent nutrition *via* refeeding, there may be significant brain change in early responders that influence later treatment outcome.

Structural

In addition to structural improvements such as brain volume (9) and cortical thickness (10), diffusion tensor imaging (DTI) studies suggest that dysfunction in brain networks in AN may be relate to reduction of myelin that surrounds the axons of neurons (11). Myelin is made of fatty acids, and thus, severe dietary (especially fat) restriction may result in deterioration of the myelin. As nutrition improves, myelination may also improve, impacting white matter integrity. Seitz and colleagues have recently conducted a meta-analysis on white matter volume in AN and found that reductions in white matter volume appear to normalize with recovery (9). Importantly, white matter volume loss predicted BMI at 1-year follow-up after hospitalization, suggesting that this is a marker for longer-term risk (12). Thus, in addition to examining change in white matter integrity during treatment, it would be useful to also investigate whether it predicts treatment response.

Intrinsic Connectivity Networks (Resting-State fMRI)

As a consequence of the shifts in white matter integrity, another likely area of change with recovery relates to network connectivity in the brain. Resting-state functional magnetic resonance imaging (r-fMRI) is a tool that allows us to understand how brain activity is organized into coherent and temporally correlated networks of brain regions (13). These networks, often referred to as intrinsic connectivity networks (ICNs), are consistent, have high test-retest reliability (14) and correspond with structural pathways (15). Various differences in ICN activity and connectivity relate to psychopathology and mood states (16). Two such ICNs have often been identified in psychopathology research, including in AN. The default mode network (DMN) was one of the first ICNs identified and its activity correlates with baseline non-task activation and is often implicated in self-referential processes (17). The salience network (SN) is involved in integrating information between a number of systems and involves connections between the dorsal anterior cingulate cortex and frontoinsular brain regions, as well as amygdala and ventral tegmental area, important for emotion and reward detection (16). Given the symptom-related features of self-relevant thoughts (related to body shape/weight, general self-esteem, etc.), as well as processing internal and external stimuli to make eating decisions, these ICNs seem particularly relevant in AN. Indeed, McFadden and colleagues found reduced SN and DMN activity in women with AN (18). Individuals recovered from AN showed DMN and SN activity somewhere between acutely ill and healthy controls, with a significant difference remaining between recovered and control groups in SN activity (18). However, the timeline of these changes from acute illness to recovery are unknown. Network activity can reflect ongoing brain processes at rest dispersed across a network, whereas functional connectivity, the synchronous activity between regions in a network, can reflect longer term activity such that those regions may have stronger connections due to frequent co-activation (19). When looking at functional connectivity rather than overall activity of the network, there is evidence of increased connectivity in the DMN in AN (20, 21). Although the activity across the DMN may be reduced in AN at rest, this may reflect difficulty with ceasing engagement of task-like processing (perhaps related to perseverative thinking about food, weight, etc.). However, connectivity between regions within the DMN may be strengthened due to frequent co-activation outside of rest, such as during self-referential processing throughout the day. No studies to date have looked at change in these networks over the course of treatment, but there is evidence that psychotherapeutic interventions can result in change in functional connectivity in brain networks in other patient populations (22, 23). It is also possible to utilize functional connectivity in these networks to predict treatment outcome, as connectivity in the DMN has been a consistent neural marker and predictor of treatment response in depression (24, 25).

Task-Based Neural Function: Set-Shifting and Fear Response to Food

Furthermore, numerous studies have investigated task-based neural activity in AN, which may relate to the illness. These are studies that have utilized fMRI to measure brain activity during specific tasks to understand neural correlates of cognitive and emotional processes. Research suggests that patients with AN have difficulty with set shifting or task switching (26). Patients often perform slower on Trail B of the Trail Making Test, make more perseverative errors on the Wisconsin Card Sorting Test, and make more errors on the Brixton Task (27), although results are not always consistent. Neuroimaging studies suggest that these difficulties may reflect neural processing differences in the prefrontal cortex and precuneus (28–30). A recent study showed task shifting deficits in acutely ill patients, but not those recovered from AN (31). Indeed, longitudinal studies show that many of these deficits improve with weight restoration (32), and performance on set-shifting tasks improved with cognitive remediation therapy (33), but it is unclear how this may change in the context of FBT and relate to early treatment response. Importantly, a recent study of adolescents with AN showed that neural differences during set shifting when acutely ill were no longer present after 6 months and renutrition (34). Based on this literature of improvements with recovery, we predict change with FBT for both patients with early treatment response or those who make gains over the full course of treatment.

In addition to set shifting deficits, there is evidence of greater activation in the amygdala in response to images of high-calorie beverages and high-calorie foods (35–37). In anxiety disorders, pre-treatment amygdala activity predicts measures of post-treatment improvement in children and adults (38, 39), and amygdala hyperfunction normalizes after exposure-based treatment in specific phobia (40). Considering that successful refeeding represents repeated exposure to feared stimuli (food) in AN, amygdala response to food images may normalize in those who respond to treatment.

Behavioral Function: Inhibited Risk-Taking

Harm avoidance is frequently associated with AN (41). This may drive food restriction due to avoidance of potential weight gain, which patients perceive as negative. This harm avoidance may reduce risk-taking (42), which has been found in prior research in individuals with AN (43). Although most prior research on risk-taking in AN has used the Iowa Gambling Task, evidence suggests that it is not a reliable measure of risk-taking (44). Thus, other measures, such as the Balloon Analogue Risk Task used previously in AN (43) or the Angling Risk Task (45) may provide stronger evidence of inhibited risk-taking in AN (45, 46). We will explore risk-taking using the Angling Risk Task outside of the scanner with plans to obtain neuroimaging correlates in the future if the behavioral data support the initial hypothesis of change with weight gain during treatment.

Specific Aims and Hypotheses

Overall, the study aims to examine the neural correlates of early weight gain in adolescents with AN undergoing FBT with MRI scans conducted at baseline prior to initiating treatment, after session 4 (the point at which weight gain is predictive of clinical EOT response), and again at EOT (18 sessions of treatment, approximately 6 months with a maximum of 9 months). Although this study is designed to provide evidence of feasibility in conducting neuroimaging in the context of FBT and establish preliminary effect sizes to guide future research, we provide the following specific hypotheses that we hope to explore in this pilot study. We hypothesize greater increases in brain volumes, surface area, and cortical thickness from pre-treatment to session 4 in those who gain more than 2.4 kg during that time. We also hypothesize that network connectivity and activity during r-fMRI will show greater changes in adolescents with early weight gain compared to those who do not show early weight gain. Specifically, we predict greater increases in default mode activity and reductions in SN activity from pre-treatment to session 4 in those who gain more than 2.4 kg during that time (47). We also hypothesize improvements in white matter integrity, measured with DTI, in those who gain more than 2.4 kg by session 4 compared to those who do not, providing evidence that consistent nutritional improvements can have rapid impact on brain connectivity (48). We also hypothesize improvements in functional tasks related to cognitive and emotional functioning in those who gain more than 2.4 kg by session 4. Specifically, we expect improvements in a task-switching task as evidenced by improved behavioral performance and altered brain activity in prefrontal cortex and superior parietal cortex. During a food image task, we expect to find reduced amygdala activity in response to food versus non-food images over time in those who show early weight gain. Although the primary aim relates to neural changes at session 4 (the time where early weight gain is predictive of outcome), a secondary aim is to examine these measures at EOT, which will allow us to capture any neural changes that may be more delayed, requiring longer length of time or more weight gain for recovery. This secondary aim is in place due to the preliminary nature of the protocol, since there is no prior research related to early treatment effects. In other words, this aim increases the likelihood to detect effects given that prior research on weight restoration in AN has shown improvements across these domains.

METHODS

Participants

Participants for this study will be recruited directly from an existing RCT. The RCT is testing an adaptation to standard FBT wherein adolescents who do not gain 2.4 kg by session 4 are randomly assigned to either continue standard FBT or to receive Intensive Parent Coaching (IPC) which involves an additional intense scene during session 4 to increase urgency to act in the parents, a parent-only session to further support parental behavior change for refeeding, and an additional family meal for greater support and guidance of parent refeeding behaviors. Prior research informed the selection of 2.4 kg as the marker of early treatment response. Five studies identified early weight gain in FBT as a possible marker of early treatment response (2–4, 6, 49) converging on a consistent weight gain range of 2–3 kg by session 4. Unpublished data on early response from the largest multi-site study of FBT for adolescent AN (2) matched the weighted average of the current published studies, a weight gain of 2.4 kg by session 4. An additional study by Hughes and colleagues (50) found that 2.8 kg by session 5 was the most sensitive predictor of remission. However, this study involved twice weekly sessions for the first 2 weeks with session 5 occurring on week 3 of treatment (unlike 1 session per week in other trials). This increased intensity of treatment delivery may have shifted the timing and amount of early weight gain predictive of remission by end of treatment (50). Thus, the proposal settled on 2.4 kg by session 4 as the marker of early response. Importantly, we considered the use of change in percentage ideal body weight or BMI-SDS (body mass index standard deviation score) per age, but the prior research showed these predictive effects with the actual weight gained regardless of initial weight, height, age, or sex.

Because participants will be recruited for the neuroimaging study prior to the start of treatment, we cannot balance the numbers of participants in a particular treatment arm. All study participants who meet eligibility criteria and are able to visit Stanford University for three imaging appointments will be invited to participate. Although the main RCT is being conducted at two sites (Stanford University and University of California, San Francisco), they are both located in the San Francisco Bay Area, and thus, are both potential sites for the recruitment of participants for this neuroimaging component. The population of the Bay Area is large and diverse, and the RCT makes specific efforts to recruit minorities for the study. The target sample size for this preliminary study is 20 in order to establish feasibility of including neuroimaging to an RCT of FBT and obtain preliminary effect sizes. Inclusion criteria include: 12–18 years of age that meet DSM-5 criteria for AN and participating in the RCT testing IPC for early non-response to FBT. Exclusion criteria include: 1) associated physical illness that necessitates hospitalization; 2) psychotic illness or other mental illness requiring hospitalization; 3) current dependence on drugs or alcohol; 4) physical conditions (e.g., diabetes mellitus, pregnancy) known to influence eating or weight; 5) Wechsler Abbreviated Scale of Intelligence (WASI) scores below the low average range defined by the test (<80); 6) family history or current child abuse or neglect (when reported in response to a question on phone screen, the perpetrator of abuse is excluded from family treatment, but the adolescent may participate with the rest of the family); 7) previous FBT for AN; 8) contraindications for MRI (e.g., orthodontia, metallic implants); 9) current or past major neurological (e.g., seizure disorder, psychosis, head trauma) or major sensory deficit. Participants are withdrawn from the study if any of the following occur: 1) sexual or physical abuse by a family member; 2) hospitalization for >21 days; 3) missing >4 consecutive appointments; worsening of psychiatric conditions such that participant would be clinically better served by referral for other treatment; 4) participant undertaking other psychotherapies during the treatment study. Visual acuity is determined by self-report, and participants with corrected vision use MR-safe lenses during scans.

Procedure

Assessments for the main RCT will be conducted at six major timepoints (baseline, 3-month mid-treatment, EOT (maximum of 9 months), and at 6- and 12-month follow-up). These assessments will include measures of weight, parental measures, and other psychopathology variables. Weekly assessment of weight and parent factors will also be conducted. For the neuroimaging study, we invite participants to have MRI and fMRI scans at baseline, session 4 mid-treatment, and EOT. All assessors are trained to reliability in the Eating Disorder Examination (EDE) (51) and other clinical diagnostic interviews, including the Kiddie Schedule for Affective Disorders and Schizophrenia (K-SADS) (52).

Neuroimaging sessions consist of structural, diffusion-weighted, and functional scans (one resting-state and two task-based). We use a 3T GE signa scanner to collect functional and anatomical imaging data. Visual stimuli are presented with a digital projector/reverse screen display system. Echo spiral imaging is used to measure the blood oxygen level dependent (BOLD) signal as an indication of cerebral brain activation. Images consist of 31 axial slices (4.0 mm with 0.5 mm gap) covering the whole brain (RT = 2 s, echo time = 30 ms, flip angle = 80, interleave = 1, FOV = 22 cm, matrix = 64 × 64). To reduce blurring and signal loss from field inhomogeneities, an automated high-order shimming method based on spiral acquisitions is used before acquisition of functional scans. R-fMRI scans consist of 240 volumes acquired over 8 min. Functional scans during the task-based paradigms will be acquired over approximately 22 min (task switching) and 8 min (food image task). Motion is measured immediately following functional scans, and the experiment is rerun if motion exceeds 1 mm. A diffusion-weighted scan (DTI) is collected with 37 diffusion directions (FOV = 22 cm, 2.3 mm slices). A high-resolution T1-weighted three-dimensional inversion recovery spoiled gradient-recalled acquisition in the steady state MRI sequence is used (inversion time = 400 ms, RT = 8 ms, echo time = 3.6 ms, flip angle = 151, FOV = 24 cm, 124 slices in coronal plane, matrix = 256 × 192, number of excitations = 2; acquired resolution = 1.5 × 0.9 × 1.1 mm). Images are reconstructed as a 124 × 256 × 256 matrix. We preprocess all data within 1-week of the scan to ensure that all the data are usable. We rescan subjects for whom we have poor data on structural and resting state scans.

Task Switching Task

We utilize a hybrid block and event-related design to examine task switching, which has been previously validated (53). This design allows for the separation of neural activity related to the cognitive load of engaging in task switching over a sustained period (block contrast) from the neural activity related specifically to the transient behavior of switching tasks on a particular trial (event-related contrast). Thus, we present blocks of mixed-task trials and blocks of single-task trials. The task requires participants to classify colored shapes (red and blue triangles and circles) based on groupings indicated by a written instruction, such as "Shape" or "Color." In the mixed-task trials, classification task of the trial are randomly intermixed throughout the block. We present 50 mixed-task trials and 50 single-task trials. This task is delivered in 2 11-min runs, and engagement will be confirmed *via* confirmation of accuracy greater than 80%.

Food Image Task

We utilize the same design as in prior literature examining neural response to food images in AN by presenting five blocks of high-calorie food images alternating with five blocks of non-food images (37). Each block consists of 10 images presented for 1.5 s. Participants are instructed to look at each picture attentively. Images are rated after scanning for disgust and fear on a visual analog scale. This task takes approximately 8 min.

Risk-taking Task

In addition to the in-scanner tasks, after the scan, participants complete the Angling Risk Task (45) *via* Experiment Factory online (54). During the ART, participants fish for 30 rounds in a pond with different numbers of fish, mostly red fish with one blue fish. Each time the participant selects "Go Fish," they randomly catch a fish in the pond. Each red fish results in points which can be collected when the participant selects "Collect" and moves on to the next round of fishing. However, if the participant catches the blue fish, the round will end, and the participant will lose all the points earned that round. Participants are told that to keep their points from round to round, they must stop fishing and press "Collect" before they catch a blue fish. There are two tournaments; one in which fish are released back to the pond after being caught, which results in the same number of red and blue fish throughout the round (Catch N Release). In the Catch N Keep tournament, caught fish come out of the lake, thus increasing the chance of catching a blue fish. The points earned in one tournament have no effect on the next, and participants are instructed to try to do as well as possible in both tournaments. Each red fish caught (point) is worth 2 cents, which is added up to a total dollar amount that participants can win at the end of the task (up to $25).

Both this neuroimaging study and the larger RCT have approval from the local Institutional Review Boards.

Data Analytic Plan

Images will be preprocessed using *fMRIPprep* 1.2.3 (55, 56), which is based on *Nipype* 1.1.6-dev (57, 58).

Anatomical Data Preprocessing

All T1-weighted (T1w) will be corrected for intensity non-uniformity (INU) using N4BiasFieldCorrection (59) (ANTs 2.2.0). A T1w-reference map will be computed after registration of all T1w images (after INU-correction) using mri_robust_template [(FreeSurfer 6.0.1, (60)]. The T1w-reference will then be skull-stripped using antsBrainExtraction.sh (ANTs 2.2.0), using OASIS as target template. Brain surfaces will be reconstructed using recon-all [FreeSurfer 6.0.1, (61)], and the brain mask estimated previously will be refined with a custom variation of the method to reconcile ANTs-derived and FreeSurfer-derived segmentations of the cortical gray-matter of Mindboggle (62). Spatial normalization to the ICBM 152 Nonlinear Asymmetrical template version 2009c (Fonov et al., 2009, RRID : SCR_008796) will be performed through nonlinear registration with antsRegistration [ANTs 2.2.0, (63)], using brain-extracted versions of both T1w volume and template. Brain tissue segmentation of cerebrospinal fluid (CSF), white-matter (WM) and gray-matter (GM) will be performed on the brain-extracted T1w using fast [(FSL 5.0.9, (64)].

Functional Data Preprocessing

For each BOLD run per subject (across all tasks and sessions), the following preprocessing will be performed. First, a reference volume and its skull-stripped version will be generated using a custom methodology of *fMRIPrep*. The BOLD reference will then be co-registered to the T1w reference using bbregister (FreeSurfer) which implements boundary-based registration (65). Co-registration will be configured with nine degrees of freedom to account for distortions remaining in the BOLD reference. Head-motion parameters with respect to the BOLD reference (transformation matrices, and six corresponding rotation and translation parameters) are estimated before any spatiotemporal filtering using mcflirt [(FSL 5.0.9, (66)]. The BOLD time-series (including slice-timing correction when applied) will be resampled onto their original, native space by applying a single, composite transform to correct for head-motion and susceptibility distortions. These resampled BOLD time-series will be referred to as *preprocessed BOLD in original space*, or just *preprocessed BOLD*. The BOLD time-series are resampled to MNI152NLin2009cAsym standard space, generating a *preprocessed BOLD run in MNI152NLin2009cAsym space*. First, a reference volume and its skull-stripped version are generated using a custom methodology of *fMRIPrep*. Several confounding time-series are calculated based on the *preprocessed BOLD*: framewise displacement (FD), DVARS and three region-wise global signals. FD and DVARS are calculated for each functional run, both using their implementations in *Nipype* [following the definitions by Power and colleagues (67)]. The three global signals are extracted within the CSF, the WM, and the whole-brain masks. Additionally, a set of physiological regressors re extracted to allow for component-based noise correction [*CompCor*, (68)]. Principal components are estimated after high-pass filtering the *preprocessed BOLD* time-series (using a discrete cosine filter with 128s cut-off) for the two *CompCor* variants: temporal (tCompCor) and anatomical (aCompCor). Six tCompCor components are then calculated from the top 5% variable voxels within a mask covering the subcortical regions. This subcortical mask is obtained by heavily eroding the brain mask, which ensures it does not include cortical GM regions. For aCompCor, six components are calculated within the intersection of the aforementioned mask and the union of CSF and WM masks calculated in T1w space, after their projection to the native space of each functional run (using the inverse BOLD-to-T1w transformation). The head-motion estimates calculated in the correction step are also placed within the corresponding confounds file. The BOLD time-series, are resampled to surfaces on the following spaces: *fsaverage5*. All resamplings can be performed with *a single interpolation step* by composing all the pertinent transformations (i.e., head-motion transform matrices, susceptibility distortion correction when available, and co-registrations to anatomical and template spaces). Gridded (volumetric) resamplings will be performed using antsApplyTransforms (ANTs), configured with Lanczos interpolation to minimize the smoothing effects of other kernels (69). Non-gridded (surface) resamplings were performed using mri_vol2surf (FreeSurfer).

Many internal operations of *fMRIPrep* use *Nilearn* 0.4.2 (70), mostly within the functional processing workflow. For more details of the pipeline, see the section corresponding to workflows in *fMRIPrep*'s documentation.

Structural measures of total gray matter volume, white matter volume, cortical surface area, and average cortical thickness will be extracted from FreeSurfer (run during preprocessing). After preprocessing, independent component analysis (ICA) will be conducted using FSL's MELODIC software to examine intrinsic connectivity networks in r-fMRI. ICA is a statistical technique that separates a set of signals into independent spatiotemporal components (71). It allows for the removal of artifact and the isolation of neural networks (72, 73). We will allow the software to estimate the optimal number of components for each subject. Components will be transformed to standard space, and the DMN and SN will be selected from among each subject's independent components using an automated template-matching procedure (73). A one-sample t-test will be performed on normalized network maps. These maps will be used to generate connectivity scores for each ICN.

Condition effects for the task-based fMRI will be estimated using the general linear model. The response to events will be modeled by a canonical hemodynamic response function (HRF). The task switching task has two events of interest: task-switch events and task-repeat events contrasted with each other, as well as two blocked conditions: mixed-task blocks and single-task blocks in another contrast. The food image task has two events of interest: food images and non-food images contrasted with each other. Condition-specific estimates of neural activity (betas, corresponding to the height of the HRF) will be computed independently at each voxel for each subject. Analyses will be conducted in FSL FEAT, which utilizes cluster-based thresholding and Gaussian Random Field (GRF) theory to identify significant clusters of voxels for each analysis. Although we have hypotheses related to certain brain regions, we will conduct whole brain analyses to ensure we are not biasing results.

DTI data will be analyzed with FSL Diffusion Toolbox (FDT) to perform affine registration to correct for eddy current distortions, extract brain from skull in the image, and fit tensors and tracts to the data. Further tensor fitting and fiber tracing will be completed with Diffusion Toolkit software. Primary measures will be of fractional anisotropy (the degree to which diffusion takes place in a given direction) and R1 (measure of relaxation rates of water protons, which has a strong relation with myelin content). Probabilistic tractography will be explored using FSL's built-in tools, particularly along fronto-striatal pathways, which may be impacted in AN (74). Of note, DTI data, as well as structural data, can be impacted by effects of dehydration, which may relate to malnutrition (75). Although objectively assessing hydration status specifically would be ideal, it is not possible in this small study. However, we will include reports of hydration, as well as recent hospitalizations, as many of the patients in the trial were in the hospital for medical stabilization (including hydration) prior to enrolling in the study.

Behavioral data from the risk-taking task will be examined by calculating the adjusted score, which is the average number of casts taken on rounds when participants chose to stop fishing. Higher scores indicate greater risk-taking.

Across all measures (gray and white matter volume, cortical surface area, cortical thickness, r-fMRI connectivity for SN and DMN, DTI FA and R1, task-based contrasts, and risk-taking scores), we will examine change over time using repeated measures analyses, including mixed effects modeling for extracted scores or repeated measures modeling in FSL for task-based measures. Because EOT will occur at different times after baseline depending on treatment duration, time will be included as a covariate. Primary comparisons will be conducted between those who gain 2.4 kg by session 4 and those who do not (early responders vs. non-early responders). We will also use weight change as a continuous variable to examine how change in the brain and behavior measures is associated with weight change, particularly if we have small cell size in one of the two responder groups. Exploratory analyses will also examine baseline brain and behavior measures as predictors of early response and end of treatment outcome *via* mixed effects.

DISCUSSION

Studies of neural change over the course of treatment in anorexia nervosa, particularly early in treatment, have the potential to increase motivation for early refeeding behavior among parents of adolescents. A recently developed treatment incorporating neurobiological research findings into treatment was considered helpful in improving understanding of AN (76), suggesting that improving knowledge about neurobiological changes through treatment may be of interest to patients and families. Anecdotally, we often hear parents and clinicians express concern about not directly targeting eating disorder cognitions early in treatment. There is worry that focusing on refeeding ignores the emotional needs of the patient. Evidence of neural change early in FBT could alleviate these concerns by showing how cognitive and neurobiological functions can be impacted without being specific targets of treatment. Further, while brain plasticity during adolescence may create a vulnerability under which AN develops (77), it can also allow for greater opportunities for neural changes (78), providing some explanation why AN that is not treated during adolescence may become enduring (79).

Conducting neuroimaging research in the context of treatment for adolescent AN comes with a number of challenges. First, families are often anxious when first receiving a diagnosis and report feeling overwhelmed by deciding on treatment. It can be difficult for families to agree to participate in a study that does not have an immediate, tangible benefit for their child's care. Later in recovery, we find that families may be more open to neuroimaging research, but at that point, we can no longer obtain pre-treatment data. Second, the timing of scans can create challenges in obtaining complete data for all participants. Families often, understandably, want to begin treatment as soon as possible, so scheduling a pre-treatment scan can feel like a delay of treatment. Our team often conducts scans on the same day as and just prior to session 1 in order to assuage this concern. Follow-up scans are also challenging to schedule, particularly the early treatment timepoint because there is a short window of time to complete the scan. Illnesses, busy schedules for scanners, or technical problems with the scanner can impact the collection of these data. Our team addresses this by scheduling the early response scan as early as possible so that it is on everyone's schedule in advance, and our research coordinators are in constant communication with families to ensure that the timeline will still work. Scheduling as early in the time window as possible also allows for some buffer to reschedule in case of illness or technical problem. Finally, there may be a bias in samples for neuroimaging studies due to mistrust of research (80), anxiety about adding too much to the child's schedule, or other reasons for declining participation (81). Although some of these biases may be exacerbated in neuroimaging studies of treatment effects due to the additional burden of assessment and treatment sessions being scheduled simultaneously, they may also be true of neuroimaging studies broadly. Thus, generalization of results must be made cautiously.

Overall, investigating brain and behavior changes over the course of FBT has great potential to improve our understanding of early treatment response and motivate engagement in treatment from the start. While many of the most pronounced neural differences in AN seem to recover with weight restoration, knowledge about how early these changes occur can support timing of treatment interventions. Further, a greater understanding that specific interventions targeting cognitive processes may not be necessary for neural and cognitive change can address fears that some families express about engaging in FBT. If hypotheses are supported from this preliminary study and in later confirmatory studies, future research could examine the influence of education about neurobiological change on treatment engagement. Further, if baseline brain function is predictive of treatment response, future research could consider augmentations or alternative treatments for those patients at high-risk for non-response.

DATA AVAILABILITY STATEMENT

The dataset for this study will be available upon study completion.

ETHICS STATEMENT

This protocol was approved by the IRB at Stanford University. Written informed consent will be obtained from all participants.

AUTHOR CONTRIBUTIONS

The design of the study was developed through collaboration between all three authors. NW contributed to task selection for the protocol. CB wrote the manuscript, and NW and JL edited the text.

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Delivery of Family-Based Treatment for Adolescent Anorexia Nervosa in a Public Health Care Setting: Research Versus Non-Research Specialty Care

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Comparing evidence-based psychotherapy (EBP) to usual care typically demonstrates the superiority of EBPs, although this has not been studied for eating disorders EBPs such as family-based treatment (FBT). The current study set out to examine weight outcomes for adolescents with anorexia nervosa who received FBT through a randomized clinical research trial (RCT, n = 54) or non-research specialty care (n = 56) at the same specialist pediatric eating disorder service. Weight was recorded throughout outpatient treatment (up to 18 sessions over 6 months), as well as at 6- and 12-month follow-up. Survival curves were used to examine time to weight restoration [greater than 95% median body mass index (mBMI)] as predicted by type of care (RCT vs. non-research specialty care), baseline clinical and demographic characteristics, and their potential interaction. Results did not indicate a significant main effect for type of care, but there was a significant effect for baseline weight (p = .03), such that weight restoration was achieved faster across both treatment types for those with a higher initial %mBMI. These data suggest that weight restoration achieved in non-research specialty care FBT was largely similar to that achieved in a controlled research trial.

Clinical Trial Registration: http://www.anzctr.org.au/, identifier ACTRN12610000216011.

Keywords: anorexia nervosa, adolescents, eating disorder, family-based treatment, treatment outcome

INTRODUCTION

Anorexia nervosa (AN) is a particularly pernicious psychiatric illness with significant morbidity and mortality rates (1), considerable distress and impairment (2), and high treatment costs (3). Implementing evidence-based psychotherapy (EBP) for adolescents with AN is a critical endeavor as onset is most commonly in adolescence and early adulthood (4), and early intervention typically yields the most favorable treatment outcomes (5). One potential stumbling block in the implementation of EBPs in usual care is that, while the former outperforms the latter, EBPs may perform more poorly in community clinical settings compared to the research settings in which they were developed and tested (6). For example, strict inclusion criteria, together with potentially different characteristics of patients and families who are willing to participate in a research trial (and subsequently be randomized to either arm of a study) might limit the representativeness of clinical trial data. As such, treatment outcomes from randomized clinical trials (RCTs) may not generalize to individuals treated outside of these settings.

A recent meta-analysis summarizing the benefit of implementing EBPs over usual care showed that 58% of randomly selected youth receiving EBPs would have better outcomes than randomly selected youth receiving usual care (effect size 0.29) (7). Notably, none of the 52 RCTs included in this analysis were for eating disorders. The most efficacious EBP for adolescents with AN is family-based treatment (FBT), a manualized intervention that emphasizes the role of parental support in facilitating their child's recovery from AN (8). An FBT approach consists of an average of 6–12 months of therapeutic intervention; the treatment includes three phases, whereby it is initially symptom focused, with parents providing meal support and prevention of compensatory behaviors with a primary goal of weight restoration. FBT differs considerably from other approaches such as individual therapy and inpatient management, in that parents are instrumentally involved in their child's weight restoration, and resumption of appropriate eating and exercise behavior. Consistent evidence suggests that FBT is an efficacious therapy for this patient population, contingent upon medical stability for outpatient management (e.g., 9–11). However, research on provider attitudes towards the use of EBPs for eating disorders suggests that there are several barriers to using manualized treatments (12). Some argue that evidence supporting EBPs is flawed in important ways (13). In particular, it is thought that manualized treatment formats may be too rigid and not a "good fit" for most patients seen in community settings (14, 15). Therapists commonly endorse misconceptions and negative beliefs about FBT prior to training (16). Further, therapists who implement FBT often make significant modifications to treatment delivery (17), and in so doing, may unintentionally compromise the effectiveness of treatment.

To date, only one study of adolescents receiving FBT for AN compared the delivery of this treatment in a research trial (n = 32) versus usual care (n = 52) (18). These authors found that for adolescents with a lower initial percent median body mass index for age and height (%mBMI; 19), time to weight restoration was significantly faster in the research trial compared to usual care. However, for those with a higher baseline %mBMI, time to weight restoration was largely similar across care contexts. In this sample, psychiatric comorbidity was greater in usual care than in the RCT, suggesting that families of patients with elevated rates of comorbidity may be less likely to participate in research trials. In fact, Couturier and colleagues (12) have argued that a patient's clinical complexity may discourage community clinicians' use of FBT. Studies using highly controlled efficacy designs, where all providers involved in care are required to follow detailed treatment protocols (e.g., RCTs), might be expected to produce better outcomes compared with studies using effectiveness designs in which EBPs are evaluated under more usual practice conditions. Therefore, evaluation of FBT with a more representative sample in comparison to a research trial may be particularly informative.

The current study aimed to build on the work by Accurso and colleagues (18), who studied a private practice sample in the United States, where cost differs significantly between usual care (insurance or self-pay cost) and randomized trial care (treatment at no cost). Instead, the current study was conducted in a geographically restricted public health care setting in Australia, that is, the only specialist eating disorders service for this particular region with no direct treatment costs to the families receiving either treatment arm. Without cost barriers, it is posited that patients managed within such a public health care environment are perhaps more representative of the general population of adolescents with AN.

The primary goal of this study was to investigate time to weight restoration among patients who received FBT in the context of an RCT versus non-research specialty care delivered within an academic eating disorder service. While our study was largely intended to generate hypotheses, we anticipated a difference in time to weight restoration in favor of those participating in the RCT. The secondary goal was to test the potential moderating effect of baseline patient demographic and clinical characteristics on outcomes, given that the public health care setting of this study is likely to manage a more diverse sample when compared to the prior US-based study conducted in a private setting (18). Given the nascent evidence to date on nuanced differences in adolescent treatment outcome relative to moderators, secondary hypotheses remained exploratory.

METHODS

Participants were 110 adolescents who met *DSM-IV* criteria for AN, were medically stable, and were treated with conjoint FBT in an outpatient setting, either through an RCT (RCT Care: n = 54) or non-research specialty care (Non-Research Care: n = 56) from 2010 to 2016. Patients presented to the Royal Children's Hospital, a tertiary public hospital in Melbourne, Australia. The Human Research Ethics Committee of the Royal Children's Hospital approved this study, and participants provided consent or assent (RCT Care = written; Non-Research Care = written/waived) prior to participation. All therapists had specialized training and weekly supervision. Patients enrolled in the research study experienced differences in treatment delivery compared to Non-Research Care, including 1) sessions that were recorded, 2) random assignment to conjoint FBT, or a separated format of FBT, called parent-focused therapy (PFT), and 3) a requirement to be on a stable course of medication for a minimum of 8 weeks, or on no medication at all. The following reasons for exclusion were noted: 3 = medication; 5 = too young; 1 = too young and parents non-English-speaking; 3 = had FBT previously; 1 = had a medical condition. Reasons for declining participation in the study were as follows: 7 = no reason given; 5 = perceived burden (e.g., time, effort, stress); 2 = did not want to commit to protocol.

A full description of the similarities and differences between RCT and Non-Research Care is detailed in **Table 1**.

Research Trial Care (RCT)

The RCT sample (*n* = 54) participants were aged between 12 and 18 years, met *DSM-IV* criteria for AN (excluding amenorrhea) or Eating Disorder Not Otherwise Specified (AN type), were ≤ 90% mBMI at baseline, lived with at least one parent who was available to participate in treatment, and were evaluated for study participation between July 2010 and July 2014. Exclusion criteria were current psychotic disorder; drug or alcohol dependence; acute suicidality; physical condition influencing eating or weight (e.g., pregnancy); previous FBT; and psychotropic medication use <8 weeks. Data on the number of participants who were screened out for these reasons are reported in the main outcome paper (10).

Non-Research Care

The Non-Research Care sample (*n* = 56) was mixed [13 not eligible for the RCT, 14 refused participation, and 29 not applicable (RCT recruitment completed)], drawn from children and adolescents aged 8–18 who were evaluated in the same outpatient eating disorders assessment clinic between August 2010 and November 2015, met *DSM-IV* criteria for AN or Eating Disorder Not Otherwise Specified (AN type), were ≤ 90%mBMI at baseline, and received FBT. The same cohort of eight clinicians who provided care in the RCT were available to provide care in this context. Therapists were doctoral- and masters-level psychologists or certified family therapists.

Measures

Demographic and clinical characteristics were evaluated for all participants during an eating disorders assessment clinic visit. The same assessment battery was conducted at baseline, end-of-treatment, and at 6- and 12-month follow-up for both groups. For the purposes of the current study, we only note the measures of relevance to our primary research question (for the RCT protocol, see 20).

Weight and height

Patient weights were taken at baseline, week 4, week 12, end-of-treatment, and at 6- and 12-month follow-up; height was also regularly measured. Depending on context and availability, weights at weeks 4 and 12 were taken by 1) researcher (gown), 2) pediatrician/nurse (gown), or 3) therapist (lightly clothed).

Eating Disorder Examination

Eating Disorder Examination (EDE, 21). Diagnoses were determined by EDE interview, and its global score was used to determine baseline and subsequent eating disorder pathology. The EDE has demonstrated good reliability and validity (see 22, for review).

Child Depression Inventory

Child Depression Inventory (CDI; 23) is a 27-item self-report measure of cognitive, affective, and behavioral symptoms of depression in children and adolescents. Each item is scored on a three-point scale (0–2) according to symptom severity. The measure has demonstrated good reliability and validity (24).

Statistical Analyses

To explore the extent to which RCT Care was comparable to Non-Research Care on baseline demographic and clinical characteristics, independent *t*-tests, and chi-square tests were used. Differences in treatment dose (i.e., total sessions, treatment duration) between types of care were also examined with *t*-tests. Survival analyses were used to compare the two samples on time to achieve 95%mBMI (25, 26). Individuals who were not weight

TABLE 1 | RCT Care vs. Non-research Specialty Care.

		RCT Care	Non-research Specialty Care
Setting	*Location*	Highly specialized eating disorder program located in a tertiary care hospital	
	Medical/psychiatry care	Provided by the team pediatrician and (if indicated) psychiatrist	
	Payment	No-cost treatment	
	Wait list	Brief (typically 2 weeks)	
	Contact and assessments	Frequent contact and assessments throughout treatment and follow-up with research staff	
	"Observation"	Sessions audio taped (with consent)	Sessions not recorded
Treatment	*Implementation*	Fixed dose (18 sessions) of manualized FBT with high adherence required in implementation	
	Assignment	Random assignment to FBT (versus parent-focused FBT)	Clinical recommendation to receive FBT
Therapists	*Degree*	Masters- and doctoral-level psychologists, or family therapy–trained social workers	
Training and Supervision	*Training/supervision*	Structured training and supervision in FBT provided on a weekly basis with oversight of treatment adherence	
Patients	*Referral route*	Clinical and personal referrals *via* a multi-disciplinary assessment clinic	
	Diagnosis	AN with %mBMI ≤90	
	Age	12–18 years	8–18 years
	Medication Other characteristics	Stable dose of medication >8 weeks (or no medication) No differences	No medication exclusion criteria

RCT, randomized controlled trial; FBT, family-based treatment; AN, anorexia nervosa; %mBMI, percent median body mass index; gray = similar; black = different.

restored by end-of-treatment (n = 73, 66.4%) were treated as "censored" observations, indicating that treatment response did not occur prior to termination of the measurement period. A Cox proportional hazard model was then fitted using a log logistic distribution. Chi-square tests were used to compare the proportion of patients who had achieved 95%mBMI at 6- and 12-month follow-up, according to treatment group.

The following baseline variables were initially examined in separate models (including main effects for the variable and type of care, and their interaction) as predictors of time to weight restoration: age, baseline %EBW, eating disorder pathology (i.e., EDE global score), duration of illness, psychiatric comorbidity, hospitalization prior to treatment, psychotropic medication use, depressive symptoms (i.e., CDI score), intact family status, and parent education. Dichotomous predictors were coded as −.5 and +.5, and continuous predictors were mean-centered (27). Main effects and interactions that significantly predicted time to 95% mBMI (p < .10) in their initial models were simultaneously entered into a final model. Factors specific to the therapist (e.g., personality, experience) were not determined in the data or included in analyses. IBM SPSS Statistics 25 was used for all analyses.

RESULTS

Missing Data

Partial to fully complete data were available for all participants up to 6 months post-baseline. Weight data missing at week 4 was only evident for those in Non-Research Care [n = 4 (3.6%)]; at week 12, missing weight data were comparable for both groups [n = 6 (5.5%) RCT and n = 7 (6.4%) Non-Research Care]. Compared to those with complete data, patients with incomplete data were largely similar on eating disorder pathology, psychiatric comorbidity, hospitalization prior to treatment, psychotropic medication use, depression scores, intact family status, or parent education. However, those with missing weight data resulting from early treatment termination were older (15.6 vs. 14.7 years, t = −2.48 p = .02), had lower initial weights (79.3 vs. 84.3%mBMI, t = 4.19, p < .001), and has longer duration of illness (10.1 vs. 7.5 months, t = −2.44, p = .02). Weight data were available for all patients at their last treatment session (end-of-treatment), for 69 patients at 6-month follow-up (RCT: n = 50, 89%; Non-Research Care: n = 19, 34%) and for 84 patients at 12-month follow-up (RCT: n = 43, 79%; Non-Research Care: n = 41, 73%).

One participant had missing EDE data at baseline. While 36 (32.7%) were missing data on baseline parent education, these data were missing at random, based on a non-significant chi-square statistic (χ2 = .36, p = .84) for Little's Missing Completely at Random (MCAR) analysis (28). The CDI was not scored if more than one item was missing, which resulted in 23 participants (21%) with missing baseline depressive symptom data. Evaluation of all CDI items in the full sample and per treatment group indicated these data were again missing at random, based on a non-significant chi-square statistic (χ2 = 288.1, p = .81) for Little's MCAR analysis.

TABLE 2 | Sample Characteristics at Baseline.

	RCT Care (n = 54)	Non-Research Care (n = 56)	p
Age (years), M (SD)	15.43 (1.33)	15.09 (2.25)	.34
Male, n (%)	6 (11.1%)	4 (7.1%)	.47
Australian born, n (%)	50 (92.6%)	54 (96.4%)	.30
Intact family, n (%)	35 (64.8%)	37 (66.1%)	.89
Parent education, M (SD)	9.56 (3.85)	8.89 (3.55)	.45
AN binge/purge subtype, n (%)	14 (25.9%)	13 (23.2%)	.74
Weight (%mBMI)	80.45 (5.41)	81.49 (7.08)	.75
Global EDE Score, M (SD)	2.12 (1.75)	1.76 (1.54)	.26
Duration of illness (months), M (SD)	11.07 (9.49)	13.50 (9.43)	.18
Co-morbidity, n (%)	19 (35.2%)	16 (28.6%)	.46
CDI Score, M (SD)	18.81 (10.87)	17.16 (9.23)	.45
Psychotropic medication, n (%)	6 (11.1%)	8 (14.3%)	.62
Hospitalization prior to FBT	21 (38.9%)	25 (44.6%)	.54

Parent education = combined mean of years of education of both parents; %mBMI = percent median body mass index for age and height; EDE, Eating Disorder Examination; CDI, Child Depression Inventory.

Participant Characteristics

Baseline participant characteristics are shown in **Table 2**. The combined sample was primarily female (90.9%, n = 100) with a mean age of 15.3 years (SD = 1.9). Mean %mBMI was 81.0 (SD = 6.3), with an average duration of illness of 12.3 months (SD = 9.5). There were no significant differences between the two types of care in psychiatric comorbidity.

Treatment Dose Across Type of Care

FBT was delivered in both arms over a course of 24 weeks (18 sessions); 15 patients (14%) (RCT = 7; Non-Research Care = 8) had extended treatment [2–7 extra sessions (one outlier had 14 sessions); and 5–14 extra weeks (one outlier had 35 weeks)]. RCT participants received a mean of 14.9 sessions [SD = 4.4; range: (4, 18)] over 19.5 weeks [SD = 6.7; range: (1.1, 26.1)]. Those in Non-Research Care received a mean of 14.4 sessions [SD = 4.9; range: (1, 18)] over 19.4 weeks [SD = 7.2; range: (0, 26.4)]. There were no significant between-group differences in treatment length or dose (all ps > .50).

Time to Achieve Weight Restoration

Of the 110 participants, 37 (34%) were weight restored within 6 months of treatment (RCT: n = 19, 35%; Non-Research Care: n = 18, 32%). Across the full sample, the mean time to weight restoration was 5 months (M = 21.12 weeks, SD = 3.86). Of patients with weight data at 12-month follow-up (n = 84, 76%), 37 (44%) were weight restored (RCT: n = 19, 35%; Non-Research Care: n = 18, 32%); there was no significant between-group difference in proportion of those weight restored, according to treatment context (χ2 = 0.001, p = .98).

In all initial models, the main effects for treatment context, eating disorder pathology, illness duration, depression scores, parent education, intact family status, psychiatric comorbidity, psychiatric medication use, and hospitalization prior to outpatient treatment were non-significant (ps > .10). There were significant main effects for age (Wald chi-square = 5.19, df = 1, p = .02, OR = 3.62, 95% CI = 1.19–10.94), such that those who were younger were less likely to achieve weight restoration by 12-month follow-up. Those with a lower initial %mBMI were also significantly less likely to achieve weight restoration (Wald chi-square = 7.11, df = 1, *p* = .01, OR = 0.66, 95% CI = 0.48–0.89). There were no other significant main effects or interactions between variables of interest and treatment group (*p*s > .10).

The overall model included main effects for type of care, age, and %mBMI. There were 16 censored cases (RCT: *n* = 7, Non-Research Care: *n* = 9) before the earliest event in the stratum, which were dropped from final analyses. The overall model did not significantly predict time to weight restoration (overall chi-square = 6.13, df = 3, *p* = .11) (**Figure 1**). The main effect of %mBMI (B = .07, SE = .03, *p* = .03, OR = 1.07, 95% CI = 1.00–1.15) remained significant, such that weight restoration was achieved faster by those who had higher baseline %mBMI. The main effects of age and treatment context were not significant (*p*s > .10).

DISCUSSION

The current study compared weight outcomes in a sample of adolescents diagnosed with AN who received FBT *via* a research trial or non-research specialty care, both treatments provided within an academic specialist eating disorder service. Specifically, this study investigated time to weight restoration across these two groups, with a secondary aim to examine these trajectories relative to potential baseline moderators. At baseline, there were no between-group differences in any variables of interest (e.g., %mBMI, eating disorder pathology). However, across both treatment groups, those who were younger, or who had entered treatment with a higher weight, were more likely to achieve weight restoration within the 18 allotted sessions. Overall findings from survival analyses indicated that the rate of weight restoration did not appear to differ according to type of care (RCT vs. Non-Research Care) but that elevated baseline weight remained a significant predictor of achieving weight restoration more quickly within treatment. These results are not surprising given that patients who start treatment at a higher weight have less weight to gain in order to achieve 95%mBMI.

Baseline demographic and clinical variables suggest that the non-research specialty care sample of patients was quite similar to the sample who participated in the RCT. Further, when provided with the same treatment in the same clinic environment, the current study provides preliminary evidence that the more strictly implemented protocol of a trial did not appear to confer any significant advantage in achieving timely weight restoration, or differences in sustained weight gain at 6- or 12-month follow-up. Certainly, null findings can be difficult to draw conclusions from when sample sizes are modest or small, which is a potential limitation of the current study. Increasing the generalizability of research findings with comparable representativeness in study samples is of critical importance. This study supports the notion that FBT can be effective across a diverse patient population since it was conducted in a public health care setting, which admits all patients (geography as the only criterion for entry). However, the highly controlled implementation of FBT across settings, which typically only characterizes clinical trials, is difficult to replicate in true usual care settings. As a result, community providers may significantly modify EBP delivery (17), because of the constraints on clinical practice outside specialty centers (e.g., lack of training, supervision, support from a multidisciplinary team who further convey to families, the value of FBT), which may ultimately impact the likelihood of weight restoration at the end-of-treatment in non-specialty settings (29). This study does not inform how setting factors may influence implementation and outcomes in a usual, community-based setting.

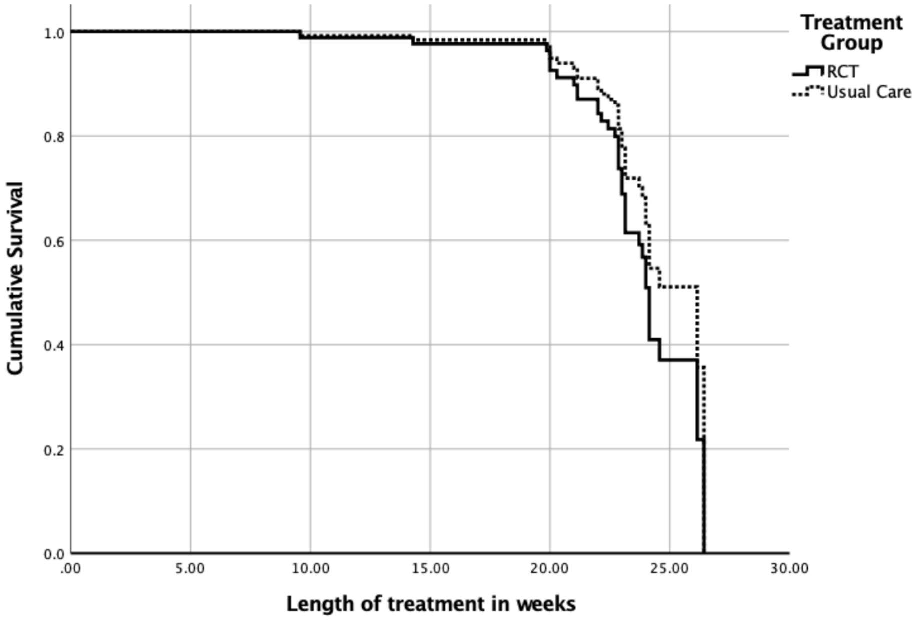

FIGURE 1 | Time to weight restoration for randomized clinical trial (RCT) care vs. non-research specialty care.

Irrespective of RCT or non-research care, participants who entered treatment with a lower %mBMI were the least successful in achieving weight restoration by end-of-treatment. While this may not seem surprising in the context of adolescents needing to gain more weight, prior research found that time to achieve weight restoration was actually similar across %mBMIs, with the exception that for patients at a lower %mBMI, significantly fewer achieved weight restoration in the context of non-research specialty care compared to RCT care (18). Future work might further explore individual differences that contribute to improved treatment outcomes in order to maximize effectiveness of FBT for patients who begin treatment at different baseline weights.

The US-based (18) and current Australia-based study were conducted in academic settings with a history of undertaking clinical trials. In these highly specialized settings, research can examine whether differences in trial eligibility criteria (generally stricter within a trial) are associated with different rates of remission. As would be expected, clinicians who work in such settings are accustomed to delivering protocol-driven care, presumably comfortable with receiving supervision, and supportive of a research environment, so treatment will look similar whether or not a trial is underway. In the current study, approximately half of the Non-Research Care group was treated after the RCT; the site also had new clinicians starting in the midst of the combined time period, rendering any specific differences that could be attributable to clinician experience difficult to track. While this is a study limitation, it may also increase the overall generalizability of its findings to real-world settings. A critical difference between the US-based study (18) and our current study is that in a public health care setting, the ability to pay typically will not affect any family or provider decisions. In effect, we have demonstrated that within the constraints of the current sample size, which arguably is modest, and in consideration of the characteristics that were measured, there were no significant differences in eligibility or baseline characteristics (e.g., psychiatric comorbidities), and that treatment intensity appeared to be the same across the two treatment contexts. However, one important question that remains unanswered is how a "real-world" representative sample, receiving true usual care and drawn from a setting outside the context where research trials are conducted, will compare to research-based care delivered in an academic setting. Very little research has been done in this area. Preliminary efforts to address this question appear promising (12, 18), but there is still relatively little implementation science in the field of eating disorders. Implementation efforts are needed to further our understanding of treatment effectiveness in community-based usual care settings and the factors that impact implementation in order to maximize outcomes in these settings.

DATA AVAILABILITY STATEMENT

The datasets generated for this study are available on request to the corresponding authors.

ETHICS STATEMENT

The studies involving human participants were reviewed and approved by The University of Melbourne, Melbourne, Australia. Written informed consent to participate in this study was provided by the participants' legal guardian/next of kin.

AUTHOR CONTRIBUTIONS

Study design and conception: DG, EH, SS, and EA. Statistical analysis: EA and SG. Writing and review of manuscript: all authors.

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Family-Based Treatment for Anorexia Nervosa Symptoms in High-Risk Youth: A Partially-Randomized Preference-Design Study

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This pilot study adapted family-based treatment (FBT) for youth with potentially prodromal anorexia nervosa (AN). Fifty-nine youth with clinically significant AN symptom constellations, but who never met full Diagnostic and Statistical Manual of Mental Disorders (4th ed., text rev.) (DSM-IV) criteria for AN, were enrolled in a partially randomized preference design study. Participants were offered randomization to FBT or supportive psychotherapy (SPT); those who declined to be randomized because of a strong treatment preference were entered into a parallel, non-randomized self-selected intervention study. Without accessing outcome data, an observational analysis with three diagnostic subclasses was designed based on AN symptom severity profiles, combining randomized and non-randomized participants, such that participants receiving FBT and SPT within each subclass were similar on key baseline characteristics. Outcomes of this pilot study were explored by calculating effect sizes for end-of-treatment values within each subclass, and also with a longitudinal mixed effect model that accounted for subclass. Weight trajectory was measured by percent expected body weight. Psychological outcomes were fear of weight gain, feeling fat, importance of weight, and importance of shape. Results show that the pattern of symptom observations over time was dependent on subclass of SAN (least symptomatic, moderately symptomatic, or most symptomatic) and on the target outcome variable category (weight or psychological). Results from this study, which should be considered in the context of the small sample sizes overall and within groups, can generate hypotheses for future, larger research trials on early treatment strategies. Feasibility findings illustrate how the innovative partially randomized preference design has potential broader application for AN intervention research.

Clinical Trial Registration: ClinicalTrials.gov, identifier NCT00418977.

Keywords: anorexia nervosa, early identification, early intervention, family-based treatment, partially-randomized preference design

INTRODUCTION

Anorexia nervosa (AN) typically onsets in adolescence, with medical and psychiatric sequelae often appearing even before the diagnostic threshold is crossed (1, 2). The compromised weight status inherent in a diagnosis of AN, whether achieved by weight loss or, for some younger individuals, failure to gain weight along an expected growth curve trajectory, is a process that occurs by degrees. As such, the AN syndrome is invariably preceded by a prodromal state (3–5), although during the prospective symptom development phase, there are no definitive markers of risk for full AN (4). Specifically, it is not known with precision for which adolescents the AN features will progress, will remain at a chronically sub-diagnostic level, or will be transient. Research has shown that all three outcomes are possible, although conclusions from longitudinal epidemiological studies of AN are limited by the low prevalence of the disorder (6–10).

The consensus in the field is that early identification and treatment of the emerging signs and symptoms of AN are critical in mitigating the risks associated with this pernicious eating disorder and in conferring an improved prognosis (11–15). That said, targeted early intervention efforts for AN are predicated on an accurate assessment of its diagnostic criteria, a task dually challenged by developmental factors as well as illness-specific ones (16). For example, expected body weight (EBW) among children and adolescents is an individualized, moving target; in turn, determining degree of deviation from this reference point requires both studying historical healthy growth curves, and modeling future ones that account for growth in age and stature over time (17). In addition, patient report of phenomena such as fear of weight gain and undue influence of shape and weight on self-concept relies on abstract cognitive capacities that are still under development in youth (18–20). Moreover, the ego-syntonic nature of AN frequently precludes direct admission of such symptoms (21). Thus, one complication in the early identification and treatment of potentially prodromal AN is missed “caseness” of frank AN. The diagnostic revisions to AN in the 5th Edition of the *Diagnostic and Statistical Manual of Mental Disorders* (DSM-5; 22) are designed, in part, to render the criteria more developmentally sensitive (9, 18, 19, 23, 24).

On the continuum of eating disorder intervention, early treatment falls at the cusp between targeted prevention of high risk individuals, and focused treatment of those already diagnosed (25). Given that a prodromal state is only accurately labeled as such in retrospect (i.e., after a full disorder develops), and targeting a potential psychopathological prodrome carries ethical risks such as unnecessary treatment and stigmatization among false positives (26), careful consideration is warranted before intervening. In the case of incipient AN, both research and expert consensus support taking action (19). The literature has long since characterized sub-diagnostic cases and argued that they are not markedly distinct from their full-AN counterparts in medical complications, comorbidities, and outcomes (2, 27–31). While these sub-diagnostic samples are generally heterogeneous with regard to course, they collectively include a portion of individuals who have not yet met the diagnosis and are at risk for progression to AN. Moreover, not only is the sub-syndromal AN symptom profile clinically significant in its own right (thus often meeting criteria for the residual diagnostic category of Eating Disorder Not Otherwise Specified or the later Otherwise Specified Feeding or Eating Disorder), but the impending AN syndrome is arguably severe enough to warrant risking treating cases ultimately revealed to be false positives.

What is yet unanswered in the literature is the optimal form of early intervention, to both resolve extant symptoms and prevent conversion to the full AN syndrome. This is particularly important to address in the stages of development when risk for AN onset is the highest.

While one community-based prevention study tested a brief, parent-based internet intervention for high risk girls (32), no randomized controlled trials (RCT) to date have focused on treatment-seeking youth who are potentially prodromal by virtue of a clinically significant, AN-like symptom constellation.

The current pilot study aimed to assess the feasibility and effect estimates for two interventions for children and adolescents with sub-syndromal DSM-IV (4th ed., text rev.; *DSM–IV–TR*; 33) AN (SAN), to inform the design and hypotheses of future, larger research trials (34) on early treatment strategies. Specifically, we evaluated family-based treatment (FBT) and individual supportive psychotherapy (SPT) for individuals exhibiting proximal risk for conversion to AN based on their symptom profile, while never having met full criteria for AN. In light of the concerns regarding missed “caseness” outlined above, we included youth with both stringent and relaxed study-specific criteria for SAN (see *Method*). Based on the literature supporting the efficacy of FBT for AN (35), we anticipated that effect estimates would favor an adaptation for high-risk youth, relative to a control intervention in (a) reducing the severity of the emerging or present AN diagnostic symptoms (specifically low weight status, fear of weight gain, disturbance in the experience of shape and weight, and overvaluation of shape and weight), and (b) decreasing the likelihood of developing full AN during the observation period.

METHOD

Study Design Development

This pilot study, part of a National Institute of Mental Health Career Developmental Award (K23 MH074506-01) granted to the first author, was originally intended to employ a pure RCT design. However, during the development and early phases, a strong and increasing preference for FBT among carers of potential participants became evident, as manifested by a steadily rising rate of declining to risk randomization assignment to a study intervention other than FBT. Specifically, within a 16-month period, among potential participants initiating telephone inquiries for the study and declining based on a stated reason, 0% cited this concern in the first quarter, 50% did so in the second quarter, 67% in the third, and 75% in the fourth.

These data posed two important issues: a practical one regarding feasibility of recruitment and a conceptual one regarding the importance of treatment preference as a variable to study in its own right. We thus implemented a simultaneous parallel, non-randomized trial in which families who declined randomization were offered their intervention of choice and followed with the identical study protocol for assessment and treatment as their randomized counterparts. Importantly, this partially randomized preference design avoids non-consent bias, i.e., restricting the observed sample to only those willing to risk randomization to an intervention other than FBT, in light of clear population-level variability on this characteristic. Non-consent may correlate with treatment response, or represent a proxy for another variable associated with differential response to FBT, thereby introducing sample bias if not addressed methodologically. Additionally, a partially randomized preference study permits objective, quantitative methods for potentially combining randomized and non-randomized groups for analysis (36–38).

Ethics Approval

The dual research protocols (randomized and non-randomized) were approved by the Icahn School of Medicine at Mount Sinai's Institutional Review Board.

Participants

This pilot study aimed to enroll 60 participants across intervention conditions. Participants were male and female children and adolescents, ages 9–18 years, who met criteria for SAN as defined below, were living with parent(s) or guardian(s) willing to participate in the study intervention and able to provide consent in English, and were deemed medically stable for outpatient treatment by their physician. For the non-randomized study, declining randomization was an additional inclusion criterion. Exclusion criteria were: a history of full AN; current psychosis, substance use disorder, or active suicidality; current antipsychotic medication; medical or physical conditions known to influence eating, weight, or menstrual status; refusal to agree to engage in ongoing medical management with a physician or permit ongoing exchange of clinical information with the treating physician; refusal to agree for the research team to obtain weight and height at study sessions; and current or previous participation in FBT. Other concurrent treatment, including psychological or psychopharmacological interventions, was permitted to increase generalizability to clinical populations, and randomization was stratified for this variable. For participants with a history of sexual or physical abuse by parents, siblings, or guardians, perpetrators of the abuse were excluded from participation in the study intervention.

As noted above, SAN was operationalized broadly to intentionally capture a heterogeneous sample of at-risk youth. Specifically, the purpose of including a “relaxed” SAN criteria profile (i.e., lenient by virtue of lower clinical thresholds as well as interpretation of symptom indicators), in addition to the more stringent one, was to target a similar profile of individuals who may be at risk of progressing to AN without intervention, by virtue of exhibiting clinically significant restrictive dietary habits leading to concerning weight loss. **Table 1** presents the study criteria for SAN.

Recruitment

Participants for this study were recruited by informing colleagues, pediatricians, organizations, and other clinics treating eating disorders of the protocol. No recruitment efforts revealed the availability of the non-randomized preference arm in order to maintain the integrity of the randomized study and to ensure that those entering the parallel study were truly declining randomization. Referral sources (e.g., pediatricians) who became aware of the parallel arm were briefed on the purpose and importance of describing only the primary study to potential participants, and agreed to abide by the research protocol.

Baseline Assessment

Potential participants were screened for preliminary study fit in a brief telephone screening interview, followed by an in-person assessment session to obtain informed consent and assent and evaluate eligibility. Inclusionary and exclusionary criteria were assessed with clinical interviews with the patient and parent(s) that included questions derived from the Schedule for Affective Disorders and Schizophrenia for School-Age Children—Present and Lifetime Version (K-SADS; 39) and the Eating Disorder Examination, edition 16.0D (EDE; 40) to rule out a history of full AN. The EDE was also used to rule in current SAN.

Randomization

Randomization to study intervention was programmed by author BTW—who was uninvolved in any other study operations—using computer-generated assignment. Random allocation assignments were stored in envelopes sequentially numbered, filled and sealed by a research assistant external to the study team. Research assistants within the study team enrolled participants. For those parents or patients declining randomization at any point during the assessment process, the parallel non-randomized study was offered, and allocation to FBT or SPT was determined by preference following an alternate consent/assent procedure. All other study procedures remained identical for the randomized and non-randomized arms of the study.

TABLE 1 | Study Criteria for SAN.

Features	Definition of SAN	
	Strict	Lenient
Number of DSM-IV AN criteria (A[1], B[2], C[3], D[4]) currently met	2-3	2-3
History of full-criteria AN	No	No
Adjustment for males	Criterion D imputed as present if Criterion A met	Criterion D imputed as present if Criterion A met
Adjustment for pre-menarcheal[5] females	Criterion D imputed as present if Criterion A met	Criterion D imputed as present if Criterion A met
Adjustment to Criterion A[5,6]	Not allowed	Allowed
Adjustment to Criterion B[7]	Not allowed	Allowed

SAN, sub-syndromal DSM-IV anorexia nervosa. AN, anorexia nervosa.

[1] *Criterion A = refusal to maintain normal body weight, strictly interpreted as at or above 85% of expected body weight by population norms.*

[2] *Criterion B = fear of weight gain.*

[3] *Criterion C = disturbance in experience or valuation of body weight/shape.*

[4] *Criterion D = amenorrhea.*

[5] *Primary amenorrhea was defined in this study as delayed menarche beyond age 16.*

[6] *If the strictest interpretation of Criterion A was not met, participants must have engaged in dietary restriction leading to a below-expected weight by population norms or individualized growth curve history, in combination with 2–3 of the remaining criteria for inclusion in the study.*

[7] *For cases with adjusted Criterion A only, extreme self-directed dietary restriction that interfered with weight gain efforts was regarded as behavioral evidence of Criterion B even if such fear was not verbally endorsed. This determination was informed by clinical assessment of both recent typical eating patterns and the participant's reaction to any attempts at renourishment, as reported by patient, parent, and/or referring clinician.*

Intervention and Medical Management Settings

The study intervention setting was a specialist eating disorders program within an academic medical center. Initial medical clearance and ongoing medical oversight, obtained external to the study and research setting, were required for all participants in the study. These were provided by participants' established pediatricians or by a specialist referral, if requested by the family, within or outside of the hospital system. Medical management visits with the physician were required to take place at least monthly, or more frequently as dictated by the physician's judgment of the patient's clinical severity. Physicians treating the participants in this study were provided with the Society for Adolescent Health and Medicine's [(41); since updated as (17)] guidelines for medical management and criteria for hospitalization with youth with restrictive eating disorders.

Interim and Outcome Assessment

Height and weight were obtained on a physician's scale as part of the EDE and at every visit for the purpose of tracking weight change and growth in participants. Percent EBW at each session, a primary outcome variable, was derived from these data by calculating current weight as a percentage of weight corresponding to 50th percentile body mass index (weight in kg/height in m^2) percentile adjusted for age and sex (42). Participants were weighed in single-layer street clothes, without shoes or heavy accessories.

If a participant's clinical status worsened to the extent that s/he was no longer medically or psychiatrically stable for outpatient treatment or developed full AN, the case was regarded as a study intervention failure and the participant was exited from the study with a referral to a more intensive level of care. Study attrition (investigator- or participant-initiated exit from the research) cases were not replaced.

The primary outcomes were changes in severity of key diagnostic dimensions (weight status, fear of weight gain, disturbance in the experience of shape and weight, and overvaluation of shape and weight) and diagnostic status (conversion to AN). The study included four major assessment points (before treatment, end-of-treatment or termination/drop-out, and 6 months and 12 months post-treatment), as well as checks for changes in diagnostic indices at every session. The current paper focuses on the study's primary hypotheses and corresponding outcome variables, within the active, 14-session intervention observation period.

Baseline, Outcome, and Classification Measures

Eating Disorder Examination (EDE)

The EDE edition 16.0D (40) interview generates eating disorder diagnoses, four severity subscales, a global score, and frequencies of key eating disorder behaviors. The EDE was originally developed for adults but has also been used successfully with adolescents (43). It has sound psychometric properties (44) and is sensitive to change. The diagnostic items of EDE, including fear of weight gain, feeling fat, importance of weight, and importance of shape, correspond to DSM-IV criteria, and were used in this study to determine baseline eligibility (using the 3-month EDE timeframe for diagnosis), in the generation of the subclass profiles described below (three-month timeframe), and in the evaluation of treatment outcome (1-month timeframe, per research convention, to avoid significant overlap with course of treatment). Denial of seriousness of low body weight per DSM-IV criteria is not directly captured in the EDE, and therefore an item assessing this was added to the EDE for purposes of diagnosis, subclass analyses, and tracking potential conversion to AN, which would necessitate withdrawing the participant from the research.

Eating Disorders Examination—Parent Version (PEDE)

The PEDE (16, 45), adapted from the EDE, was developed to systematically assess for the parent's perspective on the patient's eating disorder features, and it includes specific queries for behavioral indicators that a symptom may be present (46). It was administered at the same intervals as the EDE. The diagnostic items from the PEDE were used in conjunction with the EDE to create the subclass profiles as described below. The PEDE's construct validity and internal consistency are established as on par with the psychometric properties of the EDE (46).

Eating Disorders Examination Questionnaire (EDEQ)

The EDEQ is a questionnaire version of the EDE (47); it is reliable and valid (44), and regularly used in adolescent samples (43, 48, 49). Like in the EDE, an item was added to the EDEQ to evaluate denial of seriousness of low weight. In addition to its use at the major assessment time points, the EDEQ was administered in a modified form at each session to assess the period of time elapsed since the prior session. This session-based questionnaire, along with height and weight measurements at each session, enabled monitoring to determine if any participant's diagnostic status had converted to full AN, e.g., by virtue of further weight loss or endorsement of additional cognitive symptoms, at any point during the intervention phase of the study. In instances when end-of-treatment data were not available *via* the EDE interview, scoring from the EDEQ was substituted to minimize missing data.

Study Interventions

Intervention Delivery

Each study intervention was manual-based and consisted of 14 50-minute sessions over 6 months (weekly x eight sessions, biweekly x four sessions, monthly x two sessions). While the standard version of FBT for AN is a 20-session protocol, a briefer treatment course has demonstrated success (e.g., 50) and was deemed a suitable foundation for a sub-syndromal sample. The manuals were initially tested with a small series of pilot participants. Study therapists were clinical psychologists or advanced doctoral psychology trainees; therapists were trained with didactics, role-play, and active rehearsal of both interventions. The principal investigator (PI; KL) conducted weekly group supervision meetings that included review of videotaped sessions. A senior study consultant (DLG) reviewed a randomly selected subset of 20% of sessions across both modalities for adherence assessment and qualitative expert feedback. If problems in the application of the study interventions were identified during these reviews, supervision to correct them was conducted by DLG in conjunction with the PI.

Family-Based Treatment (FBT)

FBT for AN (51) is a symptom-focused intervention designed to enlist parents as the agents of their child's recovery, titrating down their involvement as the eating disorder recedes. FBT progresses across three phases: phase one targets renourishment, interruption of behavioral symptoms, and role structuring of family members (parents, patient, siblings); phase two fosters gradual restoration of independence around energy intake and expenditure; and phase three addresses normal adolescent development, relapse prevention, and termination. Each FBT session begins with a brief individual meeting with the patient to obtain weight and discuss any of the adolescent's concerns; the remainder of the session is conducted with the family present. FBT was adapted for SAN (for a full description of the adaptation, see 52–54). This adaptation emphasizes the risk for conversion to full AN in addition to the medical, psychiatric, and functional impairment posed by extant eating disorder symptoms, and prescribes strategies that draw from the broader eating disorders risk and prevention literatures, including family meals and parental modeling of healthy, flexible, non-restrictive eating.

Supportive Psychotherapy (SPT)

SPT is a short-term, non-directive individual therapy that represents a credible control intervention by incorporating non-specific therapeutic strategies without including any putative active therapeutic techniques for eating disorders, such as direct prescriptions for healthy eating or the modification of distorted body image experience. SPT was originally developed for intervention trials of bulimia nervosa in adults (55, 56) and was later adapted for use in adolescent research (57). In the current study, parents were included for brief check-ins, in reverse parallel to the proportion of time spent in individual contact with the patient in FBT. Parents were also provided with a basic psychoeducation handout on AN, including the high number of calories typically required for weight restoration. No direct intervention instructions were given to parents. Like FBT, SPT is delivered in three phases, with the first focused on establishing a strong therapeutic alliance, obtaining a complete picture of the eating disorder and its development, and identifying underlying problems that might contribute to the current symptoms. The second phase encourages further exploration and explication of emotional states and difficulties, and the third addresses how residual psychological challenges my affect future adjustment, highlights progress, and processes termination.

Statistical Analyses

Subclass Generation

Following Rubin (58, 59), we designed the study to parallel the ideal, hypothetical randomized experiment that would have been conducted had we been able to randomize all participants. Specifically, without access to outcome data, we created three subclasses of participants such that the individuals receiving FBT and the individuals receiving SPT within each subclass were as similar as possible on baseline characteristics. These subclasses parallel the strata in a hypothetical stratified randomized experiment, and we analyzed the outcomes by comparing FBT and SPT participants within each subclass, to account for baseline characteristics. Both participants who consented to randomization and those who declined are included in the subclasses. We pooled the randomized and non-randomized participants for analysis because the sample size in each of these groups was too small to justify separate analyses. In addition, because there were only 22 randomized participants, the FBT and SPT participants in the randomization group differed from each other on their baseline AN criteria, such that including the randomized participants in the subclassified design improved balance between FBT and SPT on baseline AN criteria. This approach, which explicitly prioritizes balance on the highest-priority covariates, is similar to post-stratification in

TABLE 2 | Higher-Priority Baseline Clinical Characteristics for Establishing Balanced Treatment Groups, by Subclass.

Treatment Group:	**Subclass**					
	Least Symptomatic		**Moderately Symptomatic**		**Most Symptomatic**	
	FBT (*n* = 23)	**SPT (*n* = 12)**	**FBT (*n* = 8)**	**SPT (*n* = 2)**	**FBT (*n* = 12)**	**SPT (*n* = 2)**
Highest-priority variables						
AN Criterion A Met (EDE)	0.00	0.00	1.00	1.00	1.00	1.00
AN Criterion A Met (PEDE)	0.00	0.00	1.00	1.00	1.00	1.00
AN Criterion B Met (EDE)	0.44	0.33	0.00	0.00	0.00	1.00
AN Criterion B Met (PEDE)	0.74	0.58	0.13	0.00	1.00	1.00
AN Criterion C Met (EDE)	0.96	0.75	0.50	0.00	0.58	1.00
AN Criterion C Met (PEDE)	0.96	1.00	0.63	0.50	1.00	1.00
EDE Global Score	2.58	1.98	0.36	0.27	0.89	4.13
High-priority variables						
EDE Feeling Fat	0.41	0.33	0.00	0.00	0.00	0.50
EDE Importance of Weight	0.67	0.50	0.38	0.00	0.08	1.00
EDE Importance of Shape	0.76	0.58	0.00	0.00	0.25	1.00
EDE Denial of Seriousness of Low Weight	0.68	0.45	0.25	0.00	0.36	0.00
PEDE Feeling Fat	0.36	0.30	0.00	0.00	0.11	0.00
PEDE Importance of Weight	0.91	0.75	0.29	0.50	0.67	1.00
PEDE Importance of Shape	0.91	0.75	0.14	0.00	0.89	1.00
PEDE Denial of Seriousness of Low Weight	0.77	0.75	0.63	0.00	0.75	0.50
AN Criterion D Met (EDE)	0.17	0.17	0.75	1.00	0.83	0.00
BN Criterion D Met (PEDE)	0.15	0.20	0.86	0.50	0.83	0.00
Number of Diagnostic Criteria Met (EDE)	1.52	1.17	2.13	1.00	2.25	3.00
Number of Diagnostic Criteria Met (PEDE)	1.39	1.50	2.38	1.50	2.92	3.00
PEDE Global Score	3.41	2.63	1.06	1.08	1.95	3.54
EDEQ Global Score	1.00	0.68	0.30	1.28	0.96	1.47

Table values represent means (mean scores of continues variables; means of 0/1 binary values for categorical variables, where 0 = not met and 1 = met). FBT, family-based treatment; SPT, supportive psychotherapy; Criterion A, refusal to maintain normal body weight; Criterion B, fear of weight gain; Criterion C, feeling fat and/or overvaluation of weight and/or overvaluation of shape and/or denial of seriousness of low weight; Criterion D, amenorrhea; EDE, Eating Disorder Examination; PEDE, Eating Disorder Examination—Parent Version; EDEQ, Eating Disorder Examination Questionnaire.

a purely randomized study, where chance imbalances on key covariates are addressed by creating subclasses as if the randomization had not taken place (60–63).

We first sorted the available baseline variables by investigator consensus regarding clinical priority. Baseline AN criteria were given highest priority, along with EDE Global Score as a broader indicator of eating disorder pathology. **Table 2** shows the highest- and high-priority baseline variables, by subclass and treatment group[1]. We then created a study design by iterating between proposing ways to subclassify the participants, comparing FBT and SPT participants within the proposed subclasses on baseline characteristics, and refining the proposed subclasses to create better balance on these characteristics. Because outcomes were not used during subclass creation, this iterative study design process did not introduce bias.

In larger non-randomized studies, subclasses can be created by estimating propensity scores (64) or *via* algorithms [e.g., (65)]. However, these methods of subclassification must be informed by clinical expertise and are only useful if the resulting subclasses contain treatment and control participants who are very similar on baseline characteristics. In a small study such as this one, using an algorithm that attempts to create balance on a large number of baseline characteristics can result in discarding most of the participants or failing to establish balance on the baseline characteristics that are most important clinically (66). Also, the resulting subclasses may not be easily interpretable.

To create baseline balance more effectively, our final design defines subclasses of participants based only on baseline AN criteria. For the purpose of developing subclasses, we used the higher symptom rating between EDE and PEDE to indicate the presence of each psychological criterion. The justification for adding the parent information (PEDE) in the generation of these subclasses is that there is both expert consensus (19) and data (67, 68) to support the idea that patient self-report, particularly for youth, is insufficient in painting the full picture of eating disorders. As getting at the "true" clinical picture for highest priority baseline characteristics is essential to create generalizable subclasses that can meaningfully combine participants from the randomized and non-randomized arms, we could not risk the marked influence of between-subject variability in denial and minimization on self-report measurement. For similar reasons, we ignored amenorrhea because it is a controversial diagnostic criterion without consistent diagnostic validity that was ultimately eliminated in DSM-5 during the course of this study (69).

There were three subclasses generated from this process. The first was the least symptomatic in terms of AN criteria, in that criteria B and/or C were met but not A (see **Table 1** for a review of the criteria). The second was a moderately symptomatic subclass, who met criterion A alone or in combination with B

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[1] Summary table of moderate- and low-priority variables, as well as data on final balance achieved on all variables, are available upon request.

or C. The third was the most symptomatic subclass, who met DSM-IV AN criteria A, B, and C at baseline.

We then checked that, within each of the three subclasses we created, FBT and SPT participants were similar not only on baseline AN criteria but also on the other baseline characteristics that are clinically relevant. Thus, while subclasses were based on diagnostic profile, balance was checked on all of the baseline characteristics. Balance was perfect or very good on the highest priority characteristics, at the expense of relatively larger baseline differences on characteristics that were initially categorized as lower priority. Given the very small sample sizes, this tradeoff between creating balance on certain characteristics versus other characteristics was expected. A benefit of the design we chose is that each of the subclasses reflects a well-defined segment of SAN (see *Results*), allowing us to estimate the effects of FBT versus SPT within these sub-samples. Our strategy of subclassifying on key baseline criteria is in many ways similar to coarsened exact matching (70).

Effects Estimates

For each outcome, by subclass, we report raw end-of-treatment effect size, calculated as the difference between end-of-treatment means in the FBT and SPT groups within a subclass, divided by the baseline standard deviation of the same variable for all 59 participants.

The statistical analysis relied on longitudinal mixed effects models, following the original analysis plan, with subclass as a key predictor, reflecting the partially-randomized preference design and creation of subclasses to establish covariate balance. All participants were included in analyses, including those who dropped out or were exited from the study. The final analyses focus on weight gain and psychological outcomes, as planned, but not conversion to AN, even though conversion to AN was a planned primary outcome. Only two participants converted to AN during the study (one prior to session 1 and one at session 3), and so it is not possible to draw meaningful conclusions about the effects of the two treatments on conversion to AN.

We fit longitudinal mixed effects linear regression models to the continuous primary outcome variables (percent EBW and EDE Fear of Weight Gain, Feeling Fat, Importance of Weight, and Importance of Shape using MIXREG software) (71). The mixed effects models implemented by Hedeker and Gibbons are specifically intended for psychiatric data and have several characteristics that provide solutions to commonly observed problems in the analysis of longitudinal data, including missing data and serial correlation (72). In addition, these analyses can model systematic person-specific deviations from the average time trend.

Specifically, we used random effects regression to model each outcome as a function of treatment, time, treatment x time, subclass, subclass x treatment, and subclass x time. We modeled the individual response of each participant as a line with intercept (baseline response) and slope (improvement rate), obtaining an average trend line for each intervention group, by subclass. We report contrasts from the mixed effect models estimating the effects of FBT versus SPT by the end of treatment. We do not report *p*-values, because this pilot study was not powered to show significant effects, particularly given that subclassification was needed to establish baseline balance. Had we calculated *p*-values or corresponding confidence intervals, they would have been large, primarily driven by the small sample size rather than the effect sizes. Following recent statements from the field of statistics (73–75), we focus on effect estimates to generate hypotheses that can be tested in future, larger studies.

RESULTS

Fifty-nine participants were entered into the primary or parallel study (see **Figure 1**). The most frequent source of referral was pediatricians (*n* = 23, 39.0%). **Table 3** shows the baseline demographic and clinical characteristics of the overall sample as well as by treatment group and randomization status. Rates of randomization (versus non-randomization study entry) were similar across the three subclasses depicted in **Table 2**: 40% (14/35) for the least symptomatic group, 30% (3/10) for the moderately symptomatic group, and 36% (5/14) for the most symptomatic group. The research was conducted from September 2005 to August 2011.

For each outcome, by subclass, **Table 4** shows baseline means, the raw difference between FBT and SPT end-of-treatment means, the effect size calculated by standardizing the raw end-of-treatment difference by the baseline standard deviation, and contrasts from the mixed effects model comparing FBT and SPT. Ranges (minimum and maximum values) for baseline and end-of-treatment means are reported as measures of variability instead of standard deviations, which would not indicate variability well for the subgroups with an *n* of 2.

There were substantially more participants in the least symptomatic group, in which B and/or C were met but not A, than in the other two subclasses (**Table 2**). Among these participants, individuals who received SPT exhibited higher percent EBW over time than those who received FBT (**Table 4** and **Figure 2**). The model-estimated effects on psychological outcomes were relatively small, with individuals in SPT possibly experiencing greater reductions than those in FBT.

For participants in the moderate subclass, who met criterion A alone or in combination with B or C, the model-estimated effect after four sessions suggests that participants in the two treatments were similar on percent EBW and on psychological outcomes (**Table 4** and **Figure 2**). We calculated an early-session (4) contrast here rather than an end-of-treatment contrast for percent EBW because of the very rapid attrition of the two SPT participants in the subclass.

For participants in the most symptomatic subclass, who met DSM-IV AN criteria A, B, and C at baseline, the model results show that by the end of treatment, individuals who received FBT had a higher percent EBW than those who received SPT (**Figure 2**). In addition, individuals in this subclass who received FBT ended treatment with a greater reduction in psychological symptoms (EDE Fear of Weight Gain, Feeling Fat, Importance of Weight, and Importance of Shape) than individuals in SPT. We note that the SPT and FBT participants were imperfectly balanced at baseline on these continuous psychological measures, even though they all met the categorical psychological criteria at baseline. This discrepancy is a function of criterion C's compound algorithm capturing

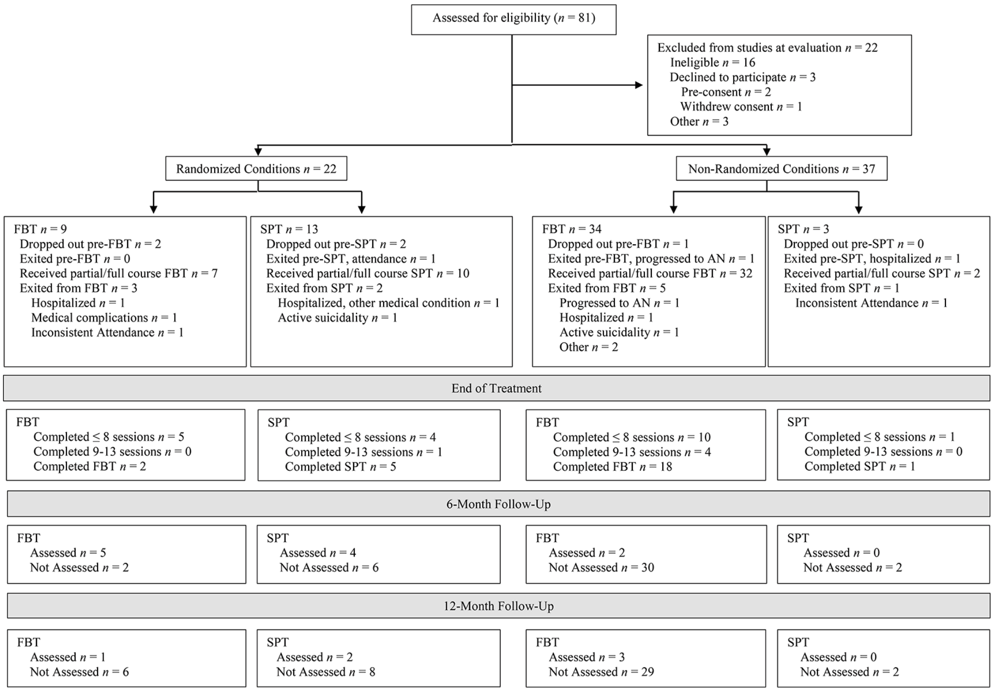

FIGURE 1 | Participant flow chart following Consolidated Standards of Reporting Trials guidelines for family-based treatment (FBT) and supportive psychotherapy (SPT) conditions in the randomized and non-randomized study arms.

disturbance in experience of body shape or weight, and/or undue influence of shape or weight on self-concept, and/or denial of seriousness of illness.

DISCUSSION

Early intervention is considered to confer an improved prognosis among children and adolescents exhibiting signs and symptoms of AN (11–15). This study adapted and explored FBT for application at the intersection of prevention and treatment, for youth with potentially prodromal AN. The pattern of symptom observations over time was dependent on subclass of SAN per DSM-IV criteria and on target outcome variable category (weight or psychological). Among those participants in the most symptomatic group, who would meet full AN diagnosis according to the more developmentally sensitive DSM-5 criteria, FBT participants experienced greater reversal of weight loss than SPT participants. For the least symptomatic group, SPT participants experienced greater weight loss correction than FBT participants. In the moderate group, weight outcomes were similar in FBT and SPT. For psychological outcomes, no clear or strong differences between FBT and SPT were evident.

These observations within the SAN population are consistent with a robust treatment literature demonstrating the efficacy of FBT in achieving weight restoration for youth with diagnostic-level AN (35, 76). Findings also align with research highlighting that specialty treatments for AN, relative to comparator interventions, more consistently achieve improvements for weight-based AN symptoms than for psychological features of the illness (77). Results should be considered in the context of the pilot nature of the study, its primary goals to observe effect estimates and feasibility indicators, and the small sample sizes. In particular, the SPT groups in the moderate and severe subclasses each had an *n* of 2, challenging confidence in their findings. Combining subclasses to increase treatment group sizes for analysis was not possible, as doing so would have imbalanced FBT and SPT participants on baseline covariates. Balance between subclasses is a prerequisite to inferring causality, and violating balance would pose an even greater problem than small group size. However, this pilot study aimed to inform the design and hypotheses of future, larger research trials (34) on early treatment strategies, rather than to draw definitive conclusions about treatment efficacy.

Conversion from SAN to AN during the observation period was rare (**Figure 1**), although attrition compromises interpretability of this finding. That said, the two cases who did progress to the full diagnosis worsened quickly after presentation to the study, one before the first treatment session and the other by the third session. Similarly, participants who exited the study because they deteriorated and required hospitalization for their eating disorder symptoms—while not converting to AN—did so early (one before the first session and two by the third). Another three participants were exited for other reasons of clinical significance (one for medical instability that did not require hospitalization, and two for active suicidality). Thus, a total of 8/59 (13.6%) participants experienced marked clinical decline, even under close observation and care. This

TABLE 3 | Demographic and clinical characteristics at baseline, overall, and by treatment group and randomization status.

	FBT		SPT		Total
	Randomized (*n* = 9)	**Non-Randomized (*n* = 34)**	**Randomized (*n* = 13)**	**Non-Randomized (*n* = 3)**	**Overall Sample (*n* = 59)**
Demographics					
Age (years)	14.01 (1.96)	13.13 (2.03)	14.66 (2.17)	15.16 (0.56)	13.70 (2.09)
Self-Identified Gender: Female	9.00(100.00)	28 (82.40)	10.00 (76.90)	3.00 (100.00)	50.00 (84.70)
Self-Identified Race/Ethnicity					
White	7.00 (77.80)	29.00 (85.30)	11.00 (84.60)	3 (100.00)	50.00 (84.70)
Hispanic/Latino	2.00 (22.20)	2.00 (5.90)	2.00 (15.40)	0.00 (0.00)	6.00 (10.20)
Asian	0.00 (0.00)	2.00 (5.90)	0.00 (0.00)	0.00 (0.00)	2.00 (3.40)
Clinical Characteristics					
Weight (pounds)	94.84 (24.21)	86.11 (20.42)	101.25 (23.70)	109.67 (2.70)	91.97 (22.17)
Height (inches)	61.97 (4.60)	60.78 (4.88)	62.97 (3.97)	64.83 (1.61)	61.65 (4.60)
%EBW	88.33 (9.16)	86.22 (8.53)	90.67 (12.81)	91.94 (2.42)	87.82 (9.56)
Duration of Symptoms (months)	15.89 (9.48)	14.18 (16.10)	10.08 (8.97)	18.34 (3.51)	13.74 (14.02)
Current Treatment (frequency)	3.00 (33.33)	16.00 (47.10)	4.00 (30.80)	1.00 (33.33)	24.00 (40.70)
Prior Hospitalizations (total count)	0.25 (0.46)	0.41 (0.99)	0.15 (0.55)	0.33 (0.58)	0.33 (0.82)
Courses of Treatment (total count)	1.22 (1.20)	1.21 (1.19)	0.77 (0.73)	1.67 (0.57)	1.14 (1.08)
EDE Restraint	1.84 (1.69)	1.84 (1.99)	1.70 (2.29)	3.07 (2.65)	1.88 (2.01)
EDE Eating Concern	1.11 (1.21)	0.98 (1.24)	1.32 (1.52)	2.40 (2.09)	1.15 (1.35)
EDE Weight Concern	1.77 (2.01)	1.72 (1.86)	1.96 (1.85)	3.73 (1.50)	1.88 (1.87)
EDE Shape Concern	1.79 (1.92)	2.19 (2.12)	2.03 (2.09)	3.75 (2.00)	2.17 (2.06)
EDE Global Score	1.63 (1.60)	1.77 (1.70)	1.75 (1.82)	3.24 (2.01)	1.82 (1.71)
PEDE Restraint	3.04 (0.97)	3.04 (1.74)	3.16 (1.66)	4.10 (0.36)	3.12 (1.57)
PEDE Eating Concern	1.41 (1.55)	1.46 (1.33)	1.24 (1.63)	1.47 (0.83)	1.40 (1.39)
PEDE Weight Concern	1.92 (1.49)	2.13 (1.86)	2.94 (2.02)	3.67 (2.04)	2.35 (1.87)
PEDE Shape Concern	2.38 (1.58)	2.74 (2.04)	2.52 (2.12)	2.84 (2.00)	2.64 (1.95)
PEDE Global Score	2.19 (1.07)	2.67 (2.38)	2.45 (1.60)	3.02 (0.36)	2.56 (1.99)
EDEQ Restraint	2.96 (1.50)	2.04 (1.88)	2.03 (1.80)	3.07 (1.81)	2.24 (1.80)
EDEQ Eating Concern	2.01 (1.65)	1.28 (1.43)	1.33 (1.33)	3.00 (2.25)	1.51 (1.51)
EDEQ Weight Concern	2.62 (1.79)	2.10 (1.80)	2.40 (2.09)	3.73 (1.40)	2.34 (1.84)
EDEQ Shape Concern	2.69 (1.74)	2.41 (1.99)	2.19 (2.16)	4.10 (1.58)	2.49 (1.97)
EDEQ Global Score	2.57 (1.55)	1.96 (1.66)	1.93 (1.75)	3.47 (1.61)	2.13 (1.67)

Table values represent mean (standard deviation) for continuous variables, and frequency (percent) for categorical variables. FBT, family-based treatment; SPT, supportive psychotherapy; %EBW, percent expected body weight (weight corresponding to the 50th percentile body mass index for age and sex); EDE, Eating Disorder Examination; PEDE, Eating Disorder Examination—Parent Version; EDEQ, Eating Disorder Examination Questionnaire.

pattern, which spanned the least to most symptomatic subclasses, underscores the importance of early intervention among children and adolescents exhibiting proximal risk by virtue of their clinically significant, diagnostic AN symptoms. This also validates the clinical concerns identified by pediatricians, who constituted the most common referral source for the study.

The observed clinical deterioration, and the fact that it was not exclusive to the most sick subclass, speaks to the composition of the study sample. Inclusion criteria, while deliberately broad in certain respects, were also designed to capture a specific cross-section of children and adolescents already exhibiting core clinically significant symptoms of AN rather than only risk factors. They were also treatment-seeking or treatment-referred, in contrast to the sample in the Jacobi et al. (32) community parent-based, internet-delivered prevention study. Perhaps not surprisingly then, participants in the current study had already had some exposure to eating disorders treatment—approximately once, a rate that included treatment before or at the time of presentation, and that was fairly consistent across randomized and non-randomized study arms, treatment groups, and subclasses. Interestingly, Jacobi and colleagues (32) encountered significant recruitment, engagement, and retention challenges; when parents declined participation after being informed that their child had screened positively for AN risk, the majority cited lack of concern about the identified risk factors (including weight loss) and therefore no interest in a prevention program, and many stated that their physicians had no concerns about their child's risk or had even advised the parents against participating. This suggests that AN researchers should consider recruitment feasibility in addition to clinical impact when identifying proximal risk definitions and early intervention timing and methods. In addition, future research on youth at risk for AN should take into account the likely heterogeneity of the study sample and anticipate a restricted range of potential improvement in particular target outcome variables for some cases (e.g., less weight gain in those with less baseline weight loss). Broader outcome indices, such as quality of life, that may be more uniformly applicable could be included.

Beyond the study's implications for further research on early identification and treatment strategies for AN-spectrum presentations, the innovative partially randomized preference design has compelling application to broader AN intervention research, which is known for its recruitment challenges (78, 79). Adults may decline to be randomized because of fear that one

TABLE 4 | Study Results.

Treatment group	**Subclass**								
	Least Symptomatic			**Moderately Symptomatic**			**Most Symptomatic**		
	FBT (*n* = 23)	**SPT (*n* = 12)**	**FBT—SPT Difference**	**FBT (*n* = 8)**	**SPT (*n* = 2)**	**FBT—SPT Difference**	**FBT (*n* = 12)**	**SPT (*n* = 2)**	**FBT—SPT Difference**
Percent EBW									
Baseline									
Mean	92.29	94.69		77.27	79.55		82.13	79.76	
Minimum	85.55	86.05		71.42	74.10		76.20	78.31	
Maximum	109.31	121.43		84.78	85.00		88.93	81.22	
EOT									
Mean	96.81	101.07	-4.26	84.52	77.88	6.65	88.02	86.10	1.92
Minimum	83.70	86.07		71.39	74.10		78.07	85.32	
Maximum	113.74	126.42		93.20	81.65		101.44	86.89	
Effect Size^			-0.45			0.70			0.20
Contrast at EOT*			-3.47			0.02#			2.95
EDE Fear of Weight Gain									
Baseline									
Mean	3.48	2.17		0.25	0.00		0.75	6.00	
Minimum	0.00	0.00		0.00	0.00		0.00	6.00	
Maximum	6.00	6.00		2.00	0.00		4.00	6.00	
EOT									
Mean	3.26	2.67	0.59	0.38	0.00	0.38	0.83	3.00	-2.17
Minimum	0.00	0.00		0.00	0.00		0.00	0.00	
Maximum	6.00	6.00		3.00	0.00		6.00	6.00	
Effect Size^			0.23			0.14			-0.83
Contrast at EOT*			1.04			0.29			-4.14
EDE Feeling Fat									
Baseline									
Mean	2.96	1.83		0.25	0.00		0.92	3.50	
Minimum	0.00	0.00		0.00	0.00		0.00	1.00	
Maximum	6.00	6.00		2.00	0.00		5.00	6.00	
EOT									
Mean	2.74	2.50	0.24	0.38	0.00	0.38	0.67	3.00	-2.33
Minimum	0.00	0.00		0.00	0.00		0.00	0.00	
Maximum	6.00	6.00		3.00	0.00		6.00	6.00	
Effect Size^			0.10			0.15			-0.95
Contrast at EOT*			0.52			-0.23			-3.05
EDE Importance of Weight									
Baseline									
Mean	4.04	3.67		2.38	2.00		1.75	5.50	
Minimum	0.00	1.00		0.00	1.00		0.00	5.00	
Maximum	6.00	6.00		5.00	3.00		6.00	6.00	
EOT									
Mean	3.17	2.75	0.42	0.38	1.50	-1.12	0.83	3.50	-2.67
Minimum	0.00	0.00		0.00	0.00		0.00	1.00	
Maximum	6.00	6.00		1.00	3.00		6.00	6.00	
Effect Size^			0.20			-0.54			-1.27
Contrast at EOT*			0.35			-0.06			-3.32
EDE Importance of Shape									
Baseline									
Mean	4.35	4.00		1.25	1.00		2.17	6.00	
Minimum	0.00	1.00		0.00	0.00		0.00	6.00	
Maximum	6.00	6.00		4.00	2.00		5.00	6.00	
EOT									
Mean	3.48	2.83	0.64	0.62	0.00	0.62	0.83	4.00	-3.17
Minimum	0.00	0.00		0.00	0.00		0.00	2.00	
Maximum	6.00	6.00		2.00	0.00		5.00	6.00	
Effect Size^			0.29			0.28			-1.44
Contrast at EOT*			0.65			0.73			-3.28

FBT, family-based treatment; SPT, supportive psychotherapy; EBW, expected body weight; EOT, end-of-treatment; EDE, Eating Disorder Examination.

^Effect sizes are end-of-treatment differences in means, divided by standard deviation of all 59 participants at baseline.

**Contrasts are estimates of FBT v. SPT effects by the end of treatment, by subclass, according to a longitudinal mixed effect model.*

#This contrast is calculated at session 4 rather than end of treatment because of the very early attrition of the two participants in the A+B/C SPT group.

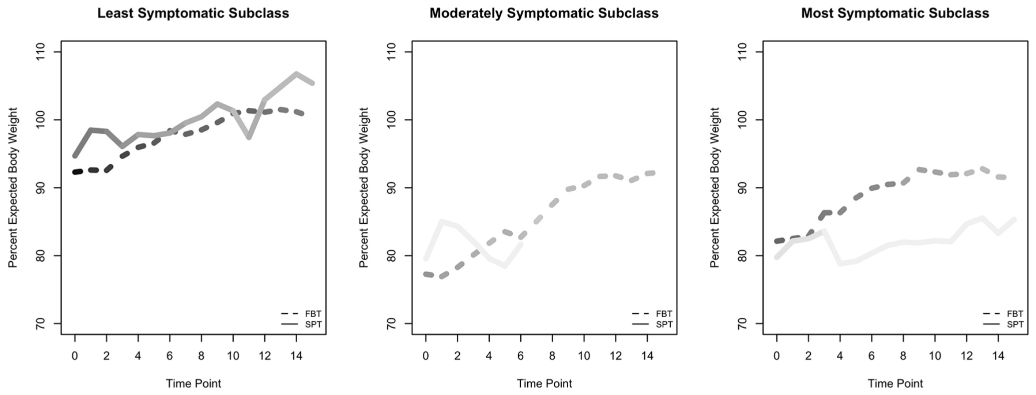

FIGURE 2 | Raw means for percent expected body weight (EBW) outcome, by subclass. Figures of time series for psychological outcomes are not shown because psychological outcomes were measured at only two time points. Lines are shaded to reflect the number of participants in each group, and at each time point within each group, with darker shading indicating greater numbers.

treatment may yield greater weight gain than another, an outcome about which individuals with AN are ambivalent. Conversely, parents of children and adolescents might decline consent for randomization for their children because of motivation to receive a specific intervention, as was the case in the current study and which represents a critical feasibility finding. Specifically, as described earlier, during the early stages of the research, a clear and rising preference for FBT among carers of potential participants emerged, resulting in a high rate of declining randomization. With the addition of the parallel arm of the study, approximately two-thirds (37/59) of the ultimate sample were non-randomized participants. Of these, over 90% (34/37) elected to receive FBT. The partially randomized preference design is a strength of the study in that it has the benefit of retaining data from participants who would otherwise remain unobserved. In addition, the unbiased process of creating balanced subclasses of participants permits an empirically-derived convergence of data from the two parallel study arms for final analysis. AN research could also benefit from other innovative designs for evaluative complex interventions, beyond the partially randomized preference model (80).

The small sample size, especially given the lack of randomization for many participants, limited both the power of the study and the ability to create subclasses that were perfectly balanced on all baseline characteristics. Our choice to prioritize balance on the A, B, and C baseline criteria necessarily resulted in less balance on other baseline variables. A larger sample size within a partially randomized preference trial design would allow for better baseline balance, and *p*-value or confidence interval calculations in addition to effect sizes. While we obtained good balance between treatment groups on the highest- and high-priority covariates in the subclass generation, greater homogeneity could be achieved with a larger sample size. It would also permit separate analyses of randomized and non-randomized groups, beyond treatment comparisons within and across the subclass formations.

Attrition is an additional feasibility finding and study limitation, especially its rate during follow-up, which prevented data analysis beyond the active intervention observation period. However, we do not know whether for certain cases, attrition was a function of limited need for treatment (i.e., by virtue of rapid response or transience of symptoms) as opposed to lack of engagement. Future research evaluating this could approach the question from both clinical and healthcare cost perspectives, and include mixed methods to gather qualitative data on parents' and patients' experiences in addition to quantitative data. Notably, rates of treatment completion among those participants who were not exited by the study team for clinical deterioration—a proxy for engagement—were similar between FBT and SPT, at approximately 50%. Importantly, while the present study design aimed to control for non-specific therapy effects in the form of SPT, it did not control purely for the effect of time with a wait-list control condition. Thus, the course of illness of SAN in the absence of any intervention—in itself and as compared to specialty clinical attention—cannot be inferred from this research. In addition, this study cannot elucidate symptom course among non-treatment-seeking samples.

One aspect of the hybrid nature of the current study—in that it incorporated elements of both efficacy and effectiveness trials—was the decision to permit participants to remain in outside treatment, e.g., psychopharmacological intervention. This allowance functions as a limitation while also increasing the pilot study's ecological validity. Another limitation of the study was that we did not collect data on the treatment preferences, if any, of the participants who agreed to be randomized. Thus, we only know the preferences of those in the non-randomized arm, and we could not analyze overall whether being matched to one's preferred treatment confers a better prognosis. The only related data we have is that there was a similar percentage of participants declining randomization in each subclass, although we did not attempt to balance the subclasses on this variable. Several further study limitations were secondary to resource limitations in the context of the grant mechanism and pilot status of the trial. These include outcome assessments being conducted by research assistants who were at times aware of randomization status or treatment arm, and the lack of inter-rater reliability data for assessment measures.

Considering feasibility findings, observations of clinical deterioration across the sample, and effect estimates from the current study all together, future trial designs with the SAN population would (a) hypothesize that utility of family-level interventions, particularly for more symptomatic patients, and with justification for close clinical monitoring and attention and (b) anticipate families' reluctance to be randomized to a less active treatment like SPT.

Future research investigating children and adolescents with potentially prodromal AN should also adjust the definition of SAN in accordance with DSM-5 and further-evolving diagnostic criteria that may better delineate between true "caseness" in youth versus sub-syndromal, high risk presentations, including those that meet criteria for a DSM-5 Other Specified Feeding or Eating Disorder (OSFED). In particular, understanding how atypical AN, one such clinically significant subcategory of OSFED that has appropriately garnered significant recent attention, fits into the paradigm of risk, prevention, and course of AN will also be critical. Further planned analyses with data from the current study seek to investigate SAN through the dual prisms of changes in diagnostic systems (DSM-IV to DSM-5) and symptom informants (patients versus parents). In addition, while controlling for the effects of time alone, without clinical attention, in SAN research is advantageous for causal inference of results, ethical considerations challenge this design. This may be particularly true for treatment-seeking and treatment-referred samples given their proximal risk of clinical deterioration or conversion to AN.

DATA AVAILABILITY STATEMENT

The datasets generated for this study are available on request to the corresponding author.

ETHICS STATEMENT

The research involving human participants was reviewed and approved by Icahn School of Medicine at Mount Sinai. Written informed consent for children to participate in this study was provided by the participants' parents/legal guardians.

AUTHOR CONTRIBUTIONS

KL, RW, SM, CP, NZ, DG, JL, JN, CT, and BW all provided substantial contributions to the conception and design of the study. KL, SM, CP, LH, KK, and DS contributed to data analysis. KL, LH, and BW contributed to data acquisition processes. All authors contributed to interpretation of data and to drafting and/or critically reviewing/revising the paper for important intellectual content. All authors approved the submitted version of the manuscript.

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[2] See Study Record Versions 1-8 for accurate identification of primary outcome measures; Versions 9 and 10 contain locked clerical errors.

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Toward A Greater Understanding of the Ways Family-Based Treatment Addresses the Full Range of Psychopathology of Adolescent Anorexia Nervosa

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Family-based treatment (FBT) for anorexia nervosa (AN) is an empirically supported treatment for this disorder. Derived from several different schools of family therapy, it is a highly focused approach that initially targets weight restoration under parental management at home. However, the view that manualized FBT is solely a behavioral therapy directing parents to refeed their children AN with the single purpose of weight gain is a common but misleading over simplification of the therapy. Indeed, weight restoration is the main goal only in phase 1 of this 3-phase treatment. When practiced with fidelity and skill, FBT's broadest aim is to promote adolescent development without AN thoughts and behaviors interfering and disrupting these normal processes. Although weight restoration is a key starting point in FBT, the entire course of treatment takes into consideration the ongoing impact of starvation, cognitions, emotions, and behaviors on adolescent development. These factors associated with maintaining low weight are viewed in FBT as interfering with the adolescent being able to take up the tasks of adolescence and thus must be overcome before fully turning to those broader adolescent tasks. In addition, FBT recognizes that adolescence takes place in the context of family and community and respects the importance of learning in a home environment both for weight gain as well as related developmental tasks to have a lasting effect. Specifically, in this article we describe how the current FBT manualized approach addresses temperament/personality traits, emotional processing, cognitive content and process, social communication and connections, psychiatric comorbidity, and family factors. This report makes no claim to superiority of FBT compared to other therapies in addressing these broader concerns nor does it add interventions to augment the current manual to improve FBT.

Keywords: family-based treatment, anxiety, cognitions, social, family

INTRODUCTION

The view that manualized family-based treatment (FBT) is solely a behavioral therapy directing parents to refeed their children with anorexia nervosa (AN) with the single goal of weight gain is a common but misleading over simplification of the therapy (1). Reports suggest that therapists implementing FBT are concerned with the lack of specific interventions in the approach to address issues such as psychiatric comorbidity, perceived family dysfunction, and broader adolescent development and functioning (2–5). While there is deliberate focus on weight and eating normalization, FBT aims more broadly at promoting adolescent development without AN thoughts and behaviors interfering and disrupting these processes. Thus, in the structure, intervention, therapeutic style, and treatment phases, FBT attends to the broad psychopathology of AN. However, in FBT, weight restoration is a key starting point and is approached from a developmental and learning perspective that recognizes the realities of adolescent abilities and the importance of their home environment for weight gain to have a lasting effect. In this article we review how FBT promotes weight restoration and in this context, temperament/personality traits, emotional processing, cognitive content and process, social communication and connections, psychiatric comorbidity, and family factors.

There are only limited data that support the view that manualized FBT leads to improvements in psychosocial functioning and related psychopathology. For example, longer term outcome studies found high levels of psychosocial functioning 4 years posttreatment with FBT (6). With a mean age of about 19 years at time of follow-up, 73% of the participants were no longer in any psychiatric treatment and 73% were in full time school or work. In addition the Youth Self Report scale (7) scores improved from 40.6 at baseline (BL) to 25.6 at 1 year posttreatment and the Child Behavior Checklist (7) scores improved by over 20%. In a separate study Agras (8) and colleagues found (unpublished results) that for those treated with FBT the Beck Depression Inventory (BDI) (9) improved from 14.59 a BL to 7.1 at 1 year follow-up. Furthermore, the Rosenberg Self-Esteem Scale (10) improved from.4.2 at BL to 2.1 at follow-up. In addition, the Quality of Life and Satisfaction and Enjoyment Questionnaire (Short) (11) improved from 47.8 at BL to 53.2 at follow-up. There were also reductions in the Self-Esteem Questionnaire—Anxiety subscale score (4.5 at BL to 4.1 at follow-up) and the Childrens' Yale-Brown Obsessive Compulsive Scale (12) (3.82 at BL to 3.64 at follow-up). Interpretation of these findings is limited by the fact that these secondary outcomes were not tested for statistical significance nor were the studies powered to examine them. In addition, there was no evidence that these changes were greater in FBT than comparison treatments.[e.g., Adolescent Focused Therapy (13) and Systemic Family Therapy (14)]. A recently published qualitative study also support the view the FBT is helpful in overall adolescent development (15). Thus, these data are provided only for descriptive purposes to illustrate that FBT appears to have positive effects on broader AN psychopathology.

The treatment stance, family context, agnostic view of AN, prioritization of AN over other psychiatric issues, as well as the emphasis on adolescent development provide the overall context for how FBT helps with the other associated problems that are often present. Much of the early emphasis in FBT is about empowering parents because AN is seen as life threatening while also limiting the adolescent's capacity for making sound decisions about eating, exercise, and weight gain (16). Thus, parents are needed to temporarily manage these issues, but only until the adolescent herself is again able to make reality based decisions about her health. Many anxieties and obsessions are directly attributable to weight loss and starvation and dissipate to a significant degree with weight gain in the home environment. Parents are not viewed as a necessary evil but rather the natural and best resource for helping their children with their problems as they navigate them during treatment. In this sense, the other problems that are common in AN such as social anxieties, mood lability, and family conflicts are seen as part of the family work in FBT. Initially, these problems are addressed mostly in the context of food and eating, but during phases 2 and 3 when the adolescent is more involved in her usual social, academic, and family life, support for taking up adolescent process around peers and family are a clear focus—that is indeed the reason for phases 2 and 3. While progress in phase 1 is highly predictive of long term outcome (17), this does not imply that phases 2 and 3 are not needed; instead, phase 1 is the foundation for the work of these phases.

It is also worth noting in this description of how FBT addresses associated problems common in adolescent AN is the important role of the individual one to one time that occurs at the beginning of every FBT session. During this approximately 10-min time when the therapist meets alone with the adolescent, there is an important and ongoing opportunity to build rapport, evaluate cognitive and emotional states, identify specific concerns the adolescent may be experiencing, and provide support. In phase 1 of FBT, these one to one meetings may be brief and consist mostly of taking the adolescent's weight and assessing her reactions to weight change and to the efforts her parents are undertaking to help her. Rapport is usually slow to build with adolescents with AN who, because of their investment in maintaining AN, initially perceive the therapist as obstructive. However, the skilled FBT therapist demonstrates consistent warmth, interest, and concern for the adolescent, particularly in those facets of her identity and behavior that are independent of AN. Studies suggest that therapeutic alliance is good in FBT, despite the often difficult beginnings (18, 19). This increased rapport built carefully over phase 1 typically improves in phases 2 and 3 as trust develops that issues will be respectfully addressed with the family. Material gathered in these brief sessions are essential for addressing cognitive, emotional, social, and family processes more broadly as FBT proceeds.

SPECIFIC STRATEGIES EMPLOYED IN FBT TO ADDRESS THE BROAD BEHAVIORAL AND PSYCHOPATHOLOGY OF ADOLESCENT AN

Weight Restoration

Many of the behaviors associated with AN can be attributed to the so called "starvation syndrome" characterized so well in the classic Minnesota Semi-starvation studies (20). It has been suggested that weight restoration should resolve much of the related psychopathology of AN and for many years inpatient settings saw this as a core treatment aim, only to find their patients relapsed on discharge.

One of the hallmarks of FBT is the early and highly focused encouragement of parental management of their child's eating while living with them in the home environment. Weight restoration in this context differs from weight restoration in a hospital or any other professionally managed environment. Home is the environment where normal eating and weight management is generalizable. FBT takes seriously the principle that for learning to be optimized, it must take place in the environment where the learning is relevant. There is good evidence that FBT's home learning environment is effective for helping adolescents with AN to eat and gain weight more quickly than other outpatient approaches, leading to both reduced hospital use and costs (8, 21, 22).

In addition to emphasizing generalization of behavioral learning, FBT also considers the developmental capacities of an adolescent, usually around the age of 14–15 years, to make sound decisions and manage eating (23–25). It is not expected nor typical for most adolescents at these ages to be in full control of what they eat—they do not earn money to buy food, generally do not regularly prepare food, nor do they eat special individualized meals; instead, parents have this responsibility in the context of family life. FBT's approach returns to the parents the authority for their adolescent's food intake, a responsibility that AN tries to take from them. FBT takes the position that this is not seen as a regression to an earlier developmental age but rather a result of AN, and uses externalization strategies to emphasize this point. During phases 2 and 3, as AN symptoms abate, adolescent processes either onset (for younger patients) or are reestablished. This is of all the more importance when the child is seriously malnourished and unable to participate meaningfully in making these decisions because of the obsessional anxieties associated with an irrational fear of weight gain (26). Nonetheless, it is important to note that it is during the first phase of FBT only that weight restoration is the almost exclusive overt focus. This phase lasts about 6–10 weeks and is followed by 2–6 months of FBT aimed at age appropriate management of eating during phases 2 and 3.

Temperament and Personality Traits

A number of temperament or personality traits are associated with AN. The best characterized temperamental traits of relevance to AN are perfectionism (27–29), harm avoidance (30), (low) novelty seeking and persistence, traits that clinicians recognize can influence the course of illness, and treatment response. However, harm avoidance is significantly lower, and reward dependence significantly higher in individuals who recover from AN than in those who remain ill (31), suggesting that what appear to be traits may in fact be features of the illness. From a developmental perspective, an anxious temperament interferes with necessary adolescent social development with peers and associated socialization processes. FBT's approach to helping with this problem takes place in differing ways depending on the phase of treatment. In the weight restoration phase (phase 1), most anxieties are focused on food and eating, and in FBT support for managing these anxieties comes principally from parents as would be the case for most adolescent problems. In this phase, the adolescent gradually experiences decreased anxiety about weight gain by continuous exposure to food, eating, and weight gain (weekly weighing) (32). This prepares her for experimenting and testing her own anxieties about eating and weight gain during phase 2. During phase 2, socialized eating—at school, with friends, in restaurants, at parties—is a main focus. Parents are asked to help facilitate and support the adolescent in these exposures, with the aim of increased mastery of social anxieties in these situations a main treatment target. Helping the adolescent manage more general social anxieties is a treatment goal in phase 3 of FBT. In this phase, eating and weight restoration are not the focus, but instead, dating, sexuality, peer group participation, and individuation from parents are targeted. If at the conclusion of FBT there continues to be significant social anxiety, then additional treatment for these problems should be considered.

Perfectionism is common in AN and interferes with psychosocial functioning and may need intervention in its own right, as has been suggested by a modular addition to transdiagnostic CBT (33). In the context of adolescents with AN, an anxious temperament is, as noted above sometimes expressed as social isolation and avoidance. Perfectionism differs from social anxiety, although both may be partly based in an anxious temperament. Some of the ways perfectionism expresses itself in AN is through rigid control over eating, mealtime rituals, strict rule following, obsessional checking of calories, weight, fat grams, etc., and weighing (34). Data suggest that the perfectionism in this sense is highly related to obsessive compulsive personality features in AN (35).These, in turn, interfere with treatment response in FBT by making the task of refeeding and weight restoration in phase 1 even more challenging (36). Of interest, perhaps, is the fact that inpatient treatment may reinforce these perfectionistic and obsessive tendencies, reducing response (37). FBT in phase 1 approaches perfectionism behaviorally, that is through parental strategies that disrupt the ability to reinforce perfectionistic and obsessional behaviors related to food and weight (e.g., calorie counting, ritualized eating, excessive weighing, and mirror checking). These expressions of perfectionism as it relates specifically to AN are then the initial FBT target. In phase 2, perfectionism may contribute to social anxieties with peers by setting unrealistic standards for appearance and behavior either for the adolescent herself, for her peers, or for both (38). During phase 2, although weight gain is still an aim, there is an explicit focus on addressing adolescent experiments with eating and socializing with others. During the individual meeting between therapist and adolescent that begins every FBT session, the therapist has an opportunity to identify perfectionism and develop strategies with the adolescent to address these anxieties. These are then brought to the parents in the family session to address their impact and ways they can help overcome them—especially with comparison with peers around eating, food, weight, and exercise. During phase 3, perfectionism when present can be addressed in FBT as a problem that interferes with the adolescent's relationships and general self-esteem (39, 40). If perfectionism continues to be at a concerning level at the end of FBT, addition stand-alone treatment for this might be indicated outside the frame of FBT itself.

Emotional Processing

Emotional difficulties are often implicated in the development or maintenance of eating disorders and may be a risk factor for their development (41). There are problems with experiencing emotions, emotional sensitivity, and emotion regulation. Alexithymia, the inability to identify and label emotions (42), is present to a significant degree across studies in patients with AN (43). Depression and anxiety are well-described antecedents as well as comorbidities of AN, with the suggestion that starvation blunts the experience of negative affect and is therefore inherently rewarding through the avoidance of aversive feelings (34, 44). Unlike emotional sensitivity, emotional regulation is conceptualized as a skill that is learnt throughout life and most especially during adolescence as many new emotions are first experienced (45). The process of effective emotion regulation is predicated on recognition of emotions, utilization of cognitive or other strategies to manage emotions, and the deployment of reflective function and emotional processing to enhance learning (46). Cognitive strategies commonly used for emotion regulation include acceptance of emotions, cognitive reappraisal, problem-solving, rumination, avoidance of emotions, and suppression. Functional cognitive strategies for emotion regulation are impaired in those with eating disorders, suggesting they are potential targets for intervention (47). For example, women with eating disorders, across ED subtypes, are inclined to suppress emotions and lack the capacity to reappraise emotions. Rumination, repetitive thoughts about negative experiences and emotions, is implicated in mood and anxiety disorders and there is a growing body of research on rumination in relation to eating disorders. In AN, rumination is particularly high around topics such as negative emotions and body-related cognitions (48).

Development of cognitive and behavioral strategies for managing emotions, once recognized, is central to the cognitive behavioral treatment (CBT) approach. In contrast, the way that FBT enhances these skills is perhaps less intuitive. As a starting point, though, FBT posits that the parents and family are the usual, natural, and potentially most effective way to help adolescents with AN learn about their emotions and how to manage them. In the first phase of FBT, the adolescent with AN displays a range of emotions—from a seeming unemotional stance to one that is highly dramatic and dysregulated, especially during mealtimes. Often the expression of these heightened emotions is new to both the patient and the family. The use of externalization helps the family to understand that these emotions are related to the disorder of AN, especially because they are expressed in contexts specifically involving demands for eating and weight gain. Externalization helps to reduce blame and judgment of the expression of these heightened emotions. The parents are helped to learn not to react to these outbursts and instead to tolerate them rather than to respond in kind or by giving in to food refusal. In this way, the adolescent is helped to learn to manage and regulate her emotions through the repeated modeling and support of parents, in the way tantrums in a much younger child respond to similar forms of containment.

Siblings can also play a role in helping to manage emotions in FBT by providing distractions and alternative supportive activities such as playing games or watching videos. Strategies for under emotional expression as well as depressed and withdrawn adolescents are similarly managed by parents with sibling support in phase 1. In phases 2 and 3, as the adolescent is eating more normally, emotional difficulties tend to be less about reactions to food and weight gain, and instead are about social and familial relationships. Anxieties about peer acceptance and sadness about the impact of AN on relationships is part of the focus of these phases. FBT sees the anxieties about self and others that “emerge” as weight and shape concerns recede as integral to the disorder rather than separate and new. The therapist identifies these issues and their specifics in the one to one meeting held before the whole family session and helps the adolescent to express these emotions with the family and together they develop plans to address them. Thus, management of these emotions is often treatment goals during the later phases of FBT.

Cognitive Content and Processes

The cognitions of greatest relevance in maintaining the psychopathology of AN are those related to the value of weight and shape in self-evaluation (49). FBT does not include interventions to directly challenge these maladaptive thoughts and beliefs. In contrast, CBT for AN includes both motivational and cognitive restructuring techniques. These approaches directly address these problems and while conceptually of interest, data supporting their effectiveness for AN, and adolescent AN in particular are limited (50, 51). In FBT, the approach to addressing distorted beliefs and cognitions about food, weight and eating is initially approached behaviorally and indirectly. Data suggest that in FBT, changes in these distorted thoughts occurs about 6–8 months after weight restoration (6, 52). The timing is important here because this “lag” is likely related to prolonged reduction in the behaviors that maintain and reinforce these distorted cognitions. In other words, FBT contends that only with sustained weight normalization and continued inhibition of under eating, dieting, and over exercise do the cognitions lessen, presumably as a result of lack of reward for them over a prolonged period.

At the same time that FBT takes this longer view of cognitive change, there are a number of interventions in FBT that facilitate cognitive change and practice. For example, in phase 1, the adolescent is usually preoccupied with weight and shape concerns, but because in each session her weight progress is discussed openly and frankly, she must learn to manage her anxieties about weight gain because she is gradually, but persistently presented with anxiety provoking data about weight to increase acceptance and toleration of them (32, 53). By insisting on these exposures, even if they are sometimes emotionally challenging, FBT blocks avoidance. The therapist in the one on one time and the parents and family in session and at home can provide emotional support as the adolescent is learning to manage her cognitions about fear of weight gain. In sum, repeated exposure over the course of FBT leads to diminished weight gain fears. In phase 2, the adolescent is asked to participate actively with her parents in thinking through dietary and activity changes. In other words, she is engaged in problem solving around challenging her beliefs and their behavioral impacts. Although not in any way formal cognitive restructuring as used in CBT, problem solving in consultation with her parents lead to shifts in thinking in FBT.

A number of studies now support the importance of addressing thinking styles in the maintenance of AN through cognitive remediation therapy (CRT) (54). CRT targets metacognitive skills by helping patients recognize when their thinking style may be impacting decision-making and subsequent actions. In the case of AN, the most consistently demonstrated cognitive inefficiencies are found in set-shifting (changing track) and in central coherence (seeing the big picture in lieu of the detail) (55). These cognitive features are more marked in patients with AN who have high obsessive compulsive traits, traits which are known to moderate the outcome from FBT (36). This is an area where the role of starvation on cognitive function is also relevant. Fasting exacerbates set-shifting difficulties and impairs global processing, indicating weaker central coherence, in healthy controls (56). These findings (36) suggest that for some patients these cognitive inefficiencies may be secondary to malnutrition while in others malnutrition may enhance existing tendencies.

The evidence about cognitive processing problems in adolescents with AN is still developing (57). It appears that a good deal of cognitive rigidity improves with nutritional rehabilitation, so FBT's initial focus on this is a strategy to address cognitive flexibility. In preliminary studies CRT has been added to FBT in adolescents with AN and increased obsessionality (a marker for cognitive inflexibility) found some improvement but the effects were small (58). In general, in addition to weight gain, cognitive flexibility and big picture thinking are encouraged in FBT during phases 2 and 3 as the adolescent is asked to take, and is able to take, a broader perspective on her life and health than AN allowed and to participate in decision making about adolescent activities related not only to food, but to other social, educational, and family processes. Again, this differs significantly from the cognitive exercise strategies employed by CRT and likely helps with the majority of children with AN with very mild and likely state dependent cognitive processing difficulties (59). For those with more severe and persistent cognitive processing challenges, a course of CRT can be added without disrupting FBT (58). It is perhaps worth noting that the use of medications, particularly atypical antipsychotics, is suggested to address cognitions in AN. While such medications may be sometimes useful for the acute management of severe anxiety in AN, there is little data to support their effectiveness for improving cognitive content or process in AN itself (60).

Social Communication and Connections

The emotional sensitivity of young people with AN appears to have particular relevance and specificity in the area of social interaction (61). Sensitivity to social rejection, such as falling out with friends, is at its peak in early adolescence, and is often cited as a trigger for onset of AN (62). Experimental studies suggest that adults with AN are hypervigilant to social rejection and avoidant of social reward. Added to this social sensitivity is increasing evidence that, at least for a proportion of those with AN, more pervasive social cognitive deficits may be a factor (63–65). Recent evidence that impaired theory of mind is also found in unaffected third-degree relatives of patients with AN supports the idea that these are trait rather than state characteristics (66, 67). Given the importance of social relationships in maintaining psychological health and wellbeing for young people, treatments, including FBT, should attend to reported difficulties in this area.

When presenting for FBT, adolescents with AN have often become socially isolated from families and friends. While there may have been social anxieties and difficulties prior to the onset of AN, these tend to be exacerbated by the illness. The preoccupations and activities required to maintain AN tend to reinforce social isolation. AN becomes the social world for many adolescents who are ill. The impact of social isolation on mental health, social and peer relationships, and overall adolescent development are potentially life altering, setting the adolescent on a life time course of a lonely life revolving around weight and eating (65). FBT takes the perspective therefore that curing AN is a necessary first step to addressing these socialization processes (68). Only by removing the behavioral and cognitive barrier that in AN leads to socially isolating the adolescent can progress be made. Parents and siblings are the first line of attack in helping the adolescent reengage with others. In phase 1, this means restoring healthy weight, meal time exposures with family, and over time at school. In phase 2, involvement with peers in an age appropriate manner, specifically around food and eating are stressed as a necessary step toward facilitating and developing peer relationships. For those who are in the early stages of adolescence, these may be novel experiments—eating on sleepovers, class birthdays, or parties. For older adolescents, this may mean eating on dates or in dining halls similar to those that would be found in boarding schools or universities. While the direct focus is on behavioral learning and there is a specific focus on food and eating, participation in socialized eating actually is more than this because it promotes overall social growth and normalization of peer relationships during phase 3. For a small number of patients, social difficulties is more marked, a factor thought to be important for prognosis and treatment response (69). It is important that these traits are identified and addressed. However, if developmental social learning processes are attended to alongside weight restoration, and reintegration with peers is achieved, the adolescent brain has potential to adapt and learn these skills in the majority of cases.

Psychiatric Comorbidities

Comorbid psychiatric disorders are commonly diagnosed with AN, particularly depression, anxiety disorders, and obsessive compulsive disorder (53, 70–72). For many, these disorders though diagnosable are part of the clinical impact of AN on the adolescent. Starvation leads to depression, fears about weight gain and food increases anxiety, and obsessive thoughts about food, eating rituals, and exercise routines are often consistent with symptoms of OCD. In those cases, FBT's highly focused approach to the treatment of AN leads to marked decreases in these disorders without focusing on them directly (6, 73). For the most part, FBT recommends postponing other psychological treatments for comorbidity until AN is resolved and a healthy weight restored. This is recommended because of the life threatening nature of AN and the demands, both psychological and physical, on the adolescent and her family. This staged approach is feasible when the comorbidities are relatively mild or moderate. However, for patients with a clear history that predates AN, medications for comorbidities may well be helpful in the context of FBT.

Another comorbid problem that is sometimes a concern is posttraumatic stress disorder (PTSD). Trauma or other adverse events can trigger eating disorders if extreme enough, even in those who might otherwise have healthy emotional responses, such that distress becomes overwhelming (74). A severe life event or difficulty, generally of an interpersonal nature, was identified prior to onset in 67% of a clinical sample of cases of AN (75). Intrusive thoughts and related anxieties and fears related to these traumas can be an impediment to treatment, whatever the approach. FBT takes the position, however, FBT takes the position that traumas like other comorbidities should be treated independently after AN is mostly resolved because of the life-threatening and long term medical effects of ongoing starvation. Attempting to address trauma at the same time as weight restoration can lead to confusion about what the focus of treatment should be. A case example of this is included in the FBT to illustrate how FBT prepares the adolescent to address trauma without the complications (medical and psychological) of AN interfering and disrupting trauma work.

Family Factors

While any suggestion that specific family "types" or processes are implicated in the causation of eating disorders remain unproven (76), the importance of family support and the responses of close others are key to recovery seems to be more certain (77). Problems in families include parental and sibling anxiety, worry, blame, criticism, or hostility, resulting in communications and behaviors which have been hypothesized to influence outcome (78), and may moderate treatment (79). The impact of these problems can be seen in common examples from clinical practice where the parental relationship, whether they are a couple or not, makes coparenting challenging. This can range from overt hostility in couples who are in the process of separating, to more subtle triangulation of young people in the parental relationship. Equally, the application of standard FBT can be impacted when a parent is grieving the loss of their partner from death or separation, or is unable by virtue of other demands (such as caring for others) or their own mental or physical health problems, to provide the necessary support to their child with AN. Data suggest the FBT may take longer in such cases (80). While there is evidence for the effectiveness of a parent only format for FBT in addressing families with these types of problems (81, 82), the usual whole family manual provides many examples of how to work with the family as a whole despite the presence of these issues. These include overtly identifying criticism, hostility, and nonalignment as impediments to effective behavioral management of AN, modeling a noncritical stance and illustrating noncritical comments through the extensive use of externalization and agnosticism to reduce blame and guilt.

CONCLUDING COMMENT

In this article we have identified a number of significant, commonly occurring problems in adolescent AN and described how the context, structure, and interventions of FBT can be used to successfully address many of them without introducing new content or augmentative treatments that to date have not been found systematically beneficial (83). Careful reading, accredited training, adequate supervision, and experience using manualized FBT would likely decrease concerns about how FBT helps with the full range of problems associated with adolescent AN. That said, there is no data available that support that FBT is superior to other psychotherapies in addressing these broader issues nor the impact of improvements in them on risk for relapse. Future studies are needed to compare the relative benefits of FBT to other approaches [e.g., CBT-E (50), Family Therapy-Anorexia Nervosa (84), Multi-Family Group Therapy (85), and Adolescent Focused Therapy (13)] on the broader psychopathology of AN. It may be particularly important to examine the relative effect of FBT compared to Systemic Family Therapy for adolescents with comorbid obsessive compulsive disorder as this was identified *post hoc* as a moderator favoring Systemic Family Therapy and should be confirmed (8). Furthermore, while FBT is effective for many, there is considerable room for improvement in outcomes and strategies to improve or augment FBT developed and tested (83). Careful study of the mechanisms mediating response to FBT, such as emotion regulation, trait characteristics, and social competence as well as parent factors as outlined above, may give clues to possible enhancements that would increase the proportion of patients responding to the intervention.

AUTHOR CONTRIBUTIONS

JL and DN conceptualized the paper and wrote the content.

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STUDY PROTOCOL
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Confirming the Efficacy of an Adaptive Component to Family-Based Treatment for Adolescent Anorexia Nervosa: Study Protocol for a Randomized Controlled Trial

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Family-based treatment (FBT) has the largest evidence base for treating adolescents with anorexia nervosa (AN); 35–50% of cases remit at the end-of-treatment and remain remitted 3–4 years after treatment. Studies of FBT demonstrate that weight restoration by session 4 (of 2.4 kgs) predicts remission at end of treatment in 85–90% of cases. One way to improve outcomes is to tailor treatments to patients depending on successful weight restoration at session 4. Pilot data found that by adding three sessions of Intensive Parental Coaching (IPC) after session 4 improved outcomes in early non-responders. Further, data suggest that the mechanism underlying FBT is early improvements in parental self-efficacy related to re-feeding their child. This manuscript describes a study protocol to examine whether adding IPC to FBT improves outcomes in early non-responders and confirm whether change in parental self-efficacy is the mechanism by which FBT works. This two-site randomized controlled trial (RCT) will randomize 60 adolescents with a DSM-5 diagnosis of AN (30 per site) who are between the ages of 12–18 years old and do not gain 2.4 kgs by session 4 of FBT. Randomized participants will either continue standard FBT or receive the three sessions of IPC and then continue FBT as usual. Both arms include up to 18 sessions over the course of 9 months. Blinded assessments will be conducted at baseline, 3-month within-treatment, end of treatment, and at 6 and 12-month follow-up. Parental-self efficacy will be assessed using the Parent versus Anorexia Scale at all major assessment time points and at each of the first eight sessions of treatment. The primary outcome is achievement of weight remission (> 94% expected mean percent body mass index (BMI) adjusted for age, height, and gender).

Clinical Trial Registration: http://www.ClinicalTrials.gov, identifier NCT03097874.

Keywords: anorexia nervosa, eating disorder, family based treatment, adolescents, randomized controlled trial

INTRODUCTION

For adolescents with anorexia nervosa (AN), family-based treatment (FBT) has the largest evidence base of effectiveness. FBT yields better outcomes than adolescent focused therapy (AFT) (1) for adolescents with AN. While there is some evidence supporting the efficacy of enhanced cognitive behavior therapy (CBT-E) for adolescents with AN (2), FBT remains the first-line approach for adolescent AN. Some 35–52% (3, 4) of cases fully recover and remain remitted 3–4 years after treatment (5–7). However, those who do not recover have a high risk of developing enduring AN for which there is no evidence-based treatment (8) which contributes to reduced quality of life and increased risk for premature death (9). Studies of FBT find that weight restoration by session 4 (of 2.4kgs) predicts outcome (e.g. weight restoration at end of treatment) in 85–90% of cases (10–13). Among the patients who do not meet weight restoration targets by session 4 under standard FBT, only 14% recover. Previous studies have also shown that FBT targets parental self-efficacy (SE) at re-feeding as a mechanism to promote weight restoration (14, 15). Families with lower parental SE tend to be less likely to reach weight restoration at end of treatment. According to pilot study data (16), the recovery rate of poor early responders who were treated with only three additional sessions focused on improving parental self-efficacy increased to 58.3%. The aim of this study is to confirm whether adding an adaptive treatment compatible with FBT significantly improves outcomes by addressing poor early response, including targeting parental SE, and to evaluate SE as a mechanism of treatment effect in FBT.

STUDY DESIGN

A pilot study investigated the development and implementation of a three-session intensive parental coaching (IPC) for adolescents with AN receiving FBT who had failed to meet weight restoration targets by session 4. Participants receiving IPC showed increased parental skills at re-feeding compared to those who did not receive the adaptation. Overall, results from this study demonstrated the feasibility of using a randomized adaptive design employing IPC combined with FBT. Parents whose children did not gain 2.4 kgs by session 4 reported lower levels of SE related to re-feeding as early as session 2 (16), however, after receiving FBT+IPC, parental SE scores in this group improved and became indistinguishable from those of parents of early responders (16). We hypothesize that low parental SE leads to failure to deploy adequate re-feeding behaviors. Thus, a sufficiently powered and controlled randomized controlled trial (RCT) using an adaptive randomized design and employing IPC as the adaptive intervention for poor early responders was developed to confirm the efficacy of the adaptive intervention and examine mechanisms and moderators of treatment. The study was designed to address the following specific aims:

- Aim 1: To conduct an RCT using an adaptive design for adolescents (ages 12–18 years) with DSM-5 AN comparing standard FBT to adaptive FBT (FBT+IPC).
- Aim 2: To examine parental SE related to re-feeding as a mediator of treatment effect (standard vs. adaptive) on expected body weight (EBW) at end of treatment (EOT). We will also explore the potential mediating effects of weight restoration and changes in parental re-feeding behavior.
- Aim 3: To evaluate target engagement of parental SE within adaptive FBT and to explore target engagement of parental re-feeding behaviors within adaptive FBT.
- Aim 4: To examine moderators of treatment outcome. We will explore all baseline variables as potential predictors and/or moderators of outcome.

PARTICIPANTS

We plan to initially recruit approximately 150 adolescents, 75 at each of two sites (Stanford University and the University of California, San Francisco). Participants who have gained 2.4 kgs by session 4 will continue to complete up to 18 sessions of standard FBT over 9 months. Participants who do not meet weight restoration targets will be randomized to either receive IPC for three sessions starting at session 4 and then continue to complete standard FBT or randomized to complete standard FBT as usual (total of up to 18 sessions over 9 months in both treatments). Of the initial approximately 150 participants recruited, we expect 30–40 per site to be randomized (for a total of 60–75 randomized adolescents). This rate of randomized participants will allow for an adequately powered study (power = 0.87, alpha = .05, two-tailed) to address our primary aim. An attrition rate was predicted as part of the initial power calculations.

In addition, of those participants randomized, 20 randomly selected participants receiving FBT+IPC using coded mealtime behaviors from session 2 (coached meal 1 in FBT) will be compared to those in session six (coached meal 2 in FBT+IPC) using observational data gathered from coded videotapes following established behavior coding frames (17). We predict there will be a significant increase in re-feeding behaviors consistent with successful re-feeding at meal 2 (session six) compared to meal 1 (session 2) among these randomly selected participants.

Inclusion/Exclusion/Withdrawal Criteria

The inclusion criteria for study participants includes: 1) A child that meets DSM-5 criteria for AN (both subtypes) who is between the ages of 12 and 18 years; 2) Child who has an expected mean body weight percentage (%EBW) >75.0% and <88.0%; 3) Medically stable for outpatient treatment according to the recommended thresholds of the American Academy of Pediatrics and Society of Adolescent Medicine (18); 4) Child not engaging in another individual or family based psychotherapy trial during the duration of treatment sessions with the study; 5) Child and parents who speak and read English fluently.

Potential participants will be excluded for any of the following reasons: 1) Current psychotic illness, mental retardation, and/or other mental illnesses that would prohibit the use of psychotherapy; 2) Current dependence on drugs or alcohol;

3) Physical conditions (e.g. diabetes mellitus, pregnancy) known to influence eating or weight; 4) Previous FBT (four or more sessions); 5) Currently taking adjunctive medication for co-morbid disorders (e.g., antidepressants) for less than 2 months (8 weeks) that cannot be safely discontinued prior to treatment; 6) In the case of patients with current, or a history of sexual or physical abuse by family members, perpetrators of the abuse will be excluded from treatment.

Participants will be withdrawn from the study if any of the following occur while in treatment: 1) Sexual or physical abuse by a family member (perpetrators will be withdrawn; child may stay in treatment) 2) Hospitalization for >21 consecutive days; 3) Missing >4 consecutive scheduled appointments; 4) Worsening of psychiatric conditions such that participant would be clinically better served by referral for other treatment; 5) Participant undertaking other psychotherapies during the treatment study.

COLLABORATING SITES

The treatment sites are directed by established clinicians and researchers in the field of eating disorders with expertise in FBT. Both sites have extensive experience and success recruiting adolescents for RCTs for the treatment of eating disorders and both have trained personnel in FBT and IPC who participated in the feasibility pilot study. We will minimize the site effect by following the manualized protocol and using highly trained therapists. Nonetheless, we expect some treatment effect heterogeneity across sites as the study participants will be recruited from the diverse population surrounding UCSF and Stanford. We will closely monitor both the sites and site by treatment interaction effects, and our analyses will be conducted allowing for differences across the two sites.

RECRUITMENT

Families in the San Francisco Bay Area with a child with a diagnosis of Anorexia Nervosa will be recruited through colleague referrals, community organizations, clinics treating eating disorders, social media (i.e., Twitter, Facebook), and by publicizing in the local media. A population-based estimate (1% of adolescent females in the tri-county referral area for our clinics) would predict that approximately 2,300 of 230,000 adolescent females in the area would meet AN DSM-5 diagnostic criteria. During the calendar year 2013–2014, both sites had over 300 referrals to their respective adolescent eating disorder programs that would meet inclusion criteria and be eligible for recruitment. Any family that calls or emails expressing interest will be contacted by the research staff to describe the study and screened over the phone for eligibility. Research staff will provide information about study procedures, including randomization, over the phone and answer any questions families may have about the study. Of note, study hypotheses about treatment arms are not included in this description. Families are told that the effectiveness of IPC is unknown and that we hope to better identify an adequate treatment for early non-responders through these trials. If participants meet initial criteria *via* phone screen, they will be asked to schedule and attend a baseline assessment if they wish to continue with the study. During the baseline assessment, trained research coordinators will obtain informed consent and assess the target participant to further determine eligibility. If families are still eligible and interested after the baseline assessment, they will be scheduled to start treatment with an FBT certified provider trained in IPC.

ASSESSMENT

The inclusion and exclusion criteria for the child will be assessed at the baseline assessment. Inclusion criteria will be determined by calculating expected mean body weight percentage (%EBW) from height and gowned weight collected, self-report assessments by parent and child, the eating disorders examination (19), and study physician clearance after baseline. Additionally, child psychopathology assessed *via* the Kiddie Schedule for Affective Disorders and Schizophrenia (KSADS) (20) will be evaluated at baseline for secondary data analysis (i.e. comorbidity) and for exclusion criteria (i.e., psychosis). The eating disorder examination (EDE) and %EBW will also be collected at every other assessment time point (3-month within-treatment, end of treatment, 6- and 12-months post treatment) as outcome measures. Assessments and measures along with the time points that they will be administered are listed in **Tables 1** and **2**.

Primary Measures

Percent Expected Body Weight (%EBW)

Will be calculated using a computer program based on the Center for Disease Control Growth Charts with weight

TABLE 1 | Patient Self-report measures.

Measure	BL	Session	3-month	EOT	6-month Follow-up (15 months)	12-month Follow-up 6pt(21 months)
TSPE		End of session 1				
HRQ		End of session 1	x			
Weight (Primary outcome; from EDE)	x	Session 4	x	x	x	x
Weight by therapist (HW Log)		Every session				
EDE	x		x	x	x	x
YBC-ED	x		x	x	x	x
BDI	x	1 - 8	x	x	x	x
BAI	x	1 - 8	x	x	x	x
CY-BOCS	x		x	x	x	x
CET	x	Session 4				
CES	x	Session 4				

TABLE 2 | Parent Self-report measures.

Measure	BL	Session	3-month	EOT	6-month Follow-up (15 months)	12-month Follow-up (21 months)
TSPE		End of session 1				
HRQ		End of session 1	x			
PvAN	x	1 - 8	x	x	x	x
SDQ	x	1 - 8	x	x	x	x

adjusted for age, gender, and height. This formula for calculating %EBW has been used in the previous RCTs of adolescents with AN (16). Achievement of >94% EBW will be the primary outcome. The assessor will obtain the potential participant's height and weight at baseline and follow up assessment time points. Weight will be assessed by means of a balance beam scale, calibrated daily, with participants in a hospital gown and no shoes. Height will be assessed using a stadiometer, calibrated in 1/8inch intervals. %EBW will be calculated from height (in meters) and weight (in kilograms) data. Height and weight along with %EBW calculation will occur at all major assessment points.

Target Engagement

Change in parental self-efficacy as a mechanism of therapeutic effect will be examined with the *Parents versus Anorexia Nervosa Scale (PvAN)* (21). It is a self-efficacy measure designed after Bandura's general self-efficacy measure, specifically focused on parental self-efficacy related to re-feeding their son or daughter with AN. The measure has been used in multiple studies and has good internal consistency. Parent participants in the study will complete this questionnaire at baseline, weeks 1–8 and all other major assessment points.

Secondary Measures

Eating Disorder Examination (EDE)

A standardized investigator-based interview assessing the severity of the characteristic psychopathology of eating disorders. The psychometric properties of the EDE are sound and have been used in many treatment studies. Version 16 of the assessment will be used by trained research coordinators who will be administering this assessment to adolescent participants at all major assessment points (19).

Yale-Brown-Cornell Eating Disorder Scale (YBC-ED)

The YBC-ED is a clinician rated scale assessing impairment, persistence and degree of obsessional thinking and compulsiveness about eating thoughts and behaviors (22). Again, research coordinators will administer this assessment at all major assessment points.

Beck Depression Inventory (BDI)

The BDI is self-report measure assessing for depressive symptoms in adolescents (23). This scale has been used in numerous studies of adolescent depression. This measure also includes questions about suicidal ideation, plan, and intent and will be used to assess suicide during the study. If participants endorse suicidal ideation with a plan or intent, this information will be reported to the site PI and/or treating clinician, who will perform appropriate clinical intervention. Participants will complete this measure weekly for weeks 1–8 and at all major assessment points.

Beck Anxiety Inventory (BAI)

The BAI is a 21-item self-report measure assessing symptoms of anxiety (24). Adolescent participants will complete this measure at baseline, sessions 1–8, and all major assessment time points. We will evaluate the feasibility of the BAI for use in future studies to examine mediation.

Children's Yale-Brown Obsessive Compulsive Scale (CY-BOCS)

The CY-BOCS (25), a modified version of the Y-BOCS, is a 10-item, clinician-rated, semi-structured instrument assessing symptom severity of Obsessive-Compulsive Disorder (OCD). This measure will be administered at all major assessment points by a trained research coordinator.

Therapy Suitability and Patient Expectancy (TSPE):

The TPSE measures perceptions of the suitability and expectancy of the treatment provided. It will be rated by both adolescent and parent participants on a visual analogue scale (0–10) at the end of session 1.

Helping Relationship Questionnaire (HRQ)

The HRQ is an 11-item questionnaire used to measure the quality of the therapist-patient relationship across the two treatments (26). The HRQ will be completed by parent participants after the first treatment session and at the 3-month within-treatment assessment time point.

Parental Mealtime Behaviors

Treating clinicians will videotape sessions 1 through 8 for randomized non-responders and sessions 1 through 4 for responders. These tapes will include the family meal at session 2 (and, if applicable, session six for patients receiving IPC). For those participants randomly selected for the videotape analyses, parental re-feeding behaviors at family meals will be coded using procedures and coding frames used in preliminary studies (17).

Compulsive Exercise Test (CET)

The CET is a 24-item multidimensional measure designed to assess core factors operating in the maintenance of excessive exercise specifically among patients with eating disorders (27). Adolescent target participants will complete this measure at baseline and at session 4.

Commitment to Exercise Scale (CES)

Similar to the CET, the CES evaluates the degree of psychological commitment to exercising (and its corresponding attitudinal and behavioral features) (28). This 8-item measure will be completed by the target child at baseline and at session 4.

WASHOUT PERIOD PRIOR TO RANDOMIZATION

Approximately 150 adolescents with AN will receive initial FBT (four sessions). Based on the largest study on FBT (29), 44% are categorized as having a poor response by session 4 under standard FBT. Thus, we expect that 40–50% of participants (i.e., 60 to 75 out of 150) will be early non-responders to FBT. Early non-responders would then be randomized within site at session 4 to either FBT or FBT+IPC conditions and repeatedly assessed, allowing for strong inference regarding the effects of FBT+IPC (compared to FBT only) on adolescent AN patients. Participants who are not randomized (responders) at session 4 will still complete follow-up assessments and provide data, but their data will not be a part of primary analyses.

It is expected that participant treatment withdrawal will be minimum as FBT is considered to be a first line treatment for adolescent AN, so feasibility of recruitment is likely further enhanced in this study by the fact that all participants will receive standard FBT at a minimum and at no cost. To help assure maintenance of the randomized participants, research staff and clinicians will emphasize building rapport with the families to increase treatment adherence and prolonged study adherence. Surveys at sessions 1 through 8 will help with building continuous rapport with the families. In addition, to further ensure that families complete follow up assessments at the 6- and 12-month post treatment time points, patients will receive $50 at the completion of the 12-month follow-up assessment.

RANDOMIZATION

Prior to the start of session 4, therapists will weigh patients with a research coordinator observing. The research coordinator will calculate weight difference between sessions 1 and 4 using a calculator, calculating weight difference twice to verify results. Patients will be considered treatment responders if weight restoration is greater than or equal to 2.4 kgs. Patients will be considered treatment non-responders if they fail to gain 2.4 kgs. After determining the responder status, the research coordinator will determine if randomization is needed. Responders will not be randomized; therefore, the therapists will be notified to continue with FBT. Prior to the start of the study, the Data Coordinating Center provided each site with 32, sequentially numbered, sealed envelopes. This envelope will be given to the therapist following the weighing at session four informing them and not the study coordinator/assessor of the randomized assignment. This system allows for efficient randomization and serves to keep research coordinators blinded to treatment condition. If a patient is hospitalized for medical instability after session 1, but before session 4, any weight gained in the hospital is subtracted from the total weight difference at session 4 to allow for accurate calculation of *out patient* weight gain during the first 4 sessions of FBT.

INTERVENTIONS/TREATMENTS

Family-Based Treatment (FBT)

FBT is a manualized treatment divided into three phases (30). In the version used in this study, the first phase (sessions 1–8), focused on the eating disorder and included a family meal. This phase is characterized by attempts to absolve the parents from the responsibility of causing the disorder (agnosticism), separating the child from the eating disorder (externalization), and by encouraging positive aspects of their parenting (parental empowerment). In consultation with their therapist, families are encouraged to work out for themselves how best to re-feed their child, which helps to bolster parental empowerment and self-efficacy. In Phase 1, parents are solely responsible for the re-nourishment of their child, including preparing and supervising meals and snacks. In Phase 2 (sessions 8–14), once weight restoration is nearing completion, therapists help parents to transition eating and weight control back to the adolescent in an age appropriate manner. The third phase (sessions 14–18) is initiated after the patient achieves a healthy weight and eating disorder behaviors (i.e. self-starvation, compensatory behaviors) have abated. The central theme in this phase is the establishment of a healthy adolescent or young adult relationship with the parents. Sessions last 1 h and are generally held on a weekly basis during most of phase 1, but are titrated to every 2–4 weeks in later phases depending on progress. A total of 18 sessions are provided over 9 months, the same as the other treatment arm. Use of all 18 sessions is not mandatory to complete treatment, and some families may complete treatment with fewer than 18 sessions or in less than 9 months (30).

Intensive Parental Coaching (IPC)

The stepped care intervention that will be used is FBT+IPC. This new treatment was developed and piloted, refined, and piloted again in an iterative process involving 21 cases prior to finalizing the format used in a feasibility study (16). In the adaptive treatment arm, FBT+IPC provides three sessions added to standard FBT focused on mealtime coaching for families whose child had not gained 2.4 kgs by session 4. Studies have suggested that direct coaching at mealtimes improves parental efficacy (17). The first of these sessions (IPC session 1) is a family session designed to present the failure to gain sufficient weight by this point in treatment as a crisis and re-invigorate the family to make definitive behavioral changes to support weight restoration. Following this session, a session with parents alone (IPC session 2) is held to identify what impediments the parents perceive might be interfering with successful re-feeding. Finally, a second family meal (IPC session 3) is held, which includes direct coaching by the therapist to help the parents address the specific challenges identified during the meeting with the parents alone. Following these three sessions, the treatment resumes the regular course of standard FBT. Thus, a total of 18 sessions are provided over 9 months, the same as the standard FBT arm. Again, patients are not required to use all 18 sessions, and some may complete treatment in fewer sessions or in less than nine months.

Therapist Training and Supervision

Each site will have a minimum of two therapists providing treatment through the research study, and all therapists will conduct both treatments. All providers are PhD clinical psychologists with experience in treating adolescents with AN. They will not be involved in research assessments. In addition, a treatment supervisor will be trained at each site. Training will involve the following: Therapists and supervisors will familiarize themselves with the manuals by reading specified preparatory materials (manuals and chapters describing FBT and FBT+IPC); Drs. Lock and Le Grange will conduct a two-day intensive workshop at the start of the study on the treatments which includes role-play and active rehearsal of the treatments. This workshop will be recorded for future reference and training for site therapists. Each therapist will attend weekly supervision by site principal investigators. During supervision each patient's progress is reviewed as well as the therapists' adherence to the treatment protocols.

Therapeutic Adherence and Treatment Fidelity

We will assess adherence and fidelity to FBT and FBT+IPC by evaluating videotapes of sessions 1–3 (FBT) and 4–6 (IPC) on a random sample of 20% of sessions employing the standardized fidelity measure focused on early FBT treatment (31). Because IPC, like FBT, focuses on enhancing parental self-efficacy through agnosticism, externalization, and focused re-feeding strategies using a second family meal (session 6) we will use this same validated fidelity measure to examine sessions 4–6 of IPC.

Adequate Dose of Treatment

For those participating in the randomized study an adequate dose of treatment is defined as eight sessions. The rationale for this decision is that this number includes three sessions prior to randomization, the three additional sessions of IPC post-randomization, and two standard FBT sessions following the completion of IPC. Those who do not complete eight sessions of treatment (IPC or continued FBT) will be regarded as treatment dropouts if they are willing to complete all or part of the standard assessments. If they are not willing to complete all or part of the standard assessments following the early termination of treatment they will be regarded as study dropouts.

DATA COLLECTION AND MANAGEMENT

All data at both UCSF and Stanford University will be collected by trained and certified assessment staff. All data will be stored by the Data Coordinating Center (DCC) housed at Stanford University on a dedicated server with secure access available to both the statistician and the DCC Data Manager. All data will be checked following participant assessments. All non-web-based data will be scored, entered, and checked by the DCC. Web based data collection will use the Qualtrics survey tool. The DCC Data Manager and statistician will be responsible for developing and maintaining the database including the creation of electronic case report forms (eCRFs) and data pipeline according to study design, performing quality control measures, assisting in protocol development, writing reports, building datasets appropriate for statistical analysis, and submitting data/documents to regulatory bodies (e.g. IRB and NIMH). Statistical analysis will utilize SPSS 25.0 as well as specialized statistical programs when necessary. All software will be updated yearly.

STATISTICAL ANALYSES

The primary outcome of our study is remission (weight > 94% EBW) by EOT. The core analysis strategy in this project is mixed effects (ME) modeling (9), where we fully utilize the repeatedly measured primary and secondary outcomes (from major assessment timepoints: baseline, 3-month within-treatment, EOT, 6- and 12-month follow-up). For maximum likelihood (ML) estimation of mixed effects models, the Mplus program version 7.4 or above will be used (32). Data points that are missing due to attrition or missing assessments will be handled assuming that data are missing at random conditional on observed information (1). The results of these analyses can be easily converted to randomized group differences at EOT and follow up assessments. The analysis is Intent to Treat using mixed effects modeling and all participant data will be included (with the exception of PI Withdrawals) in the analysis.

In Aim 1, we will compare the remission rate between the FBT and the adaptive FBT (FBT vs. FBT+IPC) groups at EOT in line with the intention to treat principle. For this comparison, we will conduct mixed effects growth modeling utilizing remission until EOT, but also including the full set of four repeated measures of remission (3-month mid-treatment, EOT, 6- and 12-month follow-up) as there is no variation in the data at baseline (i.e., no one experiences remission yet by design). We will use a random intercept/slope model treating remission status as a binary outcome (weight > 94% EBW = remission; weight < = 94% EBW = not in remission). All individuals who had the remission information at one or more assessment points will be included in our analysis. We will also evaluate %EBW as a secondary outcome using ME models to analyze %EBW as a continuous outcome.

In Aim 2, we will examine whether early change (from baseline to session 8) in parental self-efficacy mediates (i.e., treatment mechanism) the treatment effect (FBT vs. FBT+IPC) on remission at EOT. We will follow the eligibility and analytical criteria of MacArthur approach for mediator analysis. To maximize power to identify the mediator given our moderate sample, actual estimation of mediator effects will be conducted using mixed effects modeling fully utilizing all available longitudinal data. In addition to the longitudinal recovery data (described in Aim 1), we will utilize longitudinally measured mediator (self-efficacy measured at baseline and at sessions 1–8). We will also examine early changes in weight restoration and parental re-feeding behavior as potential mediators using the same analysis strategy.

In Aim 3, we will examine the target engagement by monitoring the change in parental re-feeding behaviors in a subset (N = 20) of randomized participants to FBT+IPC. We will compare parental mealtime behaviors at session 2 (pre-randomization) using behavioral data gathered from coded videotapes to coded mealtime behaviors from videotaped recordings of the second coached meal provided in FBT+IPC (session 6). We will employ pairwise t-test and mixed effects modeling for this within group investigation of behavioral change. We will also explore association between parental self-efficacy and these behavioral changes. For this investigation, using the same subset of subjects (N = 20), we will first examine correlation (Spearman) between self-efficacy and parent behavior at session 2 and session 6. Second, using mixed effects modeling, we will examine how the longitudinal change in self-efficacy (measured at baseline and at Sessions 1–8) is related to the change in parent feeding behavior.

In Aim 4, we will examine baseline moderators of treatment effect on remission. In particular, we hypothesize that family structure and higher levels of eating related obsessions will moderate the treatment effect. For this investigation, we will follow the eligibility and analytical criteria of MacArthur framework for moderator analysis (10, 16, 33).

DISCUSSION

FBT has the largest evidence base of treatments for adolescents with AN. However, despite remission rates of 30–50%, those who do not respond early with sufficient weight restoration are much less likely to recover. In addition, preliminary data suggest that early response is correlated with greater parental self-efficacy (14, 16). In summary, this multisite study aims to examine whether the efficacy of FBT can be increased for those who fail to respond by robust weight gain (2.4 kgs) by week 4 of treatment by adding additional focused content designed to increase parental self-efficacy. Based on preliminary data, it is hypothesized that increasing parental self-efficacy at re-feeding their child through three additional sessions of intensive parental coaching will lead to a 30% increase in remission rate. The primary outcome variables for this study will be %EBW and EDE scores at end of treatment and 6- and 12-month post treatment assessments and changes in parental self-efficacy as observed through the PvAN (1, 5, 16). Additional outcome variables include depression and anxiety scores, OCD symptoms, eating disorder related obsessionality and compulsivity, and exercise behaviors relating to the eating disorder.

If results from this study show that early non-responders who receive IPC+FBT have better outcomes than those who only receive FBT, this adapted treatment can be disseminated and improve overall remission rates for patients with AN receiving FBT. This is important because clinicians are uncertain about how to assist families where the child does not gain sufficient weight early in FBT. Providing a clear adaptive approach to improve outcome can support these families and prevent an enduring course of illness. Further, results may help to confirm past research showing that parental self-efficacy is the mechanism for how FBT works. Understanding the mechanism underlying the treatment effects of FBT could help identify ways to enhance this mechanism and potentially further improve outcomes.

ETHICS STATEMENT

This protocol involving human participants was reviewed and approved by Stanford University Institutional Review Board (IRB). Written informed consent to participate in this study will be obtained from each participant or the participant's legal guardian.

AUTHOR CONTRIBUTIONS

JL and DLG contributed to the scientific specification and conceptualization of the study protocol. AL, CT, CB, and SM contributed to the writing of the study protocol. All authors contributed to the writing of the manuscript.

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STUDY PROTOCOL
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Implementation of Key Components of Evidence-Based Family Therapy for Eating Disorders in Child and Adolescent Psychiatric Outpatient Care

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Background: Restrictive eating disorders with pronounced starvation are serious psychiatric conditions that often begin during childhood or adolescence. An early and efficient intervention is crucial to minimize the risk of the illness becoming longstanding and to limit the consequences. There is good evidence that weight gain during the first month of treatment provides a better prognosis. Only a limited amount of young people suffering from severe restrictive eating disorder receive an evidence-based treatment at present in Sweden. The ROCKETLAUNCH project intends to implement key components of the evidence-based family therapy during the first month of treatment in child and adolescent psychiatric outpatient care.

Methods: From the southern part of Sweden, 12 local child and adolescent psychiatric outpatient services will take part. All patients with a restrictive eating disorder and pronounced starvation together with their families will be asked to take part in the study. We expect that one hundred 50 patients will be assessed every year. The patients and their families will receive 1 month of intense manualized treatment. Body weight, days in inpatient care, eating disorder, and other psychopathology-related symptoms, will be evaluated after one month and at 12-month follow-up. Economic evaluation of ROCKETLAUNCH will also be carried out alongside the intervention. At each outpatient clinic, data from the 10 previous patients will be gathered to compare the treatment provided at ROCKETLAUNCH with the standard treatment in Sweden.

Discussion: We expect that by implementing the key components of the evidence-based family therapy during the first month of treatment, the prognosis of young newly diagnosed patients with severe restrictive eating disorders, primarily anorexia nervosa will improve, which, in turn, will reduce the need for psychiatric inpatient care.

Clinical Trial Registration: www.ClinicalTrials.gov, identifier NCT04060433.

Keywords: eating disorders, anorexia nervosa, children, adolescents, family based treatment, economic evaluation

INTRODUCTION

Restrictive eating disorders with pronounced starvation is one of the most acute and life-threatening conditions in child and adolescent psychiatry. Severe restrictive eating disorders in young people are primarily anorexia nervosa (AN), atypical anorexia nervosa (AAN), and avoidant/restrictive food intake disorder (ARFID). It is crucial to end the starvation with treatment and achieve medical stabilization with weight gain for those who are underweight (1). Current research indicates that weight gain during the first month of treatment leads to a better prognosis (2–5). The family-based treatment has the best support in research to achieve weight gain for adolescents with AN (6). Intensive family treatment which focuses on terminating starvation has proven to be able to achieve sustainable results even after 30 months (7). However, only 26.4% of children and adolescents with an eating disorder in Sweden receive any type of family therapy according to RIKSÄT, the national quality register for eating disorders (8). The first treatment that many young patients with an eating disorder receive is inpatient care. According to the RIKSÄT report inpatient care is the first registered treatment for 25% of the patients who are under 18 and with a mean age of 15 years. This underlines the need for a better initial treatment. Prompt use of manualized family therapy in the outpatient setting may prevent hospitalization, as well as improve the prognosis.

In order to improve the treatment of the patients below 18 years of age with a restrictive eating disorder and pronounced starvation within Region Skåne (i.e., the healthcare provider for the province of Scania), a working group was assigned to design guidelines for Child and Adolescent Mental Health Services (CAMHS) in Skåne. The working group consisted of representatives from the five local CAMHS units with eating disorder teams in Skåne, as well as the regional unit at Region Skånes Center of Eating Disorders in Lund. Pathways into services and initial treatment processes and outcomes were examined. Each service examined its 10 most recent patients. Information from 60 patients was collected. The working group found that the time between referral and first visit differed between units (from 12.1 to 23.7 days). The number of visits during the first month was 6.2 visits, on average (from 4.7 to 7.6) just over one visit per week. Some of these visits were in the scope of day-care. The rate of weight gain during the first month varied between the different services from 0.1 to 1.5 kg. It is lower than 2.0 kg, which is the lowest level of weight gain during the first month which international research has shown indicates a better prognosis (5).

Based on the data presented above, it was found that there is a need for service delivery improvement in three main areas:

1. For treatment to begin with less delay upon first referral.
2. Improve treatment by implementing the evidence-based treatment model.
3. Offering equal care, regardless of catchment area.

As part of this development work, the working group devised basic guidelines for intensive treatment during the first month: an evidence-based treatment focused on helping the patient normalize eating and terminate starvation. Treatment with a focus on normalizing the eating will continue even after the first month.

AIM OF THE STUDY

The working group identified some gaps and the need for better treatment. Therefore, we are providing the ROCKETLAUCH intervention in a small scale to see the effectiveness and cost-effectiveness. If successful, there may be a scope for nationwide implementation.

The ROCKETLAUNCH project aims to improve treatment by adding important key components of evidence-based practice to the treatment given today. The project is trying to close the gap between what is known about effective treatment and what is actually provided (9). By focusing on key element in the family therapy model we also hope to make it easier to implement. This has been tested in a primary care setting in a study where it seems to be a feasible way (10).

There are six central areas regarding research and evaluation.

1. Are the prerequisites for implementing the guidelines for ROCKETLAUNCH satisfactory? We want to assess how the clinicians that will carry out the treatment in the project experience opportunities and difficulties.
2. Are the waiting times shortened and is the recommended treatment intensity maintained? An important part of the study is to see if the healthcare system can improve its care for these life-threatening disorders.
3. Will the need for inpatient care be reduced?
4. Will weight gain improve as expected? The number of patients that gained 2 kg or more before the project has been 23.7%. This means that a greater proportion of the intervention group should gain 2 kg or more during the first month of the treatment. In a study of family-based treatment (FBT), 35% of the patients gained 1.8 kg during the first 4 weeks (4), which should be the proportion that the project aims for.
5. Does the family meal make a difference for those patients that do not gain weight? One particular issue is to evaluate the effect of family meals that will only be offered to those patients who do not gain weight as expected. The importance of family meals has been very sparingly evaluated in research (11). In treatment studies, there is no clarity on whether the family meal is needed. There may even be indirect support that the family meal is not crucial to the outcome (12, 13). In one study comparing separated family therapy *versus* conjoint family therapy and another comparing parent-based therapy (PBT) with FBT there were no differences in outcome. In both studies, one treatment arm did not offer a family meal. On the other hand, there may be support for providing an additional family meal when the weight gain is not satisfactory and treatment has to be intensified (14).

6. Is the ROCKETLAUNCH intervention cost-effective comparing to the standard care both at the short-term and long-term duration?

The hypothesis in the study is that by implementing key components of the evidence-based family therapy during the first month of treatment, this will improve the prognosis of young newly diagnosed patients with severe restrictive eating disorders, primarily AN, and reduce the need for psychiatric inpatient care.

METHODS

The study is a single group assignment, with a historical comparison group to evaluate the implementation of evidence-based treatment at 1 month and 12 months follow-up. The provisional flowchart is presented in **Figure 1**.

The total study duration will be 4 years. The participation duration for study subjects will be 12 months, i.e., a 1 month treatment period followed by an evaluation 11 months after the end of the intervention.

Participants

The project covers the Southern Healthcare Region in Sweden, and its eating disorder units in the counties of Skåne, Halland, and Blekinge will participate in the project. In addition, AnorexiBulimiCenter in Kalmar and Västervik are also involved in the project.

Patients should all be below 18 but over 7 years of age. The inclusion criteria for the patients are that they fulfill one of the

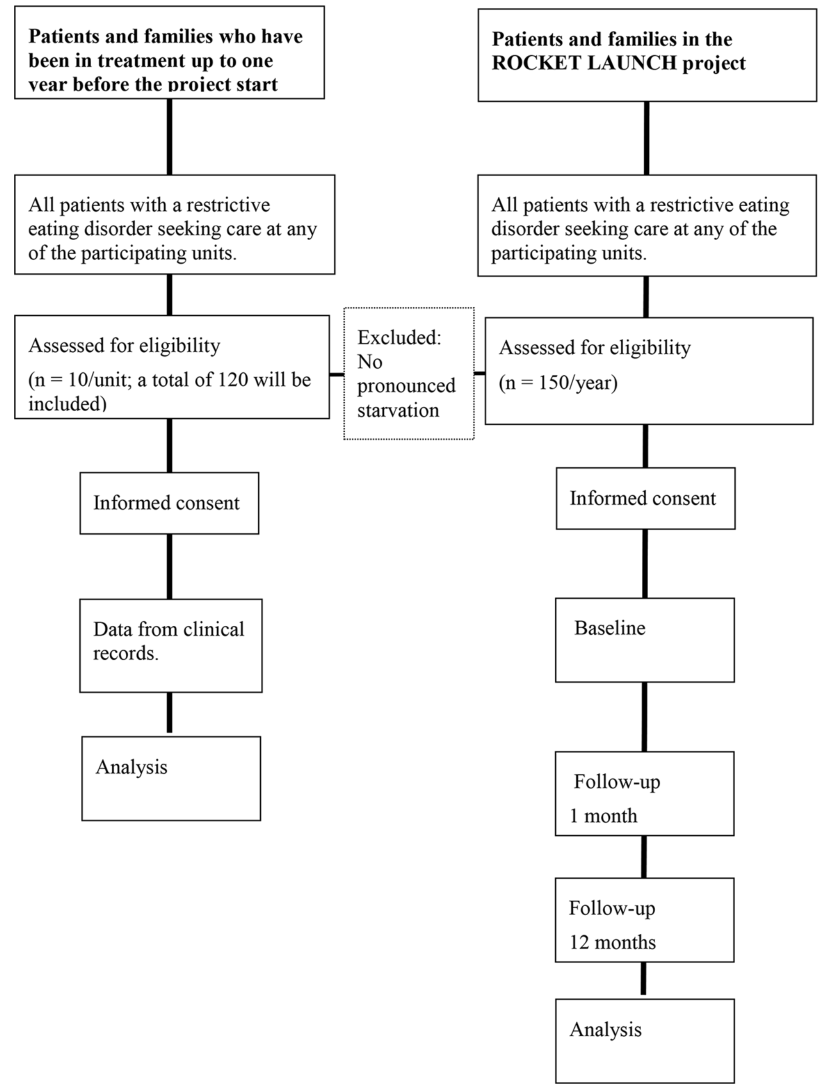


FIGURE 1 | Provisional flowchart.

three diagnoses: AN, AAN, or ARFID and that they are in pronounced starvation. The inclusion of ARFID with pronounced starvation is justified by the fact that the treatment needs to focus on weight gain and medical stabilization during this first month of treatment. There are not much research yet on which treatment is most effective, but there are indications that key components of FBT might be crucial during the first phase of treatment (15). All patients that fulfill the inclusion criteria and their parents will be asked to participate in the research. Each CAMHS collects information from 10 previously treated patients who meet the same inclusion criteria and have completed the 1 year observation period before the ROCKETLAUNCH project starts. Informed consent is obtained by mail from the previous patients and their parents. All patients with severe restrictive eating disorders and their families in Skåne, Halland, Blekinge, and Kalmar will be offered to participate in the project. A total of 12 out-patient services will provide the treatment.

The exclusion criteria are patients who are diagnosed with psychosis, mental deficiency, organic cerebral disorder, or any pathology that interfere with feeding or cause regurgitation. Patients who does not speak Swedish and patients who are already in any form of family therapy for other conditions will also be excluded.

Intervention

The general guidelines for the initial treatment of restrictive eating disorders with pronounced starvation are as follows:

The first assessment shall be offered promptly, normally at the latest within 14 days of referral. If significant cardiac symptoms are reported, assessment must be made within a few days. The treatment services should be prepared to offer at least 1–2 visits a week directly at treatment start. The assessment includes the following:

- A medical assessment including a physical examination and blood tests [see national guidelines (16) for relevant tests]. An ECG should be requested in case of pronounced bradycardia. The assessment should focus on whether the patient suffers from pronounced starvation (see the manual for medical inclusion criteria).
- Detailed background history including: eating habits including developmental trajectory; physical activity; the eating disorder's impact on family and siblings; parent's efforts to help their child; basic medical history, screening for any co-morbidity.

Based on the assessment, it can be decided whether the patient is in pronounced starvation and ROCKETLAUNCH is applicable. If so, treatment begins instantly.

Treatment During the First Month

The treatment has a high intensity with focus on medical stabilization and weight gain from the first visit. The goal of the treatment during the first month is to gain at least 2 kg (exception made for normal or high weight AAN—where the primary goal is to achieve medical stabilization).

- The treatment always begins at the first visit. Both parents receive "parental allowance for a seriously ill child." This is a possibility that exists in Sweden for both parents to simultaneously utilize parental leave to care for their child. This applies up to the age of 18.
- The patient is put on sick-leave from school. It is important to reconsider this decision at every visit to minimize the time the patient is excluded from their natural social context. As soon as possible a gradual return to school should be instigated.
- At the first visit, the clinician must clarify that the patient is suffering from a serious, life-threatening condition, far too severe to be managed by the young person him- or herself. Then, the clinician has to charge the parents with the full responsibility for what their child should eat and support all the meals.
- The treatment should focus on helping the parents to support each other with the difficult task of helping their child to eat. The clinician should meet with the whole family, and follow the manual. [Family therapy in case of restrictive eating disorder with pronounced starvation (first month)].
- Following the first visit, a maximum of 1 week should pass until the second visit.
- Physical assessments should be done at least weekly.
- If the patient has lost weight at the second visit, a family meal shall be scheduled within a few days. The crucial element in the family meal is to help the parents to support their ill child emotionally and help the child to eat food such as the parents believe their son or daughter needs. For guidelines on implementing the family meal, please see the manual.
- If the patient has not gained weight at the third visit, a second family meal is scheduled.
- The ROCKETLAUNCH intervention ends after 1 month and then treatment continues as usual at the local CAMHS. Most often it will be a family based treatment.

Family Therapy for Eating Disorders

The concept of family therapy in eating disorders has different designations at different research units. The first study was performed at the Maudsley hospital in 1987 (17) where they termed it as family therapy for anorexia nervosa (FT-AN). Family-based treatment (FBT) (18) is the most commonly used family therapy at present. It is a manualized version that has been used in most of the research on family therapy for eating disorders outside Maudsley Hospital. The Swedish manual developed for the ROCKETLAUNCH project "family therapy in case of restrictive eating disorder with pronounced starvation (first month)" is in its design very close to the FBT manual. Our unit in Lund has worked closely with the team at the Maudsley Hospital since 1988, this has affected our treatment tradition. The interventions during the first phase are very similar in both traditions and since the ROCKETLAUNCH project only covers the first month of treatment, the differences in the practical work may be negligible. There are two differences in relation to manualized FBT. The first is the family meal, the family meal session is not offered to all families. We have chosen to implement the family meal in cases where the treatment needs to be intensified when a satisfactory weight gain is not achieved. The manual for the family meal is fully in line with FBT. The second difference is when weighing the patient. This a part of a more thorough medical check-up at each family session with heart rate, blood pressure, and body temperature control. This is done by a nurse and not by the therapist.

The focus in our manual is on the practical and behavioral elements assumed to be the key components, which makes it possible to use the Swedish manual even for those who are not trained family therapists.

Standardized Protocols and Treatment Manuals

The above crude guidelines for the ROCKETLAUNCH project are supplemented with standardized protocols and manuals:

1. Medical inclusion criteria: a manual for medical inclusion criteria has been devised, according to the Swedish Nation Clinical Guidelines (16). The manual gives a clinically useful definition of pronounced starvation based on the results of the physical assessment. On the basis of this assessment the healthcare professional may decide whether the patient should be included in a “ROCKETLAUNCH treatment.”
2. Family therapy in case of restrictive eating disorder with pronounced starvation (first month): a Swedish manual for the family therapy based on the manuals used in the international research (18, 19). The manual describes how family therapy is carried out in the standardized care process, the guidelines outlines its core procedures.
3. Family meal: a manual in Swedish for a therapeutic family meal based on the manuals used in international research (17, 19).
4. Treatment course, physical assessment data: a standardized protocol will be used regularly during the family sessions in order to communicate clearly how the patients' physical condition changes during treatment. In this protocol data on weight, and parameters such as heart rate, blood pressure, and body temperature are collected. This is important when evaluating the outcome for AAN, as they may need weight gain but not necessarily in the same magnitude as AN.
5. Percentage of expected body weight (%EBW): when assessing underweight in children and adolescents with restrictive eating disorders, it is recommended to use the weight percentage calculated on the body mass index (BMI) value (20). In this project, we have prepared a guide for %EBW-calculation, where Swedish population norms for different ages are stated. Height stunting can affect the calculation of EBW and risks underestimating it if you only use average values. When you look at an individual child's growth curve, you can have a more valid result. In this project we choose not to look at each child's own weight curve. This protocol is a support for the physical assessment.
6. Blood pressure: a compilation of blood pressure for different ages and in relation to length, based on Swedish normal value (21) will be used. This will support the physical assessment.
7. Heart rate: a compilation of normal heart rate for different ages, based on a systematic review of current research (22) will be used.

Training and Supervision

In order to facilitate for clinicians to work according to the manuals developed, we will carry out a training program for the healthcare professionals. The training program consists of:

- A day with lectures and seminars on the background of the project and the principles of family therapy for eating disorders.
- A training day for the local team is planned to be implemented during the first year, and will be located in Lund, Halmstad, Karlskrona, and Kalmar.
- Seminars on the guidelines in smaller groups in the workplaces, which are based on the current skill level among the staff at the various services.
- Training around family meals with those who work in the same workplace, and co-training with other units to ensure investigators that the patients are offered the same treatment.
- Supervision in the clinical work of family therapy in eating disorders, with focus on delivering the family meal, will be given continuously during the 3 years at each services, mainly by one of the authors (UW).

Data Collection

Implementation Evaluation

Before the project starts, we intend to make an employee survey. The purpose of the survey is to provide each service with a basis for planning and creating favorable conditions for the implementation of ROCKETLAUNCH. In previous research (23–25), the areas that are affected in the survey proved to be important for the success of implementing new methods. In the previous implementation within Child and Adolescent Psychiatry in Sweden within the framework of the so-called “Deplyftet,” where national guidelines for the treatment of depression were implemented, an employee survey was used to identify the impeding and facilitating factors. The purpose was that each unit should have knowledge of specific factors such as:

1. Features of the innovation, the guideline itself, and the manuals in this case.
2. Features of the user of the guideline, i.e., the clinicians.
3. Characteristics of the target group, the patients.
4. Properties in the social environment and the organization.
5. Features in the system, economy, and administration
6. How similar or dissimilar is the new guideline compared to the current treatment as usual at the service level?

Clinical Data

Patients That Had Been in Treatment Before ROCKETLAUNCH

At each CAMHS data from the 10 previous patients will be gathered from the clinical records in order to compare the treatment as usual with the ROCKETLAUNCH intervention. The previous patients should all have started treatment 1 year before the start for the ROCKETLAUNCH project. The outcome variables that will be gathered are weight gain, waiting time, frequency of treatment sessions, and amount of inpatient care.

This data will include 120 patients from before the project start, and will be collected in the following manner:

- At first visit: age, waiting time from referral to the first consultation and weight and height.
- At 1 month: weight. Number of visits to reception. If the family and patient have been in day care or inpatient care, days of admission will be counted.
- At 1 year: weight and height, diagnostic status, and the days of admission will be counted.

This information about patients before the start of the project will be collected from the same time period at all services. The data from this early group will be compared with the outcome data from the ROCKETLAUNCH group.

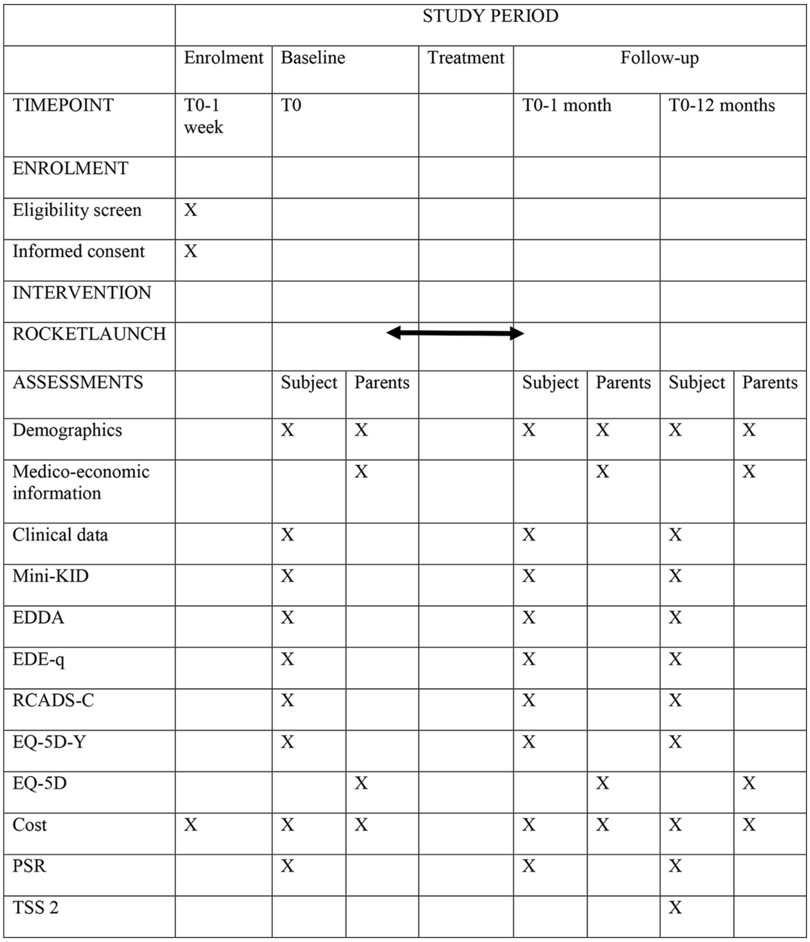
The Intervention Group

Approximately 150 patients who will enter the project annually. A summary of the data collection is presented in **Figure 2**. Weight gain and medical data such as heart rate, blood pressure, and body temperature are regularly monitored in the treatment according to the protocol.

- At first visit: age, waiting time from notification to the first time offered and weight and height.
- At 1 month: weight. Number of visits to reception and number of visits with family meal. If the family and patient have been in day care or in-patient care, days of admission will be counted.
- At 1 year: weight and height and diagnostic status and the days of admission will be counted.

Cost and Health Related Quality of Life

We will calculate the intervention cost, direct costs, and indirect costs. The intervention costs include training costs and costs associated with setting up and performing the intervention including the rent for the family house. Direct costs included all the cost for the healthcare sectors such as treatment, medication, foods etc. In the indirect cost, we will estimate the costs related to productivity loss of the parents while they are taking their children to the hospitals, taking care of them i.e.,



	STUDY PERIOD							
	Enrolment	Baseline		Treatment	Follow-up			
TIMEPOINT	T0-1 week	T0			T0-1 month		T0-12 months	
ENROLMENT								
Eligibility screen	X							
Informed consent	X							
INTERVENTION								
ROCKETLAUNCH			↔	↔				
ASSESSMENTS		Subject	Parents		Subject	Parents	Subject	Parents
Demographics		X	X		X	X	X	X
Medico-economic information			X			X		X
Clinical data		X			X		X	
Mini-KID		X			X		X	
EDDA		X			X		X	
EDE-q		X			X		X	
RCADS-C		X			X		X	
EQ-5D-Y		X			X		X	
EQ-5D			X			X		X
Cost	X	X	X		X	X	X	X
PSR		X			X		X	
TSS 2							X	

FIGURE 2 | Schedule of enrolment, interventions, and assessments (SPIRIT figure).

informal care cost and loss of income due to the intervention. The cost of informal care will be estimated by a validated questionnaire, Resource Utilization in Dementia (RUD) which is used for dementia patient (26). For the purpose of the study, the questionnaire will be modified. Overhead and administrative costs will also be calculated according to recommended methods. The patient and their accompanying parents will rated using a questionnaire about their healthcare resources utilization at baseline and also at one-month follow-up with the standard questionnaire. The questionnaire includes information regarding the primary care visits, inpatient care visits, and use of medication. For the treatment as usual group, the healthcare resources utilization will be estimated from the health registers. The registers we will use in this study are, longitudinal integration database for health insurance and labor market studies (LISA by Swedish acronym), drug or pharmaceutical register (Läkemedelsregistret), National Patient Register (Patientregistret), Cause of Death Register (Dödsorsaksregistret), Region Skåne's Health Care Utilisation Database (RSVD). The Swedish unique personal identification number will be used to identify the patients and their parents and all the registers will be linked to get the information on primary care, inpatient care, outpatient care, and use of medication. We will also use these registers to get the same information from the intervention group and their parents at 1-year follow-up.

Health related quality of life in patients and their parents will be estimated by using EQ-5D questionnaire. The investigators will use two different: one for the patient (EQ-5D-Y) (27), and one for parents (EQ-5D) (28). These two questionnaires should be completed both at the start of treatment and at the conclusion of the treatment. The questionnaires will be used to convert into a unity measures, quality adjusted life years (QALY) using the Swedish tariff.

Instruments

The investigators will also look at psychological improvement, and evaluate the improvement in specific eating disorders psychopathology and improvement in general psychiatric psychopathology.

The course of the eating disorder is primarily intended to be followed through the national quality register "RIKSÄT," and the additional modules that are there. The supplement to RIKSÄT is called the FEDiCS (Feeding and Eating Disorder Clinical Support System). FEDiCS is developed to be used in clinical practice. After the ROCKETLAUNCH project has ended, the CAMHS are encouraged to continue to use these instruments in the clinical assessment.

The following is included in FEDiCS:

- EDDA Standardized diagnostic interview based on Diagnostic and Statistical Manual of Mental Disorders 5 (DSM 5), which enables the interviewer to assign an eating disorder diagnosis. This instrument has recently been developed, and not yet validated. It can be used from the age of 12. (Prepared by RIKSÄT).
- MINI kid (29). A structured psychiatric diagnostic interview schedule for DSM-IV.
- EDE-Q (Eating Disorder Examination—questionnaire) (30). A self-assessment questionnaire for eating disorder symptoms. It consists of four subscale scores, relating to dietary restraint, eating concerns, concerns about weight and shape are derived from the 22 items addressing attitudinal aspects of eating-disorder psychopathology. This has been part of the national evaluation system STEPWISE for eating disorders since 2005, and the Swedish version has been studied and proven to be of good validity (31). For patients from the age of 12.
- PSR (Psychiatric Status Rating Scale) (32). Clinical assessment of the severity of the eating disorder and if the eating disorder is in remission. Rating is made by the interviewer.
- RCADS-C (Revised Children's Anxiety and Depression Scale and Subscales) (33–35). A self-rating questionnaire which is a screening for symptoms of anxiety, obsession, compulsion, and depression. For patients from the age of 12 years. RCADS consists of 47 items developed to measure DSM-IV relevant symptoms of anxiety disorders and depression in children.
- TSS-2 (Treatment Satisfaction Scale version 2) (36). A Swedish self-rating questionnaire that measures how satisfied the patient is with the treatment. For patients from the age of 12 years.

The Therapists

The therapists will complete a questionnaire that follows the two family therapy manuals "Family therapy in case of restrictive eating disorder with pronounced starvation (first month)" and "Family meal" in order to describe the fidelity to the manual. One questionnaire for each family therapy will be used.

Economic Evaluation

Cost-effectiveness analysis will be performed from patient, healthcare, and societal perspectives. In the societal perspective, all costs are included irrespective of who is burdened by them, while the healthcare perspective is only concerned with costs relating to the healthcare sector. The patient perspective focuses on the costs to the patient and caregiver relating to the intervention. The results will be presented in terms of incremental cost-effectiveness ratios (ICERs), which show the change in costs for an incremental benefit (37). We will perform two types of economic evaluations: 1) cost-effectiveness analysis (CEA), 2) cost utility analysis (CUA). In CEA, we will use the clinical effectiveness of the intervention such as weight gain after 1 month and at 1-year follow-up. In CUA we will use utility values using the EQ-5D questionnaires which provide the health-related quality of life as quality adjusted life years (QALY). The Swedish tariff will be used to estimate the QALY (38). The QALY for the standard care group might not be available from the registers. In this case, we will estimate the QALY for standard care for these types of patients and their caregivers from published scientific literature. The maximum willingness to pay for a QALY will be assumed to be 430,000 SEK (45,000 Euro) according to a recently published Swedish study (39).

We will perform the economic evaluation in two different time frames; short-term and long-term. In the short-term, we will calculate the cost and effects after 1 month of the intervention and in the long-term we will estimate the costs and effects with 1-year follow up data. We will analyze uncertainty by both one-way and multi-way sensitivity analysis, and also by non-parametric bootstrapping. We will calculate 95% confidence intervals for the ICERs.

Outcome

The primary outcome measures are BMI and medical stabilization. BMI is calculated in relation to the patients expected BMI (%EBW). The change is analyzed at baseline and after 1 month and 12 months. Medical stabilization is measured as the rate of participants that have normalized heart rate and blood pressure during the first month. The secondary outcome measures are amount of days the patient needs to be hospitalized due to medical risk, change in nature, and seriousness of eating-disorder symptoms as measured with EDE-Q (Eating Disorder Examination—questionnaire) at baseline, after 1 month and after 12 months and change in emotional symptoms as measured by RCADS after 1 month and after 12 months. The ARFID group will be will analyzed separately to evaluate the effect of the intervention compared to the other patients. Other pre-specified outcome measures are the therapists' treatment fidelity. This will be evaluated as the percentage of therapists in the study following the treatment manual "Family therapy in case of restrictive eating disorder with pronounced starvation (first month)." Treatment fidelity will be measured with a questionnaire that is designed based on the treatment manual and will capture the essential treatment interventions.

Timetable

During the four years, the clinical data and data from the FEDiCS will be collected. During the first year, the project will focus on training in the treatment method, and supervision. The investigators will start collecting data from the various units. During the second year the investigators will continue collecting data, and the supervision. During the third year, the clinical activities of the project and the supervision continue. Evaluation of the project becomes an important part in the third year. During the fourth year the investigators will compile data from the 3 years and process and begin writing reports and articles.

Statistical Analyses

As for the primary objective, we will compare the development of %EBW between baseline after 1 month and after 12 months follow-up in the ROCKETLAUNCH group. At first, we will compare whether there was a difference in weight gain in the intervention group from baseline to 1 month. We will also compare the differences in %EBW from baseline to 12 months and 1 to 12 months. Thereafter we will compare the inter group differences, intervention group *vs.* historical control group in terms of %EBW at two different points of time 1 month and 12 months. We will use inferences statistics such as students t-test and analysis of covariance (ANCOVA) to compare the intra group and inter group differences. Furthermore, bivariate and multivariate analyses will assess the effect of the intervention while controlling for other factors such as age and gender. We plan to perform linear regression for continuous variables and logistic regression for categorical variables with 95% confidence intervals.

DISCUSSION

The primary objective of the project is to improve the prognosis for young newly diagnosed patients with severe restrictive eating disorders, primarily AN, and to reduce the need for in-patient psychiatric care. To achieve this, the project aims to increase skill levels so that the CAMHS may offer equal care regardless of where the patients live. According to the national quality register RIKSÄT, only 26.4% of children and young people with eating disorders in Sweden receive the evidence-based family therapy. In addition, 25% are admitted to inpatient care as the first treatment intervention. There is a need to increase the accessibility of effective treatment and to prevent unnecessary inpatient care.

By implementing key components of evidence-based family therapy during the first month of treatment, we hope to reach more patients and families than if we had tried to implement the full evidence based FBT model where the treatment runs for 20 sessions during a year. The first month of treatment is also the most crucial, when it is most important to achieve change.

LIMITATIONS OF THE STUDY

The main limitation of the ROCKETLAUNCH project may be the challenge of involving many different CAMHS in southern Sweden. Some of the units are stable and the staff have worked together for several years, while others have clinicians with less experience. The employee survey that we plan to perform before the project starts will provide us with information that will help us provide proper training and supervision to the various units.

ETHICS STATEMENT

The studies involving human participants were reviewed and approved by Swedish Ethical Review Authority (Dnr 2019-01852). Written informed consent to participate in this study was provided by the participants' legal guardian/next of kin.

AUTHOR CONTRIBUTIONS

UW is responsible for the study, and SS is responsible for health economic part.

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Investigating Early Response to Treatment in a Multi-Site Study for Adolescent Bulimia Nervosa

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Background: This secondary data analysis seeks to replicate and extend findings that early response to treatment in adolescent bulimia nervosa (BN) predicts outcome, resulting in earlier identification of patients who might need a different treatment approach.

Methods: Participants were 71 adolescents (*M* ± *SD*: 15.69 ± 1.55 years; 93% female; 75% non-Hispanic) with a Diagnostic and Statistical Manual of Mental Disorders, 4th Edition (DSM-IV) diagnosis of BN or partial BN enrolled in a two-site treatment study. Participants were randomized to cognitive behavioral therapy for adolescents (CBT-A), family-based treatment for BN (FBT-BN), or supportive psychotherapy (SPT). The Eating Disorder Examination was administered at baseline, end-of-treatment (EOT), 6-month, and 12-month follow-up. Binge eating and purge symptoms were self-reported at each session. Outcome was defined as abstinence of binge eating and compensatory behaviors (self-induced vomiting, laxative use, diet pills, diuretics, compensatory exercise, fasting) in the 28 days prior to assessment. Receiver operating characteristic (ROC) analyses were utilized to assess the viability of predicting treatment outcomes based on reduction of symptoms within the first 10 sessions of treatment.

Results: ROC analyses suggest that reduction in purging at session 2 (AUC =.799, $p < .001$) and binge eating at session 4 (AUC =.750, $p < .01$) were independently related to abstinence of symptoms at EOT, regardless of treatment type. Symptom reduction later in treatment predicted outcome at follow-up, as change in binge eating at session 8 and purging at session 9 were the strongest predictors of abstinence at 6-month follow-up (AUCs =.726–.763, *ps* < .01). Change in binge eating, but not purging behaviors, was significantly related to abstinence at 12-month follow-up (AUC =.766, $p < .01$). Only slight differences emerged based on treatment group, such that reductions in symptoms most predictive of abstinence at EOT occurred one session sooner in FBT-BN than SPT.

Conclusion: Reductions in binge eating and purge symptoms early in adolescent BN treatment suggest better outcome, regardless of treatment modality. Additional research with larger samples is needed to better understand which treatments, if any, contribute to earlier change in BN symptoms and/or likelihood of improved patient response.

Keywords: bulimia nervosa, adolescent, treatment, early response, family-based treatment, cognitive behavioral therapy

INVESTIGATING EARLY RESPONSE TO TREATMENT IN A MULTI-SITE STUDY FOR ADOLESCENT BULIMIA NERVOSA

Bulimia nervosa (BN) impacts an estimated 1–3% of adolescents (1, 2), with additional youth meeting partial criteria for the disorder (3, 4). In addition to binge eating episodes and compensatory behaviors (e.g., self-induced vomiting, laxative misuse, excessive compulsive exercise), BN is associated with serious medical consequences, such as electrolyte imbalances and cardiac risks (5, 6), as well as psychiatric comorbidities (7, 8), psychosocial impairment (2), and decreased quality of life (9). Binge eating and compensatory behaviors typically onset during middle to late adolescence (10–13). Thus, targeting intervention efforts in adolescents is critical to address BN symptoms early and prevent chronicity.

Early response to treatment has been studied in adults with BN (14–19) and binge eating disorder (20–23). Specifically, symptom reduction by session 4–8 (week 4) of treatment is predictive of positive outcomes (17, 22). One study found that a 70% reduction in purging by session 6 (4 weeks) of cognitive behavioral therapy (CBT) was related to remission of binge eating and purging symptoms at end-of-treatment (EOT) for adults with BN (14). A separate study found that purging abstinence by session 6 (4 weeks) of treatment (CBT and interpersonal psychotherapy) in adult women with BN was predictive of treatment response at EOT and 8-months post-treatment (15). A 65% reduction in purging by session 8 (4 weeks) of cognitive behavior therapy enhanced (CBT-E) predicted remission at EOT in a sample of adult women with BN (18). In treatment studies for adults with binge eating disorder, reduction of binge eating episodes by 65% at week 4 of treatment (across four medication and psychotherapy treatment conditions) predicted abstinence of binge eating at EOT (21). Thus, symptom change of 65–70% after just 4 weeks of treatment appears to be a critical marker of outcome in adults, regardless of diagnosis or treatment modality.

To date, only four randomized controlled clinical trials have been conducted for the treatment of BN in adolescents (24–27), with one study investigating early treatment response (28). Across both family-based treatment for adolescent bulimia nervosa (FBT-BN) and supportive psychotherapy (SPT) treatment arms, a reduction of binge eating and purging frequency by 85% or more by session 6 (6 weeks) was predictive of remission (defined as the absence of binge eating and purge symptoms in the previous 28 days) at EOT (28). Reductions in symptom frequency by session 6 also predicted remission at 6-month follow-up, such that a ≥ 93% reduction in binge eating and purge symptoms was associated with remission of symptoms (28). Treatment group analyses showed that symptom reduction at session 4 was the strongest predictor of response for the SPT group whereas symptom reduction at session 6 was the strongest predictor for the FBT-BN group (28). Regardless of treatment type, these findings converge with studies suggesting that early treatment response is predictive of improved outcome in adolescents with anorexia nervosa (AN) (29–32).

Given consistent data suggesting that early response to treatment is predictive of improved outcomes in adolescents with AN as well as adults with BN, additional research is needed to assess early treatment response in adolescents with BN and to explore whether early response differs by treatment modality. This secondary data analysis seeks to replicate and extend the findings from Le Grange et al. (28) using a unique data set of adolescents who met Diagnostic and Statistical Manual of Mental Disorders, 4th Edition (DSM-IV) criteria for BN or partial BN. We hypothesize that early treatment response within the first four sessions of treatment will predict abstinence at EOT as well as at 6-months and 12-months post-treatment. We expect time points of early treatment response may differ when analyzing binge eating episodes and purging frequency separately. Results could help to identify patients early in treatment who might benefit from alternative or augmented treatment approaches.

METHOD

Participants

Participants were 71 adolescents with a DSM-IV diagnosis of BN or partial BN (defined as binge eating and purging for more than once/week in last 6 months) enrolled in a two-site treatment study. Participants were randomized to one of three treatment arms: cognitive behavioral therapy for adolescents (CBT-A), family-based treatment for adolescent BN (FBT-BN), or supportive psychotherapy (SPT). Full sample characteristics including treatment outcomes are described in the main outcome report [see (25)]. Participants in this secondary data analysis were a subset of a larger clinical trial (N = 130) for whom weekly binge and purge frequencies during treatment were available (25). Participant data were included if weekly symptoms were recorded for at least 1 of the first 10 treatment sessions. Treatment sessions generally occurred on a weekly basis in the first phase of treatment, with the exception of patient illness, vacations, and other unforeseen absences. Thus, the number of sessions will be reported to account for any disconnect between weeks in treatment and number of sessions delivered. The protocol was approved by the institutional review boards at Stanford University and The University of Chicago. All participants and their parents/guardians completed informed consent procedures and provided written informed assent or consent in accordance with the Declaration of Helsinki.

Measures

The Eating Disorder Examination

The Eating Disorder Examination [EDE; (33)] is a semi-structured interview designed to assess eating disorder behaviors and cognitions with acceptable reliability and validity in treatment-seeking samples (34). The frequency of objective and subjective binge eating episodes as well as purging (self-induced vomiting, laxative misuse, diet pill consumption, diuretics use) and compensatory behaviors (compulsive over-exercise, fasting) were assessed over the previous 28 days. Given that loss of control may be a more salient clinical correlate than episode size (35–37), particularly in younger populations (38, 39), objective and subjective binge eating episodes were summed to calculate total binge eating episodes. The EDE was administered by trained assessors at baseline, EOT, 6-months, and 12-months post-treatment.

Binge Eating and Purge Frequency

Participants self-reported the frequency of binge eating and purging episodes over the past week to their study therapist at the start of each session. Participants did not report on additional compensatory behaviors, such as compulsive exercise or fasting, at weekly treatment sessions. Thus, only purging behaviors (self-induced vomiting as well as laxative, diuretic, and diet pill use) were used in calculating reduction of symptoms by treatment session. Study therapists documented these numbers in participants' study folders.

Statistical Analysis

Receiver operating characteristic (ROC) analyses were utilized to assess the viability of predicting treatment outcomes based on reduction of symptoms within the first 10 weeks of treatment. Weekly baseline symptom counts were approximated by independently averaging binge eating and purge symptoms over the past 28 days as assessed on the EDE. Participants without reported binge eating or purging behaviors in the past 28 days were not included in relevant analyses. Reductions in baseline binge eating and purge symptoms were calculated relative to these counts for the first 10 sessions of treatment, consistent with prior research (28). Two separate ROC analyses evaluated the relationship between the reductions in binge eating and purge symptoms with treatment outcome at EOT, 6-months, and 12-months post-treatment. Treatment outcome was defined as abstinence from binge eating and compensatory behaviors (self-induced vomiting, laxative use, diet pills, diuretics, excessive exercise, and fasting) in the 28 days prior to assessment, as measured by the EDE. Defining outcome as abstinence of behavioral symptoms is often used as a marker of treatment effect in BN studies (14, 25). Area under the curve (AUC) values were calculated to evaluate the probability that greater reductions in either binge eating and purging symptoms would occur for randomly selected participants that met abstinence criteria compared to those who did not at EOT and follow-up time points. Sensitivity and specificity were also calculated. Results are presented for the entire sample as well as by sub-group analyses based on treatment condition. Analyses were conducted in SPSS version 26 and considered significant at the $p < .05$ level.

RESULTS

Participants were 71 adolescents between the ages of 12 and 18 years old (*M* ± *SD*: 15.69 ± 1.55 years). The majority of participants were female (93%) and non-Hispanic (75%). Average duration of illness for the sample was a year and a half (*M* ± *SD*: 18.12 ± 17.85 months). The average number of binge eating episodes (objective and subjective binge episodes) over the prior 28 days for the sample at baseline was 22.13 ± 23.17. The average number of purging episodes (self-induced vomiting, laxative use, diet pills, diuretics) over the prior 28 days at baseline was 22.49 ± 22.21. Treatment groups did not statistically differ based on demographic variables or baseline binge eating episodes or purging behaviors (**Table 1**). The average number of treatment sessions completed across the sample was about 14 sessions (*M* ± *SD*: 13.6 ± 5.48 sessions). Number of attended sessions did not significantly differ by treatment group.

Early Response Across Treatments

ROC analyses investigated the association between reductions in binge eating and purge symptoms with abstinence at EOT, 6-month, and 12-month follow-up. Reduction in binge eating at sessions 2–5, 9, and 10 was significantly associated with abstinence at EOT, with AUC values ranging from .685 to .750 (**Table 2**). Session 4 was the strongest predictor (AUC =.750,

TABLE 1 | Participant demographics.

	Sample *N* = 71	FBT-BN *N* = 30	CBT-A *N* = 26	SPT *N* = 15	Test Statistic
Age (years)	15.69 ± 1.55	15.87 ± 1.61	15.81 ± 1.65	15.13 ± 1.19	$F = 1.24, p = .230$
Sex (female)	66 (93%)	28 (93%)	26 (100%)	12 (80%)	$\chi^2 = 5.82, p = .054$
Ethnicity (% non-Hispanic)	75%	73%	69%	87%	$\chi^2 = 1.58, p = .455$
Race (% Caucasian)	80%	83%	77%	80%	$\chi^2 = 6.19, p = .626$
Duration of illness	18.12 ± 17.85	16.38 ± 20.47	19.00 ± 16.49	20.21 ± 14.82	$F = .264; p = .769$
Binge eating episodes	22.13 ± 23.17	26.33 ± 30.06	21.31 ± 16.52	15.13 ± 15.31	$F = 1.20, p = .307$
Purge episodes	22.49 ± 22.21	21.10 ± 20.42	25.84 ± 23.79	19.67 ± 23.76	$F = 0.46; p = .635$
Session attendance	13.6 ± 5.48	13.96 ± 5.86	14.1 ± 4.87	12.13 ± 6.09	$F = .709; p = .496$

FBT-BN, family-based treatment for bulimia nervosa; CBT-A, cognitive behavioral therapy for adolescents; SPT, supportive psychotherapy.

TABLE 2 | AUC for reductions in binge eating and purge symptoms for treatment sessions 1–10.

Session	Binge Eating				Purge			
	N	AUC	SE	CI	N	AUC	SE	CI
EOT								
1	58	.563	.091	.385-.741	48	.579	.103	.377–.781
2	57	.716**	.080	.558-.873	47	.799***	.078	.647–.952
3	48	.685*	.091	.507-.863	40	.712*	.093	.529–.894
4	53	.750**	.078	.598-.902	43	.739**	.080	.582–.897
5	45	.688*	.084	.524-.852	37	.615	.104	.412–.818
6	46	.672	.092	.491-.853	40	.644	.099	.450–.839
7	49	.572	.088	.401-.744	39	.600	.102	.401–.799
8	48	.674	.089	.499-.848	40	.648	.099	.454–.843
9	49	.696*	.080	.54-.852	39	.686	.098	.494–.878
10	48	.714	.073	.571-.858	39	.624	.098	.432–.816
6-month follow-up								
1	47	.544	.090	.368-.720	38	.386	.106	.178–.595
2	46	.705*	.082	.545-.866	37	.563	.115	.337–.789
3	38	.662	.092	.482-.842	32	.600	.116	.372–.828
4	43	.607	.097	.416-.798	34	.575	.111	.357–.793
5	36	.675	.092	.495-.856	29	.397	.120	.162–.632
6	37	.670	.093	.487-.853	33	.593	.101	.396–.791
7	39	.597	.092	.417-.777	31	.469	.109	.256–.683
8	39	.763**	.075	.616-.909	33	.651	.095	.465–.837
9	41	.750**	.075	.604-.896	33	.726**	.087	.556–.897
10	38	.675	.088	.503-.848	31	.577	.106	.368–.785
12-month follow-up								
1	39	.629	.090	.452-.806	30	.397	.108	.186–.609
2	39	.680*	.087	.509-.851	30	.458	.112	.239–.676
3	32	.702*	.097	.512-.893	26	.452	.116	.224–.680
4	36	.583	.097	.392-.774	27	.500	.113	.278–.722
5	31	.679	.097	.489-.868	24	.437	.122	.199–.675
6	31	.575	.106	.368-.782	27	.478	.114	.255–.701
7	33	.656	.096	.468-.845	25	.487	.120	.253–.722
8	32	.689*	.095	.503-.876	26	.509	.116	.282–.736
9	34	.766**	.084	.601-.932	26	.683	.107	.473–.894
10	33	.699*	.095	.513-.884	26	.538	.115	.312–.764

**= p < .05; **= p < .01, ***= p < .001; AUC, area under the curve; CI, confidence interval; EOT, end-of-treatment; SE, standard error.*

$p < .01$; $n = 53$), with a 96.4% reduction in binge eating by this session achieving optimal sensitivity and specificity (sensitivity =.929; specificity =.615; **Figure 1**). These results indicate that 93% of patients that achieved abstinence at EOT decreased binge eating episodes by at least 96% at session 4 of treatment. Reduction in purge symptoms at sessions 2, 3, and 4 were significantly associated with abstinence at post-treatment, with AUC values ranging from .712 to .799 (**Table 2**). Session 2 was the strongest predictor (AUC =.799, $p <. 001$; $n = 47$), with a 96.8% reduction in purge symptoms by this session achieving optimal sensitivity and specificity (sensitivity =.818; specificity =.778; **Figure 2**). Thus, almost 82% of patients classified as treatment responders showed a decrease in purging episodes by 96.8% at session 2 (**Table 3**).

Symptom reduction later in treatment predicted abstinence at follow-up, with reductions in binge eating at session 8 (AUC =.763, $p < .001$; $n = 39$) and reductions in purging at session 9 (AUC =.726, $p < .05$; $n = 33$) predictive of abstinence at 6-month follow-up. Optimal sensitivity and specificity were obtained for a 96.4% reduction in binge eating (sensitivity =.857; specificity =.600) and a 94.4% reduction in purge symptoms (sensitivity =.833; specificity =.571). A decrease in binge eating but not purging episodes at session 9 was predictive of abstinence at 12-month follow-up (AUC =.766, $p < .01$; $n = 34$), with a 96.4% reduction in symptoms predicting outcome (sensitivity =.929; specificity =.615). Reduction in purging behaviors during sessions 1–10 did not significantly predict abstinence at 12-month follow-up ($p > .05$).

Early Response Differences by Treatment Group

Slight differences emerged based on treatment group, such that reduction in purging at session 2 in FBT-BN (AUC =.754, $p < .05$) and sessions 3 and 4 in SPT (AUC =.917, $p < .001$) were the strongest predictors of abstinence at EOT (**Table 4**). CBT-A demonstrated poor model quality for significant results, due to small sample size with few responders at EOT. Group differences occurred later for binge eating, with reductions by session 4 in FBT-BN (AUC =.767, $p < .01$) and sessions 5 and 6 in SPT (AUC =.833, ps $< .05$) most predictive of treatment response. Although session 5 in CBT-A demonstrated the greatest AUC values for binge eating, the results were not significant (AUC =.773, $p > .05$). Small sample size and missing data precluded meaningful sub-group analyses for follow-up time points.

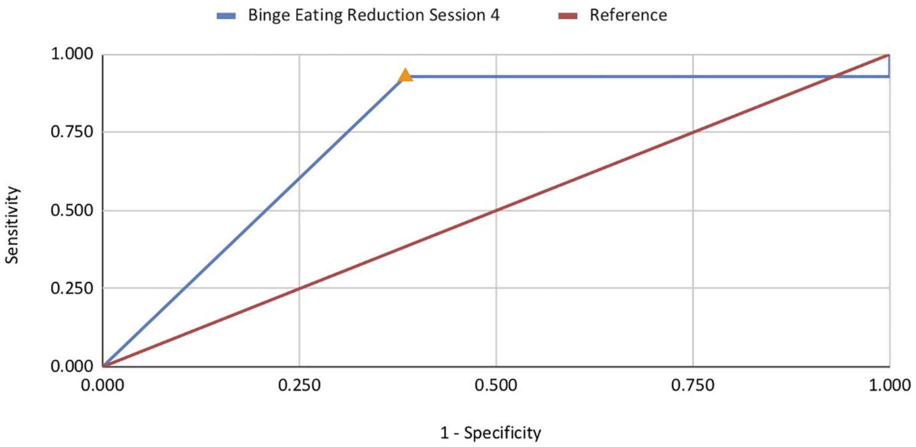

FIGURE 1 | ROC curve for reduction in binge eating predictive of abstinence at end-of-treatment.

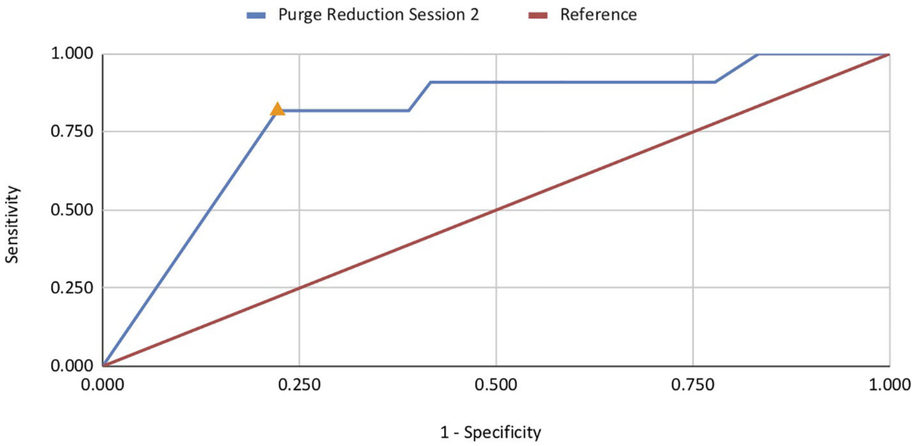

FIGURE 2 | ROC curve for reduction in purging predictive of abstinence at end-of-treatment.

TABLE 3 | Sensitivity and specificity for largest predictors of abstinence by time point.

	Session	AUC	SE	CI	% Reduction	Sensitivity	Specificity
EOT							
Purge	2	.799***	.078	.647–.952	96.8%	.818	.778
Binge eating	4	.750**	.078	.598–.902	96.4%	.929	.615
6-month							
Purge	9	.726**	.087	.556–.897	94.4%	.833	.571
Binge eating	8	.763***	.075	.616–.909	96.4%	.857	.600
12-month							
Purge	9	.683	.107	.473–.894	—	—	—
Binge eating	9	.766**	.084	.601–.932	96.4%	.929	.615

***= p < .01, ***= p < .001; AUC, area under the curve; CI, confidence interval; SE, standard error.*

TABLE 4 | Treatment group differences in AUC for reductions in binge eating and purge symptoms for treatment sessions 1-10 predicting abstinence at end-of-treatment.

	FBT-BN				CBT-A				SPT			
	N	**AUC**	**SE**	**CI**	**N**	**AUC**	**SE**	**CI**	**N**	**AUC**	**SE**	**CI**
Binge eating												
1	27	.465	.122	.226-.703	18	.563	.239	.094–1.031	13	.750	.139	.477–1.023
2	27	.700	.105	.494-.906	18	.453	.324	-.182–.906	12	.722	.152	.425–1.02
3	23	.662	.118	.431-.892	15	.423	.308	-.180–1.026	10	.813*	.142	.533–1.092
4	26	.767**	.096	.579-.955	18	.422	.306	-.178–1.021	11	.813*	.131	.555–1.07
5	24	.611	.119	.377-.844	12	.773	.178	.424–1.121	9	.833*	.140	.559–1.107
6	23	.658	.119	.424-.891	15	.442	.275	.834–.982	8	.833*	.150	.540–1.127
7	23	.569	.121	.332-.807	16	.304	.251	-.189–.796	10	.813*	.142	.533–1.092
8	23	.615	.122	.377-.854	16	.767	.170	.434–1.100	9	.813	.171	.477–1.148
9	23	.658	.119	.424-.891	16	.750	.142	.472–1.028	10	.750	.165	.426–1.074
10	23	.654	.114	.429-.878	16	.750	.142	.472–1.028	9	.750	.204	.350–1.150
Purge												
1	22	.513	.137	.246-.781	15	.464	.135	.200–.728	11	.556	.261	.045–1.066
2	22	.754*	.107	.545-.964	15	.214	.110	-.001–.429	10	.875**	.116	.649–1.101
3	20	.635	.127	.387-.884	12	.318	.143	.039–.598	8	.917***	.107	.708–1.126
4	20	.654	.123	.413-.894	15	.393	.132	.134–.652	8	.917***	.107	.708–1.126
5	20	.648	.131	.391-.905	11	—	—	—	6	.750	.210	.338–1.162
6	19	.648	.131	.391-.905	12	.167	.108	-.044–.378	8	.750	.182	.394–1.106
7	19	.659	.128	.409-.909	13	.250	.125	.005–.495	7	.667	.261	.156–1.177
8	19	.608	.133	.347-.869	14	.769	.173	.430–1.109	7	.667	.261	.156–1.177
9	19	.648	.131	.391-.905	13	.792	.164	.470–1.114	7	.750	.220	.318–1.182
10	19	.568	.135	.303-.833	13	.792	.164	.470–1.114	7	.333	.192	-.044–.771

*= $p < .05$; **= $p < .01$, ***= $p < .001$; AUC, area under the curve; CBT-A, cognitive behavioral therapy for adolescents; CI, confidence interval; FBT-BN, family-based treatment for bulimia nervosa; SE, standard error; SPT, supportive psychotherapy.

DISCUSSION

Significant reductions in binge eating and purge symptoms earlier in treatment suggest better outcome for adolescents with BN at EOT, regardless of treatment modality. This study demonstrated that reductions ≥ 96.8% in purging episodes by session 2 and reductions ≥ 96.4% in binge eating episodes by session 4 predict abstinence at EOT. Additionally, this study sought to better understand differences in symptom change for binge eating and purge behaviors separately, suggesting that an earlier reduction in purging behaviors compared to binge eating was related to treatment response at EOT. The only prior study of early response to treatment for adolescent BN collapsed across binge eating and purging symptoms (28), while Nazar et al. (17) in their review note that adult studies reported purging reduction only. Thus, it is unknown if reductions in behavioral symptoms, i.e., binge eating or purging, which are indicative of early response, occur at similar or differential rates. It may be important to assess for and evaluate early reductions in these behaviors separately in order to better predict early treatment response. The results of this study also found an earlier treatment response than the only prior study in adolescent BN, which reported symptom change by session 6 predicted outcome at EOT (28). In contrast to previous findings, reductions in binge eating and purging later in treatment (session 8 and session 9, respectively) as opposed to session 6 (28), were related to abstinence at 6-month follow-up. Similarly, binge eating, but not purge, reductions at session 9 were predictive of abstinence at 12-month follow-up in the current study. Given the limited data available for the 6-month and 12-month time points, results should be interpreted cautiously. Additional research should be conducted to understand what relationship, if any, early treatment response has in predicting abstinence over time.

These preliminary results indicate that change in symptom reduction suggestive of a positive outcome occurs at similar time points in treatment across modalities. Specifically, abstinence at EOT is predicted by change in behavior one session sooner for both binge eating and purging frequency in FBT-BN compared to SPT. It is possible that the direct focus on symptom reduction in behaviorally-focused treatments or the involvement of family members in disrupting eating disorder behaviors contributes to this slightly earlier change. However, the cell size for each treatment was quite small (n = 8–26) and thus research with larger-sized treatment arms is needed. Future research should investigate treatment-based differences in early symptom reduction predictive of response status. Additional research into treatment-specific early behavioral response could help develop clinical benchmarks to guide treatment and assess progress.

Importantly, identifying behavioral markers predictive of treatment response could signal the need for adaptations or different treatment approaches earlier in treatment for individuals likely not to respond (32). Research suggesting the importance of early weight gain (2.4 kg by session 4) in FBT for adolescent AN led to the development of treatment adaptations for likely non-responders in an effort to improve outcome (40, 41). Additional studies across eating disorder diagnoses are needed to assess whether supplementing or shifting treatment course improves outcomes for individuals identified as not likely to respond based on failure to achieve early behavioral change. Further, clinicians may consider assessing change in symptoms during early treatment sessions and re-evaluate by session 4 if lack of improvement noted. It may also be useful for clinicians to examine changes in binge eating and purging episodes separately if future research confirms purge reduction occurs earlier than binge eating reduction for patients who may be most responsive to treatment.

This study, as well as the Le Grange et al. (28) study, showed larger percent reductions in binge eating and purging episodes early in treatment for adolescents compared to studies in adults [82–97% compared to 45–70%; (17)]. Differences in study design and definition of treatment response may account for variability in symptom reduction. Further, these observed age-based differences could also be related to duration of illness, as adolescents on average may not have suffered as long as adults from BN symptoms. Given that shorter duration of illness is related to improved treatment response for eating disorders as well as other psychiatric disorders (42–44), it is possible that adolescents may be more responsive to treatment and therefore show earlier reductions in symptoms compared to adults. Future research should seek to better understand differences between youth and adults on markers of early treatment response and clinical improvement.

There are several limitations of the current study, including missing data and small sample size, particularly in sub-group analyses. Participants self-reported binge eating episodes and purging frequency to their therapist each session, and as such, accuracy may be limited by recall difficulties or presentation bias. The use of weekly monitoring logs or ecological momentary assessment strategies may help combat these limitations in future studies (45). Additionally, the sample was largely female, non-Hispanic, and Caucasian, and thus findings may not generalize to more diverse populations. Further, purging behaviors reported at treatment sessions were not separated by type. Thus, it is unknown if different rates of change occurred based on purging behavior or whether certain purging behaviors, such as laxative use, were more resistant to early change. Moreover, participants only reported purging episodes and thus reductions in additional compensatory behaviors, such as excessive exercise and fasting, are not captured in this study. Future research should seek to collect information on various compensatory behavior strategies separately to further identify whether reductions differ by type of behavior.

Research investigating treatment outcomes for adolescents with BN is lacking. As such, this study sought to better understand behavioral markers of early treatment response within this population. This study also provides additional evidence that clinical improvements in behavioral symptoms within the first four sessions of treatment is indicative of treatment response. Interestingly, reductions in purging episodes occurred before binge eating in this sample, which suggests that researchers and clinicians may want to evaluate these behavioral symptoms separately when ascertaining likelihood of treatment response. These data also suggest that routine assessment of symptom change early in treatment could help providers decide to augment or switch modalities if significant reductions in behavioral symptoms are lacking by session four. Future research should continue to investigate the relationship among early symptom change and treatment outcomes to better inform clinical care for adolescents with BN.

DATA AVAILABILITY STATEMENT

The datasets generated for this study are available on request to the corresponding author.

ETHICS STATEMENT

The protocol was approved by the Institutional Review Boards at Stanford University and The University of Chicago. All participants and their parents/guardians completed informed consent procedures and provided written informed assent or consent in accordance with the Declaration of Helsinki.

AUTHOR CONTRIBUTIONS

All authors contributed to the conception and design of this study. DG, JL, and WA designed and implemented the randomized controlled trial from which this secondary data analysis resulted. All authors contributed to the writing, editing, and revision of this manuscript and approved the final version.

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A Brief Modified Family-Based Treatment Intervention for Youth With Mild Eating Disorders: A Case Series

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Background: Family-based treatment (FBT), an outpatient treatment which is typically offered for 6–12 months by specially trained therapists, is currently the first line treatment for adolescent anorexia nervosa and bulimia nervosa. The success of FBT for adolescents with moderate to severe eating disorders indicates a potential use for a short course of modified FBT which could be offered as an early intervention by nonspecialized community mental health counselors to adolescents with mild or subsyndromal eating disorders.

Methods: In 2016, seven adolescents with mild eating disorders underwent a brief intervention in the form of five FBT-inspired therapy sessions (called 'DREAMS' sessions). The DREAMS sessions consisted of five replicable family sessions given over 6 weeks, each with a specific area of focus for treatment, such as nutrition and eating disorder symptoms, mood, relationships and anxiety. Charts of these seven patients were reviewed in 2019 to determine whether this treatment might be worthy of further study.

Results: Based on a review of the progress notes, all seven patients reported an improvement in intake, a decrease in ED symptoms and an improvement in mood by the end of the sessions. All seven families reported that the sessions had been beneficial.

Conclusion: Early intervention is recommended for adolescents who present in the early stages of an eating disorder, yet there are no guidelines to recommend which treatment should be offered to this population. Further research is required to determine whether a short course of modified FBT, such as these five FBT-inspired 'DREAMS' sessions, may be an effective intervention to offer to youth who present with mild eating disorders.

Keywords: eating disorders, adolescents, family based treatment, anorexia nervosa, bulimia nervosa, community treatment

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INTRODUCTION

Eating disorders (EDs) are defined by the Diagnostic and Statistical Manual of Mental Disorders 5th Edition (DSM-5) as life-threatening illnesses marked by morbid preoccupation with body weight and shape (1). The DSM-5 currently recognizes anorexia nervosa (AN), bulimia nervosa (BN), and other specified feeding or eating disorders as clinically significant and distinct EDs. In adolescent and young adult women, lifetime prevalence rates have been estimated at 0.3–0.9% for AN, 1–2% for BN, and up to 15% in total for all EDs (2, 3). Whether due to medical complications or the frequency of suicide, standardized mortality rates in AN are the highest of any psychiatric disorder and are 12 times higher than the annual death rate from all causes in females 15–24 years of age (4–6).

Studies highlighting the importance of early intervention for AN and other EDs demonstrate that prolonged periods of illness (along with low weight and poor psychosocial functioning) can raise mortality risk associated with AN (7). A paper by Le Grange and Loeb stresses the urgency of early identification and treatment of adolescent EDs in preventing disease progression (8). The article argues that adolescent subsyndromal EDs (those which do not meet DSM-5 diagnostic criteria) "are not only clinically significant in their present state, but may represent legitimate candidates for preventive efforts in light of: (i) a risk of progression from subthreshold anorexia nervosa (SAN) to AN or subthreshold bulimia nervosa (SBN) to BN; (ii) the detrimental effects on outcome of delaying treatment; and (iii) the refractory, severe nature of eating disorders once the diagnostic threshold is crossed….Given that AN is notoriously difficult to treat, and there are limited efficacy data for adolescent BN, attempts to disrupt these disorders in what is arguably their early phases is an important goal in preventing more chronic and treatment-resistant forms of these disorders" (8). The authors provide a strong argument for the need for effective early intervention in adolescent EDs. Yet despite strong evidence for early intervention, there are no guidelines or evidence-based treatments for treating youth who present in the early stages (or subsyndromal stages) of an ED (9, 10).

Family-based treatment (FBT), as described by Lock et al. in *Treatment Manual for Adolescent AN: A Family Based Approach* (11), is well established as the gold standard for treatment of adolescent AN (9) and has even seen clinical success as a treatment for young adults with AN (12). FBT is an outpatient therapy consisting of three phases with the goal of restoring the health of adolescents through family support (11). Phase 1 focuses on empowering parents to take control of nutrition, while siblings provide support. In phase 2, the control over eating and physical activity is gradually shifted back to the adolescent. Phase 3 gives the therapist an opportunity to ensure that normal family life has resumed and to identify developmental challenges and associated coping mechanisms for the adolescent (11). Numerous studies have found FBT to be the most effective treatment for sustaining full remission of AN symptoms and generalized ED symptoms over a period of 6–12 months (13, 14). There is some preliminary evidence suggesting the effectiveness of FBT for adolescent BN as well (15, 16). However, one drawback to this treatment is that it requires special training in the treatment of eating disorders. While the approach is manualized in a textbook, which is helpful for training, it nonetheless is a 6–12 month intensive treatment best offered by therapists who specialize in the treatment of adolescent eating disorders. Thus, while early intervention is strongly recommended for adolescents who present with mild or subsyndromal EDs, the recommended treatment for EDs may be overly expensive or difficult to access for this population, who may be more likely to present to a nonspecialized community mental health service than to a specialized ED program.

Despite the need for effective treatments and guidelines for treating youth who present in the early stages of an eating disorder, a literature review on early intervention for adolescent EDs or on the use of FBT and community-based approaches for the treatment of mild or subsyndromal adolescent EDs revealed few studies. Two studies examined the use of an online, 6-week, parent-based intervention for adolescents at risk of developing anorexia nervosa (17, 18). Jones et al. (17) examined the feasibility and acceptability of an online program in families of 46 adolescent females either at risk of developing AN or with an ED of duration less than 6-months. The program received positive feedback from parents, and 16 of 19 participants "remained stable or increased in ideal body weight and reported decreased eating disorder attitudes and behaviors" (17). Jacobi et al. (18) used this same intervention to compare patients randomized to either the internet-based intervention *versus* a wait-list control in 66 families of adolescents at high-risk of developing AN (18). Unfortunately, high dropout rates limited the findings of this study. Of the 27 families who completed 12-month follow-up measures, weight gain was significantly higher in the intervention group, although risk profile was no different between groups. Another study was found which examined the use of modified FBT in a primary care setting (19). This study described the treatment of 15 adolescents with low-weight and/or restrictive eating disorders with a mean weight loss of 11.6 kg. Treatment providers included two pediatricians and one nurse practitioner who had received a 4-hour training session based on Phase 1 FBT principles followed by 1-hour monthly consultation sessions. Modifications to the FBT model to allow for delivery within a primary care setting included shortening sessions to 30–45 min, eliminating the family meal and minimizing sibling involvement. Patients received a mean of 9.2 sessions over 3 months. At the end of the study patients had gained an average of 6.76 kg and demonstrated a significant increase in their BMI percentile (19). Thus, these and other strategies for early treatment of EDs are actively being studied, yet to date there remains no evidence-based treatment guidelines for early intervention in adolescent EDs.

FBT is traditionally provided over the course of 20 sessions which take place over approximately 12 months. However, some studies have suggested that reducing the number of sessions or time period over which treatment is provided may be possible (20–23). Lock et al. examined the outcomes for patients who were provided FBT over 10 sessions *vs* the traditional 20 sessions. Outcomes at the end of 12 months and at 4-yr follow-up showed no differences between groups, although it appeared as though those patients with eating-related obsessive compulsive thinking or from non-intact families may benefit more from longer treatment (20, 21). Rockwell et al. (22) described 19 cases of adolescent patients with AN treated in a 5-day intensive FBT treatment program. At follow-up (mean 278.4 days posttreatment), weight had risen from 84 to 99% of goal weight, and all but one patient had experienced sustained weight gain (22). Marzola et al. (23) used a similar protocol of a 5-day intensive therapy for adolescents with AN and restrictive eating disorders. They compared groups in which this therapy was provided to families individually versus in a multi-family format to 74 adolescent patients with AN. At 30-month follow-up, 60.8% of patients were found to be in full remission and an additional 27% were in partial remission. There were no differences noted between the group that received the treatment as single families *vs* multifamily formats (23).

Given the successful treatment of patients with moderate to severe EDs using FBT (9, 12–15), and given the known benefit of early detection and treatment of EDs (7, 8), it is plausible that a short course of modified FBT has an unexplored therapeutic use as an effective treatment for mild or ‘subsyndromal' EDs. Thus, the aim of this study was to retrospectively examine the potential effectiveness of a short targeted intervention, consisting of five modified FBT sessions, designed to treat adolescents with mild EDs before the disease progresses and worsens.

We are based in a medium-sized Canadian city (population 990,000) where specialized care for nonsevere adolescent EDs is largely unavailable within the community. Hospitals such as ours, with multidisciplinary teams specialized in the treatment of pediatric EDs, cannot accommodate the number of referrals for adolescents presenting with EDs, and as such we can only accept patients with severe EDs. Patients with mild or moderate EDs are unfortunately left to seek treatment in the community, where counselors typically lack training or confidence in treating EDs. As a result of this gap in services, an intervention targeted towards adolescents with milder EDs was developed in 2016 by first author W.S. (a child and adolescent psychiatrist). Five innovative modified FBT sessions (termed ‘DREAMS' therapy sessions) were developed based on her 17 years of clinical experience as a noncertified FBT therapist treating youth with severe EDs. Inspired by FBT, the family sessions were developed to address issues of nutrition and ED symptoms, cognitions and urges, as well as mood, anxiety, sleep, school issues, and peer and family relationships. The acronym DREAMS was created based on the themes of the various sessions. In order of the letters of the acronym, but **not** the relevant order of sessions, the themes are **D**epression (mood, self-harm and suicidality), **R**elationships (with family and with peers), **E**ducation (school issues/stressors), **A**nxiety/stress, **M**eals/nutrition/ED symptoms, and **S**leep (and **S**ubstance use if relevant), spelling DREAMS as a memory aid for community counselors.

The objective of this case series was to review the hospital charts of the seven patients with mild EDs who were treated in 2016 by W.S. using the five DREAMS sessions that she had developed. Her progress notes were reviewed by a research student to determine the potential of the DREAMS sessions as an early intervention for youth with mild EDs and to determine whether there is value to further studying this approach. It should be noted that only seven patients were treated because no research funding or extra resources were provided, and as such after treating those seven patients, the team and W.S. had to return to only accepting referrals and providing treatment for patients with severe eating disorders.

MATERIALS AND METHODS

Participants

Participants consisted of seven patients with EDs deemed to be mild in severity who were referred to our hospital-based specialized multidisciplinary pediatric ED program. Under normal circumstances, these referrals would have been denied as their conditions (as described on the referral form) would not have been deemed severe enough for treatment by our team. Instead of being declined, these seven families were offered treatment with the five DREAMS sessions. The progress notes from the 2016 DREAMS sessions of the seven patients included in this case series were examined retrospectively in 2019. This retrospective chart review was approved by our hospital Research Ethics Board.

Study Protocol

Patients underwent treatment between January and December 2016 in the form of five DREAMS family therapy sessions. The patients and families were not ‘handpicked' but rather consisted of the first seven mild–moderate ED referrals received by the team at the time, which normally would have been rejected and returned to the family physician. The patients who were offered the DREAMS sessions were deemed to be eligible for treatment if they were between 13 and 18 years of age, and had a nonsevere ED that met the following criteria: 1) they were at least 89% of their premorbid body weight; 2) symptoms of bingeing and purging occurred no more than seven times per week; and 3) the patient was taking at least 50% of their daily nutritional needs (OR, if there was more significant restricting, it had only been occurring for less than two months).

All seven families were sent a letter offering them five family therapy sessions, with no further follow-up, and all seven gave written consent for treatment. The patients did not receive a formal assessment by our hospital-based ED team, or by W.S., in order to determine whether a community counselor could feasibly offer these sessions without the need for a psychiatric or psychological assessment (in Canada, these resources can be very difficult for patients to access). A letter also went to the family doctors of the patients informing them that these therapy sessions would be offered to the patient, but that the family physician was responsible for their medical care and follow-up. The DREAMS therapy sessions developed by W.S. can be best described as a form of brief modified FBT, which entailed five sessions across 6 weeks for each patient and their family, with one week between each session, but with a two week break between sessions 4 and 5. The DREAMS sessions were conducted by first author W.S. based on her clinical experience of the most important components of FBT for treating youth with EDs, who often present with comorbid anxiety and depression. The breakdown of each session is as follows:

Session 1: (This session represents the '**M**' in 'DREAMS,' as the focus of the session is on meals, nutrition and ED symptoms.) The highlights of session 1 include:

- The therapist raises anxiety by stressing the seriousness of the ED, lifts blame from the patient and parents, externalizes the illness, and empowers parents to contain symptoms of the ED.
- Psychoeducation on EDs is provided to the family, including the importance of nutrition to the well-being of teenagers and the side effects of insufficient nutrition.
- The ED is compared to an 'OCD-like' illness in that the patient experiences obsessive ED thoughts and then feels compelled to have symptoms to decrease the intensity of the thoughts (and insufficient nutrition exacerbates all of this).
- Families are helped to see the ED as related to stress or to feeling "not good enough." Patients are helped to describe the stressors or triggers that might be associated with the development of the ED in order to increase empathy in the family.
- Parents are empowered to take charge of nutrition, contain ED symptoms, and supervise meals, in a firm but compassionate manner. If siblings are present, they are encouraged to offer support to the patient. For underweight patients, weight is recorded, and a weight graph is started.
- The family is given a 'folder' of resources to take home with them, that includes the name of a book for parents ("Help Your Teenager Beat an Eating Disorder") (24) and a sample 2400 calorie 'meal plan' (*i.e.* a list of suggestions for snacks and meals, to give parents an idea of what a typical day's intake might look like).

Session 2: In keeping with FBT principals, the focus of this session remains on nutritional intake and ED symptoms, in order to stress the key importance of normalizing nutrition, eating, and weight for the patient's recovery. The following topics are covered in session 2:

- The family is asked whether nutrition has improved or if symptoms have decreased, and the patient is weighed, and the weight is graphed if indicated (*i.e.* if there is a history of weight loss, and weight at referral was below premorbid weight.)
- The family is asked about what the patient is eating, eating patterns, meal and post meal supervision times, and any symptoms of bingeing, purging, or exercising.
- The family's efforts to help the patient normalize his or her eating are reviewed, including asking about what is and is not working, praising them for their efforts, and helping them to focus on containing any ongoing ED symptoms.
- The patient is helped to voice their thoughts and feelings associated with the family's efforts to contain the ED symptoms. The therapist works to help separate the patient from the illness, and the conversation remains focused on ED thoughts, urges, and symptoms.

Following this, the family and patient are told that EDs tend to be associated with stress or feeling 'not good enough,' and they are informed that the brain needs to be well nourished in order to cope with and recover from anxiety, depression, or stress. They are told that now that nutrition has begun to improve (thanks to their efforts), these topics will be covered next week.

Session 3: This session (which includes the letters **D**, **A** and **S** from the acronym DREAMS) starts by ensuring that eating is normalizing and ED symptoms are being contained. Lots of praise is given for any improvements. The weight is graphed if indicated (*i.e.* if weight at referral was below premorbid weight, and one goal of treatment is weight gain. Note that patients had to be at least 89% of premorbid weight to be in this study). The therapist then asks the patient about any low mood, worries, or sleep problems. Psychoeducation is provided on the relationship between nutrition, sleep, mood, and anxiety (*e.g.* how insufficient or irregular nutrition can worsen these problems, and these problems in turn can make the ED worse):

- The family is helped to understand that negative feelings 'fuel' the ED so that as well as containment of symptoms and a focus on improving nutrition, the family can help by supporting the patient to get treatment for anxiety, depression or insomnia and by encouraging self-care. Treatment options are discussed, and the therapist can recommend that the patient consult a physician to consider whether medication might be indicated.
- The family is asked what might be causing the patient to feel sad, worried, angry, or 'not good enough,' and to problem-solve ideas on how to decrease the negative emotions fueling the ED.
- The patient is encouraged to talk openly about any symptoms of self-harm or suicidality. The counselor helps the family to empathize, express concern, and support, and problem-solve how to keep the patient 'safe' from these symptoms.

Session 4: The patient is weighed again if indicated, and the weight is graphed (if patient is not yet at premorbid weight). A brief discussion can take place regarding weight, intake, and ED symptoms if needed. (Note that unlike FBT for moderate–severe EDs, in which the focus needs to remain on weight gain and containment of ED symptoms, after 3 weeks of symptom containment and improved intake, many patients with mild EDs and a short history of restricted intake will be weight-restored.) Therefore, the main areas of discussion in session 4 are school (educational) issues and relationships (the **E** and **R** in DREAMS). This includes:

- Asking the patient about any stressors associated with school (*e.g.* any social anxiety or anxiety about tests, assignments, class presentations, peer rejection, bullying, *etc*). The therapist explains that while poor nutrition can cause anxiety, anxiety and stress can also fuel the ED symptoms. The family is encouraged to problem solve (*e.g.* by helping to make a homework schedule, reaching out to the teacher or school guidance counselor, using resource rooms, *etc*).
- Ensuring family awareness of any other stressors affecting the patient. The family is again helped to understand that

negative feelings 'fuel' the ED, and that they can help by supporting the patient to feel 'good enough,' by decreasing stressors, or by improving relationships with peers or at home (which may require tackling conflict in the family).

At the end of the session, the counselor points out any improvements observed, expresses confidence in the patient and family's ability to overcome challenges, and notes that the next session will be the last one. A return session is scheduled in two weeks rather than the usual one week return.

Session 5: The following topics are covered in the final session:

- A full and final review of nutrition and ED symptoms is undertaken, and weight graph is reviewed if indicated. The ED is externalized, and if there have been improvements, the patient and family are commended for their role in helping to protect the patient from the devastating effects of an ED.
- Ongoing challenges are discussed (*e.g.* "still afraid to take desserts"), and the patient and family are encouraged to keep the momentum and progress going until eating gets back to "normal."
- Mood, anxiety, and stressors are reviewed, empathy is provided and modeled for any ongoing challenges or stressors, and praise is given to the family for any improvements and any support the family has provided which the patient has accepted.
- The patient and family are asked to problem-solve what might be some helpful next steps or follow-up now that therapy is ending. For example, patients with ongoing mental health problems might be referred for individual CBT, or a DBT group, or be given information about workbooks or online resources. They could decide it would be helpful to ask the family doctor to monitor weight or to prescribe medication. (If the ED has worsened, the patient should be referred to a specialized ED therapist or team.)
- The counselor ends the session by praising all of them for any improvements made, for their ability to work together, and for their ability to problem-solve. The follow-up plan is carefully described, and the family is tasked with supporting each other and problem-solving any unresolved or new challenges.

Hypothesis

These five DREAMS therapy sessions were created as a treatment that could be offered to youth who present with mild EDs. The hope was to provide a treatment that, if deemed helpful by these 7 families, could then eventually be studied for its potential effectiveness in treating mild EDs and for its potential utility in training nonspecialized community counselors on how to approach the treatment of youth who present with mild EDs. It was hoped that patients who received the treatment would demonstrate improved mood, anxiety, and sleep, decreased ED symptoms, and for underweight patients, improved weight gain. It was hoped that parents would develop a better understanding and knowledge of EDs and enhanced feelings of efficacy in supporting their child's recovery. Unfortunately, this was not a funded study, and no measures were used. Seven patients were treated by W.S. with the DREAMS family sessions, and their charts were reviewed (by ZA) in an attempt to discern whether or not there is evidence that this treatment is worthy of further study.

RESULTS

Seven out of eight patients referred for the DREAMS sessions met the inclusion criteria and received the five therapy sessions (the 8th patient was deemed to have a more severe ED and was referred back to the hospital ED team for treatment). The average age of the patients was 15.0 years, with a range from 13 to 17 years at the first DREAMS session. Six of the patients were female and one was male. None of the patients were given a psychiatric assessment or formal psychiatric diagnosis (in keeping with the idea that community counselors should be able to offer this treatment). Three of the patients had symptoms of restricting, bingeing and purging, two had symptoms of restricting and bingeing, one had symptoms of bingeing and purging, and one had symptoms of restricting only (and was 93% of premorbid weight). Along with the ED, all seven patients reported depressed mood (four with self-harm, four with suicidal ideation), and all seven patients described symptoms of an anxiety disorder (six with symptoms of social anxiety, six with generalized anxiety, one with panic attacks). At the first DREAMS session, when asked about the main problem that brought them to treatment, five of the seven patients identified that ED was their main problem that they would like help with, and they expressed motivation to recover (in contrast to many patients with severe EDs, who may not be motivated to recover). Four of the seven parents expressed during the first session that they did not know how to help their child recover from the ED. Six of the seven patients completed all five sessions in an average of 6.33 weeks. (One patient did not complete session 5 as the family felt she had improved enough that they did not need the final session.) Six of the seven families had the patient, mother, and father attend all sessions (for one patient the father missed one session), and one patient also had their brother attend three of the sessions.

Of the seven patients, all reported significant improvements in their ED by the end of the five sessions, with four of the patients being described as in full remission from their ED and with eating described as "completely normal." One patient was deemed to be 93% of her healthy weight in the first session and had her weight graphed during the sessions; she gained 3.4 kg in 4 weeks and was 98.5% of her goal weight in the final session. Six of the seven patients described improvements to their mood, with two declaring that their depression had resolved. Three of the seven patients described improvement in anxiety, but the remaining four patients stated that their anxiety persisted in the final session. (See **Table 1** Summary of improvements/results).

Some key factors contributing to the success of the DREAMS sessions that were identified by the families included: parents providing consistent praise and support, parents taking control of meals and making nutrition "mandatory," finding creative solutions to problems (*e.g.* having the patient create videos to show parents that they had eaten when parents could not be home), and coping strategies that were discussed in the sessions. Some challenges to recovery identified by patients and families included a patient feeling as if parents were 'lecturing' them as opposed to supporting them, and some adolescents feeling as if parents were being overly controlling and telling them what to do.

DISCUSSION

Despite strong evidence for the importance of early intervention in the treatment of adolescent EDs (8), there are no guidelines or recommended treatments for youth with new onset, subsyndromal or mild eating disorders and little is known about what factors affect outcomes in this population. According to Currin and Schmidt, "Whilst existing research provides preliminary indication that early intervention for EDs may be useful, not enough is known about the variables critical for ensuring good outcomes" (25).

In addition, despite the evidence for the importance of early intervention, there are also many communities, including our own, where access to treatment for EDs is limited to specialized hospital-based programs that only treat those with moderately severe to severe eating disorders. (In Ontario, Canada, these specialized programs are evidence-based and offer FBT to most children and adolescents who present with restrictive EDs.) Thus, many young people with new onset or mild EDs receive no treatment at all until the ED has progressed. Others seek treatment in the community, where many nonspecialized community mental health counselors lack experience, training, or confidence in treating EDs.

TABLE 1 | Summary of improvements/results documented in the progress notes for each patient in the final session.

	Presenting Symptoms	Physician Notes from Final Session	Family Feedback in Notes from Final Session
Patient 1	Restricting, dieting, bingeing, purging, fear of weight gain/wanting to lose weight.	ED and major depressive episode in remission. Anxiety remains severe but coping strategies discussed (*i.e.* deep breathing, relaxation, counseling, yoga). Able to enjoy activities previously could not. Sleep an ongoing problem even with trazodone. Relationships with friends and family good.	"Eating disorder and eating are no longer concerns." Parents noted improved coping with school anxiety. Overall positive feedback but acknowledgment that anxiety remains a problem. Eating normal, weight normal. Patient reports some ED thoughts but "I push them to the back of my mind."
Patient 2	Restricts and avoids all 'unhealthy' food but still eating three meals a day, fear of weight gain, wanting to lose weight. 93% of goal weight. Strong ED thoughts and urges. Also not attending school due to severe anxiety	Now 98.5% of goal weight. Improved coping with anxiety, improved self-esteem, denies any eating disorder thoughts/ urges now. Eating, mood, sleep and friends all going well. Still has severe social anxiety and school avoidance.	Huge improvements in eating; no longer restricts 'unhealthy' foods, eating is 'completely normal." "Seems much happier these days." Noted improvements in "maturity." Family relationships reported as positive and family was thankful for the sessions.
Patient 3	Restricting, bingeing, fear of weight gain, exercising to lose weight, body image concerns, recent self-harming.	Eating improved tremendously; eating now described as 'normal'. No longer exercising to lose weight, no longer bingeing. Increased anxiety and low mood associated with school starting. No more suicidal ideation or self-harm. Patient gaining ability to voice concerns and has increased coping strategies.	Parents felt empowered to take charge of nutrition and make it mandatory, and patient reported this as helpful. Eating now normalized. Patient reported the ED thoughts and urges are there but decreased from before. Relationship with friends and family remain supportive.
Patient 4	Restricting/skipping meals, bingeing, recent suicide attempt.	Full remission of eating disorder; denies any ED thoughts whereas these previously took up 80% of brain. Patient eats well and normally, with no avoidance of foods. No trouble sleeping, mood is good whereas previously very low with suicidal ideation and self-harm. Denies significant anxiety whereas previous severe social anxiety.	Very positive feedback from family due to increased mood and full remission of ED symptoms.
Patient 5	Restricting, avoiding unhealthy food, bingeing, purging, fear of weight gain, exercising to lose weight, body image concerns.	Nutrition was improved and weight approaching healthy weight. Patient learned to eat challenging food like cake for dessert. Significant body image concerns and ED thoughts and urges still present but now copes by trying to push them away and distract.	Patient reports "mood was improved, anxiety had decreased, confidence had improved, was being more independent and more social with friends." Patient and both parents describe significant improvement in all areas, including mood, anxiety and ED.
Patient 6	Bingeing (7×/week), purging (7×/week), fear of weight gain, exercising to lose weight, body image concerns, history of self-harm and suicidality.	Mood 3/10 midtreatment, now improved to 6–7/10, with no self-harm or suicidality. Bingeing and purging decreased to 3×/week. Expresses more positive outlook, now motivated to recover from ED.	Patient slightly more irritable from feeling parents are being overly controlling. Overall thankful for sessions and hopeful for recovery.
Patient 7	Restricting, bingeing, purging, body image concerns, history of self-harm and suicidal ideation and previous suicide attempt.	Decreased anxiety. ED thoughts and urges still there but no symptoms, *i.e.* no restricting, bingeing, or purging. Eating is normalized, not avoiding any foods; at healthy weight. Mood is good, no self-harm or suicidality. Enjoys spending time with friends. Relationships at home and with friends are very good.	Eats three meals and one snack per day but parents feel patient's eating is "not yet 100%" because she will not choose to eat and sometimes resists. Parents felt patient had made significant progress and parents had learned to help her. Improved family communications and support.

The five DREAMS sessions were developed in an attempt to address this problem. They were based on the first author's experience of using FBT to treat severe EDs in adolescents and were created using the ‘principles' of FBT. They were designed to be replicable and consistent such that they could potentially be taught to nonspecialized mental health counselors as a short-term intervention for adolescents who present with mild or new onset EDs. (It is expected that these patients will also be followed by their family physicians.) The purpose of this case series was to review the progress notes of the seven patients who received the DREAMS sessions, in order to determine whether this treatment is worthy of further study. Based on the results, the treatment does seem to have been effective in improving ED symptoms and mood in these patients. For some but not all, sleep and anxiety also improved.

There are significant limitations to this case series, including the small sample size, lack of reliable and valid measures, lack of a comparison group, possibility of bias, and possibility that the outcomes were positive as a result of the author's experience in treating EDs (and thus perhaps not replicable if treatment were to be provided by an inexperienced counselor). Nonetheless, the positive results based on what was written in the progress notes (including feedback from families) suggest that these five family therapy sessions are worthy of further study as a possible treatment for adolescents with mild EDs. Prior to further research, it would be worth modifying the current sessions based on feedback from other ED experts and from families who have had previous ED treatment, and then documenting in detail the proposed content of the five sessions in order to make them replicable. Funding could then be obtained to more formally study the effectiveness of this intervention in a randomized controlled trial while also studying the effectiveness of the intervention as a training tool for community counselors who lack experience in the treatment of adolescent EDs.

CONCLUSION

It is imperative that we find effective, brief, innovative treatments that will prevent youth with mild or new onset EDs from deteriorating and developing more severe or chronic EDs. It is also imperative that we train nonspecialized counselors in the community to recognize and treat these illnesses. Further research is needed into early interventions for adolescent EDs, such as the five FBT-inspired DREAMS sessions described in this paper.

DATA AVAILABILITY STATEMENT

The data that support the findings of this study are available on request from the corresponding author, WS. Data is not publicly available as it would compromise the privacy of research participants through the release of identifiable information.

ETHICS STATEMENT

This study involving human participants was reviewed and approved by the CHEO Research Institute Research Ethics Board. Written informed consent to participate in this study was provided by the participants and by the participants' legal guardians/next of kin.

AUTHOR CONTRIBUTIONS

WS created the DREAMS sessions, treated the patients, designed the study, wrote the protocol, and wrote much of the first draft of the manuscript. ZA wrote the REB proposal, created the data extraction form, extracted the data from the charts, and wrote some of the first draft of the manuscript. MN and LI commented on the protocol. BB created an Excel sheet of the data, summarized the data, and wrote the results section. ZA and BB conducted literature reviews. DV, ZA, and BB created the reference list, ZA and BB conducted literature reviews and LI summarized some of the relevant literature. DV helped with formatting the manuscript. All the authors commented on the manuscript. All the authors contributed to and have approved the final manuscript.

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PERSPECTIVE
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Rebooting “Failed” Family-Based Treatment

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Family-based treatment (FBT) has become well established as the first-line evidence-based treatment for adolescents with anorexia nervosa. However, fidelity to the FBT model can be poor, and treatment is often augmented or modified in various untested forms in the hope of increasing its effectiveness and acceptability. The New Zealand Eating Disorders Clinic, a private specialist outpatient clinic in New Zealand, has been seeing increasing numbers of families presenting for treatment reporting an experience of “failed FBT”. All of the families who presented with a child under the age 19 living at home agreed to restart FBT with the author when re-engaging in treatment. This essay summarizes the experience of the author in repeating FBT with previously “failed” FBT cases over 20 months between 2017 and 2019. Common themes of the first course of FBT were identified that raised questions for the author as to whether FBT had been implemented with sufficient fidelity and proficiency the first time around. This clinical perspective essay describes how these identified issues were addressed when FBT was administered again. It does not intend to make broad claims, but instead is intended to be helpful to clinicians who are implementing FBT, to assist them in carefully examining and assessing whether key FBT principles and procedures have been exhausted before evaluating the need for modification or augmentation. Furthermore, this perspective provides suggestions as to how the identified common themes can be addressed if families re-present for FBT treatment after having had a course of “failed FBT”.

Keywords: family-based treatment, anorexia nervosa, adolescents, treatment fidelity, failed FBT, modified FBT

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INTRODUCTION

Manualized family-based treatment (FBT) is an empirically supported treatment for adolescents with anorexia nervosa with outcomes of full and sustained remission in 35–45% of cases (1–3). Full remission is defined as percent median body mass index (BMI) greater than 95% as expected for age and an Eating Disorder Examination (EDE) score within one standard deviation (SD) of the population mean (4). The efficacy data to date for manualized FBT are promising (5, 6). FBT has been established as a first-line treatment for adolescent anorexia, which is now reflected in treatment guidelines for eating disorders (7, 8). However, the effectiveness and acceptability of FBT in its manualized form has been questioned (9–11). There is also a growing trend among clinicians and treatment providers to describe the treatment they provide as “FBT informed” or “modified FBT,” although, to date, there is no definition of what these terms actually mean. Based on anecdotal discussions among colleagues and presentations at conferences, it seems that a "modified" approach entails some or all of the following: additional individual treatment for the adolescent, the use of a dietitian to provide dietary advice or meal plans, the use of adjunct groups (e.g., self-compassion, distress tolerance), or a planned hospital admission or residential stay to assist with weight restoration or management of eating disorder behaviors. Incorporating these kinds of interventions deviates from the empirically tested manualized version and is not informed by any research. There are indications that "modified" versions of FBT might even be more commonly practiced than the manualized version. In a study of 40 therapists providing treatment to youth with anorexia (12) concluded that there remained not one participant who reported practicing FBT with fidelity to the model. An online study examining FBT adherence demonstrated that one third of respondents deviated from the model (13). A study of therapist adherence to manualized FBT showed that adherence to the model decreased over time, and that adherence was strong only on behavioral interventions focused on meals and eating but weaker on other elements of the treatment such as modification of parental criticism and attending to general family process issues (14).

This perspective essay summarizes the author's learning and reflections of providing FBT a second time around for cases with a reported history of "failed" FBT. Using the families' narratives of their previous FBT treatment the author amalgamates identified issues into five key themes that appear to have contributed to the failure of the first course of FBT. Each of these themes will be discussed with a description of interventions of how these themes have been addressed in the second course of FBT.

SUMMARY OF CASE DATA

Since this clinical perspective essay is based on reflections on a cohort of cases it is helpful to provide a summary of the key data of the cases. Nine cases in total presented to the New Zealand Eating Disorders Clinic over a 20-month period between October 2017 and May 2019, reporting "failed FBT". All of them agreed to re-engage in FBT for a second time with the author. One family dropped out, four families are still in treatment, and four families have successfully completed treatment. The mean age at beginning of treatment was 17.3 years (range 14–19 years), with an average illness duration of 3 years (range 1–8 years). All are female with two cases with separated parents. Two cases identify as having 50% Maori descent. Seven cases have a diagnosis of anorexia nervosa restricting type, and one with anorexia nervosa binge-eating/purging type. Mean BMI at the beginning of treatment for all eight cases was 17.8 (range 16.6–19). Four cases have completed treatment after a mean of 21.75 sessions (range 17 to 25) with a mean BMI of 20 (range 18.5–21.6) and resumption of menses at EOT. Three completed an EDE-Q at EOT, all with a total score within one SD of community norms. The four cases still in treatment are also on track to achieve the same recovery standard, despite a longer duration of illness for two of the cases (>4 years). All of the cases are seen by the author, who is a certified FBT therapist and certified supervisor and has worked with eating disorders for 19 years and practicing FBT for 10 years. The author has regular specialist FBT supervision.

GETTING IT RIGHT FROM THE BEGINNING

Theme one relates to whether families "started well". All families reported knowing what FBT was; they had done their own reading about FBT; they had often connected with support groups and online forums. However, they reported mixed experiences of treatment delivery. In all cases, families were aware of the core tenets of FBT, namely externalization of the illness, parents being in charge of re-nourishment, being united, and not criticizing their child. In all cases, the entire family, including siblings, had been present at the first two sessions. It seemed that the structural components of the therapy had originally been set up appropriately. However, the *depth* of understanding and knowledge of these core principles and their translation into treatment appeared deficient. The parents reported that they felt they were prescribing something to their child in an inauthentic and mechanical way rather than embodying it. When session one was re-done, every family commented that they had not really "gotten it" the first time around. Particular attention was paid by the therapist to helping the parents *truly* understand the nature of anorexia and how it affected *their* child. Persistent circular questioning was used to draw out the parental understanding of the connection between what they knew about anorexia and its specific manifestations in their child. Multiple analogies and examples were re-visited until the therapist and family felt satisfied that the session one tasks had been fully addressed. Session two, the meal session, was a session that families wanted to skip because significant anxiety had been generated during the previous experience. The therapist needed to spend more time at the initial set-up exploring with sensitivity any reservations the families had and setting the right "tone". This included empathy for the previous experience of the family and at the same time being mindful of the necessity of this session. It was framed up as a new learning opportunity, to assess where the anorexia may have taken ground; to supply the input needed to help set the family back on track, and to discover where unhelpful "blind spots" may have developed. In all cases, the intensity of the meal session was slightly reduced because the families had done it before. However, the participants had greater openness to learning because they "knew" the anorexia better. This provided an opportunity to empower the parents to utilize knowledge and experience they had already acquired in dealing with any problem areas that arose during the session.

FACILITATING PARENTAL EMPOWERMENT

A strong early predictor of success in FBT is achievement of weight gain of 2.3 kg or more over the first month of treatment (15–17). In the reviewed cases, all patients had achieved weight gain of 2.3 kg or more in the initial stages of the first FBT treatment, which has been established by the above studies as a key predictor of increasing recovery chances. This raises the question, what happened? The parents described hearing the message clearly that weight gain was needed, and reported having been mobilized to ensure their child was eating sufficient amounts to gain weight. However, it seemed that the need to "re-feed" had become the *only* goal of FBT. The parents described the feeling of being in panic mode and managing to achieve early weight gain but eventually becoming stuck. Three families reported staying in phase one for up to 30 sessions and not being able to transition to phase two. Two families had transitioned to phase two on the recommendation of the previous therapist despite disagreeing. In two cases, at the suggestion of the therapist, when weight gain became stalled or distress remained high, the adolescents had received concurrent individual therapy, as an adjunct to FBT.

All parents, when seen for the second time, reported feeling exhausted, hopeless and sometimes feeling guilty about being a "failure" at parenting, or failing to feed their daughter. This situation called for particular attention. The issue of parental empowerment is a core tenet of FBT and one that is commonly misunderstood (18); yet it is the fundamental principle that underpins FBT. Empowerment is more than "being in charge of food," which appeared to be the predominant understanding of the term. Parental empowerment is a complex concept, which refers to the process of parents becoming more confident in making decisions in the context of the tasks required to help their child recover from anorexia. Empowerment can only be achieved if the parents are on the same page, can understand the illness fully, and learn how to transfer their general parenting skills to the specific needs of treatment. If this is not achieved from the beginning and continually attended to throughout treatment, it can contribute to a number of problems in the long run. Problems in managing the anorexia behaviors that had been identified with the parents needed to be explored with the author for long enough to ensure that there was agreement and certainty about the plans and strategies the family were to implement. This also involved detailed and focused discussions when reviewing how plans had succeeded and what could have been done differently. Families are complex, and they do not have the knowledge or experience of anorexia at the beginning of treatment. The therapist needs to sensitively attend to issues such as parents not being in agreement or when one parent takes more control than the other. The therapist also needs to avoid being overly directive or too passive, thereby inhibiting the learning process for the parents. It is not easy to detect whether parents are not *really empowered*. This was one of the critical issues that required careful attention when undertaking FBT the second time. The empowerment of parents involves recognizing nuances of the delicate balance of actively identifying the family's perspectives and strengths, reinforcing healthy decision making together, and simultaneously, setting clear expectations for treatment tasks and goals (18).

IMPORTANCE OF ATTENDING TO ANOREXIC BEHAVIORS, NOT JUST WEIGHT GAIN

In its first phase, FBT is highly focused on weight restoration (19). However, this does not occur at the expense of allowing anorexia behaviors and habits to go unchecked. All families reported that they had been instructed to keep a sustained focus on weight gain, and all families had achieved partial weight restoration the first time they did FBT. Families also reported that despite some weight restoration, eating disorder cognitions and body image concerns had remained unchanged. When this theme was explored further with the families, it became apparent that they had been under the impression that weight restoration was the *only* key to recovery, "As long as they eat and gain weight." Families appeared to have an insufficient understanding of the need to challenge eating disorder-related behaviors. Instead, the families were offered individual treatment or a hospital admission for that purpose. Many of the adolescents admitted that they had hidden food, used water loading and weights, or secretly exercised throughout previous treatment. Families had not tackled fear foods or transitioned to normal levels of exercise before transferring responsibility back to the young person. The question of *why* cognitions were not changing had not been fully explored with families. This was a perplexing theme, as the FBT manual discusses the need in phase one as "Directing, redirecting and focusing the therapeutic discussion on food and eating behaviors and their management until food, eating and weight behaviors and concerns are relieved" (p.125, 19). Phase two involves gradual transfer of responsibility from the parents back to the child. The second time around, the first task the families had to learn was to take particular notice of anorexia behaviors, or uncover them, when the only cue was high distress and anxiety of their child. Parents also learned how to solve problems and how to extinguish *all* unwanted behaviors systematically. Parents reported that this was a new concept to them, a concept that had not been highlighted in their previous treatment, and, in some cases, had not even been mentioned. Frequently, these anorexia behaviors had become habit-based, and the adolescents and young adults were initially anxious about having to "give them up". However, as the behaviors reduced over time, they were able to experience less anxiety and agitation with accompanying quieting of cognitions; the adolescents became very active participants during the later parts of phase two. Attending to the behaviors fully contributed to the affected adolescent feeling more "heard" and "understood," and the experiments with parents became more collaborative as phase two progressed. Adolescents reported that in their previous treatment the focus had only been on increasing food amounts and that the lack of recognition by their parents and therapists of how distressing this was for them had increased their resistance to treatment and ultimately had resulted in their lack of faith and trust in their parents and in the effectiveness of FBT.

THERAPEUTIC ALLIANCE AND COMPASSION

A common theme raised by almost all of the parents was the concern about a lack of a therapeutic alliance between the previous therapists and their children. This is of interest because the therapeutic alliance in FBT has been demonstrated to be positive with parents and the adolescent (20, 21). In seven cases, the families had transitioned to individual treatment when FBT was "failing". However, following this transition, every one of those seven patients deteriorated in weight and symptoms. The patients themselves later admitted that they had asked for individual treatment as a deliberate strategy to exclude their parents because they knew it would mean that there would be less pressure for weight gain and more chances of avoiding stress and conflicts around the challenges related to their eating behavior.

Re-booting FBT after the adolescent has already had individual treatment is always more challenging because of the reluctance of the young person to renounce their perceived control and autonomy. With five of the families who restarted FBT, this issue was addressed by agreeing that the young person would have more individual time at the beginning of sessions (the adolescents were older than 17 years of age). Initially, individual time was approximately 15 min (as opposed to 5–10 min), with sessions being 60–70 min in duration. However, it had to be made explicit that this was not "individual treatment" and the therapist was mindful of continuing to empower the parents, of the need to not be drawn into potentially divisive behaviors, and of reiterating the need for the parents to be part of conversations that involved making decisions. Particular attention was given, in a compassionate way, to linking the young person's distress to being under the influence of anorexia and, at the same time, frequently acknowledging that it would be a normal instinctual response to want to avoid "feeling worse" by experiencing the intense anxiety when challenging the anorexia. This required the therapist to fully understand and believe that exposure was required to overcome these anorexia anxieties and to have a genuine, compassionate understanding for the affected adolescent and the parents, knowing how difficult it was to agree to decisions that would lead to having to tolerate distress and anxiety. Demonstrating compassion for the struggle of the adolescent is inherent to FBT and so is giving the adolescent more individual time as treatment progresses.

In all cases the second time around, there was never a question raised about the quality of the therapeutic alliance with the therapist. It is important for therapists to understand and feel confident that it is absolutely possible to maintain a strong therapeutic connection with the affected person without compromising the relationship with the parents and the fight against the anorexia. Although it is more challenging to restart FBT following individual treatment, it was useful that all families and adolescents acknowledged that the individual sessions had not resulted in the desired outcomes. This was helpful in directing the parents to the FBT framework without having to address requests for alternative forms of therapy at times of difficulties.

THE IMPORTANCE OF FULL COMPLETION OF TREATMENT

None of the families had previously experienced phase three therefore, this phase was a new concept for them. Some families, the second time around, were tempted to finish treatment after the relief of weight recovery, having established normalized eating and exercise behavior. One study (2) suggested that phase three may not be needed for some families, but it was noted that cases with high levels of obsessive-compulsive features appeared to benefit from a more extended treatment regime. All patients and families discussed in this essay had already been in treatment for some time and understandably, were feeling exhausted and ready to move on. It took persistence on part of the therapist to ensure that families did not rush to finish or "jump over" the final stages. Typically, phase three is intended to be brief and is aimed at ensuring that the adolescent is on track developmentally. It also helps the family to identify areas of potential deficits that may have left their adolescent child vulnerable in the first instance (19). Most patients displayed heightened anxiety about "life without anorexia" and felt inept at knowing how to manage developmentally appropriate life challenges like moving away from home or navigating intimate relationships. In those cases, phase three was extended beyond the three to four sessions typically required. The parents also needed help to "let go" and time to experience that their child was genuinely managing well. In all cases, there was additional individual time at the beginning of the sessions. The content of these sessions no longer focused on eating disorder management or related concerns, but rather on other life issues to model age-appropriate developmental independence. The author does not see this as a modification to FBT but rather a reflection of the greater need, made more apparent by a longer duration of illness, to attend to ensuring the patient is developmentally "back on track".

CONCLUSIONS

There are several points worthy of reflection. The most critical one might be that it was possible to achieve full recovery using FBT treatment even after a course of previously "failed" FBT. It might be re-assuring to know for FBT therapists faced with similar cases that revisiting FBT is a valid treatment option. This perspective essay is based on eight cases seen by one therapist in one clinical setting over the course of 2 years. This raises the question of how often this phenomenon of families presenting for treatment as having "failed" may be occurring elsewhere. The themes discussed were present in all cases and, while comprehensive conclusions about the families' previous treatment cannot be drawn, they were common and clear enough to question whether important key principles of FBT treatment had not been attended to with sufficient fidelity and proficiency the first time the families had engaged in FBT treatment. The emphasized points and solutions discussed in this essay are not outside what FBT clinicians should already be aware of. It might be helpful and reassuring to clinicians to know that with persistence, even a second course of FBT treatment can go well without the need for additional adjunct interventions like individual treatment. In fact, greater success was achieved in these cases by not adding major modifications of FBT. Even though this clinical perspective has not been based on a systematic review, the reflections on these cases warrant the message that, when an FBT case is not going well, deviating from the original FBT model needs to be carefully evaluated. Part of such an evaluation would need to be the clinician's self-reflection on whether they have been delivering treatment with sufficient proficiency. All of the identified themes relate to key principles and tenets of FBT but their actual practical application might require some additional emphasis in teaching FBT. Clinicians may need to be better supported to develop sufficient depth of practice in FBT. An important step can be to ensure that clinicians receive adequate training and ongoing expert supervision including the need to focus on the themes addressed in this paper. It needs to be acknowledged that the narrative and the assumptions of the families' previous experience is speculative and has not been systematically checked. Equally, the previous therapists may hold different views about the treatment they provided.

This clinical perspective has been written with the intention to assist practicing FBT clinicians with reflection and new learning. Further research would be helpful to help establish if these findings can be replicated when systematically investigated in a more extensive study.

AUTHOR CONTRIBUTIONS

KL is the sole author contributing to this paper and its associated contents.

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Adolescent and Parent Experience of Care at a Family-Based Treatment Service for Eating Disorders

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Objective: Incorporating consumer perspectives is an important but often overlooked opportunity to optimize treatment engagement and outcomes for adolescents with eating disorders. This study explored the experience of care of adolescents and their parents at a multidisciplinary specialist eating disorders service providing family-based treatment (FBT) as first-line treatment.

Method: Eighty-five adolescents and 145 parents who completed FBT at the service between 2013 and 2015 were surveyed in 2017 about their experience of care. A study-designed survey asked respondents to rate on Likert scales their experience of service access, intake assessment, education, support, interactions with the treatment team, recovery, and the discharge process. Open-ended comments on helpful and unhelpful aspects of the service provided further context on the ratings.

Results: Overall families were very positive about their experience, particularly in regard to assessment, education, interactions with the team, and achieving physical health. Although parents tended to be more satisfied, adolescents also held the service in high regard. Some areas were identified that could be improved, including treatment delays, carer support, therapeutic alliance, and preparation for discharge.

Conclusions: Surveying families about their experience of care provides an important opportunity to identify service strengths as well as services gaps. The results indicated several areas that specialist eating disorder services could focus on to ensure that the services provided, including FBT, fully meet the needs of families and optimize adolescents' treatment experiences.

Keywords: anorexia nervosa, adolescents, family therapy, consumer research, patient and family-centered care

INTRODUCTION

The importance of consumer perspectives for effective evidence-based practice (1, 2) has received increasing recognition in relation to optimizing treatment of eating disorders (3). For adolescents with anorexia nervosa (AN), current evidence supports family-based treatment [FBT (4)] preferably within a specialist multidisciplinary service (5–7). Despite its strong evidence base (8), FBT only achieves full remission in approximately one third of adolescents, although partial remission rates are higher (9–12). Treatment engagement can be especially challenging for families and clinicians given the ego-syntonic nature of AN (13) and the intense demands of FBT for the family. Therefore, exploring adolescents' and parents' experience of care within a specialist FBT service may identify important opportunities to optimize treatment engagement and outcomes (3).

Few studies have examined the experience of adolescents with AN, particularly in relation to FBT. A recent qualitative meta-synthesis identified 15 studies exploring patients' experience of family therapies for AN (14). However, only nine of these explored adolescents' experience of which only two were of adolescents who had received FBT (15, 16). Nonetheless, the review identified several key aspects of treatment viewed as helpful by patients including parental control of eating, externalization of the illness, reduced criticism, and improved family relationships. In contrast, aspects of treatment perceived as unhelpful included lack of attention to underlying issues, failure to address some family issues, and an unmet need for individual therapy. Similar perspectives regarding the helpfulness of aspects of FBT have been reported by parents (16) and found in studies of parents' and patients' experience of variants of FBT, including separated and inpatient delivered FBT (17–19). Moreover, when both parent and patient perspectives are included, parents are generally more positive about FBT than their children (16–19).

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Although informative, consumer studies of FBT to date have been small (i.e., maximum 46 adolescents and 66 parents), and have largely focused on the helpfulness of aspects of FBT rather than the broader service setting. A handful of larger community-based studies have explored consumer perspectives on eating disorder treatment services. These have typically involved adults with a variety of eating disorder diagnoses and asked them to reflect on what they value in services. In one survey of current and former patients with eating disorders (n = 304) in The Netherlands (20, 21), the most highly valued aspects focused predominantly on the personal qualities of the therapist and the therapeutic relationship (e.g., trust in the therapist, being taken seriously, being able to talk about feelings, being respected). Therapists surveyed in this study (n = 73) also valued these aspects but tended to place greater importance on the content of therapy than did patients (e.g., learning to eat normally, recovery of weight, improving body image). A similar study (22, 23) surveyed patients (n = 196), carers (n = 79), and clinicians (n = 136) in the USA and UK. In that survey, patients rated the personal and professional qualities of the staff as the most important features of a high quality service, followed by the provision of psychological interventions. For carers and clinicians, professional qualities of the staff were also of high importance; however, support for carers and service availability and access were also rated as highly important.

This pattern of findings was confirmed in a review of 23 qualitative studies of the consumer experience of eating disorder treatments (24), with empathic and supportive relationships and psychological interventions viewed as the most helpful. This review also found that medical interventions and interventions focusing on food and weight were viewed more negatively. Such findings are not surprising given the ego-syntonic nature of AN and the distress that changing behaviors related to food and weight may provoke. Indeed, Swain-Campbell and colleagues (25) found that among 120 young adults treated at a specialist eating disorder service in New Zealand, many disliked components of treatment typically deemed essential by clinicians, such as gaining weight and loss of compensatory behaviors. Yet as Bell (24) pointed out, despite the difficulties patients experience with these interventions, many may well understand their necessity.

In sum, only a number of small studies have explored consumers' experience of FBT which have largely focused on the perceived helpfulness of specific aspects of this treatment. Conversely, larger studies of broader treatment settings have been conducted with adults with a range of diagnoses who have received a variety of treatments. What is lacking are larger studies that provide an understanding of the overall service experience of adolescents and parents who have received FBT at a multidisciplinary specialist service, the currently preferred treatment modality for adolescents with AN (5–7). This study therefore explored the experience of care of adolescents and parents with regard to the multidisciplinary specialist service setting in which they engaged in FBT (c.f. components of FBT). By soliciting formal feedback from adolescents and parents on their experience of care, the study aimed to identify aspects of service provision that could be improved, or fortified, with the ultimate objective of understanding how to promote greater engagement and more positive outcomes for patients and their families.

MATERIALS AND METHODS

Setting

The study took place at a multidisciplinary specialist eating disorders program at a tertiary pediatric hospital in Australia. The program provides treatment for restrictive eating disorders and includes staff from pediatrics, psychiatry, nursing, dietetics, social work, and psychology. Following referral to the program, all families attend an intake assessment. This includes clinical evaluations with the adolescent by a pediatrician, psychiatrist, dietitian, and nurse. Parents complete an evaluation with an FBT therapist covering development history, family life, and the onset of eating disorder symptoms. Both the adolescent and their parents also complete a set of standardized interviews and questionnaires. The intake assessment is typically completed in the outpatient clinic over a single day, and concludes with the team discussing the diagnosis and treatment plan with the adolescent and their parents. Adolescents referred to the program via admission to the inpatient ward (e.g., following presentation to the emergency department) complete the intake assessment over several days during the admission.

Outpatient treatment involves FBT delivered by mental health clinicians alongside medical monitoring by pediatricians and nurses and, if needed due to the acuity of mental health comorbidities, consultations with a psychiatrist. A standard course of FBT is 18 sessions over 6 months, with extended treatment provided for complex cases. Following FBT, adolescents continue to be monitored by their pediatrician for as long as necessary, or until transfer to adult services at 18-19 years of age. During the period of this study, FBT was the only outpatient treatment provided. If further mental health care is required beyond the initial course of FBT, it takes place in the community. During treatment, adolescents can be admitted to the inpatient adolescent medicine ward if required; for example, if they become medically unstable (e.g., due to bradycardia).

Participants and Procedure

The study was a retrospective cross-sectional survey undertaken in 2017. Participants were adolescents and their parents who received FBT at the service between 2013 and 2015. The period was selected to ensure adolescents had completed FBT and that there were sufficient participants for meaningful analysis. Parents could include mothers, fathers, step-parents, and grandparents if they were a primary caregiver involved in FBT. Both parents were eligible to participate in the survey if they had been involved in FBT, including separated families. The term "parents" is used given this represents the vast majority of participants. Participants were excluded if no current contact details were available (n = 11), they had previously indicated that they did not want to be contacted regarding research (n = 4), they could not read or speak English at a level that would allow them to complete the survey (n = 3), or the adolescent was still receiving FBT with the program (n = 5) or was under 12 years old (n = 1).

A total of 175 eligible families were identified. Each family was sent a study information statement by the head of the clinical department, and given a 2-week opportunity to opt out of participating. After this time, a researcher attempted to contact parents by phone. Once contacted, parents who agreed to participate were emailed a link to complete a survey online (88%) or posted a hardcopy survey (12%), depending on their preference. The adolescent survey was sent *via* the parent, or directly to the adolescent if the parent was willing to provide their child's contact details. Often only the mother was able to be contacted by phone as this was the only number available in the adolescents' record. In these cases, the mother had to be willing to supply the father's contact information or pass on the survey to the father. If surveys were not completed after 1 week, a reminder email was sent. Reminder phone calls were made after 2 weeks, 4 weeks, and 6–10 weeks if the survey had not been completed.

The study was approved by the institutional human research ethics committee. Participant consent was implied by completion of the survey and parent/guardian consent was implied by parents providing the contact details of their child and/or passing on the survey to their child.

Measures

A study-specific survey was designed which sought participants' experience of the range of elements of the specialist program. This included access to the service (including delays), experience of the intake assessment, provision of education and information, support for parents during treatment, support for the adolescent during treatment, interactions with the treatment team (including communication and expertise), perceptions of recovery, and experience of the discharge process. The questions utilized five-point Likert Scale responses ranging from Completely Disagree to Completely Agree, or Completely Unsatisfied to Completely Satisfied. At the end of the survey, three open-ended questions invited participants to comment on what they found helpful about the program, unhelpful about the program, and any specific suggestions they had about what could be improved. The parent survey (120 items) and adolescent survey (94 items) were nearly identical apart from wording appropriate to the respondent's role and some additional items for the parent (e.g., referral process, parent-specific aspects of FBT). Demographic and clinical information about the adolescent were also collected from existing records including sex, age, diagnosis, and weight at presentation.

Analysis

The data were analyzed using SPSS version 24. For ease of interpretation, the five-point Likert scales were collapsed into three categories: Disagree (*Mostly Disagree* and *Completely Disagree*), Neutral, (*Neither Agree or Disagree*), and Agree (*Completely Agree* and *Mostly Agree*), or Unsatisfied (*Very Unsatisfied* and *Unsatisfied*), Neutral (*Neither Satisfied nor Unsatisfied*), and Satisfied (*Very Satisfied* and *Satisfied*). Missing data were under 5% across the survey items; no missing value replacement was undertaken. Descriptive statistics were calculated for each item. Answers to the open-ended questions were coded into domains covered by the quantitative rating scales. Representative quotes were then selected to demonstrate the quantitative findings for each domain explored in the survey.

RESULTS

Sample Characteristics

Among the 175 eligible families (175 adolescents, 172 mothers, 153 fathers), 14 adolescents, 13 mothers, and 18 fathers and were unable to be contacted. A further 40 adolescents, 27 mothers, and 29 fathers declined participation. At the first phone contact, 50 mothers asked that the survey be sent only to them, and not to the father, despite the researcher requesting that both parents complete separate surveys. A total of 121 adolescents, 132 mothers, and 56 fathers were sent surveys. Ultimately, 85 adolescents (49%), 106 mothers (61%), and 39 fathers (22%) completed the survey. Thus, 120 families (69%) had at least one member participate, and 112 adolescents (64%) had at least one parent complete the survey.

Of the 85 adolescent participants, 80 (94%) were female, with a mean age of 18.4 years (SD =1.8; range 13.1–22.0) at the time of the survey. At presentation, adolescents had a mean age of 15.5 years (SD = 1.7; range 9.4–18.0), mean %mBMI of 86.8 (SD = 13.5; range 13.53–135.8), and were diagnosed with AN (n = 50; 59%), avoidant/restrictive food intake disorder (ARFID; n = 1; 1%), or other specified/unspecified eating or feeding disorder (n = 34; 40%; primarily atypical AN). At the time of the survey, 29 (34%) reported that they were currently engaged in regular treatment for an eating disorder.

The 145 parent participants comprised 104 mothers, 1 stepmother, 1 grandmother, 38 fathers, and 1 step-father. Given the smaller number of male caregiver participants, responses from all parents were combined for analysis. Most parents were born in Australia (79%) and spoke English as their main language (94%). At the time of the survey, 58 (40%) reported that their child was currently engaged in regular treatment for an eating disorder.

Delays in Treatment Access

Around one-third of parents reported that they experienced a delay in being referred to or seen at the service from the time they became concerned, with 19 (13%) reporting a major delay, 29 (20%) reporting a minor delay, and 95 (66%) reporting no delay. A follow-up question prompted parents to describe the reason for any delay. The most common reasons given were that the primary healthcare provider (e.g., general practitioner) did not recognize or act on the eating disorder symptoms (n = 17), that treatment was sought from other professionals such as dietitians or psychologists before referral to the eating disorders program (n = 12), or there was a delay in getting an appointment with the program (n = 17).

> *"We saw a GP, counsellor, psychologist, dietician and eventually a heart specialist for about 6 months before anyone even mentioned eating disorders. We only ended up at [the hospital] by accident due to an allergic reaction. Staff there [who were] experienced in eating disorders admitted her immediately."*—Parent

Experience of the Intake Assessment

Overall satisfaction with the intake assessment was very high for parents (96%) and somewhat lower for adolescents (72%), as can be seen in **Table 1**. Among parents, almost all felt they had an opportunity to talk about their concerns about their child (95%), that it was helpful to meet with a variety of professionals (97%) and that, at the end of the assessment, they were given clear information about whether their child had an eating disorder (96%) and understood how unwell their child was and why treatment was needed (96%). Somewhat fewer parents felt that other causes for their child's eating or weight problems were

TABLE 1 | Experience of the intake assessment.

	Parents (n = 145)			Adolescents (n = 85)		
	n (%)	n (%)	n (%)	n (%)	n (%)	n (%)
	Disagree	Neutral	Agree	Disagree	Neutral	Agree
Thinking about your intake assessment, how much do you agree with each of the following?						
1. I was given an opportunity to talk about my concerns about my child (parents only)	4 (2.9)	3 (2.1)	133 (95.0)	–	–	–
2. I felt comfortable and safe to talk about my problems (adolescent only)	–	–	–	15 (17.9)	23 (27.4)	46 (54.8)
3. I was given an opportunity to talk about our family situation	5 (3.6)	8 (5.8)	126 (90.6)	9 (10.7)	13 (15.5)	62 (73.8)
4. It was helpful to have assessments completed by a variety of professionals (e.g., medical doctor, psychiatrist, dietitian, family therapist)	2 (1.4)	2 (1.4)	135 (97.1)	8 (9.5)	19 (22.6)	57 (67.9)
5. Other causes for my [*my child's*] eating or weight problems were considered	15 (10.7)	22 (15.7)	103 (73.6)	21 (25.0)	21 (25.0)	42 (50.0)
6. Any additional problems I [*my child*] had were considered (e.g., other physical or mental health problems)	16 (11.4)	21 (15.0)	103 (73.6)	15 (18.1)	19 (22.9)	49 (59.0)
7. At the end of assessment, I was given clear information about whether or not I [*my child*] had an eating disorder	3 (2.2)	2 (1.4)	134 (96.4)	4 (4.8)	9 (10.8)	70 (84.3)
8. I was given a clear treatment plan	4 (2.9)	7 (5.0)	128 (92.1)	10 (12.2)	10 (12.2)	62 (75.6)
9. At the end of the assessment I understood how unwell I [*my child*] was and why treatment was needed	2 (1.4)	3 (2.2)	134 (96.4)	5 (6.1)	12 (14.6)	65 (79.3)
	Unsatisfied	**Neutral**	**Satisfied**	**Unsatisfied**	**Neutral**	**Satisfied**
Overall, how satisfied were you with the intake assessment?	2 (1.5)	3 (2.2)	131 (96.3)	7 (8.5)	16 (19.5)	59 (72.0)

considered (74%) or that additional physical or mental health problems their child were considered (74%) during the intake assessment. This was also the case for adolescents, among whom just 50% and 59% felt that other causes and problems were considered during the intake assessment, respectively. Of interest, only 55% of adolescents expressed that they felt safe and comfortable to talk about their problems at the intake assessment. Despite this, 84% of adolescents felt that, at the end of the assessment, they were given clear information about whether they had an eating disorder and 79% understood how unwell they were and why treatment was needed.

> *"She was in a steep decline and I was completely lost and overwhelmed by the beast that is an eating disorder. I began to feel an inkling of reassurance and even hope from the moment we had our first appointment with the team."*—Parent

> *"I found the intake to be very overwhelming and scary because it was all in such a quick succession"*—Adolescent

Education and Information

Parents and adolescents were asked about the amount of information they received about eating disorders and related issues during their time at the service. As can be seen in **Table 2**, most parents felt they received enough information about eating disorders (87%), how eating disorders affect physical health (84%) and mental health (77%), and where to find more information (81%). However, 31% of parents would have liked more information about evidence for treatment and 29% would have liked more information about medications. While most adolescents also felt they received enough information about what eating disorders are (80%) and how they affect physical health (73%) and mental health (68%), up to half wanted more

TABLE 2 | Education and parent support during treatment.[a]

	Parents (n = 145)			Adolescents (n = 85)		
	n (%)	n (%)	n (%)	n (%)	n (%)	n (%)
	More	Enough	Too Much	More	Enough	Too Much
During your time with the program, did you receive enough information about…?						
1. What eating disorders are	15 (10.6)	122 (86.5)	4 (2.8)	10 (12.5)	64 (80.0)	6 (7.5)
2. The effect of eating disorders on physical health	18 (12.9)	117 (83.6)	5 (3.6)	13 (16. 3)	58 (72.5)	9 (11.3)
3. The effect of eating disorders on mental health	29 (20.4)	109 (76.8)	4 (2.8)	15 (18.5)	55 (67.9)	11 (13.6)
4. Prognosis (e.g., likelihood of recovery, time to recovery)	32 (22.9)	104 (74.3)	4 (2.9)	36 (44.4)	39 (48.1)	6 (7.4)
5. Evidence for treatment (e.g., findings from research studies showing the effectiveness of treatment)	43 (30.5)	94 (66.7)	4 (2.8)	38 (47.5)	37 (46.3)	5 (6.3)
6. Medications (e.g., effectiveness, side-effects)	34 (29.3)	78 (67.2)	4 (3.4)	37 (51.4)	31 (43.1)	4 (5.6)
During your time with the program, did you receive enough guidance about…?						
1. How to support your child at mealtimes	30 (21.3)	106 (75.2)	5 (3.5)	–	–	–
2. How to support your child not to vomit after eating	14 (17.1)	65 (79.3)	3 (3.7)	–	–	–
3. How to support your child not to exercise	25 (20.8)	92 (76.7)	3 (2.5)	–	–	–
4. How to help your child cope with weight gain	59 (44.4)	70 (52.6)	4 (3.0)	–	–	–
5. How to help your child when they were distressed	63 (45.0)	74 (52.9)	3 (2.1)	–	–	–
6. How to cope with your own distress about your child's illness	73 (51.8)	65 (46.1)	3 (2.1)	–	–	–

[a] *Response scale was More = I would have liked more information/guidance, Enough = I received enough information/guidance, Too Much = I received too much information/guidance.*

TABLE 3 | Support for the adolescent during treatment.

	Parent (n = 145)			Adolescent (n = 85)		
	n (%) Disagree	n (%) Neutral	n (%) Agree	n (%) Disagree	n (%) Neutral	n (%) Agree
How much do you agree with each of the following? The Program…						
1. Regularly monitored my [*my child's*] physical health (e.g., heart rate, blood pressure)	1 (0.7)	2 (1.4)	138 (97.9)	1 (1.2)	5 (6.2)	75 (92.6)
2. Regularly monitored my [*my child's*] mental health (e.g., mood, anxiety)	6 (4.3)	8 (5.8)	124 (89.9)	8 (9.8)	7 (8.5)	67 (81.7)
3. Regularly monitored my child's risk for self-harm or suicide (parent only)	4 (3.3)	11 (9.2)	105 (87.5)	–	–	–
4. Responded appropriately when I had concerns about my child's wellbeing or safety (parent only)	5 (3.7)	8 (5.9)	123 (90.4)	–	–	–
5. Responded appropriately when I was feeling distressed (adolescent only)	–	–	–	10 (12.3)	18 (22.2)	53 (65.4)

information on prognosis (44%), evidence for treatment (48%), and medications (51%).

> *"I found [the therapist] to be most helpful in providing us with the right information and knowledge needed to guide us in [our daughter]'s treatment and recovery."*—Parent

> *"They gave me the right information and guidance towards overcoming my eating disorder."*—Adolescent

Support for Parents During Treatment

Parents were asked about the amount of guidance they received in several areas. As shown in **Table 2**, around three-quarters of parents reported that they received enough guidance in key areas related to FBT including how to support their child at mealtimes (75%), how to support their child not to vomit after eating (79%), and how to support their child not to exercise (77%). However, nearly half of the parents would have liked more guidance around supporting their child cope with weight gain (44%) and distress (45%) and more guidance on how to cope with their own distress about their child's illness (51%).

> *"I found the program helpful with having all doctors and other health care professionals around to support all of us and always give us advice on how to cope with the stressful times that we were going through."*—Parent

> *"We needed more support as parents. Our own mental health deteriorated as we put all our energy into getting our daughter well."*—Parent

Support for Adolescents During Treatment

Most parents were satisfied that the team regularly monitored their child's physical health (98%), mental health (90%), and risk of self-harm/suicide (88%), and felt that their concerns for their child's wellbeing and safety were responded to appropriately (90%), as shown in **Table 3**. Similarly, most adolescents reported that the team regularly monitored their physical health (93%) and mental health (82%); however, fewer adolescents agreed with the statement "*the team responded appropriately when I was feeling distressed*" (65%). The item regarding monitoring of safety was not asked of adolescents.

> *"I wish there was more emphasis on dealing with the mental health side (DBT and CBT) but I do know that when a child is severely malnourished it is difficult for them to think clearly."*—Parent

> *"I felt like they weren't taking my anxiety and depression into consideration and only considered the idea that anorexia caused the mental issues when in fact it was the other way around and when we tried to explain that, they weren't listening."*—Adolescent

TABLE 4 | Interactions with the team and overall satisfaction.

	Parents (n = 145)			**Adolescents (n = 85)**		
	n (%)	**n (%)**	**n (%)**	**n (%)**	**n (%)**	**n (%)**
	Disagree	**Neutral**	**Agree**	**Disagree**	**Neutral**	**Agree**
How much do you agree with each of the following? Our treatment team…						
1. …was knowledgeable about eating disorders	1 (0.7)	1 (0.7)	138 (98.6)	2 (2.4)	3 (3.7)	77 (93.9)
2. …was experienced with eating disorders	1 (0.7)	2 (1.4)	137 (97.9)	0 (0.0)	5 (6.1)	77 (93.9)
3. …communicated well with each other	3 (2.1)	5 (3.6)	132 (94.3)	6 (7.4)	6 (7.4)	69 (85.2)
4. …communicated well with me	4 (2.9)	8 (5.7)	128 (91.4)	11 (13.4)	14 (17.1)	57 (69.5)
5. …communicated well with my parents (adolescent only)	–	–	–	9 (11.0)	8 (9.8)	65 (79.3)
6. …gave us consistent information (i.e., they were in agreement with each other, didn't give conflicting advice)	3 (2.2)	8 (5.8)	128 (92.1)	10 (12.3)	10 (12.3)	61 (75.3)
How much do you agree with each of the following in regard to your treatment team?						
1. I was treated with respect and courtesy	3 (2.2)	1 (0.7)	133 (97.1)	6 (7.3)	4 (4.9)	72 (87.8)
2. I had confidence in the team's ability to help me [*my child*]	3 (2.2)	5 (3.6)	131 (94.2)	11 (13.4)	16 (19. 5)	55 (67.1)
3. The team had confidence in my ability to help my child (parent)/ The team had confidence that I could get better (adolescent)	3 (2.2)	13 (9.4)	123 (88.5)	8 (9.8)	10 (12.2)	64 (78.0)
4. They didn't blame me for my child's illness (parent)/They didn't blame me for my illness (adolescent)	4 (2.9)	1 (0.7)	135 (96.4)	9 (11.0)	12 (14.6)	61 (74.4)
How would you rate the overall care and treatment you received from the program clinicians…?	**Unsatisfied**	**Neutral**	**Satisfied**	**Unsatisfied**	**Neutral**	**Satisfied**
1. Your family-based treatment therapist	15 (11.3)	7 (5.3)	111 (83.5)	21 (26.6)	13 (16.5)	45 (57.0)
2. Your pediatrician/medical doctor	6 (4.5)	4 (3.0)	122 (92.4)	6 (7.3)	5 (6.1)	71 (86.6)
3. Psychiatrist	8 (7.5)	12 (18.7)	87 (81.3)	8 (12.9)	7 (11.3)	47 (75.8)
Overall, how satisfied were you with the program as a whole?	8 (6.0)	7 (5.3)	118 (88.7)	9 (11.0)	14 (17.1)	59 (72.0)

TABLE 5 | Perceptions of recovery.

	Parents (n = 145)			Adolescents (n = 85)		
How much do you agree you [your child] was able to achieve each of the following at some point during your time with the program? I [my child]…	**n (%)**	**n (%)**	**n (%)**	**n (%)**	**n (%)**	**n (%)**
	Disagree	**Neutral**	**Agree**	**Disagree**	**Neutral**	**Agree**
1. … reached a healthy weight	12 (8.8)	13 (9.5)	112 (81.8)	13 (15.9)	10 (12.2)	59 (72.0)
2. …achieved physical health	12 (8.8)	15 (11.0)	109 (80.1)	14 (17.1)	12 (14.6)	56 (68.3)
3. …achieved mental health/wellbeing	34 (24.8)	20 (14.6)	83 (60.6)	28 (34.1)	17 (20.7)	37 (45.1)
4. …recovered from their eating disorder	43 (31.4)	22 (16.1)	72 (52.6)	24 (29.3)	12 (14.6)	46 (56.1)

TABLE 6 | Experience of discharge.

	Parents (n = 145)			Adolescents (n = 85)		
	n (%)	**n (%)**	**n (%)**	**n (%)**	**n (%)**	**n (%)**
	Disagree	**Neutral**	**Agree**	**Disagree**	**Neutral**	**Agree**
Thinking about the end of your [your child's] care at the RCH Eating Disorders Program, how much do you agree with each of the following?						
1. I was well prepared for the end of family based treatment	21 (16.0)	21 (16.0)	89 (67.9)	22 (28.6)	11 (14.3)	44 (57.1)
2. I was well prepared for discharge from seeing the medical doctor	18 (14.6)	15 (12.2)	90 (73.2)	15 (19.7)	11 (14.5)	50 (65.8)
3. I was provided with appropriate referrals to other services (parent only)	22 (17.5)	17 (13.5)	87 (69.0)	–	–	–
4. I was assisted to continue treatment at another service (adolescent only)	–	–	–	14 (18.9)	15 (20.3)	45 (60.8)
5. I [*We*] received enough information about adult services	24 (20.5)	24 (20.5)	69 (59.0)	17 (23.3)	23 (31.5)	33 (45.2)
6. I knew what to do if I [*my child*] relapsed	16 (12.2)	16 (12.2)	99 (75.6)	24 (30.4)	18 (22.8)	37 (46.8)

Interactions With the Treatment Team

Parents were very positive regarding the team's expertise, communication, and interactions, with 89–99% of parents agreeing with the statements related to these areas, as shown in **Table 4**. Most adolescents also agreed that the team was knowledgeable and experienced with respect to eating disorders (both 94%) and that the team treated them with respect and courtesy (88%). However, fewer adolescents agreed that the team communicated well with them (70%), that they had confidence in the team's ability to help them (67%), and that their concerns were listened to (64%) and acted on appropriately (64%). Of interest, 96% of parents did not feel the team blamed them for their child's illness, and 74% of adolescents did not feel the team blamed them for their illness.

Most parents were satisfied with the care and treatment they received from their FBT therapist (84%), pediatrician (92%), and psychiatrist (81%). Similarly, most adolescents were satisfied with the care and treatment they received from their pediatrician (87%). Somewhat fewer adolescents were satisfied with the psychiatrist (76%), while just over half were satisfied with their FBT therapist (57%). When asked to rate the program as a whole, 89% of parents and 72% adolescents were satisfied with the care and treatment they received.

> *"From the moment we entered we felt surrounded by expert help. We were guided through everything and even though recovery took a long time, it did happen and we are so thankful. The doctors we had were amazing, so helpful and understanding, but at the same time firm and very clear in their directions to us."*—Parent

> *"The unbound kindness and help from all the doctors and team members during my treatment. Whatever concerns or questions I had, they supported me and gave me solutions to work through them."*—Adolescent

Perceptions of Recovery

When asked about signs of recovery that were achieved during their time with the program, there was considerable variation (see **Table 5**). Most parents thought their child reached a healthy weight (82%) and achieved physical health (80%) during their time with the program. However, only 61% thought their child achieved good mental health. Around half the parents (53%) thought their child had recovered during this time. Similarly, while 72% of adolescents thought they achieved a healthy weight and 68% thought they had physically recovered, just 45% thought they had achieved good mental health; 56% thought they had recovered during their time with the program.

> *"The outcome was stabilization of our daughter and that probably saved her life, but not complete recovery."*—Parent

> *"Even though my weight is normal, I don't feel like I am psychologically free from this eating disorder."*—Adolescent

Experience of Discharge Processes

With regard to discharge processes, 16% of parents and 29% of adolescents did not feel they were well prepared for the end of FBT and 15% of parents and 20% of adolescents did not feel they were well prepared for discharge from their pediatrician (see **Table 6**). Similarly, 18% of parents and 19% of adolescents reported that they did not receive appropriate referral to other services, and 21% of parents and 23% of adolescents reported that they did not receive enough information about adult services. Furthermore, while 76% of parents reported that they knew what to do if their child relapsed, just 47% of adolescents reported that they knew what to do if they relapsed.

> *"When the program finished we had nowhere to go. We were left to our own devices. There needs to be more care beyond FBT."*—Parent
>
> *"When I was shifted off to the [adult] hospital (as I was too old to continue treatment at the children's hospital) I felt like everything changed. It wasn't a smooth transition."*—Adolescent

DISCUSSION

This study provides important insights into the experience of care of adolescents and their parents in a specialist eating disorder service providing FBT as its primary treatment modality. It is novel in its inclusion of a relatively large adolescent sample, the exploration of both treatment-specific and broader service aspects of care, and its locality within a country with a federally-funded healthcare system. Reassuringly, we found that, despite the challenges that treatment of restrictive eating disorders such as AN can present, families were generally very positive about their experience of care within a specialist adolescent FBT service. Consistent with previous research (16–19), parents tended to be more satisfied with the service than were adolescents, although on the whole, most adolescents also held the service in high regard. Nonetheless, several areas were identified where greater attention could improve the experience of adolescents and their parents and potentially improve engagement and outcomes of FBT.

Of note, many families reported a delay in accessing treatment. This is important given that shorter duration of symptoms is associated with more favorable prognosis (26). Many parents attributed delays to general practitioners not recognizing symptoms or the need for referral, or because families seeing other practitioners prior to referral, such as psychologists and dietitians who did not specialize in eating disorders. Several parents also reported delays in getting an appointment with the service. Although the wait time for an appointment at this service is generally only a few weeks, a triage system operates to prioritize patients who are very unwell which can mean that at busy times patients with less severe symptoms may have to wait longer for an appointment. Unfortunately, this can mean symptoms worsen before the adolescent can be assessed. These findings point to a need for greater education for clinicians in primary care, mental health, and dietetics, as well as a need for greater investment in specialist services to enable them to respond and provide care in a timely manner.

Once families were able to access the service, most had a very positive experience of the multidisciplinary intake assessment and felt it provided them with a good understanding of the diagnosis and need for treatment. Of importance, however, only around half of adolescents reported that they felt safe and comfortable to talk about their problems at this assessment. This may be understandable given that completing multiple assessments with different clinicians, usually in a single day, allows little time to build rapport with the adolescent. This may be exacerbated by the fact that many adolescents, and also some parents, felt that other causes for eating and weight problems were not considered and that other physical and mental health problems were neglected. An alternative approach used by some other services, is to spread intake assessments over several days or weeks. This may give additional time for clinicians to build rapport with the family and demonstrate that other issues are being given full consideration. However, the one-day intake assessment at this service has the benefit of providing a comprehensive evaluation in a relatively short period of time so that FBT can commence immediately. First appointments are typically within one week of assessment and any outstanding investigations are followed up by the team concurrently. Within this format, the assessing clinicians might better demonstrate a holistic approach by enquiring further about other problems at each stage of the assessment, being explicit about how differential diagnoses are evaluated, and checking in with the family that they are satisfied that other causes and issues have been given due consideration.

Moving into treatment, parents felt that they received appropriate education about eating disorders and most felt they received sufficient guidance in key areas of FBT such as meal support and prevention of compensatory behaviors. They were also very positive about the team members and thought their child's health and wellbeing were monitored and responded to appropriately. Of importance, parents did not feel the team blamed them for their child's illness. This is a key tenet of FBT which aims to alleviate parents' feelings of guilt and empower them to help their child (4). In contrast to these very positive views, many parents wanted more information on evidence for treatment and medications, and many parents wanted greater guidance in supporting their child to cope with weight gain and how to manage their own distress during treatment. Previous research has similarly identified a need for carer support in eating disorder services (22, 23), which is especially relevant to FBT given the central role of parents. Since the survey was administered, a parent education and support group has been implemented at the current service (27). This group is attended by all parents in the first few weeks of treatment and provides information on topics including treatment evidence and how to support adolescents during treatment, as well as providing parental peer support. Other carer support approaches include the New Maudsley Method which is a treatment adjunct designed to reduce the stress and anxiety associated with caring for a person with an eating disorder (28). Finding ways to support parents during treatment could not only have benefits for parents' wellbeing but may also promote engagement, more adept skills in managing and treating the illness and, in turn, improved outcomes for patients (29).

Like their parents, and possibly more so, adolescent wanted more information on evidence for treatment and medications, as well as prognosis. When and how best to provide this needs further consideration given that some adolescents expressed they were too overwhelmed early in treatment to absorb much information. In addition, adolescents were less positive about their interactions with the team than were parents. While the vast majority felt they were treated with respect and that their health and wellbeing were well monitored (i.e., 82–94%), notably fewer had confidence in the team's ability to help them and felt that their concerns were listened to and acted on appropriately (64–67%). Some adolescents responded neutrally to these statements (i.e., neither agreeing nor disagreeing); however, other adolescents felt quite negative about the team. This was most apparent in ratings of clinicians, as a quarter of adolescents reported being dissatisfied with the care and treatment they received from their FBT therapist. It is perhaps unsurprising given that the therapist is central in driving behavioral changes which are difficult for someone with AN, many of whom are likely to be resistant to treatment (30). Indeed, previous research confirms that adolescents tend to report lower therapeutic alliance with FBT therapists than do parents (31). Building and maintaining therapeutic alliance with the adolescent while achieving the goals of FBT is a difficult balance; however, research suggests that greater alliance with the therapist predicts better outcomes for adolescents (32). Exploration of how therapists can achieve and maintain therapeutic alliance with adolescents in the context of FBT requires greater attention.

One area that could be explored with regard to therapeutic alliance was the experience of some adolescents that their concerns and distress were not listened to and acted on. From responses to the open-ended questions, this experience was frequently related to the focus on physical health (including weight gain) and behavioral symptoms which some adolescents perceived was neglectful of their mental health. A lack of individual therapy and attention to underlying issues are common themes in previous qualitative research on family therapies for AN (14) including FBT (16). This is also consistent with the findings of the current study regarding perceptions of recovery, in that most parents and adolescents reported that the adolescent achieved physical health but much fewer thought that good mental health was achieved. The urgent physical health complications of AN mean that restoring physical health through weight gain is prioritized in FBT for AN. However, ensuring mental health issues are addressed with the adolescent and their family during treatment is clearly of importance to the experience of care. Beyond FBT, consideration also needs to be given to what follow up might be needed for comorbid conditions and by whom. Given the focus of specialist eating disorder services and their limited resources, these may best be managed by another service; however, greater communication with families around this may be indicated.

When FBT comes to an end and discharge and/or transfer to other services is needed, this can be a challenging time, regardless of families' experience to date. Although most parents and adolescent were satisfied with their discharge experience, several expressed that they did not feel well prepared for the end of treatment or did not receive appropriate referrals to other services or information about adult services. Importantly, less than half of adolescents reported that they knew what to do if they relapsed. A transition service was in operation during this study which aimed to support adolescents being transferred to the adult hospital; however, this was not available to all families (e.g., younger adolescents, those not in the geographical catchment). Other discharge support efforts have since been implemented including three "booster sessions" which are provided during the 6 months following FBT to monitor symptoms, reduce risk of relapse, and provide a less abrupt cessation of treatment with the FBT clinician. While these efforts may go some way to improving the experience of discharge, more research into how services can support families during this time is needed. This may ultimately require greater investment in resources to allow specialist services to provide longer or more individualized approaches.

This study has several strengths which make the findings of importance to the provision of services to families of adolescents with restrictive eating disorders. To our knowledge, this is the largest survey of consumer views of a specialist FBT service to have been conducted for adolescents with AN and other restrictive eating disorders. Previous large surveys have been with current or former adult patients and carers with experience of a range of diagnoses and services, while studies of family therapies have been mostly small qualitative studies, or have focused on the components of FBT rather than the broader service in which FBT is delivered. In addition, by designing a survey for our specific service, we were able to capture parents' and adolescents' experience of care in a more nuanced manner than a standardized service satisfaction scale would allow. However, this type of service-specific measure does have limitations. Psychometric aspects such as reliability and validity cannot be demonstrated, and there may be bias inherent in the selection and design of survey items. Importantly, the specificity of the survey might mean it cannot be readily used in other service settings. Another feature of the survey, the open-ended questions at the end of the survey, provided important context to supplement the quantitative findings. The responses were not sufficient for a rigorous qualitative analysis; however, they gave a voice to the parents and adolescents who participated beyond what can be expressed in rating scales alone. Future studies might benefit from applying a mixed-methods approach which more fully explores families' experience of care in eating disorder services.

The moderate response rate could be considered a limitation of the study; however, that over two-thirds of eligible families were represented is an achievement given the nature of the research. Furthermore, only around half the sample reported achieving full recovery during treatment, suggesting that participation was not necessarily skewed toward those who had a more positive experience. That said, fathers were not well represented, which was in part due to mothers declining to pass surveys on to fathers to complete. Fathers are expected to be fully involved in FBT, and their attendance at treatment sessions is associated with better patient outcomes (33). Engaging them in a survey such as this could be important for uncovering unique factors that contribute to the engagement of fathers. Likewise, including greater numbers of participants across different diagnostic classifications could be informative. There were not sufficient numbers in the current study for subgroup comparisons; however, larger studies could explore whether individuals with diagnoses such as AN, atypical AN, and ARFID have different experiences of care related to variations in clinical features and treatment approach.

An important limitation was that for some families the invitation to participate was up to four years since they received treatment at the service. This may have reduced their ability to recall details of their treatment, or their experiences since treatment may have influenced how they retrospectively perceived the quality of care. The delay may also have impacted on response rates due to waning motivation to participate or changes in contact details. Prospective collection of data on experience of care (e.g., during treatment or at point of discharge) would be the preferred design but was not possible due to constraints on time and funding. However, services should consider including prospective assessment of experience of care in their processes. The development of standardized measures would be especially beneficial in this regard to enable benchmarking across services which can subsequently inform service development including distribution of funding.

Overall, the study provided many insights into the experience of care of both parents and adolescents at a specialist multidisciplinary eating disorder service proving FBT as its primary model of care. As the preferred treatment for adolescent AN, it was reassuring that most parents and adolescents were positive about their experience. In particular, they were positive about the multidisciplinary assessment process, education about eating disorders, monitoring of adolescents' physical and mental health, expertise of the team, and the care they received from their treating team. Nonetheless, there were some important indicators of areas that could be improved including treatment delays, carer support, therapeutic alliance, and preparation for discharge. This study provides direction for aspects of care that services could focus on to improve the experience of adolescents and their parents. Further research is needed to better understand the extent to which the experience of FBT and the broader treatment setting relate to outcomes (including relapse) and to explore the most effective options for addressing areas of concern. Subsequent investment in resources for specialist services will be needed to implement strategies that optimize treatment experience and outcomes. There may also be benefit in incorporating standardized repeat surveys across services to allow for benchmarking and evaluation of the effectiveness of strategies to enhance families' experience of care.

DATA AVAILABILITY STATEMENT

The datasets generated for this study are available on request to the corresponding author.

ETHICS STATEMENT

The studies involving human participants were reviewed and approved by Royal Children's Hospital Human Research Ethics Committee, Melbourne, Australia. Written informed consent from the participants' legal guardian/next of kin was not required to participate in this study in accordance with the national legislation and the institutional requirements.

AUTHOR CONTRIBUTIONS

SS conceptualized the study. EH supervised the project, designed and facilitated the study, supervised and undertook the analyses, interpreted the results, drafted the manuscript, and approved the final version. SP and AB contributed to obtaining and cleaning the data, initial data analysis, interpreting the results, and writing the manuscript. MY, MT, and SS supervised the project, designed and facilitated the study, and contributed to interpreting the results and editing the manuscript.

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Attitudes Toward Family-Based Treatment Impact Therapists' Intent to Change Their Therapeutic Practice for Adolescent Anorexia Nervosa

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Community-based clinicians who treat patients with eating disorders rarely use empirically-supported treatments, and research demonstrates that clinicians make significant modifications when implementing family-based treatment (FBT) for anorexia nervosa. This study examined clinician attitudes toward FBT and explored the extent to which attitudes predicted intent to shift practices following training in FBT. Clinicians (N = 129) completed a standardized training in FBT for AN, either a two-day introductory training (n = 99) or a one-day "advanced" training (n = 30). Linear regressions were used to examine the association between therapists' attitudes toward FBT and their intent to use strategies consistent with FBT in the future, adjusting for pre-training use of strategies. Providers reported very positive attitudes toward evidence-based practices in general and moderately positive attitudes toward FBT. There were no significant differences between "novice" and "advanced" providers on attitudes toward evidence-based practices or FBT (ps > .10). For the subset of providers attending their first training in FBT, more positive attitudes toward FBT significantly predicted greater intent to use FBT-consistent strategies (p = .004), and more positive attitudes toward evidence-based practice significantly predicted lesser intent to use FBT-inconsistent strategies (p = .009). This study suggests that both general attitudes toward evidence-based practice and specific attitudes toward FBT may impact implementation. Future research might examine whether a brief intervention to improve attitudes toward FBT might increase the likelihood of seeking expert consultation post-training.

Keywords: family-based treatment, eating disorders, children and adolescents, dissemination and implementation, clinician attitudes

INTRODUCTION

Anorexia nervosa (AN) has severe medical and psychological consequences (1–4) and the highest mortality rate of any psychiatric disorder (5). Research supports family-based treatment (FBT) as an efficacious treatment for youth with AN (6), and initial studies generally support the effectiveness of FBT when disseminated to teaching hospitals (7, 8). However, community-based clinicians who treat patients with eating disorders rarely use empirically-supported treatments (9, 10), and the use of FBT in "usual care" is no exception. Clinicians who do utilize FBT often make significant modifications in its implementation (11) that may impact its effectiveness. One study that coded for fidelity found that almost three-quarters of clinicians had at least considerable fidelity initially, but this decreased to about half of clinicians in the second and third phases of FBT (7). Therefore, understanding factors related to adoption and implementation is critical.

Common provider-level barriers to the use of empirically-supported treatments are perceptions that these treatments are too rigid or inadequate for the complexity of cases seen in their practice (10, 12–14). Understanding therapist attitudes and beliefs about evidence-based treatments may help to inform dissemination and implementation efforts. Preliminary research shows that patients view FBT as effective and acceptable (8, 15). Preliminary data also suggest that community-based clinicians may hold negative beliefs about FBT that decrease over the course of supervision and implementation. However, a better understanding of these beliefs may be helpful to more fully appreciate what may prevent clinicians from seeking additional supervision and implementing FBT (16).

Therefore, the main aims of this study were to: 1) examine treatment provider attitudes toward FBT (in order to identify potential barriers to implementation), and 2) test whether treatment provider attitudes predict intent to use FBT-consistent strategies with greater frequency in the future.

METHODS

Clinician participants (N = 129) enrolled through a training institute in eating disorders for a fee and completed training in FBT for AN in New Jersey or Illinois between 2012 and 2013. Most clinicians attended one of three standardized two-day introductory training (n = 99); the remainder (n = 30) attended an "advanced" training; all trainees participated in this study. The introductory training included a review of the research literature related to treatment of adolescent AN, an overview of the main tenets of FBT and the treatment frame, an overview of each phase and specific techniques at each phase/key sessions of FBT, role-plays, common challenges in FBT, and opportunities for questions/discussion. The advanced training focused on complex case presentations and complicating factors in implementing FBT, including role-plays to illustrate advanced skills. Pre-training, clinicians provided information about their clinical experience and reported on their use of a range of different treatment techniques for adolescents with AN using the Therapeutic Strategy Checklist for Adolescent Anorexia Nervosa. Post-training (last activity of the day on the last day of training), clinicians reported on their intent to use the same set of treatment techniques in the future and completed the Family-Based Treatment Attitude Scale. The institutional review board at the University of Chicago approved all protocols.

Measures

Therapeutic Strategy Checklist for Adolescent Anorexia Nervosa (TSC-AN)

The TSC-AN, which developed for the current study, includes a list of 25 treatment techniques that may be used in the treatment of adolescents with AN (e.g., provide education about the mortality and morbidity associated with AN, externalize the disorder to reduce blame of the parents and the adolescent, weigh adolescent at every session) (see **Appendix A** in the **Supplemental Material**). A total of 40 items were initially developed to attempt to capture a range of interventions that might be used in the treatment of adolescent AN, including key FBT interventions. In collaboration with one of the FBT treatment developers and five other experts in adolescent eating disorders, the list was reduced to the 25 items that comprise this measure, incorporating edits to clarify and simplify wording. Pre-training, clinicians reported on the frequency with which they *currently use each strategy* with adolescent AN cases in the first 2–3 months of treatment from 0 (never) to 4 (almost always or always). Some of the treatment components are consistent with FBT (n = 12) and other elements are inconsistent with FBT (n = 8); other treatment elements were neither consistent nor incompatible with FBT (n = 5). The FBT-consistent strategies (range: [0, 48]) and FBT-inconsistent strategies subscale scores (range: [0, 32]) were used for this study. Post-training, clinicians completed a parallel version of the same measure in which they reported on the frequency with which they *intend to use each strategy in the future*. The FBT-consistent strategies demonstrated good reliability with a Cronbach's alpha of.83. FBT-inconsistent strategy items would be expected to demonstrate poor interdependence due to their heterogeneity in theoretical underpinnings—in addition to a small number of items—consistent with a Cronbach's alpha of .66.

Evidence-Based Practice Attitude Scale (EBPAS)

The EBPAS (17) is a 15-item measure that assesses therapists' attitudes toward the adoption of manualized evidence-based treatments, with higher scores indicating more positive attitudes toward evidence-based practices [range: 0, 4]. The EBPAS does not ask about specific practices. Its total score indicates global attitudes toward adoption of evidence-based practices, with good reliability and predictive validity (18, 19) and a Cronbach's alpha of.83 in this sample.

Family-Based Treatment Attitude Scale (FBT-AS)

The FBT-AS, which was developed for the current study, is a 20-item measure that assesses clinician attitudes toward FBT for AN (see **Appendix B** in the **Supplemental Material**). The initial 30 items were developed to capture four domains that would impact implementation, including perceived relevance and clinical appropriateness of FBT (e.g., *FBT is relevant to the needs of the adolescent AN cases that present to my practice*), treatment credibility (e.g., *FBT can be an effective treatment for my adolescent clients with AN*), implementation confidence (e.g., *I feel confident that I could successfully implement FBT with further supervision*), and feasibility (e.g., *My agency will not provide me with the resources and/or time necessary to be competent in FBT*). After review by six experts in adolescent eating disorders (including one of the FBT treatment developers), the list was reduced to the 20 items that comprise this measure, incorporating edits to clarify and simplify wording. Items are rated from −2 (strongly disagree) to 2 (strongly agree), with higher scores indicating more favorable attitudes toward FBT [range: −40, 40]. The scale demonstrated good internal reliability in the current sample (Cronbach's alpha = .84), as well as a small positive correlation with the EBPAS total (r = .33, p = .012).

Analyses

Linear regressions were used to examine the association between therapists' attitudes toward FBT and their intent to use strategies consistent with FBT in the future, adjusting for pre-training use of strategies. Regressions including all three independent variables were adequately powered (.81) to detect a medium effect size (Cohen's d = 0.3) (20).

RESULTS

Therapist participants were primarily women (n = 115, 89.1%) with a mean age of 37.6 years (SD = 9.3) who had been practicing therapy for 9.5 years (SD = 8.4) on average. The majority of clinicians worked in settings that offered traditional outpatient treatment (n = 108, 86.4%). In addition, their settings offered intensive outpatient and/or partial hospitalization programs (n = 42, 33.6%), residential treatment (n = 13, 10.4%), and inpatient treatment (n = 38, 30.4%). Eating disorders cases comprised approximately two-thirds of cases on their caseload (M = 63.8, SD = 37.7), and about three-fifths of their cases were 18 years of age or younger (M = 57.1, SD = 30.8). Given that there were no significant differences in demographic characteristics between "novice" providers who were attending an introductory training in FBT (n = 99) and "advanced" providers who were attending an advanced training in FBT (n = 30) (ps > .10), the data are presented in aggregate in **Table 1**. At pre-training, three-fifths (59.1%, n = 74) of all providers reported that they would recommend a higher level of care than would be typically warranted for a medically-stable adolescent with AN, including intensive outpatient (34.1%, n = 42), partial hospitalization (15.4%, n = 19), and residential or inpatient (10.6%, n = 13). Prior training/expertise in FBT was relatively low, with 9.6% (n = 12) of the total sample reporting training in FBT to a "great" or "very great" extent. There were no significant differences between "novice" and "advanced" providers on level of care recommendations or prior training in FBT (ps > .10).

TABLE 1 | Characteristics of therapists in the full sample (N = 129).

Therapist Characteristics	***M* (*SD*) or %**
Gender (female)	89.9%
Age (yrs)	37.8 (9.5)
Therapy experience (yrs)	9.8 (8.7)
Discipline	
Psychology	40.8%
Social work	33.7%
Other	25.5%
Primary theoretical orientation	
Cognitive behavioral or behavioral	44.8%
Eclectic	17.7%
Family systems	6.3%
Psychodynamic	11.5%
Other	19.7%
Primary employment setting	
Private practice	35.7%
Hospital	27.6%
For-profit agency	13.3%
Community mental health clinic	11.2%
University-affiliated clinic	9.2%
Other	3.1%
Levels of care offered at employment setting	
Outpatient treatment	87.5%
Intensive outpatient and/or partial hospitalization	36.5%
Residential	11.5%
Inpatient	30.2%
Caseload comprised of eating disorders patients (%)	65.2 (37.1)
Caseload comprised of 18 and under patients (%)	59.9 (33.8)

Current Use of Treatment Strategies

Several treatment strategies consistent with FBT were *frequently* to *always* utilized by most clinicians, including providing education about mortality and morbidity (82.4%, n = 75), impressing upon the parents the need to take immediate action (92.3%, n = 84), externalizing the eating disorder (92.3%, n = 84), and supporting parental management of eating (85.7%, n = 78). However, only about half assessed weight at each session (47.8%, n = 43) or openly discussed changes in weight (55.0%, n = 50). Across the 25 treatment strategies assessed, there were no significant differences in frequency of use between providers (ps > .10) with the exception that "novice" providers were significantly more likely to use behavioral contracts for weight gain than "advanced" providers (t = −3.38, p = .001; M = 1.87, SD = 1.21 v. M = 0.96, SD = 1.10). **Figure 1** provides the reported frequencies of use for each treatment strategy at pre-training across the full sample. Current use of FBT-consistent strategies and FBT-inconsistent strategies did not significantly differ between groups (ps > .10).

Attitudes Toward and Intent to Use FBT

Prior to training, providers reported very positive attitudes toward evidence-based practices in general (M = 3.08, SD = 0.50). Following training, providers also had moderately positive attitudes toward FBT specifically (M = 20.30, SD = 9.23). There were no significant differences between "novice" and "advanced" providers on attitudes toward evidence-based practices or FBT (ps > .10). Intent to use FBT-consistent strategies post-training (M = 44.61, SD = 11.72) was significantly greater than use at pre-

FIGURE 1 | Pre-training therapeutic strategy use in the first three months of treatment for adolescent anorexia nervosa (AN). Note: *Family-based treatment (FBT)-consistent strategies; ϕ FBT-inconsistent strategies; values less than 7% are rounded down to the nearest whole number, and those less than 3% are not noted numerically due to space.

training (*M* = 34.56, *SD* = 8.12, *t* = −7.84, *p* < .001). Intent to use FBT-inconsistent strategies post-training (*M* = 8.57, *SD* = 4.33) was significantly less than use at pre-training (*M* = 11.55, *SD* = 4.33, *t* = −5.85, *p* < .001). Post-training intent to use FBT-inconsistent strategies in the future did not significantly differ between groups (*p* > .10), but "advanced" providers reported post-training intent to use FBT-consistent strategies more frequently in the future than "novice" providers (*t* = 3.69, *p* < .001; *M* = 52.05, *SD* = 21.60 v. *M* = 42.51, *SD* = 5.16).

For the subset of providers attending their first training in FBT, we examined whether providers' baseline attitudes toward evidence-based practices or post-training attitudes toward FBT influenced their reported intent to increase use of FBT-consistent strategies or decrease use of FBT-inconsistent strategies in the future. More positive attitudes toward FBT predicted greater intent to use FBT-consistent strategies in the future (*B* = 0.224, *SE* = .055, *t* = 4.042, *p* < .001, adjusted R^2 = .116), adjusting for current strategy use (overall model: *F* = 28.253, *p* < .001, adjusted R^2 = .408). More positive baseline attitudes toward evidence-based practices also predicted greater intent to use FBT-consistent strategies in the future (*B* = 2.826, *SE* = 1.252, *t* = 2.257, *p* = .028, adjusted R^2 = .046), adjusting for current strategy use (overall model: *F* = 15.265, *p* < .001, adjusted R^2 = .338). When both variables were entered into a model simultaneously, the overall model predicting intent to use FBT-consistent strategies remained significant (*F* = 14.821, *p* < .001, adjusted

R^2 = .425). Adjusting for current strategy use, more positive attitudes toward FBT significantly predicted greater intent to use FBT-consistent strategies (B = 0.201, SE = 0.066, t = 3.043, p = .004) whereas more positive attitudes toward evidence-based practice at baseline did not (B = 2.129, SE = 1.188, t = 1.792, p = .08).

More positive attitudes toward FBT predicted lesser intent to use FBT-inconsistent strategies in the future (B = −0.203, SE = 0.054, t = −3.792, p < .001, adjusted R^2 = .113), adjusting for current strategy use (overall model: F = 12.591, p < .001, adjusted R^2 = .227). Similarly, more positive baseline attitudes toward evidence-based practices predicted lesser intent to use FBT-inconsistent strategies (B = −0.203, SE = 0.054, t = −3.786, p < .001, adjusted R^2 = .172), adjusting for current strategy use (overall model: F = 10.776, p < .001, adjusted R^2 = .266). When both variables were entered into a model simultaneously, the overall model predicting intent to use FBT-inconsistent strategies remained significant (F = 8.389, p < .001, adjusted R^2 = .291). Adjusting for current strategy use, more positive baseline attitudes toward evidence-based practice significantly predicted lesser intent to use FBT-inconsistent strategies (B = −2.421, SE = 1.261, t = −2.714, p = .009) whereas more positive post-training attitudes toward FBT did not (B = −0.149, SE = 0.088, t = −1.688, p = .10).

DISCUSSION

This study found that providers who attend introductory or advanced workshops in FBT already report using various techniques that are consistent with FBT, but also multiple techniques that are incompatible with FBT, some of which would require a significant shift in order to implement FBT. Interestingly, there were generally no pre-training differences between “novice” or “advanced” providers in their overall use of strategies. This is not perhaps surprising given that brief workshops increase provider knowledge but are insufficient to change provider behavior (21). It is also not entirely unexpected that a large percentage of providers generally recommend a higher level of care than traditional outpatient treatment since nearly half of providers worked in a setting that provided intensive outpatient, partial hospitalization, and/or residential programs.

Providers intended to use practices consistent with FBT more frequently and those inconsistent with FBT less frequently following training, although the intended shift in practice was far from implementing FBT as a manualized treatment. On average, providers reported very positive attitudes toward evidence-based practice generally and moderately positive attitudes toward FBT specifically despite several barriers, including the focus on higher levels of care in many of their employment settings. For providers exposed to their first training in FBT, both attitudes toward evidence-based practice and attitudes toward FBT mattered for implementation, but for different targets. More positive attitudes about FBT specifically predicted greater intended early uptake of FBT-consistent therapeutic techniques (e.g., openly discussing changes in weight, support parental management of eating), while attitudes about evidence-based practices generally predicted greater intent to reduce use of therapeutic techniques that would interfere with FBT implementation early in treatment (e.g., reducing treatment focus on AN to build an alliance with the adolescent, exploring issues related to the development of AN).

Given evidence that workshop attendance may improve attitudes toward evidence-based practice (22), it may also be worthwhile to identify and target negative attitudes about FBT specifically. Improved attitudes toward FBT may increase the likelihood of providers seeking expert consultation and supervision following the training, which does predict increased clinical skill and adoption of the intervention (21, 23). Providers need to actively choose to initiate supervision or expert consultation, so a brief intervention that could positively impact early attitudes about FBT and increase the likelihood of seeking consultation post-training might in turn increase the odds of implementation “intent” becoming “action.” Further, supervision could provide an additional venue for improving general attitudes toward evidence-based practice. Indeed, prior research indicates that participation in group consultation calls with an expert may improve attitudes toward evidence-based practice (24) and that more open attitudes toward evidence-based practice are associated with greater use of evidence-based treatment techniques (25) and more fidelity-consistent adaptations (26).

Nevertheless, setting and organizational factors impacting implementation would also need to be considered given their link to evidence-based practice use (27) and adherence (25). In addition to not examining organizational factors, this study has several additional limitations, including the relatively small sample that self-selected to attend an FBT training, the use of newly-developed measures with limited psychometric data on their reliability and validity, and short-term outcomes (28) that included reported use of therapeutic practices and reported intent to use therapeutic practices immediately post-training, which may be different than actual behavior or intent even just a couple of weeks following the training. Further, intended shifts in practice were confined to the first two to three months of treatment, which generally constitutes just over half of treatment sessions, primarily focused on phase I of FBT. Despite a biased sample given their proactive choice to attend an FBT training, provider attitudes toward FBT were only moderately positive, and there were no differences demonstrated between the “novice” and “advanced” groups.

Findings suggest that providers use some strategies consistent with FBT prior to formal training in FBT, and that they planned to significantly change their practice following training to be more in line with FBT principles. However, their intended changes were perhaps far from what would be required to implement FBT. Given that provider attitudes about FBT and evidence-based practice predicted greater intended shifts in practice, brief interventions intended to improve attitudes may have a role in increasing adoption. Future research may target negative attitudes toward FBT to determine whether these can be diminished or reversed, and whether doing so increases FBT uptake.

DATA AVAILABILITY STATEMENT

The raw data supporting the conclusions of this article will be made available by the authors, without undue reservation, to any qualified researcher.

ETHICS STATEMENT

The studies involving human participants were reviewed and approved by University of Chicago. The patients/participants provided their verbal informed consent to participate in this study.

AUTHOR CONTRIBUTIONS

EA developed the two new measures (TSC-AN and FBT-AS), designed the study, collected data, developed the data analytic plan, analyzed and interpreted the data, and drafted the manuscript. DL provided feedback on items in both the TSC-AN and FBT-AS. All authors aided in the interpretation of the data, edited the manuscript, and approved the final version of the manuscript.

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SUPPLEMENTARY MATERIAL

The Supplementary Material for this article can be found online at: https://www.frontiersin.org/articles/10.3389/fpsyt.2020.00305/full#supplementary-material

APPENDIX A | Therapeutic strategy checklist for adolescent anorexia nervosa (TSC-AN).

APPENDIX B | Family-based treatment attitude scale (FBT-AS).

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CASE REPORT
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Family-Based Treatment for a Preadolescent With Avoidant/Restrictive Food Intake Disorder With Sensory Sensitivity: A Case Report

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Background: Individuals with Avoidant/Restrictive Food Intake Disorder (ARFID) experience eating problems that cause persistent failure to meet appropriate nutritional and/or energy needs. These eating problems are not driven by body image concerns but rather by persistent low appetite, sensory sensitivity, or fear of aversive consequences of eating (e.g., choking or vomiting). Although increasing numbers of youth are being referred for treatment of ARFID, no evidence-based treatments yet exist for the disorder. Given family-based treatment (FBT) has demonstrated effectiveness with other pediatric eating disorders (anorexia nervosa, bulimia nervosa), a manualized version of FBT adapted for use with ARFID patients has been developed and is currently under study.

Case Presentation: The following case report demonstrates how FBT was used to treat a 9-year-old patient with ARFID characterized by sensory sensitivity. Similarities and differences with FBT for anorexia nervosa are illustrated. After 17 sessions across 6 months, the patient no longer met DSM criteria for ARFID, she demonstrated major declines in measures of clinical symptoms, and she gained 2.1 kg.

Conclusions: FBT for ARFID relies upon the same key interventions as FBT for AN. However, we discuss critical differences in the application of these interventions given the unique challenges of ARFID, particularly when characterized by sensory sensitivity.

Keywords: eating disorders, feeding disorders, avoidant/restrictive food intake disorder, treatment, family based treatment

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INTRODUCTION

Avoidant/Restrictive Food Intake Disorder (ARFID) is a feeding and eating disorder introduced in the DSM-5 that describes a wide range of eating difficulties which often onset in childhood (1). Individuals with ARFID experience eating problems that cause persistent failure to meet appropriate nutritional and/or energy needs. Children may present with serious nutritional deficiencies, a reliance upon liquid supplements or enteral feeding, faltering growth or failure to gain expected weight, or psychosocial impairments. However, these eating problems are not driven by body image concerns, but rather by persistent low appetite, sensory sensitivity, and/or fear of aversive consequences of eating (e.g., choking) (2). A variety of approaches have been utilized to treat ARFID, but no evidence-based treatments yet exist. Given family-based treatment (FBT) has demonstrated effectiveness with other pediatric eating disorders, an initial description of how FBT could be applied to sensory sensitive presentations of ARFID was published (3), followed by the development of a broader manual to treat all presentations of ARFID and the first randomized treatment study for this condition (4). This case report illustrates a detailed application of this novel manualized treatment (FBT-ARFID) and highlights its similarities and differences from more well-known forms of FBT.

FBT for anorexia nervosa (AN) mobilizes families to help the child overcome AN in three phases. Phase 1 focuses on weight restoration by parents taking control of the child's eating. In the first session, the therapist emphasizes the seriousness of AN in an intense scene in order to increase parents' urgency and responsibility to take on this task. The therapist takes an agnostic approach, emphasizing that the cause of AN is unknown, in order to alleviate parental guilt and redirect parents away from focusing on potential causes and toward taking action. The therapist externalizes the eating disorder, framing it as separate from the child and not under her control. The second session involves a family meal and allows the therapist to assess and intervene with family dynamics that may affect weight restoration. Phase 2 occurs when the child is eating without much resistance, there has been steady weight gain, and parents feel empowered to manage symptoms. Phase 2 focuses on helping parents return control of eating back to their child in a way that is age-appropriate and consistent with their family. Phase 3 occurs when the child is weight restored, AN behaviors are gone, and the child is managing her own eating and exercise. This phase focuses on addressing adolescent development issues which AN disrupted.

This case illustrates differences in FBT when it is applied to ARFID. Externalization of the illness and fostering a sense of urgency to take action may be more challenging. Treatment goals may focus on eating behaviors (e.g., improving variety, flexibility, speed) rather than on weight restoration. The child may provide more helpful input during treatment and be more responsive to rewards than children with AN. Finally, Phase 2 and 3 differ; Phase 2 occurs when the child is able to try new foods consistently, and there is often no Phase 3 given children with ARFID are often pre-adolescent.

CASE REPORT

T was a 9-year-old female who was referred to treatment by her pediatrician due to longstanding selective eating. As an infant and young toddler, T "ate everything." However, around age two and half, T began to lose interest in some foods she had previously enjoyed and developed aversions to certain textures and tastes. By age three, her food restriction became "categorical". For example, she would not eat fruit, soup that was not pureed completely smooth, or vegetables that were not pureed into a food she already liked. For several years, the family and pediatrician thought this was typical "picky eating" that she would "grow out of," and the family largely accommodated it. Instead, T's dietary restriction worsened over time. Although her pediatrician felt T's weight and growth were unaffected, her limited food variety caused marked psychosocial distress and functional impairment (see **Table 1**), suggesting a need for intervention.

Phase 1

T presented for FBT-ARFID with her mother, father, and younger brother (age 7). In the first session, the therapist used circular questioning, a strategy where families members are asked to comment on the statements made by previous family members (5) to engage the family in crafting a narrative of the impact of ARFID on their family. T was unable to eat with her family given anxiety and disgust she felt around the foods they served. T's mother felt "tired of being a short order cook," always preparing a second separate meal for T after she prepared a meal for the rest of the family. The family spent "enormous time and effort" obtaining and preparing food for T to take with her to school and to friends' homes so that she could participate in these activities without going hungry. The family expressed frustration regarding T's being "stubborn" and "unwilling" to consider new foods no matter the growing impact on herself and the family.

The therapist used this information to help the parents to externalize ARFID as an illness rather than blame T for her eating problems. To illustrate the seriousness of ARFID and emphasize the need to help T overcome the disorder, the therapist highlighted the multiple impacts of ARFID on the child and family including impacts on growth, pubertal development, and relationships. The therapist also provided psychoeducation regarding the processes by which ARFID is maintained and thus not likely to remit unless the family takes action. As the family's anxiety heightened, the therapist transitioned into charging the parents with the task of challenging ARFID and framing them as T's best hope for recovery. The therapist asked the family to complete an Always, Sometimes, Never list (3), a form used to classify foods into those the child will eat regularly ("Always"), those their child can eat but with difficulty ("Sometimes"), and those that would be very difficult for the child to eat but very helpful,

TABLE 1 | T's eating disorder diagnosis, PARDI scores, and weight at baseline and end of treatment.

	Baseline	End of Treatment
EDA-5 diagnosis	ARFID	OSFED
PARDI severity score	2.18	1.71
PARDI sensory subscale	1.50	0.50
PARDI loss of interest subscale	0.91	1.64
PARDI fear subscale	0.30	0.00
Weight in kilograms (kg)	28.00	31.07
% EBW	96.95	97.62

EDA-5, Eating Disorder Assessment for DSM-5 [EDA-5; (6)] PARDI, Pica, ARFID, Rumination Disorder Interview (PARDI) (7), a new measure designed to assess ARFID symptom severity; EBW, expected body weight, calculated using Center for Disease Control metrics in children and adolescents (8).

important, or meaningful if the child were able to do so ("Never").

In session 2, as instructed by the therapist, the family brought a meal to the session that included items from the Always, Sometimes, and Never categories. The parents chose sandwiches and explained that normally, T's sandwich would be different than everyone else's, but for this meal they prepared her the same sandwich as everyone else. This meant that the sandwich included an array of items across T's Always, Sometimes, and Never categories, and the sandwich itself was a Never item. The family also brought some of T's Always foods as a "backup" (pita bread, cheese). T's father explained that he assumed T would never really eat the sandwich they brought given "we've tried a million times before." Therapist invited the family to try something different today and decide together what they'd like to see T eat in order to take a meaningful step toward challenging ARFID. Parents decided that they'd like her to have a bite of the sandwich; therapist coached parents to decide on a specific, observable amount they meant and invited them to work together to help her do so.

Initially, the father tried rationalizing with T about why it was important for her to eat, while the mother tried gently asking T to please eat it. Throughout these efforts, T sat with arms folded glaring angrily at her parents, then moved to sitting hunched on the floor under the table in protest. Therapist used T's behaviors to externalize the illness, helping the family see these regressive behaviors as clear signs they were challenging ARFID (rather than signs that T was being stubborn, manipulative, or immature). Therapist attempted to help parents identify strategies they were using that tend to be effective, recognize strategies they were using that were not working well, and try new strategies in their place. Specifically, therapist praised mother's strategy of keeping the food close to T and not letting her avoid it. Therapist also asked father whether reasoning with T tended to work (no) and asked mother whether asking T to eat usually worked (no); therapist then coached parents to clearly state to T the behavior they wanted to see (e.g., "please take a bite" or "you need to eat your sandwich"). After time passed without T budging, father unilaterally informed T that she could earn screen time if she ate what was expected of her. Therapist interrupted and coached parents to discuss and decide on this strategy together before introducing it to T; parents agreed that if T ate a bite, she would earn 15 minutes of iPad time when she got home that evening. T initially did not react, but mother persisted in repeating their behavioral expectation; therapist coached father to support his wife in increasing pressure against ARFID. Father also tried making T laugh and smile. After a few moments of giggling, T took the bite.

The remainder of Phase I sessions focused on helping the family gain momentum and a sense of agency in their ability to increase T's eating flexibility. Each session, the therapist used circular questioning to help the family learn from their previous week's efforts, reinforcing strategies they were using that were working well. The therapist used the Always, Sometimes, Never list to measure progress as well as help the family plan what foods they would like to help T eat next. The therapist also provided consultation regarding the use of behavioral strategies and asked specific questions to help the family make a concrete, pragmatic plan for making progress toward their goals each week. The family prioritized entrees typically prepared in their home, fruits, and vegetables. Toward this end, parents gradually increased the level of challenge of foods they presented T in increasing approximations of their ultimate goals. For example, given T would only eat vegetables that were completely pureed, the family gradually presented to her vegetables that were less and less pureed, via soups and smoothies. T's family chose to continue using contingency plans and found them effective. For example, they offered T a daily food challenge, completion of which earned her 15 minutes of screen time. Initially, T completed her challenges only after lengthy time periods and crying, but after parents instituted a time limit for the food challenge, T soon was able to complete them most days within 15 minutes. Throughout this phase, T's brother's involvement was limited but important; the therapist framed him as a vital support to T as parents took on the task of challenging ARFID. The family worked together to brainstorm and monitor ways in which T's brother was supporting her, from agreeing to color with her after a tough meal, to distracting her with jokes at the dinner table, to not interfering with his parents' efforts even when they evoked distress from T.

Phase 2

Once T's parents were feeling empowered and T had been able to consume new foods consistently, treatment moved to Phase 2. In this phase, focus shifted to helping T eat a wider variety of foods outside the specific context and strategy the family had found effective (at home, in the afternoon, as part of a daily contingency). For example, family wanted T to be able to eat at extended family gatherings and friends' houses. During this phase, T became a more willing participant in the sessions, giving her parents feedback about ideas they were considering and making requests for foods she would be more interested in trying. As such, one new strategy the family was able to use during this phase was involving T in food preparation and cooking; T found this fun, and being able to prepare her own food challenges and food for the family seemed to help her feel more excited about eating and "proud" of her accomplishments. The family completed treatment after 17 sessions across 6 months. At termination, T was able to regularly eat several vegetables in their original forms (not pureed), several dishes that were staples in the family's home, any soup (did not need to be blended), and three fruits. They added a total of 13 new foods to her Always list. Please see **Table 1** for objective measures of clinical improvement.

DISCUSSION

This case highlights how FBT-ARFID maintains the key interventions central to FBT for AN and bulimia nervosa (BN). Specifically, as in other forms of FBT, there was no focus on the cause of dysfunctional eating behaviors, in order to reduce any parental guilt or blame and to help the family stay focused on taking action (*agnosticism*). Secondly, the parents were the agents of change, rather than the child or the therapist (*parental empowerment*). Although the therapist often facilitated the family's decision-making and learning and shared insights from expertise, the therapist was never prescriptive (*consultative stance*). The therapist also supported the family in maintaining a *pragmatic focus*, i.e. making specific, realistic plans to address eating behaviors (not cognitions). Additionally, the therapist repeatedly separated ARFID from the child (*externalization*), which helped the parents to recognize and challenge ARFID-driven behaviors. The therapist also repeatedly *emphasized the seriousness of ARFID* in order to help the parents maintain enough sense of urgency that they were spurned to persistently take action against an illness they have lived with and accommodated for quite some time, despite it requiring significant time and mental and emotional resources.

Despite using these same key interventions, this case also illustrates how FBT-ARFID differs from FBT for AN or BN. In some cases of ARFID, it can be harder to build a sense of urgency than it is for AN or BN. Unlike the more acute and salient medical concerns of AN and BN, some children presenting for treatment of ARFID, particularly those with sensory sensitivity, may not yet have experienced clear medical or nutritional consequences of the illness (1). Immediate distress and impairment may be primarily in psychosocial realms, as was the case for T. Thus, the urgency and intense scene the therapist orchestrates may need to be focused on preventing future detriment ARFID could cause if parents fail to intervene now (e.g., growth potential, pubertal development, peer and family problems). With AN or BN, or cases of ARFID with more acute onset and impact (e.g., those with fear of aversive consequences) (1), the urgency and intense scene can include more immediate consequences of the illness.

Similarly, throughout Phase I of FBT-ARFID for T, separating the illness from the child was more challenging than when treating AN or BN. ARFID tends to have an earlier onset, and thus many families have been living with it most of the child's life. It is thus often hard for families to envision their child's life separately from the eating problem, and they often view the eating behaviors as an inherent part of their child. This stands in stark contrast to the acute and later onset of AN and BN, which enables parents of children with those illnesses to clearly remember life before the eating disorder, more easily recognize the eating behaviors as part of an illness that has come into their child's life, and more readily see the possibility of returning to life without these eating behaviors if they can address them.

In addition to challenges with separation of the illness and urgency to action, FBT-ARFID also often differs from FBT-AN in that children with ARFID are more able to participate in the treatment and can do so at earlier stages. Many youth with AN wish to maintain their eating disorder (9). During Phase I of FBT for AN it is not advisable for the adolescent to be involved in decisions about eating. Parents often need to ignore children's requests as most of them are counterproductive. However, children with ARFID are less invested in maintaining their illness. Although many are reluctant to participate in treatment and find it difficult, once they accept that their parents are addressing their eating, they are often motivated to "have a say" in setting goals and challenges. For example, in the case presented, T suggested foods she wanted to be able to eat or options she was interested in her parents considering for food challenges.

Lastly, another difference this case demonstrates between FBT-ARFID and FBT for other eating disorders is that certain strategies may be effective in addressing ARFID that would likely not be with AN or BN. Specifically, T's parents were able to very effectively use behavioral contingencies to help T learn to eat a greater variety of foods. However, incentives are seldom enough to overcome fear or strong motivation to maintain the disorder in AN.

It is worth noting that ARFID is quite heterogeneous, and applying FBT-ARFID to patients with fear of aversive consequences and/or low appetite may require adaptations. Although core FBT interventions reviewed here (e.g., parental empowerment) appear relevant across any ARFID presentation, changes to more specific interventions may be warranted, such as the focus of treatment (e.g., weight gain, expanding eating flexibility) and specific instructions given for the family meal; please see case reports from Lock and colleagues (4) for further guidance on treatment considerations across different ARFID presentations. However, the appropriateness of this treatment for many presentations of ARFID (e.g., older adolescents or young adults, patients relying on enteral feeding or all-liquid diets, patients with significant psychiatric or medical comorbidities) is unknown. While preliminary case reports suggest the feasibility and potential utility of FBT-ARFID (4), systematic study of its effectiveness and for whom is needed.

CONCLUSION

This case demonstrates how FBT-ARFID may be used to treat ARFID in a preadolescent with sensory sensitivity and how the approach compares with FBT used to treat other eating disorders. Given the limited evidence base for treating ARFID (10, 11) and growing number of youth referred for its treatment (12), further study of this promising approach is warranted.

ETHICS STATEMENT

The studies involving human participants were reviewed and approved by Stanford University Administrative Panels on Human Subjects Research. Written informed consent to participate in this study was provided by the participants' legal guardian/next of kin.

AUTHOR CONTRIBUTIONS

KR and JL co-wrote the manuscript. KR served as a therapist to the patient. JL provided supervision of the treatment and created the manual used during treatment.

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Neuroscience of Adolescent Anorexia Nervosa: Implications for Family-Based Treatment (FBT)

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Over the past 20 years significant progress has been made to elucidate some of the neurobiological underpinnings of the development and maintenance of anorexia nervosa and their possible implications for treatment. There is increasing evidence supporting the notion that anorexia nervosa shares neurobehavioral patterns with anxiety disorders and involves reward processing aberrations and habit formation. There is consensus for the need of early intervention to ameliorate the effects of starvation on the adolescent brain and the effects of illness duration on neurodevelopment. Family-based treatment (FBT) is the first line evidence-based treatment for adolescents with anorexia nervosa achieving sustainable full remission rates of over 40%. FBT has an agnostic treatment approach and its mechanisms of change have until now not been fully understood. To help fill this gap in theoretical understanding, this paper will provide a review of the treatment model of FBT through a neuroscientific lens. It argues that FBT is well designed to address the implications of current key findings of the neuroscience of anorexia nervosa and that it is also well aligned with the current understanding of neuroscience principles underpinning therapeutic change. The paper supports the perspective that FBT utilizes principles of parent facilitated exposure response prevention. It concludes that an integration of a neuroscience perspective to the provision of FBT will assist the clinician in their practice of FBT.

Keywords: eating disorders, anorexia nervosa, family-based treatment (FBT), neuroscience, adolescence

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INTRODUCTION

Anorexia nervosa (AN) is a serious psychiatric illness with a peak age of onset during adolescence (1) and is associated with high rates of chronicity and the highest mortality rate of psychiatric disorders, alongside substance use disorders (2, 3). Longer illness duration is associated with a more chronic course of illness and poor prognosis (4). Self-induced starvation leads to acute and chronic states of malnutrition with potential life-threatening physical complications as well as neurocognitive sequelae. The causes of AN are of a complex nature and neuroscience has begun to elucidate some of the likely underpinning factors contributing to its aetiology (5).

The need and importance for early intervention has been well established (6). Outcomes of psychological specialist individual treatments are generally poor with full recovery rates between 22% and 28% (7). Recovery rates of family-based treatment (FBT) for adolescent AN are far superior to individual treatment with rates of full recovery of 47% at 12-month follow-up versus 23% at 12-month follow-up for adolescent-focused therapy (AFT) (8). FBT is effective for adolescents up to the age of 18 with an illness duration of up to 3 years.

There have been calls to develop treatments that specifically target some of the underpinning factors contributing to aetiology and maintenance of psychiatric illnesses and move away from treatment approaches that are agnostic to illness aetiology. The National Institute of Mental Health (NIMH) has developed a framework of Research Domain Criteria (RDoC) based on observable behavior and its underpinning neurobiology with the aim to help develop precision medicine for psychiatry (9). This has over the past few years also increasingly been applied to research of eating disorders (10) and is being translated into novel treatment concepts (11, 12). For instance, Maudsley Anorexia Treatment for Adults (MANTRA) has been developed based on empirical research and its treatment targets are aimed to address putative predisposing and maintaining factors like a perfectionistic rigid thinking style as well as an emotionally avoidant interpersonal style. However, in RCTs MANTRA has not outperformed any of the other psychological treatments for adult AN like Cogntive Behavior Therapy Enhanced (CBT-E) or Specialist Supgtive Clinical Management (SSCM) (13). Most of the other treatment approaches that have been developed based on neuroscientific findings such as repetitive Transcranial Magnetic Stimulation (rTMS) and Deep Brain Stimulation (DBS) are still in their experimental stage with reasonably small case series even though they are starting to show promising results (14). It is critical that academic centers continue to develop and test treatment models based on neuroscience with the ultimate objective to match a targeted treatment approach with the individual's presentation.

Understanding the neurobiology of AN also holds potential for a variety of treatment applications in relation to existing psychological therapies (15). In order to bridge the gap between research and practice this paper undertakes a review of manualized FBT through a neuroscientific lens. It needs to be acknowledged that the scope of the paper is necessarily focused in its description of the neurobiology of AN.and does for instance not explore models focussing on abnormal neurotransmitter systems (16) or dysregulated frontostriatal systems (17). It will first provide a synopsis of the key tenets of FBT before describing pertinent aspects of the neuroscience of AN with reference to FBT such as the effects of malnutition on the adolescent brain, anxiety as a core feature of AN, and reward processing aberration and habit formation. This will be followed by a discussion of general neuroscience concepts underpinning fear-based learning, habit formation and new learning through neuroplasticity and their relevance to FBT treatment of AN. The conceptualisation of FBT as parent facilitated exposure response prevention (ERP) therapy (18) will be discussed arguing the importance of the need for parent facilitation of ERP in light of the disabling effects of a state of high anxiety in the context of malnutrition for the adolescent brain.

The paper concludes that FBT does address the salient key findings of the neuroscience of AN and that its interventions map well on these neuroscientifically based concepts and models. It argues that it is important that clinicians providing FBT are aware of neuroscience findings of AN and have a general understanding of applied neuroscience informed principles to learning and facilitating change, especially in the context of treatment of anxiety.

It concludes that an integration of a neuroscience perspective to the provision of FBT will assist the clinician in their practice of FBT and will also help shift the parents' perspective from a stigmatised view of the illness to an easily understood biological basis, thereby increasing their motivation and perseverance in helping their child recover.

KEY TENETS OF FBT

FBT is theoretically agnostic with no assumptions about the origin of the disorder (19). It has a strict focus on what can be done to alleviate symptoms. Treatment consists of three phases over approximately 1 year. Core tenets of FBT are the use of externalization with separating the illness from the adolescent and the use of the parents as a resource and empowering them to be the agent of change, with no blame directed to either the parents or the ill child/adolescent. Parents are empowered to be in charge with the therapist actively mobilising a sense of urgency in the parents for the need to address the anorexic behavior and focus on weight recovery, without delay.

The therapist is tasked to support the parents to manage and help regulate the extreme anxiety felt by the adolescent when faced with having to eat more. The therapist emphasizes the need for the parents to be on the same page in order to ensure predictability and consistency. The parents are tasked to help manage the anxiety of the adolescent, maintain sight of the needs and importance to adhere to the goals of full recovery of their adolescent. FBT's use of externalization of the illness helps the parents to maintain a supportive, caring relationship with their child.

EFFECTS OF MALNUTRITION ON THE DEVELOPING ADOLESCENT BRAIN

Cerebral gray and white matter deficits due to malnutrition in adolescents have been well established (20). Bernardoni et al. (21) have been able to demonstrate that reductions in gray matter volume and cortical thickness are reversible with full weight recovery. Adolescence is a time of significant change in the brain leading to unstable networks. In particular, the maturation of the prefrontal cortex and its executive ability to inhibit impulses of the limbic system is significantly delayed. (22) These neurodevelopmental changes during adolescence involve synaptogenesis and neural pruning and require myelination of neurons permitting faster neurotransmission. This process is linked with the development of abstract thinking, executive function and decision making and emotion regulation. This means that starvation with restricted fat and carbohydrate consumption will have a significant effect on the development of complex neural networks. Recent studies in AN have identified alterations in a range of white matter structures in the limbic system associated with anxiety, body image and cognitive functions (23). These effects on the brain occur at a period of high instability of developing networks. It is unclear yet to what extent these alterations will be reversible but it is likely that faster and full weight recovery will be of benefit.

As much as the need for full weight recovery and the risks of malnutrition might appear obvious to both parents and clinicians, having a deeper understanding and appreciation of the actual impact of malnutrition on the brain, which is less apparent than the more visible effects of malnutrition on the physical body, is of great benefit, because it provides a strong clinical rationale to achieve full weight restoration rather than being satisfied with a weight level that might be sufficient to allow the adolescent to function at a greater capacity physically but does not address the impact on adolescent brain development. This issue of definition of full weight recovery tends to often become a challenge during phase 2 of FBT and the adolescent themselves can also be more receptive to a neuroscientific rationale on the effects of brain functioning.

ANXIETY AS A CORE FEATURE OF AN

AN is characterised by the experience of very high levels of anxiety in the adolescent in the context of eating. AN and anxiety disorders have a genetically overlapping phenotype with a high incidence of premorbid and comorbid anxiety disorders (24, 25), elevated traits of harm avoidance and trait anxiety (26). This has led to the development of aetiological models centering around the role of anxiety in AN (27, 28). Strober's model posits a heightened sensitisation to fear stimuli leading to the development of rapid pathological fear conditioning. This predisposition to fear conditioning leads to behavioral avoidance with increased resistance to fear extinction learning (28, 29).

Set-shifting deficits (30, 31) are found in adults with AN and tend to persist after full weight recovery but have not been found in adolescent AN indicating that illness duration could play a role highlighting the need for early intervention. High obsessionality has also been identified as a predisposing trait and moderator, adversely affecting treatment outcome and requiring longer treatment (32).

Individuals with predisposing traits of anxiety tend to feel easily overwhelmed, which will be further exacerbated by the state of starvation. The adolescent suffering from AN will try to ignore the starvation induced stress signals in order to be able to continue to pursue their goal of weight loss. This conflict between a cognitively based top down motivation to want to lose weight and the inherent biological need of body and brain to have its nutritional energy needs met will create an ongoing internal dissonance, which in itself is causing increasing stress for the adolescent (33). The implicit effects of starvation on brain and body as well as the acute effects of anorexic anxieties create a permanent state of ongoing heightened levels of stress and anxiety with all its neuroendocrinological effects including chronically elevated cortisol levels. This chronic heightened state of anxiety leads to further fear sensitisation and further impacts on the development of the cortico-limbic pathways required for development of emotion regulation.

It can be very helpful to describe to parents and adolescent how this interplay of factors exacerbates the severity of the anxiety and disadvantages the adolescent, rendering them incapable of reversing the negative cycle of anxiety and avoidance without parental help.

REWARD PROCESSING ABERRATION AND HABIT FORMATION

There have been a number of functional neuroimaging studies (34, 35) demonstrating reward processing aberrations with an underactive "bottom-up" processing of interoceptive pleasure experience in combination with overactive cognitive inhibitory control (27). Reward processing and fear-based learning are fundamental core learning patterns essential for survival that are prone to lead to chunking of motivation behaviors, i.e., habit formation. Automatic and habitual cognitive bias towards AN related preoccupations and behaviors leads to further neural progression and entrenchment of these behaviors. These findings have led to the development of reward centred models of AN (36–39), which describe a process from initial "liking" the consequences of weight loss to "wanting" to pursue this goal further, and then a progression to habit learning over time. This correlates with a shift from behavior being encoded in neural circuits involving amygdala, ventral striatum and orbitofrontal cortex, to those of the dorsal striatum and dorsal prefrontal cortex. These habit learning behaviors are being maintained by the strong reward of fear relief and therefore become even more quickly entrenched and increasingly difficult to change the longer they persist. However, early in the development of AN habits should be less entrenched and the dorsal striatum circuits less engaged (40). This is a strong rationale for the necessity to address the behaviors maintaining AN, which the clinician can use to elicit the same sense of urgency with the parents to challenge anorexic behavior early on to prevent the development of entrenched cue-stimulus learning.

GENERAL NEUROSCIENCE CONCEPTS UNDERPINNING LEARNING THEORY

There are a number of fundamental neuroscientific principles underpinning fear-based learning, habit formation and new learning through neuroplasticity that are relevant to the treatment of AN. A highly aroused anxious state involves an inability to utilize the left prefrontal cortex to down-regulate emotions and instead is entirely directed towards immediate threat avoidance (41, 42). Fear-based learning is very fast (just one single synapse from the thalamus to the amygdala), which is very effective to promote survival but in the context of the AN leads to overwhelming distress for the adolescent when exposed to food. Understanding these underpinning neuroscience concepts can help the parents appreciate that in the actual moment of having to eat, their child will feel too overwhelmed with fear and will try to avoid eating even though at other times they might genuinely state that they want to recover.

This can provide compassion and understanding in the parents for their child and at the same time a recognition that they, at least initially, need to be the agent of change to facilitate new behavior.

The cost of fear-based learning is closed loop neural activation of entrenched patterns of avoidance (43, 44). Repetition of behavior strengthens synaptic connections through long-term potentiation (LTP) from α-amino-3-hydroxy-5-methyl-4-isoxazolepropionic acid (AMPA) to N-methyl-D-aspartate (NMDA) glutamate receptors (45), which is particularly relevant for the development of habits. This implies that not engaging in change behavior further strengthens the neural connections underpinning the AN behavior resulting in further entrenchment. Unlearning of behavior is challenging and requires multiple repetitions of new learning experiences in order to build new neural connections. Neuroplasticity is enhanced through new learning and ongoing neural activation results in increased neural wiring (46). The concept of the "window of tolerance" provides an understanding that new learning requires a certain degree of safety to minimize feeling overwhelmed and out of control (47–49). This understanding of the importance of a sense of safety as an essential foundation for exposure work can enhance the parental effort to try to remain calm and compassionate with the adolescent to ensure a sense of safety. Explaining these basic concepts to the parents can emphasize the need to be persistent and consistent in reshaping behavior. It also provides hope that there are known mechanisms of neural change.

PARENT FACILITATED ERP AS A THERAPEUTIC MECHANISM OF FBT

ERP is the treatment of choice for both OCD and anxiety disorders. It is now understood that extinction processes largely rely on the development of new inhibitory learning pathways through new positive associations with the original stimuli as opposed to just the habituation to fear stimuli (50). This kind of learning requires multiple supported repetitions and is highly context specific and is based on the development of left prefrontal cortex control over the fear circuit (amygdala), memory retrieval (hippocampus), and reward- and habit-related processes (basal ganglia) (51).

Steinglass et al. (52) conducted a small study using ERP to address anticipatory anxiety with weight restored patients with AN in an inpatient setting, which was moderately successful. Hildebrandt et al. (18) argued that FBT can be conceptualised as a form of parent facilitated ERP therapy. He and his team have subsequently developed exposure-based FBT (FBT-E), which includes a coaching manual and also a range of submodules (53). While his preliminary findings show modest improvements they are difficult to generalise due to low numbers of participants and the fact that it was not compared with standard FBT.

It is a plausible concept to view FBT as a form of parent facilitated exposure, utilizing extinction processes with facilitation of inhibition learning through the development of new behaviors (54). The neuronal pathways required to establish new inhibitory learning are still under construction in a developing adolescent brain and, in a state of malnourishment and heightened anxious arousal will not have an opportunity to develop sufficiently unless parents facilitate this process of preventing an avoidance response in order for inhibitory learning to become more permanently encoded. From a neuroscience perspective one could argue that FBT is designed to mobilise the capacities of the joined prefrontal cortices of the parents, based on the assumption that the adolescent, due to the nature of the illness, is not in a position to make sound decisions while overwhelmed with a state of anxiety. Introducing the idea that the adolescent is feeling too overwhelmed by anxiety to think clearly and make good decisions can help the parents understand that some of the less acceptable behaviors associated with the illness are not deliberately disobedient or manipulative but rather a response to extreme fear. Supporting the relationship of the parents with their child activates attachment behavior, which provides the empathy, emotional warmth, and safety, which are the foundation of successful exposure challenges.

SUMMARY AND DISCUSSION

This paper proposes that an understanding of a neuroscientific model of AN can enhance the clinician's practice of FBT and may help explain to both practitioners and families why certain principles and practices inherent in FBT are effective. The provision of psychoeducation on the neuroscience of AN can help families shift away from a perspective of stigmatised illness with attributions of blame, to accepting the biological basis of AN and thereby assist with the process of externalization of the illness (55). Understanding the malleability of its biological causes can also increase the parents' motivation and perseverance to ensure that they help their child to achieve full recovery (56). It also validates the subjective experience of the adolescent of high distress and fear and thereby can give them a sense that their experience is viewed as "real" rather than just a reflection of insensible resistance. The extent of the adolescent's fear response provides a clear rationale why the parents need to be in charge to help the adolescent tolerate exposure. The concept of the window of tolerance for learning provides an understanding for the parents of the need to be calm and to provide a sense of safety for their child in order to meet the challenge of exposure to eating more. Having a true understanding of the basis of the distress of their child can invite compassion and understanding from the parents without them losing sight of the need to ensure weight recovery and extinction of anorexic behaviors. Appreciating the vulnerable and highly susceptible state of the developing adolescent brain provides a strong rationale, not only for rapid and full weight recovery but also for the need to explicitly address behavior maintaining AN anxieties. This can address the development of habit formation and risk of entrenchment of behavior with its adverse effect on prognosis. ERP therapy is the treatment of choice for OCD and other anxiety disorders. It requires multiple repetitions of exposure to the feared object with response prevention leading to the development of new inhibition learning. The concept of parent facilitated ERP maps well onto FBT. The core tenets of FBT of parental empowerment, use of externalization of the illness and emphasis on attachment and connection with the adolescent through compassion and empathy provide a framework within which the objectives of ERP can be achieved. FBT should not be conceptualised as just another form of ERP but it can be helpful for both clinicians and parents to understand the principles and theoretical underpinnings of ERP as a likely therapeutic mechanism of FBT. Further study of extinction learning in the context of treatments of AN (57) may hold the potential to refine therapeutic mechanisms and thereby hold the potential to improve its efficacy and thereby treatment outcomes.

The past 20 years of research have not only established and confirmed the efficacy of manaualized FBT but have also increasingly provided more data to develop neuroscientific models of the aetiology and maintenance of AN and to improve our understanding of the mechanisms by which treatment works. The task is now to integrate that knowledge into existing therapies like FBT.

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The content of this paper is solely the responsibility of the author.

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Recognizing and Responding to Child Maltreatment: Strategies to Apply When Delivering Family-Based Treatment for Eating Disorders

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Child maltreatment encompasses a constellation of adverse parental behaviors that include physical, sexual, or emotional abuse, physical or emotional neglect, as well as exposure to violence between parents. A growing body of literature indicates that exposure to child maltreatment is a significant risk factor for the development and maintenance of eating disorders (EDs) and that practitioners experience challenges related to recognizing and responding to various forms of child maltreatment in their practice. Parent-child interactions signifying possible child maltreatment can be subtle; furthermore, the emotional and behavioral symptoms associated with an ED can overlap with those linked with child maltreatment, making it difficult for practitioners to distinguish whether children's symptoms are attributable to underlying psychopathology versus exposure to child maltreatment. This challenge can be further complicated in the context of delivering family-based treatment (FBT); FBT reaffirms that there is no single cause of EDs and asserts the leadership role of parents in their child's recovery process—both of which may lead practitioners to inadvertently miss indicators of child maltreatment. In this article, we provide an overview of the evidence linking child maltreatment to EDs among children and adolescents, as well as evidence-informed strategies for practitioners to safely recognize and respond to suspected child maltreatment when delivering FBT to children and adolescents in their practice.

Keywords: child maltreatment, eating disorders, children, adolescents, intervention, mandatory reporting

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INTRODUCTION

Maltreatment in childhood or adolescence is a non-specific risk factor for a substantial proportion of mental disorders detailed in the Diagnostic and Statistical Manual of Mental Disorders (DSM); (1–3) this includes eating disorders (EDs) (3, 4). Generally speaking, child maltreatment includes physical, sexual, or emotional abuse, as well as physical and/or emotional neglect by a parent or caregiver (hereafter referred to as "caregiver") toward a child (i.e., under 18 years of age) which results in actual or potential physical or emotional harm to the child. In addition, children's exposure to intimate partner violence (IPV) between adults is increasingly considered a form of child maltreatment; (5) its negative impacts are similar to other forms of child abuse and neglect (3, 4, 6). **Table 1** provides a definition for each type of child maltreatment, as well as examples of adverse caregiver behaviors that are characteristic of each child maltreatment type. Importantly, rates of exposure to child maltreatment among individuals with an ED are high relative to population norms, as well as individuals with other types of psychopathology (8, 9). In addition, individuals with an ED and a history of maltreatment tend to have earlier ED onset, higher rates of psychiatric comorbidity, a greater frequency of suicidal ideation and attempts, as well as a more severe course of eating-related pathology compared to their non-maltreated peers (8–10). The objectives of this paper are to provide an overview of the evidence linking child maltreatment to EDs among children

TABLE 1 | Types and Examples of Child Maltreatment (7).

Child Maltreatment Sub-type	Definition	Example Adverse Parenting Behaviors
Physical abuse	Includes the use of physical force, a tool or apparatus to physically harm or control a child or adolescent. Physical abuse has also occurred when a parent or caregiver commits an act that can or does result in physical injury to the child or adolescent, including red marks, cuts, welts, bruises, muscle sprains, head injury, and/or broken bones.	• Hitting • Kicking • Shaking • Throwing • Poisoning • Burning or scalding • Drowning • Suffocating • Deliberately inducing illness *via* intentional exposure to known communicable diseases or viruses.
Sexual abuse	Includes forcing or enticing a child to take part in sexual activities, whether or not the child is aware of what is happening to them. The activities may involve penetrative and non-penetrative acts and non-contact activities.	• Inappropriate fondling of the child or touching of any kind. • Vaginal, anal, or oral rape, or attempted rape. • Making the child read, watch, hear or participate in sexual acts or pornography. • Talking about sex, sexual activity, and sexual acts with a child that is outside the scope of developmentally appropriate discussions of sex and sexuality.
Emotional abuse	Used interchangeably with psychological abuse, this maltreatment involves a non-physical, repeated pattern of caregiver behavior that is likely to be interpreted by the child that they are disliked, unwanted, unloved or rejected by the caregiver and which undermines the child's development, well-being and socialization. If severe enough, a single incident by a caregiver could be considered emotionally abusive if deemed emotionally harmful or potentially harmful for a child.	• Spurning the child (belittling, denigrating, ridiculing, humiliating in public). • Terrorizing the child (e.g., placing in unpredictable or chaotic circumstances, placing the child in dangerous situations, etc.). • Isolating the child (e.g., confining the child within a room, structure or environment for a non-medically necessary reason; or restricting social interaction within the community, etc). • Exploiting or corrupting the child's behavior and development (e.g., modeling, permitting or encouraging antisocial behavior, purposefully restricting the child's cognitive development)
Emotional neglect	Used interchangeably with psychological neglect, emotional neglect involves caregivers repeated acts of omission and which place their child at risk of emotional harm; including a caregiver's repeated failure to notice, attend to, or respond appropriately to a child or adolescent's feelings.	• Denying affection when warranted for the child or requested by the child. • Demonstrating coldness or little-to-no warmth toward the child. • Ignoring or refusal to engage with the child when demonstrating certain emotions (e.g., anger, sadness, excitement, etc.). • Providing no praise when warranted
Physical neglect	Refers to a caregiver or parent's inability, refusal, or failure to provide their child with the resources needed for healthy physical development, as well as the level of monitoring and supervision needed to keep the child physically safe from harm or potential harm that is within the control of the caregiver.	Failure or inability to provide: • Adequate food for the child's growth and development. • Clothing adequate for the weather. • Necessary medical or dental care for the child's development and continued well-being. • Adequate shelter for the child.
Child exposure to intimate partner violence	Refers to any child or adolescent's exposure to, witnessing or awareness of any incident of violent or threatening behavior between adults who are or have been intimate partners.	Failure or inability to prevent one's child from witnessing or having an awareness of: • Physical violence (e.g., slapping, kicking, punching, beating, etc.) between adult caregivers. • Emotional abuse (e.g., belittling, degradation, humiliation, etc.) between adult caregivers. • Consensual and/or non-consensual sexual behavior (touching, petting, viewing of pornographic material, intercourse, rape, etc.), between adult caregivers. • Financial control or abuse of the other caregiver/parent for purposes of socially controlling or harming (e.g., precluding one parent/caregiver from having access to household finances, spending uncharacteristically large sums of money to punish the other parent/caregiver; etc.).

Adapted from: National Institute for Health and Care Excellence (7).

and adolescents. Second, we discuss how the strict adherence to the principles of family-based treatment (FBT) for EDs has the potential to interfere with a practitioner's ability to readily recognize and respond to any historical or ongoing child maltreatment exposure. We follow this discussion by providing evidence-informed strategies for practitioners to safely recognize and respond to suspected or disclosed child maltreatment when implementing FBT with children, adolescents, and their families in practice.

High rates of a history of child maltreatment have been found among adults with all ED diagnoses, including anorexia nervosa restricting and binge-purge subtypes.(8–10). Most studies focus on female adult samples. In addition, studies vary in their approach to measuring child maltreatment (11). Recent reviews and meta-analyses (8–11) indicate that the prevalence of any form of child maltreatment ranges from 21 to 66%, though much of the literature has focused on physical, sexual, and emotional abuse (8–11). To our knowledge, there is no published study detailing the prevalence of children's exposure to IPV among youth or adults diagnosed with EDs. However, a review of studies based on adult retrospective self-reports indicates that conservatively, at least 10–20% of youth are exposed to IPV annually; high rates of this exposure have been replicated in a national sample of US youth (12–15). Lastly, it is important for practitioners to be aware that different forms of child maltreatment tend to co-occur (16, 17) and exposure to more than one form of child maltreatment is strongly associated with disordered eating behavior in adults (8) and adolescents (18).

Evidence suggests that the inability to express emotion in healthy and adaptive ways may be the mechanism linking child maltreatment exposure and the development of an ED. Caregivers who maltreat their children show less positive emotion (i.e., joy and warmth), more negative emotion (e.g., anger and sadness), and have less favorable perceptions of emotional expression than their non-maltreating peers. Each of these factors is associated with emotion processing challenges in their offspring, as well as the onset, severity, and duration of child mental health problems and successful intervention (19). Children who experience inconsistent, harsh, dismissive, or overinvolved caregiver responses to their emotions have been shown to demonstrate deficits in emotion processing, including recognizing, understanding (e.g., labeling), and expressing emotion. More specifically, when these caregiver responses occur, the emotional experience of the child is ignored, minimized, or incongruent with their expectation. If this emotional incongruence happens frequently or repeatedly, this can contribute to the internalization of negative beliefs toward emotional expression. Such internalizations may alter the child's cognitive processing of emotion information and lead to the use of maladaptive strategies (e.g., emotional suppression) (20–22) to process emotion, as well as the subsequent development of behavioral and psychological symptoms (e.g., purging, restriction, binge eating, excessive exercise, etc.), to manage their emotion states (23–26). Though this explanatory framework is a promising line of research, additional longitudinal studies capable of disentangling the influence of maltreatment exposure on maladaptive emotion processing and ED development, persistence and intervention are needed.

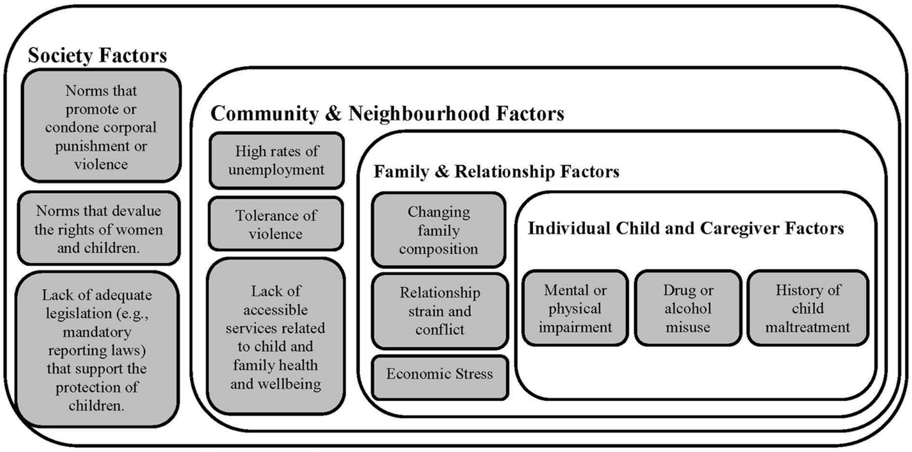
RECOGNIZING CHILD MALTREATMENT WITHIN THE THERAPEUTIC STANCE OF FBT

A recent qualitative meta-synthesis highlighted that healthcare and social service providers experience challenges related to recognizing and responding to child maltreatment in their practice (27). Emerging work suggests that this is also the case among ED specialists (28). There are several potential implications of this practice challenge. First, FBT continues to be the first-line intervention for youth diagnosed with anorexia nervosa and bulimia nervosa; (29, 30) additional evaluations about the tenability of the intervention for treating binge ED, as well as other-specified feeding and EDs are being explored (31–33). As a behaviorally-based intervention, FBT involves several key processes and principles that could complicate practitioners' ability to effectively and efficiently recognize and respond to child maltreatment. These include a non-determinant view of the illness, a non-authoritarian therapeutic stance, empowerment of caregivers to facilitate the recovery process, as well as an initial prioritization on nourishment and symptom interruption (34–36). In the context of FBT, an unequivocal belief that caregivers are a positive resource to their child's recovery has the potential to negate the identification of adverse caregiver behavior in the context of a child's physical and psychological vulnerability, as well as magnify the impacts of any ongoing child maltreatment (28). Second, a non-determinant view of the illness may implicitly suggest to practitioners that attending to the relational patterns in the family system is secondary to the emphasis on symptom interruption. However, it is important to note that chronic, cumulative exposure to child maltreatment may lead to enduring vulnerability to ED sequelae. In particular, exposure to child maltreatment has been implicated in suboptimal functioning of the system responsible for neuroendocrine stress regulation—the hypothalamic-pituitary-adrenal (HPA) axis. Emerging evidence indicates that altered HPA-axis functioning has the potential to mediate the onset, severity, and persistence of mental health symptoms, (37, 38) including ED pathology (39–42). In addition, recent studies suggest the possibility of protracted psychiatric vulnerability *via* changes to the HPA-axis among individuals with an ED and a child maltreatment history given the effects of ED symptomology (e.g., starvation, binge-purge cycles) on the neuroendocrine response system (43, 44). Thus, recognizing and halting any ongoing child maltreatment exposure is critical to short and long-term recovery from an ED.

Safe recognition and response to child maltreatment refers to the practitioner's use of assessment and therapeutic strategies that limit the possibility of additional harm related to child maltreatment exposure. There are two key considerations relevant to the safe recognition of child maltreatment: (a) engaging in an ongoing assessment of child maltreatment risk factors; and (b) being attuned to the interactions between a child and their caregiver. The literature cites several common sources of risk for child maltreatment, which can be understood within an adapted version of Bronfenbrenner's (45, 46) ecological model of human health and development. Framed within this model, child maltreatment exposure can be considered a consequence of multiple risk factors at the individual, family, community, and societal-level and which interact to create the conditions in which child maltreatment has a stronger likelihood of occurring (45, 47, 48). An overview of the risk factors associated with child maltreatment exposure are provided in **Figure 1**. Briefly, the experience of multiple and chronic stressors within and outside the family system is associated with child maltreatment exposure. For example, stress related to caregiver unemployment may be compounded by a child or caregiver's mental health challenges, which can place caregivers at greater risk of maltreating their children. Changes in family demographics (e.g., pregnancy, martial separation, etc.), as well as chronic family conflict (e.g., custody disputes, disparate caregiving practices, etc.), are contexts in which children are at greater risk of being maltreated. In addition, tolerance for discrimination on the basis of gender, racial, or ethnic identity within one's community, as well as societal social and cultural norms that condone the use of violence can all contribute to the risk of child maltreatment (47–52).

Importantly, all forms of child maltreatment can lack overt indicators of their occurrence. In addition, children and youth with and without maltreatment exposure and who are presenting for ED intervention can exhibit similar emotional and behavioral symptoms. For example, the "alerting features" for child maltreatment listed in the National Institute for Health and Care Excellence (NICE) Guidelines (7) (pg. 9) overlap with the symptoms associated with ED psychopathology (e.g., significant changes in mood, etc.). For these reasons, initial and ongoing assessment of the relational patterns within the family and based on information from multiple family members is crucial for safe and efficient recognition and response. This approach is consistent with those detailed in the FBT manuals, which indicate that a comprehensive assessment that consists of an interview with the child, the caregiver(s), a medical evaluation and the administration of standardized questionnaires is critical. The assessment should include a review of the child's ED symptoms and their onset, family dynamics, as well as the impacts of the illness on the youth's short and long-term goals for academics, peer, and family relationships (34, 36).

The FBT manual suggests that practitioners should meet with caregivers separately from the youth. In addition, some time spent with each caregiver alone is important for ensuring that any inquiry related to child maltreatment—and in particular, exposure to IPV—is done safely. The two most common forms of IPV are situational couple violence and intimate terrorism; the former is rooted in couple conflict that escalates to violence and the latter refers to an interactional pattern whereby one partner explicitly attempts to exert general, long-term control, over the other partner; this is known as coercive control (53). In the context of intimate terrorism, coercive control tends to encompass three key characteristics: (a) the use of coercion *via* demand or threat; (b) the abuser's ability and willingness to follow through on threats; and (c) the surveillance of a victim's activity with the intention to make good on the threats (54). In the context of an FBT assessment, initial interviews with caregivers could raise issues of conflict related to disparate caregiving practices, financial challenges, disagreements about their child's diagnosis, as well as the perceived need for intervention, and other family-related challenges, including violence. Given this information, as well as the possibility that violence could intensify in the context of psychosocial stress related to their child's serious illness, (55, 56) it is critical that each caregiver be provided an opportunity to meet with the FBT therapist independently from their partner. In doing



Adapted from: Bronfenbrenner[38] and Krug et al[40]

FIGURE 1 | Adapted Ecological Model for Child Maltreatment—Risk Factors.

so, FBT practitioners can prioritize the safety of any caregiver who is currently experiencing IPV, as well as safely inquire about child exposure to the IPV, and gain a clearer understanding of the dynamics of the caregiver-dyad, which is critical to the FBT process.

Principles for Safely Recognizing Child Maltreatment in FBT

The principles for safely recognizing child maltreatment in the context of delivering FBT align with the general principles for providing trauma-informed care (TIC). TIC refers to mental health care that is strengths-based and which explicitly seeks to minimize the possibility of iatrogenic effects related to the therapeutic process (57, 58). TIC recognizes that exposure to trauma, including child maltreatment, is widespread in the population and that trauma is a strong antecedent of mental health challenges. From a practice perspective, TIC involves the key elements of: (a) ensuring patient collaboration and autonomy; and (b) a commitment to inquiring about and responding to experiences of trauma sensitively and in a way that prioritizes the patient's physical *and* emotional safety (58). The last decade has seen significant advocacy and discussion related to TIC and though there remains little empirical evidence related to how best to provide TIC in mental health settings, (59) many of its principles parallel recommendations for good clinical practice. Aligning with the key elements of TIC, there are three key principles for safely recognizing child maltreatment in the context of delivering FBT. First, universal screening for child maltreatment is not recommended at any point during FBT. There is no evidence that universal screening for child maltreatment leads to reduced harm, reduced exposure, or optimal outcomes among those who have experienced child maltreatment (60–63). Second, an explicit discussion about the limits of confidentiality with each family member is needed. During the initial assessment, the family should be advised about the limits of confidentiality, jointly. An additional review about the limits of confidentiality should be completed with each family member who participates in an individual interview as part of the assessment process; special attention should be paid to ensuring that youth understand the concept of safety and the limits of confidentiality when issues of safety arise. Third, practitioners should implement a phased inquiry approach. Specifically, practitioner questions about potential child maltreatment exposure should begin with questions focused on the presenting concern (i.e., disordered eating and the onset of symptoms) and then proceed to ask broader questions about well-being and safety. For example, after taking a history of ED symptoms and behaviors, the practitioner might ask: "how does everyone get along at meal times," and then "what about outside of meal times?" These questions might be followed by, "what happens when someone gets upset or angry," and then, "what's the worst thing that has happened?" If the practitioner is considering physical abuse and notices an overt sign for inquiry (e.g., large bruise on a child's leg), in the individual interview with the child, they may say something like, "I see that you have a bruise on your leg. Tell me about that, how did it happen?" There is no evidence to support routine screening for child maltreatment—in other words, asking everyone a standardized set of questions about child maltreatment exposure, irrespective of presenting signs and symptoms is not supported by evidence. A phased inquiry is the safest and most robust approach for recognizing child maltreatment when signs and symptoms suggest possible exposure.

Opportunities for Ongoing, Phased Inquiry During FBT

Processes embedded within the delivery of FBT provide additional opportunities for safe, ongoing, inquiry into historical, or ongoing maltreatment. These processes include the discussion of the caregiver dyad's efforts to support their child to interrupt ED symptoms, as well as sibling(s') efforts to support the patient. Practitioners can continue to monitor family dynamics with input from multiple family members. In addition, as detailed in the FBT manuals, each session begins with the practitioner weighing the youth, which is a process that is about 10 min in duration and completed separately from the caregivers and siblings (34, 36). During this time, practitioners can check in with the youth individually. In line with FBT, practitioners can initiate the inquiry by asking youth, during their weigh-in, about how meals and snacks have been going since the last session, as well as asking about any instances of ED behavior (e.g., restriction, exercise, binging, purging, etc.),. This can be followed with open-ended questions that elicit the youth's recall of their caregiver's reactions and interactions with the adolescent (e.g., after you came back from exercising, what happened)? that relate to ED symptomology and the FBT model more generally. Potential "signals" for phased inquiry include the sustainment or worsening of ED or comorbid mental health symptoms, misalignment in reports of progress (or lack thereof) between caregivers, youth and/or their siblings, as well as sudden worsening of the youth's or caregiver's mood, willingness to engage in treatment, as well as their interactions with each other.

RESPONDING WHEN THERE IS A SUSPICION OR DISCLOSURE OF CHILD MALTREATMENT IN THE CONTEXT OF FBT

Fears of being reported to child protection authorities, as well as the potential outcome of a report, can influence a family's ongoing attendance at sessions. It can also influence the information that youth and caregivers share with their practitioners (64). Importantly, in jurisdictions with mandatory reporting, a suspicion of maltreatment meets the threshold for a report to child protection authorities (although the definition of maltreatment can vary) (65, 66). For this reason, the reporting of suspicions and disclosures of child maltreatment constitute a principal (and challenging) component of the response process.

The NICE guidelines offer important information regarding the distinction between "considering" and "suspecting" child maltreatment (7). To "consider" child maltreatment means that "child maltreatment is one possible explanation" (among others) for the sign or symptom (7). To "suspect" child maltreatment means that the practitioner has a serious level of concern about the possibility of child maltreatment exposure (7). It is not the responsibility of FBT practitioners to obtain proof of child maltreatment exposure and it is important that practitioner's inquiry about signs and symptoms, as well as their responses, do not interfere with the role of child protection professionals. A practitioner's suspicion of maltreatment is justified when the explanation for a sign or symptom is unreasonable or unsuitable. This would mean that the explanation is implausible, inconsistent, or insufficient relative to the child's typical activities, presentation, medical condition, or their developmental trajectory; in these instances, the explanation for the sign or symptom may differ between caregivers, between accounts over time, and/or differs between a child and their caregiver. Importantly, under no circumstances should caregiver preferences for culturally-based practices, rituals or behavior justify emotional or physical harm toward a child. To this end, it is essential for practitioners to be familiar with the legislative requirements concerning the threshold of suspicion and the protection of youth. In addition, it is helpful for practitioners to be aware of, and utilize strategies that can be facilitative of more positive response and reporting experiences. These include empathic responding, appropriate documentation procedures, and ensuring the provision of ongoing support.

Empathic Responding and Mandatory Reporting in FBT

When child maltreatment is suspected or disclosed, it is important to respond to the information that has been shared in a respectful and compassionate manner. Acknowledging that it can be difficult to talk about these experiences and thanking clients for sharing the information with you is important for respecting the vulnerability of their position and the trust they have placed in you as their practitioner. When a suspicion of child maltreatment has arisen or a disclosure of child maltreatment has been made, it is important to directly communicate your professional concern about what has been shared. Second, the youth and caregiver should be reminded about the limits of confidentiality. Upon doing so, the practitioner can then share that their professional concern warrants a report to the child protection authorities, whose role is to support families. Only in instances where the practitioner is concerned that the caregiver may flee with the youth or when there is an imminent safety risk, should the practitioner withhold their plan to report to child protection professionals from the caregiver or the child. As much as possible and where safe to do so, the non-offending caregiver's participation in the practitioner's report to child protection services (CPS) should be considered and implemented. The youth and their caregiver should be informed about the CPS' potential responses to the report; the practitioner should refrain from making any definitive statements about what will occur. Letting the youth or caregiver know that CPS responses are family-specific, is important. The youth and caregiver can be advised that the practitioner will ask CPS about what they plan to do and that this will be shared where possible with the family. Practitioner transparency about the process, when appropriate and safe to do so, can demonstrate the practitioner's ongoing commitment to supporting the youth and caregiver in the process.

When making the report to CPS, the practitioner should communicate to CPS any and all information that is relevant to their concern about suspected or disclosed child maltreatment; details that are not relevant should not be shared. It is important that an interpretation of what has reportedly occurred not be offered, unless it is within the practitioner's scope of practice (e.g., the individual is an expert in child maltreatment impact). In addition, it is important for the practitioner to clarify with CPS directly what they anticipate for their ongoing role. For example, the practitioner should communicate whether the family will continue to be seen for ED treatment or whether further sessions will be put on hold until after CPS has completed an assessment. In addition, it is possible that a report to CPS will result in the family's termination of the relationship with the FBT practitioner. If a family indicates that they will not return for FBT, as much as possible, providers should offer to connect the youth and caregiver to a new provider whose scope of practice includes ED intervention. The plan should be communicated to the youth and caregiver and the CPS professional. Any concerns that the practitioner has about the delay in treatment for the ED can be made explicit to CPS. It is important for the practitioner to carefully document interactions with the youth, caregiver, and CPS professionals throughout the process. Good documentation practices include: (a) recording verbatim statements by the youth or caregiver; (b) noting discrepancies in the youth's or caregiver's account, if any, and without interpretation; (c) recording a detailed description of the youth's emotional state, behavior, symptoms, or injuries; (d) a note that the call to CPS was made; (e) a note as to whether or not a conversation with the caregiver and/or child about contacting CPS occurred before and/or after the call (if appropriate); and (f) a note about what CPS communicated as potential next steps. Additional guidance for making a report to CPS is available elsewhere (27, 64, 67).

Providing Support Alongside CPS

It is important for ED specialists to have familiarity with their local CPS. To date, there are no guidelines as to whether or not FBT should continue when child maltreatment is suspected or disclosed. Plans for ongoing FBT that involves an offending or non-offending caregiver should be informed through collaboration with CPS. If working with a caregiver raises safety concerns or if the CPS professional indicates that caregiver involvement is not possible, there are options that can be discussed with CPS. These include reconstituting the family for the purposes of FBT (e.g., having an aunt/uncle participate in the therapy) or implementing an individual-based psychotherapeutic approach with the youth. For example, Adolescent Focused Psychotherapy for Anorexia Nervosa (AFT-AN) (68) is a developmentally-oriented, individual-based model of psychotherapy that focuses on supporting the youth to address negative affective states that are assumed to be driving ED behavior. Compared to FBT, AFT-AN has been shown to be similarly effective in producing full-remission of ED symptoms among youth with anorexia at end-of-treatment (69). Similarly, Cognitive Behavioral Therapy for Eating Disorders (CBT-ED) (70) or CBT Enhanced (CBT-E) (71–74) may be appropriate for youth with anorexia, bulimia, or other-specified food and EDs where caregiver involvement is not appropriate or possible. Importantly, AFT-AN, CBT-ED, and CBT-E have not been evaluated among samples of youth with identified maltreatment exposure, but are listed in guidelines, systematic reviews and meta-analyses as possible interventions for the treatment of youth EDs when FBT is not available, appropriate, or when FBT is contraindicated (29, 30, 75, 76).

In cases where a youth has disclosed exposure to child maltreatment or when exposure has been confirmed by CPS professionals, it is recommended that the FBT practitioner seek consultation with a trauma or child maltreatment expert. A child maltreatment impact assessment may determine that FBT should cease or that adjunctive intervention for trauma-related symptoms is needed. For example, for youth who are exhibiting posttraumatic stress disorder symptoms, a referral to services offering cognitive behavioral therapy (CBT) with a trauma focus (TF-CBT) is appropriate; (77, 78) in particular, the TF-CBT model detailed by Cohen, Mannarino, and Deblinger (79–81). Similarly, for youth up to the age of 12 who have been exposed to physical abuse or neglect and are exhibiting externalizing symptoms, the family can be referred to parent-child interaction therapy (PCIT) (77, 82). The literature also indicates that in the absence of an available intervention, the provision of psychoeducation about trauma and its associated responses can be an important initial step in addressing trauma-related symptoms (83). Importantly, there is no evidence to support universal screening for exposure to adverse childhood experiences (ACES)—which includes exposure to child maltreatment (84–86). Recent papers report insufficient evidence that ACES screening yields any health benefits for individuals with a history of exposure to child maltreatment (84). In addition, the World Health Organization (87), recommends against universal screening for child maltreatment in the context of mental health and developmental assessments for children and youth. As with the continuation of FBT, any screening, ongoing care or referrals provided to the youth or caregiver for trauma-related symptoms should be clearly documented and made in collaboration with a trauma expert and CPS professionals.

CONCLUSIONS

There is very little information on how exposure to various types of child maltreatment influences the provision of mental health interventions, including FBT for EDs. ED practitioners need to consider child maltreatment exposure in the assessment of youth; safe inquires and responses build upon the principles of TIC, as well as the communication and psychotherapeutic skills that are already central to their practice. Recognition and response to suspected child maltreatment within the context of FBT involves a clear, developmentally appropriate discussion about the limits of confidentiality at the outset of the therapeutic process. This is followed by a phased inquiry that starts with the presenting concern and which elicits reasonable explanations for signs and symptoms. General questions about interpersonal relationships should be included in the assessment. In those regions where mandatory reporting laws are in place, when practitioners suspect child maltreatment, a report to CPS should be made. Safe responses to suspected maltreatment begin with listening and conveying an emphasis on keeping the child safe. This should be followed by the report to CPS (where required) and the development of a plan for ongoing care related to the youth's mental health, which may or may not include FBT. Critically, FBT practitioners are not required to be experts in the recognition and response to child maltreatment; they are also not required to be experts in the assessment of trauma symptoms or the delivery of trauma-focused care. However, they do have a professional and ethical responsibility to do what they can to ensure the safety and well-being of the children and adolescents for whom they are providing FBT.

AUTHOR CONTRIBUTIONS

MK wrote the first draft of the manuscript. AG and HM contributed to the conception, editing, and research for the manuscript. All authors contributed to the article and approved the submitted version.

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