FULL AND PARTIAL HOSPITALIZATION INTERVENTIONS FOR EATING DISORDERS

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FULL AND PARTIAL HOSPITALIZATION INTERVENTIONS FOR EATING DISORDERS

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Editorial: Full and Partial Hospitalization Interventions for Eating Disorders

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Editorial on the Research Topic

Full and Partial Hospitalization Interventions for Eating Disorders

Eating disorders (EDs) are complex psychiatric illnesses posing a severe burden on patients and their significant others. Physical and psychological sequelae can occur, with low quality of life and high mortality rates complicating this picture even further. Treatment is challenging and only 50% of patients respond to gold-standard treatments. There are many psychological hallmarks leading to treatment resistance (1), and state-related pernicious (sometimes life-threatening) conditions (2). In this light, for a substantial number of patients, an intensification of outpatient treatment is needed over the course of illness. For example, from 1999 to 2009, hospitalizations of patients affected by EDs increased for all age groups (3), and during the COVID-19 pandemic hospitalisations increased in particular among the youngest (4). Therefore, full and partial hospitalization interventions become necessary for a substantial portion of patients. Although it has been stated that recovery from EDs may entail a long journey ["hope despite mortal risk" (5) p. 1309], it is also true that an ongoing ED tends to exacerbate patients' depression, anxiety, and chronic stress (6), thus generating a slippery slope toward unfavorable outcomes. Further, intensive treatments are costly; the average cost of inpatient ED treatment is $2,267 per day, residential/partial-hospital are $1,000 per day, not accounting for the high costs associated with acute hospitalization and medical stabilization (7, 8). Despite the high need and cost of intensive treatments, there is scant research on the effectiveness and clinical utility of these approaches. Therefore, this call for research aimed to stimulate scientific debate on treatment of one of the most common types and difficult phases of an ED. Our ultimate goal is to begin to improve the state of science behind intensive treatments for EDs.

It is noteworthy that one-third of the contributions to this collection focused on adolescents with EDs. Interestingly, Baudinet and Simic conducted a comprehensive review of 49 studies of day programs for adolescents with mixed EDs finding substantial evidence of their effectiveness when compared to inpatient treatment. In line with this, Zanna et al., after retrospectively comparing adolescents who followed inpatient treatment and adolescents who received partial hospitalization, provided further support for day programs as effective alternatives to hospitalization for young patients with anorexia nervosa (AN). Relatedly, Litmanovich-Cohen et al., found day programs to be an effective strategy for former adolescent inpatients with EDs. In fact, those who completed a post-hospitalization day program reported greater improvement at follow-up when compared

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to adolescents who did not undergo such an intervention. Finally, three studies provided data on the broad spectrum of family-based interventions. Datta et al. raised the question as to whether hospitalization could impact weight restoration for adolescents undergoing outpatient treatments for AN, finding a different impact depending on the baseline treatment provided. That is, those undergoing Adolescent Focused Therapy gained more weight during hospitalization than those receiving Systemic Family Therapy and Family-Based Treatment. Mensi et al. highlighted the relevance of including family members when working with adolescents with a restrictive form of EDs including restrictive and binge-purging subtypes of AN, avoidant/restrictive food intake disorder (ARFID), atypical AN, other specified feeding or EDs with restrictive characteristics. Finally, Wallin and Holmer focused on the Family Treatment Apartment (FTA) model, which was pioneered as an alternative to psychiatric inpatient care. Comparing short- and long-term outcomes of adolescents with AN receiving FTA vs. inpatient stay, the authors found favorable outcomes for those who underwent FTA with respect to readmissions due to weight loss, general psychiatric pathology and quality of life. Overall, these studies provide evidence for the efficacy of intensive treatments for adolescents with EDs, and describe which specific treatment modalities within intensive treatment might be most effective. More and similar research is needed in adult populations also given the lack of evidence-based effective approaches available for adults with EDs (9).

Several contributions focused on adults with EDs; of those, only one paper investigated a day program intervention. Tenconi et al. analyzed the impact of undergoing a partial hospitalization treatment on cognitive functioning in adult patients with AN. They found that decision-making improved after treatment, while cognitive monitoring and cognitive inhibition remained stable over time. While Body Mass Index (BMI) and duration of illness predicted treatment response, neuropsychological performance did not contribute to the prediction model.

In addition to the aforementioned study, several papers of this Research Topic focused on inpatients. It is of relevance that treating patients who are in an acute phase of their ED can stimulate the pioneering testing of novel interventions. In many situations, patients are hospitalized without motivation to address ED behaviors, in part because of the intrinsic ego-syntonic (i.e., overall acceptable to the patients) nature of the ED. As a result, many patients are placed in a therapeutic setting without being ready to start the recovery process. In this light, Ziser et al. explored a novel intervention called "Motivation-Enhancing Psychotherapy for inpatients With Anorexia Nervosa (MANNA)" aimed to enhance readiness for behavioral change. The authors conducted a randomized controlled trial (RCT) evaluating the feasibility of a novel 10-week program for individual psychotherapy sessions using elements of motivational interviewing. These preliminary data pointed to a better outcome, in terms of hospitalization completion, for those patients with AN who received MANNA. Echoing this line of research, it is noteworthy that Smith and Tchanturia investigated the use of "huddles" (sometimes referred to as treatment teams), namely time-limited and focused meetings, to support clinical teams. These findings are of high interest because of the significant and often unaddressed burden posed by the disorder on clinicians involved in the treatment of EDs. The authors found that huddles were rated as highly useful and could have potential in higher-level of care for EDs. Thompson-Brenner et al. analyzed the long-term effects of a transdiagnostic, evidence-based treatment for patients with mixed EDs requiring a residential level of care, named "Renfrew Unified Treatment of Eating Disorders and Comorbidity," and found positive outcomes for those who underwent this intervention. Outcome measures included eating, depressive, and anxiety symptoms. Interestingly, those who responded less well to the intervention had reported marked levels of emotional dysregulation. Outcomes were maintained over a 5-year timeframe, providing substantial support for this type of intervention during residential care. Finally, addressing the additional challenges brought about by the COVID-19 outbreak, Latzer et al. analyzed the pros and cons of a virtual home-based treatment during the COVID-19 pandemic for Ultra-Orthodox young women previously hospitalized because of an ED. The authors reported that online therapy was effective for patients and parents motivated to undertake virtual treatments (e.g., parents using their COVID-19-related presence at home to further assist their children during meals); in contrast, virtual home-based treatment hindered treatment under specific circumstances (e.g., lack of suitable online devices, over-crowded families, specific religious beliefs). We are encouraged by the burgeoning literature on novel interventions in higher levels of care and look forward to seeing the field continue to progress in this area.

Four papers focused on treatment predictors of severe EDs. Redgrave et al. conducted a study on inpatients diagnosed with severe and enduring AN, investigating weight restoration as a predictor of follow-up clinical status. They found that those with greater weight restoration showed significantly better outcomes at 6-month follow-up. Simpson et al. investigated the predictors of full hospitalization or residential treatment after receiving day treatment for patients with mixed ED diagnoses. Low BMI, residential treatments in the past, and anxious and depressive comorbidity were found as relevant predictors of needing a higher level of care after partial hospitalization. Also, Kaufmann et al. highlighted the role of BMI as an outcome predictor in AN. Not only low lifetime BMI predicted weight at the admission of inpatient treatment, but higher lifetime BMI also predicted a positive outcome both at discharge and at follow-up. Finally, Marzola et al. investigated the phenomenon of readmission and "revolving door" (i.e., rapid readmission) in AN. Focusing on predictors of time-to-readmission, the authors found drive for thinness as a robust predictor of a shorter time to readmission - even stronger than weight gain during hospitalization - for patients with severe AN. Taken together this research begins to piece together specific clinical markers that could be targeted to improve acute care.

Suicide is a leading cause of death for patients with EDs and a major public health problem worldwide. Additionally, active suicidality is one cause of emergency hospitalizations for patients with EDs (10). In this light, Zeppegno et al. reviewed the Interpersonal-Psychological Theory of Suicide across EDs aiming

at disentangling the differences in individual suicidal behaviors. Three main constructs that need to be present in case of lethal suicide attempt were considered: Thwarted Belongingness, Perceived Burdensomeness, and Acquired Capability. After scrutiny of 10 studies also including patients undergoing high levels of care, Perceived Burdensomeness, namely the subjective experience of feeling themselves as a burden to their loved ones and self-directed anger and disgust, was found to be relevant with respect to the risk of suicidal ideation for patients with EDs.

This Research Topic was designed to promote a research debate around, and efforts to address, the complex needs of patients with acute and severe EDs receiving intensive therapeutic interventions. Relevant contributions were collected to expand knowledge on several aspects of full and partial hospitalization in EDs, across different ages, and encompassing predictors of outcome, efficacy of interventions, testing of novel therapeutic approaches, and follow-up outcomes. Nevertheless, in keeping with our initial aim to promote a scientific debate on these relevant matters, it is noted that future studies are warranted to investigate less well-known EDs (e.g., ARFID) and to test novel treatment strategies (e.g., innovative medications, online interventions, neuromodulation, combined approaches). The research literature on inpatients and partially hospitalized patients is challenging because studies involve patients with different demographic and clinical characteristics (e.g., BMI and weight trajectory) and with different levels of motivation for treatment. It is key to broaden the scope of this research to less studied and represented groups, such as those belonging to minority ethnic groups, non-binary gender, and people who live in marginalized geographical areas. Notwithstanding the need for further research, it is our opinion that the papers included in this Research Topic provide a valuable contribution to expanding knowledge on the very challenging topic of intensive treatment of patients with severe and enduring EDs. If much attention is being paid to improve early detection and treatment of these conditions, it is our hope that these efforts will be mirrored to improve outcomes and quality of life in those with longstanding difficulties.

AUTHOR CONTRIBUTIONS

EM wrote the first draft of the manuscript. RR, VC, and CL provided critical revision of the manuscript and important intellectual contributions. All authors read and approved the submitted version.

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ORIGINAL RESEARCH
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Are Huddles the Missing PEACE of the Puzzle in Implementing Clinical Innovation for the Eating Disorder and Autism Comorbidity?

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Huddles are brief, time-limited, focused meetings to help organize and support clinical teams. Huddles have demonstrated their value and transferable benefits across a range of settings. Based on their transferable nature, their potential could be unacknowledged as a clinical implementation technique, particularly in specific subgroups of patients with anorexia who need a higher level of care. An innovative clinical pathway aimed at supporting autistic patients with eating disorders (PEACE Pathway) evaluated the use of weekly PEACE huddles for the multidisciplinary team as part of the implementation process across a 12-months period. A total of 283 responses evaluated the huddle as useful on average 84/100. Using content analysis, several perceived benefits were found of the huddles which were in line with the underpinnings of traditional huddles, suggesting that huddles are transferable as implementation techniques, as evidence by a team providing higher-level care for eating disorders.

Keywords: huddle, team, multidisciplinary, communication, implementation, autism, eating disorders, innovation

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INTRODUCTION

Huddles can be defined as brief, regular meetings aimed at keeping team members informed, actively evaluating and maintaining procedures, goal setting, and thinking about future directions (1). Huddles are different to other types of team meetings, such as rounds which take place with the patient (2), briefings and debriefings which take place before and after specific events (2). Huddles have demonstrated successes by increasing effective and efficient work, particularly regarding safety, across various professions from healthcare to the military (3, 4). Although most commonly utilized daily or prior to a procedure (5), the use of weekly huddles has been successful, especially with increasing clinician attendance (6, 7). Furthermore, huddles have been found to be the most beneficial when adapted to the demands of the environment they are supporting (8).

Huddles have been used successfully in mental health-related concerns in dementia care with improvements in collaboration, teamwork, support and discussing specific behaviors (9). With such translatable benefits, huddles are potentially a very important implementation strategy when rolling out clinical innovation in mental health services. Identifying and evaluating strategies for implementation increases the chances of successfully implementing clinical innovation. Implementation science is developing theory-based knowledge about implementation techniques

and approaches that help roll out an innovation, sustain it, and facilitate scaling up (10). There is an existing body of evidence on integrated care in mental health settings (11) but little evidence on huddles as a clinical implementation tool and why it might be important.

Theoretical underpinnings of huddles suggest that they promote benefits to attendees which include teamwork, communication, education and training, and shared professional identity (12). Teamwork can be defined as understanding competencies and principles that people use to accomplish interdependent work (13). Healthcare settings have acknowledged the role of teamwork in delivering high-quality patient care (14). Care is often collaborative, with different disciplines working together to ensure patients are provided the expertise and support they require (14). We know that an important part of creating an integrated care team is a defined identity. A socially constructed identity helps to mobilize and create shared ownership with diverse members which helps a team to run smoothly (12). Best and Williams (12) identified several things that enable collaborative identity: open-mindedness, communication and education, clear organization and structure of the new team, goal congruence, profession-specific mentoring and training, understanding the role of others, more diversity in the team.

A new clinical innovation, the Pathway for Eating Disorders and Autism developed from Clinical Experience (PEACE) team, decided to utilize brief huddles as an implementation technique. Research suggests that up to 37% of eating disorder patients have comorbid autistic traits (15). PEACE was formed as a direct result of the high level of comorbidity and the evident lack of response to traditional eating disorder treatment for this subgroup of patients (16, 17). It was apparent that this patient group needed a different treatment approach and with no current treatment guidelines available, the PEACE Pathway was innovated. PEACE is a care pathway with the aims of specifically supporting autistic patients with their eating disorder recovery, as well as their cares and clinicians (18). It is currently being piloted in South London and Maudsley NHS eating disorder services and PEACE resources and support materials are available freely online. For full details of PEACE implementation, see Tchanturia et al. (18) and for free materials visit our website: peacepathway.org.

Based on the apparent transferability of huddles [3, (4)], the aim of introducing huddles for this care pathway was: to improve team communication; to support efficient and effective, higher-level care; and to increase patient safety in a large specialist eating disorder (ED) treatment service. This patient groups' resistance to typical eating disorder treatment is a cause for safety concern, with the high mortality rates seen in eating disorder patients (19). Not all ED patients are autistic, so huddles aimed to be brief and weekly to fit with the needs of the Multidisciplinary team MDT they were supporting: evidence suggests tailoring huddles makes the benefits more pronounced (8). Whilst we can infer from our research that over the past 18 months that care has become more efficient and effective as the length of admission of autistic patients has decreased significantly (20), we need to evaluate the role of huddles in this context in order to see if they have a beneficial role in providing higher-level care.

Due to the complexity of EDs and their high medical risk, there is often involvement from different clinical disciplines such as nursing, psychology, dietetics and occupational therapy, making up the MDT. Improving communication and providing efficient and effective care was thought important as research and naturalistic observations provided evidence that autistic people fare far worse in standard eating disorder treatment than those who have low levels of autistic traits (16, 17). With approximately more than 80 members of the MDT, good communication and teamwork is a key element for implementing clinical innovation within a large service.

This study aimed to evaluate the benefits of the piloting use of MDT huddles in eating disorder treatment settings in providing a higher level of care for autistic patients with eating disorders.

METHODS

Design and Period of Study

The implementation of the pathway took place over a national, specialist ED service, which was made up of two different sites: an inpatient/intensive daycare program (IP/ID) and a regular daycare/outpatient program (DC/OP). Due to the geographical distance between the two sites, initially in August 2019, it was decided that each site would have its own face-to-face huddle. Due to COVID-19 restrictions, in April 2020 these two huddles were combined to make on virtual 30-min huddle (see **Figure 1** for a flow diagram showing huddle structure over time). Both settings were clinical services for adults (ages 18+).

The inpatient setting was made up of 18 beds, the intensive daycare program saw 10 patients at capacity, the regular daycare program saw 10 patients at capacity and the outpatient service saw ∼500 patients per year at capacity. Of these eating disorder patients, research estimates that up to 37% are autistic or have high autistic features (15).

Huddle Structure

Both face-to-face huddles lasted 15 min each taking place on different days to allow facilitators to attend both. The facilitators, in this case, were the pathway Principle Investigator (KT) and the Pathway Project Manager (KS). Following Plan, Do, Study, Act (PDSA) quality improvement cycles allowed frequent review of all aspects of implementation, including the huddles (21). The agenda of the huddle started unstructured, to see how the space was utilized and this was dependent on the feedback taken in the evaluation process. However, it always ended in a short evaluation. Toward the end of a year-long evaluation, the structure evolved into fixed pattern: general updates from the PEACE pathway implementation, specific feedback from clinicians on current PEACE patients, any other business and evaluation. Due to COVID-19, the huddles also had to be reviewed, with the last 4 months of huddles taking place virtually. This allowed flexibility in facilitator attendance and the two 15-min huddles, previously separate due to geographical location, merged into one 30-min huddle. With longer huddles, the time was often utilized at the start in the form of a short presentation

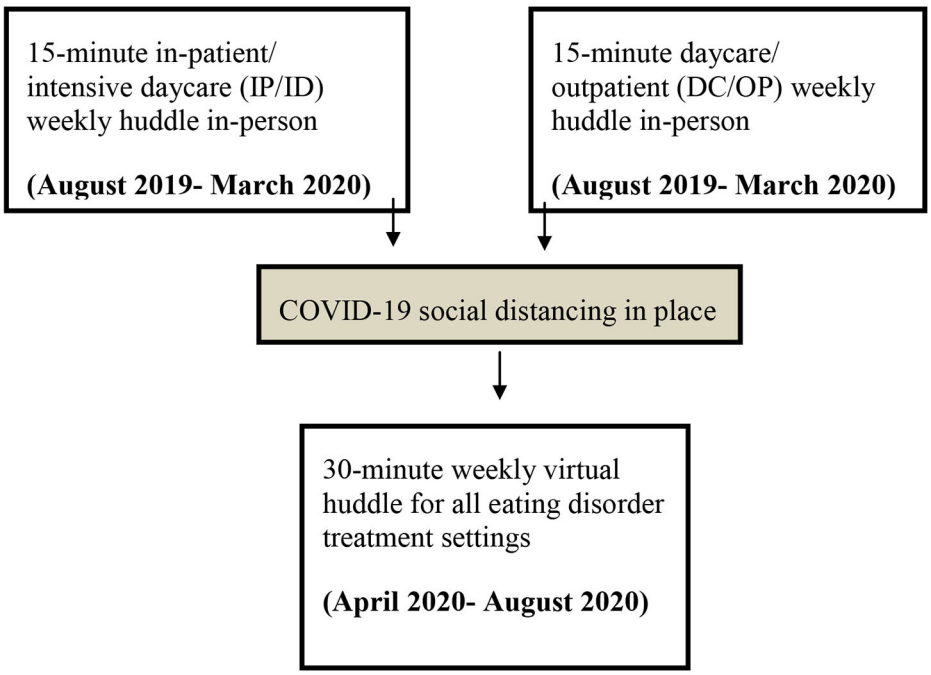

FIGURE 1 | A flow diagram showing the huddle structure over time.

on an adaptation or evaluation of the pathway. For example, if a new resource had been developed, a clinician would present it to the huddle, allowing clinicians to ask questions before it was rolled out and to open a discussion to get feedback for further development. Another presentation on the evaluation of these resources could then be presented after piloting it for a month.

Participants

All members of the MDT were invited to join the weekly face-to-face huddles in their respected sites, and then after COVID-19 all to the same virtual huddle. Attendance was not mandatory, and attendees were welcome to come and go as their availability allowed, this became more relevant when the virtual huddles were extended to 30 min. Ethical approval for the study was obtained from South London and Maudsley NHS Foundation Trust (2019-004) as part of a service development project.

Setting

The face-to-face huddles took place in the meeting room or the conference room at each respective site. These rooms both have seats available for up to 20 people and a dedicated huddle whiteboard for evaluation. After COVID-19, the huddles used a virtual conferencing program with a larger capacity.

Data Collection and Analysis

The evaluation was collected in the form of a short 3-question survey weekly after each huddle. When huddles were face-to-face (pre-COVID-19), this was collected informally on a whiteboard where the three questions were written on the board and each attendee wrote their individual feedback underneath each other's comments after each face-to-face huddle. After the introduction of the virtual huddles, the same three-questions were sent out as a survey *via* email straight after the huddle had ended to each attendee for anonymous feedback.

The three evaluation questions were: 1. "How useful was the huddle?" (attendees were asked to mark /100 on a scale), 2. "What went well?," and 3. "What could be improved?" Question 2 and 3 were open-ended questions. All attendees were encouraged to provide feedback at the end of each huddle.

Authors KS and KT read and reread qualitative data to ensure familiarity with the subject matter. Qualitative content analysis was then conducted on the data response to the two open-ended questions to identify themes (22). KS and KT independently reviewed each sample and proposed variables/themes for the analysis of each question, they then agreed on final variables/themes for each question response and coded each sample independently. The content of these codes in responses to each question was then calculated.

RESULTS

Question 1: How Useful /100 Was the Huddle?

In total, 283 responses were collected with 88 from the IP/ID huddles, 65 from the DC/OP huddles and 103 from the virtual huddles (**Table 1**).

Question 2: What Went Well in the Huddle?

In total, 240 responses were collected to question 2: "What went well?" This was either collected on the whiteboard

after a huddle or *via* the online survey collected after the huddle. Content analysis of the responses identified four distinct themes: organization, pathway progress updates, team contribution/collaboration, learning about the comorbidity (see **Figure 2** for a pie chart demonstrating theme representation in responses to question 2; see **Table 2** for a table demonstrating the frequency and percentage representation of each theme across the different huddles; Examples of each theme and subtheme can be found in **Table 3**).

Theme 1: Pathway progress updates. Feedback regarding appreciation for being kept up to date made up 36% or the responses to question two, the largest theme. Subthemes identified included: knowing about future events and dates, being informed about successes, and challenges the pathway is currently facing (including funding, catering, conferences, informing the team of new resources and PEACE dissemination). Additionally, once the huddles became virtual, a subtheme of updating on progress was identified through expressions of appreciation for the short presentations on the pathway. Theme 1 made up 18% ($N = 14$) of IP/ID responses, 39% ($N = 25$) of DC/OP responses, and 49% ($N = 48$) of virtual responses.

Theme 2: Team contributions/collaboration was expressed by 33% (N=) of responses to question 2. Several subthemes included: generating new ideas together, general discussions about adaptation and implementations, team-work ethos. Another subtheme identified which was only present in the daycare/outpatient and virtual huddle feedback was the discussion of specific cases. Theme 3 made up 40% ($N = 31$) of IP/ID responses, 33% ($N = 21$) of DC/OP responses, and 28% ($N = 27$) of virtual responses.

Theme 3: Organization of the huddle. Positive feedback for how the huddles were organized made up 21% ($N = 51$) of the "what went well" responses. Subthemes included: attendance, structure, facilitation, timing and efficiency. An additional subtheme was identified from the virtual huddle feedback: enjoyment of virtual structure. This theme made up 27% ($N = 21$) of IP/ID responses, 25% ($N = 16$) of DC/OP responses, and 14% ($N = 14$) of virtual responses.

Theme 4: Learning/educative. The final theme identified was the smallest theme and made up 10% of response data to question 2. Subthemes identified here included learning about adaptations, learning about the needs of the PEACE stakeholders and learning about relevant research application. Theme 4 made up 15% ($N = 12$) of IP/ID responses, 3% ($N = 2$) of DC/OP responses, and 9% ($N = 9$) of virtual responses.

TABLE 1 | A table showing the N, M, and Mode weekly responses in each huddle forum to "How useful /100 was the huddle."

Huddle	Number	Mean	Mode
All	283	84	80
Inpatient/ Intensive Daycare	88	85	80
Daycare/Outpatient	65	81	80
Virtual	103	87	100

Question 3: What Could Be Improved?

In total, 117 responses were collected from question three "What could be improved?" After cleaning the data set of

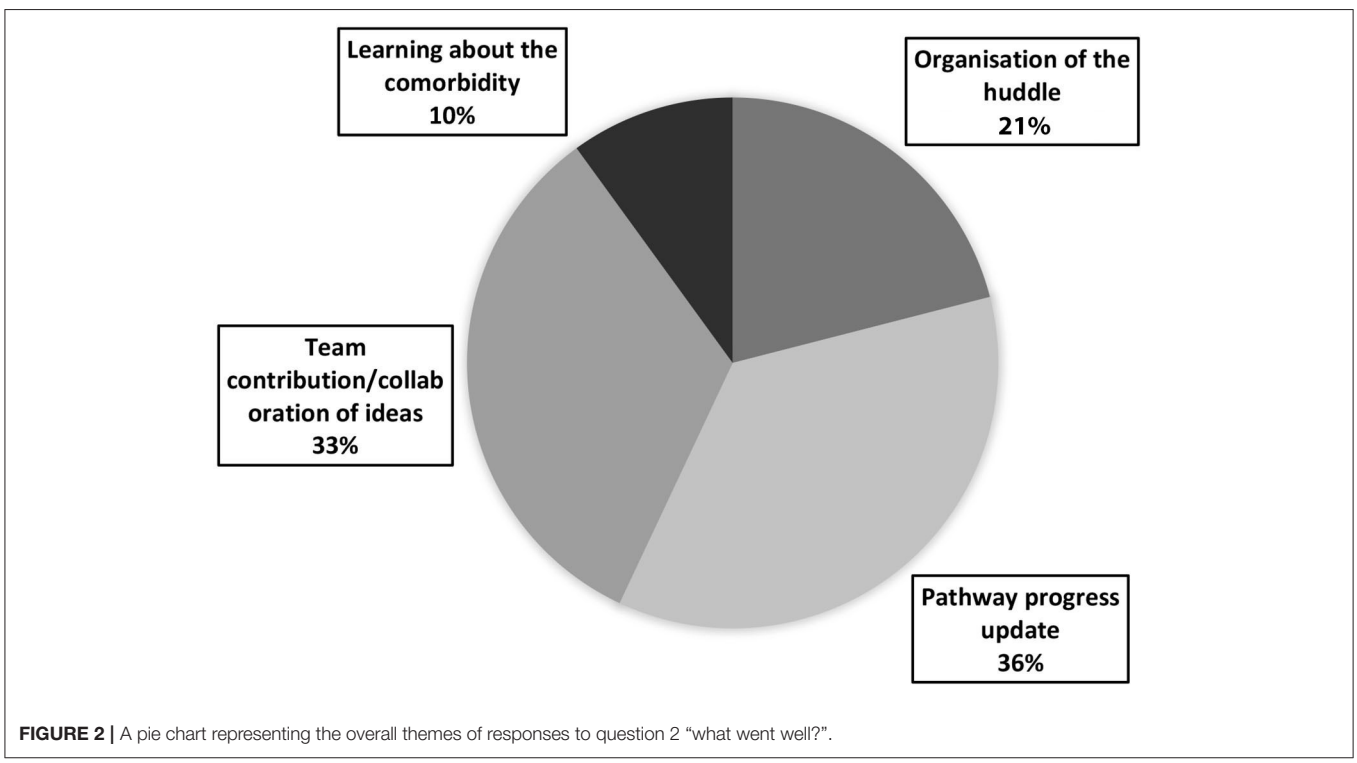

FIGURE 2 | A pie chart representing the overall themes of responses to question 2 "what went well?".

TABLE 2 | A table showing % themes identified from responses across the huddles to question 2 "what went well in the huddle."

	All responses to Q 2	Theme 1: pathway progress updates	Theme 2: team contribution/ collaboration of ideas	Theme 3: organization of huddle	Theme 4: learning about the comorbidity
All	240 (100%)	87 (36%)	79 (33%)	51 (21%)	23 (10%)
Inpatient/ Intensive Daycare	78 (32.5%)	14 (18%)	31 (40%)	21 (27%)	12 (15%)
Outpatient/daycare	64 (26.67%)	25 (39%)	21 (33%)	16 (25%)	2 (3%)
Virtual	98 (40.83%)	48 (49%)	27 (28%)	14 (14%)	9 (9%)

TABLE 3 | A table showing example quotes from each theme and subtheme identified from responses to question 2 "what went well in the huddle."

Theme	Subtheme	Clinician quotes
Theme 1: pathway progress updates	Knowing about future events and dates Being informed about successes and challenges of the pathway Enjoyment of short presentations	*"Exciting to hear about future plans"* *"Keeping up to date with changes"* *"Hearing about the food provision problem "* *"Great to be updated on positive news"* *"A very interesting, useful presentation"* *"Very informative presentation on sensory processing. good links to clinical practice"*
Theme 2: team contribution/collaboration of ideas	Generating new ideas together General discussions around adaptations and implementations Team-work ethos	*"Joint thinking"* *"Lots of useful ideas generated"* *"discussing potential tools to support ASD patients"* *"website discussion and brainstorming generated good ideas"* *"Involvement from different services, and everyone's willingness to listen"* *"very inclusive team with members from all related disciplines"*
Theme 3: organization of the huddle	Attendance Structure/ Facilitation/ Timing and Efficiency Enjoyment of virtual structure	*"Lots of people joined"* *"MDT presence "* *"Smooth and to the point"* *"Well run and structured"* *"Good organization, competent, enthusiastic"* *"Creativity around remote working"* *"Keeping PEACE live throughout the recent upheavals"*
Theme 4: learning about the comorbidity	Learning about adaptations Learning about the needs of the stakeholders Learning about relevant research application	*"It is helpful to hear about the different techniques to use"* *"information giving on opportunities for patient and carers"* *"Understanding more about our clients"* *"very informative- good to know about patient presentations"* *"very informative presentation on sensory processing. good links to clinical practice"* *"Sharing info from conference"*

responses that were irrelevant to our research question (i.e., personal circumstance, writing "N/A" or regarding technical issues), 61 responses were coded using a content analysis approach (22); (see **Figure 3** for a pie chart demonstrating total theme representation in responses to question 3; see **Table 4** for a table demonstrating the frequency and percentage representation of each theme across the different huddles; examples of each theme and subtheme can be found in **Table 5**).

Theme 1: Improved MDT attendance/input. By far the largest theme of the responses was about improving MDT attendance/input. The majority of these responses were in terms of increasing attendance, where a few were on increased involvement from those attending. This theme made up 66% ($N = 22$) of IP/ID responses, 3% ($N = 1$) of DC/OP responses, and 21% ($N = 6$) of virtual responses.

Theme 2: Improvements to structure. This theme made up 21% of overall responses for "what could be improved." Reoccurring suggestions included providing more information before such as a pre-agenda, keeping focus in the meeting and creating action points. This theme made up 6% ($N = 2$) of IP/ID responses, 22% ($N = 2$) of DC/OP responses, and 47% ($N = 9$) of virtual responses.

Theme 3: Punctuality. Making up 20% of response data, punctuality was indicated as something that could be improved in the huddles with staff wanting to finish the meetings on time. Theme 3 made up 6% ($N = 2$) of IP/ID responses, 67% ($N = 6$) of DC/OP responses, and 21% ($N = 4$) of virtual responses.

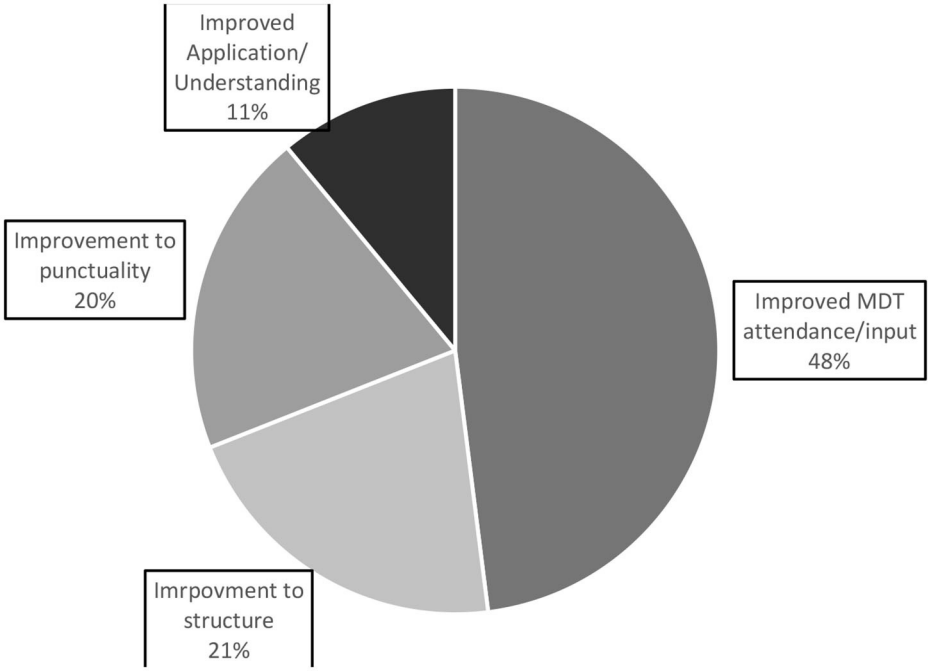

FIGURE 3 | A pie chart representing the overall themes of responses to question 3 "what could be improved in the huddle?".

TABLE 4 | A table showing % themes identified from responses across the huddles to question 3 "what could be improved in the huddle."

	All responses to Q 3	Theme 1: improved MDT attendance/ input	Theme 2: improvements to structure	Theme 3: punctuality	Theme 4: improved application and understanding
All	61	29 (48%)	13 (21%)	12 (20%)	7 (11%)
Inpatient	33	22 (66%)	2 (6%)	2 (6%)	7 (21%)
Outpatient/daycare	9	1 (3%)	2 (22%)	6 (67%)	0 (0%)
Virtual	19	6 (21%)	9 (47%)	4 (21%)	0 (0%)

TABLE 5 | A table showing example quotes from each theme and subtheme identified from responses to question 3 "what could be improved about the huddle?"

Theme	Subtheme	Clinician quotes
Theme 1: improved MDT attendance/input	Attendance	*"attendance I wish more of the MDT could hear it!!!!"*
	Input	*"Even more staff attendance"*
		"More input from attendees"
		"some people did not speak—please join in!"
Theme 2: team improvements to structure	Pre-agenda	*"Email agenda prior to snapshot"*
	Focus	*"Some conversations that are not truly relevant for the larger group"*
	Action points	*"was not really sure what we suggestions we came out of the huddle with"*
Theme 3: punctuality		*"Timing"*
		"Finishing on time"
Theme 4: improved application and understanding		*"learning about what else can be done for our patients "*
	Learning	*"training for newbies!"*
	Improving Application	*"Kitchen noise and foot traffic during mealtimes"*
		"Chance to apply this in an admission "

Theme 4: Improving application and Understanding of the pathway. This final theme made up 11% of overall feedback for question 3 "What could be improved?" Sub-themes for this were more learning and improving application. This theme made up 21% ($N = 7$) of IP/ID responses, 0% ($N = 0$) of DC/OP responses, and 0% ($N = 0$) of virtual responses.

DISCUSSION

This paper looked at how useful weekly huddles are as an implementation technique in implementing an innovative pathway in a multi-disciplinary mental health service. A total of 283 responses evaluating huddles were collected over a 12-months period, and huddles were assessed as useful on average 84/100. Looking at what went well in the huddles, feedback suggested several benefits; keeping the teams updated on the pathway's progress, collaborations and MDT discussions, and education. Feedback suggests huddles were well-organized and well structured. In terms of what could be improved with the weekly huddles, themes identified in the feedback included the need for improved MDT attendance/input, Improvements to structure, improvements in punctuality and improved fostering understanding and application.

Question One: How Useful Was the Huddle?

Overall, all three huddle "types" were well-received, but It is interesting to consider why Virtual huddles, which were twice a long and combined IP/ID and DC/OP staff, were rated higher in usefulness than in-person huddles. We can understand from the literature, that the theoretical underpinnings of huddles may have better been supported in this virtual format.

The virtual huddles were reintroduced in a time of uncertainty (COVID-19 lockdown) and responses showed that people appreciated some form on consistency and opportunity to meet with their colleagues: "Great to catch up with everyone," "keeping in touch with PEACE," "good to check in on everyone now we are remote working," and "Keeping PEACE alive through recent upheavals." This suggests that some form of shared professional identity may have been built, resulting in a sense of belonging and group ownership, as is common with the use of huddles (12). As a result of COVID-19, this professional identity would have been disrupted with many staff working from home, virtual huddles may have given an opportunity to reinstate that identity, leading to a higher level of usefulness. Furthermore, this shared, professional identity could have been strengthened with the introduction of short presentations, which would have increased communication and education (12). Virtual huddles also bridged the gap between the two huddles: "I'm really impressed by how well the PEACE huddles have transitioned to virtual meetings- I think if anything they're better as we get more attendance/ it's nice having combined perspectives from the out/day/inpatient teams." "Hearing what happened in other parts of the service," "joint meeting across the service is great," "The attendance is still really good, better than when we did in-person huddles?" and "I always enjoy the updates from different staff and services," further emphasizing the shared identity and the role regular huddles serve in nurturing that. From the observation of the principal investigator (corresponding author), the huddles created a space for shared knowledge, developing culture and confidence to implement the PEACE pathway.

Question Two: What Went Well in the Huddle?

We examined the themes identified to understand how huddles were received as an implementation technique. We wanted to know if the themes supported the theoretical underpinnings of huddles for this innovative clinical pathway and if huddles are transferable as implementation techniques.

Our four themes identified were: pathway progress updates, team contribution/collaboration of ideas, organization, and learning about the comorbidity. Theoretical underpinnings of huddles have been identified as promoting benefits to attendees such as teamwork, communication, education and training, and shared professional identity (12).

Theme one "pathway progress updates" made up 36% of total responses. From the literature, we can infer that our first theme relates to the shared professional identity around the new pathway, and this identity was created and dynamically constructed through participation in huddles (12). Attendees felt invested in the pathway, meaning that updates specifically around the pathway progress were seen as highly important. Furthermore, this theme featured most strongly in virtual huddles (49%) which supports this interpretation. Professional identity is likely to diminish and become more uncertain through remote working during the COVID-19 pandemic and because we joined the two huddles together, prompting shifts in identity constructions. Also looking at the theoretical underpinnings of a huddle, we can see this theme of updates incorporates communication. Enhanced communication is a desired benefit of huddles leading to team cohesion as failure to communicate has often been identified as the reason for medical errors (23). The theme confirms the theoretical underpinnings of huddles and demonstrates the potential transferable nature of huddles as a valuable technique or strategy in implementing and integrating an innovative pathway.

The second theme, "team contribution/collaboration of ideas" made up 33% of total responses. Again, looking at the theoretical underpinnings of huddles, we can see alignment in the importance of the role of teamwork, communication, and shared professional identity. These themes made up the largest part of IP/ID huddles responses (40%), higher than in the other two huddles (DC/OP- 33%, virtual- 28%), probably because the IP/ID programmes require an MDT given the higher medical risk to patients. The DC/OP services run more independently with some patients only seeing one member of staff in OP, meaning that team cohesion from an MDT may not have existed before joining the huddles. A separate sub-theme of the value of specific case study discussions was identified and was not present in the other groups. This suggests that the DC/OP huddle was utilized more as group supervision for individual cases where attendees had an opportunity to share ideas and develop consistency in treatment implementation. Huddles, therefore, created teamwork which creates cohesion. We know that without teamwork and cohesion bad things happen to patients.

Data from the IP/ID produced subthemes of generating ideas together, general discussions about adaptation and implementations and team-work ethos. The IP/ID programmes already have allocated spaces to discuss shared cases

collaboratively and therefore clearly utilized huddles differently. This demonstrates the transferable nature of huddle as an implementation technique, and how it adapts depending on the needs of the group. We know that structuring the huddle to suit the needs of the attendees brings pronounced benefits (8). In this case, the group and feedback determined the structure. We need to mindful that the group's determination of how a huddle is utilized may clash when combining groups. However, with the weighting of this theme focused on teamwork ethos, it would seem the benefits of combining the two groups outweighed the balancing of differing needs.

Theme three "organization of the huddle" made up 21% overall of feedback on what went well in the huddle. This was made up of several subthemes: attendance, structure, facilitation, timing and efficiency. An additional subtheme from the virtual huddle feedback was enjoyment of virtual structure. With attendance being the largest sub-theme of "organization of the huddle" we can see again how valuable that shared identity (12) is to the huddle attendees. This themes also demonstrates the value of the structuring the huddle to suit the needs of the attendees for pronounced benefits (8). We can also see with the introduction of the subtheme "enjoyment of the virtual structure" that attendees valued combining the huddles to emphasize the teamwork and shred professional identity as well as the role of education as a theoretical underpinning for huddles (12) with the introduction of brief, educative presentations.

Theme four of question 1: "what went well" was "learning/educative" and made up 10% of responses. Subthemes identified included learning about adaptations, learning about the needs of the PEACE stakeholders and learning about relevant research application. This was identified most in IP/DC (15%, then virtual (9%) and then 3% for DC/OP. When looking at the underpinning themes of huddles again, education and communication are both highlighted, which suggests that the huddles are a valuable implementation technique due to their transferable nature.

Question Three: What Could Be Improved?

For question 3: "what could be improved," four themes again were identified. These were: improved MDT attendance/input, Improvements to huddle structure, punctuality and application & understanding. This was useful in seeing how elements of huddles were perhaps not transferable or highlighting aspects to attend to when using huddles as implementation techniques.

Theme 1 was "improved MDT attendance/input." This was by far the majority of IP/ID responses, making up 66% what could be improved. This reflects the importance of MDT treatment cohesion, how the inpatient model relies heavily on the MDT and how clinical innovations can be hard to implement if the attendance/input is not representative of all disciplines. It suggests that the huddle could be more useful if there was greater representation from diverse disciplines: "Attendance- I wish more of the MDT could hear it!," "More disciplines," and "Other disciplines to attend." This is contrasted to only 3% of DC/OP identifying this because as already discussed, multidisciplinary cohesion is not a norm. The virtual huddle responses predictably represented both with 22% of responses suggesting there was a lack of MDT representation. Again, this theme could be interpreted as supporting how the team value the shared identity and teamwork, and how they want more attendees and disciplines to join (12).

Theme 2 was "Improvements to structure," making up 21% of total responses. This was considerably higher for the virtual huddles (47 vs. 6% and 22%) which reflects the novel structure of the virtual huddles and the need to refine the structure as these incorporated two different groups. The refinements happened over time using the PDSA format.

This theme also covered content, including suggestions on how to improve huddles with "Email agenda prior" being the most popular. This was implemented during the virtual huddles. Other responses included the need to keep a focus in the huddles: "Some conversations that are not truly relevant for the larger group," as well as creating action points: "Was not really sure what suggestions we came out of the huddle with." This feedback makes it clear that in implementing this type of huddle, a pre-agenda (and sticking to it) is useful for keeping focused. Creating action points after each huddle is needed, perhaps documenting these in the minutes. However, some of this data might arise from the necessary combining of two huddles, as there may be information shared which is only relevant to one treatment program, and therefore not "for the larger group." Further structure refinements could improve this.

Theme 3 for question 3 was "Punctuality," and it made up 20% of responses. This was particularly noted in DC/OP huddles where 67% of responses to question 3 were in regards to running to time. This could be due to the fact that these huddles would often be used to discuss individual cases more, perhaps leading to a looser agenda and consequently running overtime.

Theme 4 for question 3 on how the huddles could improve was "improved application and understanding," representing 11% of responses. Interestingly, this theme was only found in IP/ID responses (21%). This could be due to research suggesting that patients with the comorbidity have more severe clinical presentations and longer inpatient admissions (16, 17), perhaps meaning the IP/ID clinicians encountered this comorbidity more and that application and understanding was more important. The fact that this was not highlighted in the virtual huddles feedback could mean that the introduction of presentations satisfied this need.

Future Research and Limitations

Future research could examine the option of implementation of a virtual huddle or face-to-face, determining which format is best received in different clinical settings. Examining the application of huddles to other clinical implementation pathways would be useful. Another direction could be to evaluate care effectiveness and efficiency as a result of regular huddles.

One limitation of this study is that in the face-to-face huddles, feedback was not completely anonymous. Although the facilitators did not monitor the identity of anyone writing feedback on the whiteboard, other team members would have seen what was being written. This could have impacted what attendees wrote down due to social perception and wanting to be in the in-group. Furthermore, with the scale

on question one, attendees would often cluster their score around the first score noted down. Although this was a pilot study and to ensure that the maximum amount of feedback was received meant making the evaluation as time-efficient and straightforward as possible. Future research may want to make this face-to-face data anonymous. A further limitation of this study is its implementation to a single service, giving a limited scope for the data as well as a potential bias. However, as previously mentioned this was a pilot study, which allows for other groups to adopt practice and further evaluate effectiveness.

CONCLUSIONS

Overall, the data suggest that weekly huddles for quality improvement implementation were well-received and useful, both face-to-face and virtually. The weekly evaluation suggested that huddles are a useful implementation tool in creating a shared identity, teamwork culture and space for education in innovation implementation. This highlights the value of huddles and demonstrates their transferability (12). The longer, virtual huddles were potential better received due to it reintroducing a sense of structure, shared identity and learning during the COVID-19 pandemic. Furthermore, they bridged the gap between different treatment teams and allowed more detailed updates. Pathway progress updates were well-received in all the huddles, with team contributions and attendance being most valuable in inpatient/intensive daycare huddles. Attendees appreciated when the huddles were well-structured and lead by an agenda, as well as keeping to the allotted time. Pre-agendas, agendas and brief presentations were looked on favorably and helped to keep the huddle focused. The data suggested that the huddle may have different benefits for each treatment team, with outpatient clinicians, often working individually, enjoying using the huddle time as group supervision and the inpatient/intensive daycare team looking for more opportunity for understanding and application. Huddles in the context of novel clinical pathway developments are valuable in creating a shared identity, culture, and educative space.

DATA AVAILABILITY STATEMENT

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

ETHICS STATEMENT

The studies involving human participants were reviewed and approved by Ethics 2019-004 from South London and Maudsley NHS Foundation Trust governance committee. Written informed consent for participation was not required for this study in accordance with the national legislation and the institutional requirements.

AUTHOR CONTRIBUTIONS

KS and KT collected, analyzed the data, and wrote the paper. KT is the principal investigator of the PEACE pathway project, developed the study protocol, and supervised team. KS is a project manager collecting the data and managing day to day activities in the project. All authors contributed to the article and approved the submitted version.

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BRIEF RESEARCH REPORT
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Exploring Differences in the Role of Hospitalization on Weight Gain Based on Treatment Type From Randomized Clinical Trials for Adolescent Anorexia Nervosa

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Background: This study explores the impact of weight gain during medical stabilization hospitalization on weight outcomes between three outpatient treatments for adolescent anorexia nervosa (AN): Adolescent Focused Therapy (AFT), Systemic Family Therapy (SyFT), and Family Based Treatment (FBT).

Methods: A secondary analysis of weight gain data ($N = 215$) of adolescents (12–18 years) meeting DSM-IV criteria for AN (exclusive of amenorrhea criteria) who participated in two randomized clinical trials (RCTs) was conducted. Main outcomes examined were changes in weight restoration (≥95% expected body weight or EBW) and differences in weight change attributable to hospital weight gain.

Results: Weight gain resulting from hospitalizations did not substantially change weight recovery rates. Hospital weight gain contributed most to overall treatment weight gain in AFT compared to FBT and SyFT.

Conclusion: Brief medical stabilization weight gain does not contribute substantially to weight recovery in adolescents with AN who participated in RCTs.

Keywords: anorexia, hospitalization, inpatient, weight gain, treatment outcome, adolescent

INTRODUCTION

Medical hospitalization to address the physiological effects of starvation and related maintaining behaviors of Anorexia Nervosa (AN) plays an important role when treating adolescents with AN. However, the extent to which hospitalization contributes to weight restoration is unclear. The few available studies suggest limited impact (1, 2). Madden et al. (3) found no benefit of longer term hospitalization aimed at achieving higher weights for patients receiving Family-based Treatment (FBT) upon discharge, suggesting that limited hospital stays were sufficient

for these patients. Additionally, prior studies found that hospitalization rates differ between outpatient treatments for adolescents with AN, leading to significant differences in cost-effectiveness between treatment types (4, 5). However, it is unknown whether hospitalization during evidence-based outpatient treatments for adolescent AN differentially contributes to overall weight outcomes depending on treatment type. Thus, the purpose of this retrospective exploratory study is to examine the relative impact of hospital weight gain on treatment outcomes [i.e., weight restoration: ≥95% expected body weight (EBW)] (6, 7) in the context of three outpatient treatments: FBT (8), Adolescent Focused Therapy (AFT) (9), and Systemic Family Therapy (SyFT) (10), employed in two randomized clinical trials (RCTs) for adolescents with AN.

While hospitalization for psychiatric and behavioral treatment of adolescent AN is a potentially important component of care and outcome, the current study focuses on the role of brief medical hospitalization used to treat medically unstable adolescents with AN in studies of outpatient psychosocial interventions for this disorder. These hospitalizations are unplanned and occur in response to medical instability. Medical instability results from physiological impacts of behaviors that maintain AN and can result in bradycardia, hypotension, and orthostatic hypotension (11). In addition, starvation and rapid re-feeding can result in blood chemistry changes leading to potentially lethal re-feeding syndrome (12). Treatments during medical hospitalization vary, but in general these admissions focus on promoting safe but rapid weight gain through close meal monitoring, limited activity, focused psychological support for patients and parents, and preparation for discharge to outpatient care (13). Lengths of stay for medical hospitalization vary but are usually between 1 and 3 weeks for adolescents in the US and Canada (14, 15).

There are few RCTs for adolescent AN; two relatively large studies examined individual therapy aimed at promoting adolescent development in the context of AN (AFT), systemic family therapy (SyFT) aimed at improving family communication and process in the context of AN, and family-based treatment (FBT) aimed at parental behavioral management of weight gain and adolescent development (4, 5). Results of these RCTs found that FBT had higher rates of recovery than AFT at follow-up and was more cost-effective than SyFT.

While previous studies demonstrate that FBT generally uses less medical hospitalization than AFT and SyFT (4, 5), the impact of hospitalization on weight gain itself is unaccounted for in the outcomes. Thus, weight gain during hospital admissions might vary between treatment types and contribute differentially to weight restoration. Based on the previous studies we expect that when looking at the entire sample (both hospitalized and non-hospitalized participants), hospital weight gain will likely have minimal effects on weight recovery rates, or remission, regardless of treatment type. When looking at the impact of hospitalization weight gain on end-of-treatment (EOT) weight outcomes, we predict differing effects of hospitalization depending on treatment type. Specifically, we anticipate greater overall impacts on weight at EOT for participants receiving individual treatment (AFT) compared to family treatment (FBT or SyFT). This hypothesis is rooted in prior literature (4), reporting that in AFT, alliance building and relatedly weight progress takes longer than in FBT, resulting in a prolonged period of time during which the adolescent is more medically vulnerable. Hospitalization for adolescents receiving AFT may serve as a "safety net" while they develop the motivation and skills to change behaviors independently. These hypotheses are exploratory due to the preliminary nature of this study. Results stand to inform future systematic studies designed to investigate the role of hospitalization on weight outcomes in adolescents receiving evidence-based treatments for AN.

MATERIALS AND METHODS

Data used in this study were collected from two RCTs of adolescents (ages 12–18) who met DSM-IV criteria for AN (exclusive of amenorrhea criteria). The first clinical trial randomized participants ($N = 121$) to receive either FBT or AFT in a two-site study (4); the current data are only those recruited at the Stanford site ($N = 60$), as The University of Chicago did not have a dedicated inpatient unit and participants were admitted, when appropriate, to facilities outside of the university. The second clinical trial randomized participants ($N = 158$) to receive FBT or SyFT in a 6-site study (5). For this paper, the FBT samples from the two RCTs were combined. The studies were reviewed and approved by their respective Institutional Review Boards and all participants provided written informed consent or assent.

The criteria for hospitalization at the time of the study followed the guidelines of the American Academy of Pediatrics (16) and the Society for Adolescent Medicine (17) for medical hospitalization of adolescents with AN: heartrate <45 beats-per-minute, orthostatic blood pressure changes >35 points, gastrointestinal bleeding, dizziness, syncope, EBW <75%, body temperature below 36°C, electrolyte abnormalities, and/or prolonged QTc. Using these criteria, a total of 59 participants (27%) were hospitalized for medical reasons during the treatment period of the two studies: AFT = 48% (16/33); SyFT = 22% (17/79); FBT = 19% (20/106).

Demographic characteristics of the hospitalized sample can be found in **Table 1**. The outcome variables of interest were: (1) Hospitalization days and number of admissions for medical stabilization by treatment type; (2) Total hospital weight gain; (3) Treatment weight gain; (4) Change in EOT weight outcomes (defined as EBW percent for age, height, and sex, using CDC norms) from baseline to EOT; (5) Timing of hospitalization (weeks in treatment until first hospitalization). Weight was measured and is reported in kilograms.

The effect of hospitalization on weight outcomes according to treatment allocation was calculated by subtracting the mean hospital weight gain from the mean weight gain at EOT for each individual participant and from this, calculating a mean difference score for weight. This new "adjusted" weight was then used to re-calculate percent EBW for age, height and sex using CDC norms, producing an "adjusted EBW" for each participant, accounting for hospitalization weight gain. Weight recovery or

TABLE 1 | Demographics by treatment type.

	AFT ($N = 33$)	SyFT ($N = 79$)	FBT ($N = 106$)
Age M (SD)	14.7 (1.3)	15.0 (2.4)	14.4 (1.7)
Sex (%)			
Male	3%	7.6%	13.2%
Female	97%	91.1%	86.8%
Race (%)			
Asian	18.2%	5.1%	10.4%
Black or African American	3%	–	–
White	72.7%	92.4%	82.1%
More than one race	6.1%%	2.5%	7.5%
Ethnicity (%)			
Hispanic/latino	6.1%	12.7%	11.3%
Not hispanic/latino	93.9%	87.3%	88.7%
Baseline % EBW M (SD)	80.0 (3.8)	81.8 (3.7)	82.1 (3.6)
Medications at baseline (%)	6%	37.9%	24.5%

remission was defined as ≥95% EBW, consistent with prior research demonstrating this criterion as the best predictor for long-term recovery (6, 7). The entire sample, including those not hospitalized, was assessed to calculate differences in number of people meeting weight recovery after accounting for hospital weight gain.

Timing (by weeks of treatment) of hospitalizations was determined by average number of weeks in treatment to first hospitalization by group and number of weeks in treatment to each admission thereafter (if there were multiple admissions). Frequency of hospitalizations and multiple admissions were not controlled for in the current analyses.

Data were analyzed using SPSS version 26.0. Analyses involving the subset of participants who were hospitalized were not normally distributed and had unequal cell sizes, thus non-parametric statistics and *post-hoc* analyses were utilized. All measures of central tendency reported are medians (Mdn) with Interquartile Ranges (IQR) or frequencies (count). Due to the exploratory nature of this study, we report effect sizes (ES) for comparisons, specifically, success rate differences (SRD).

RESULTS

For those hospitalized during the study, the median number of hospitalized days in SyFT was 23 (IQR = 15–31), compared to a median of 6 days in AFT (IQR = 4–14) and 9.5 days in FBT (IQR = 5–16.8).

Weight Remission

Medical hospitalization had little effect on the number of participants who were weight recovered at EOT. When accounting for weight gained during hospitalization, the recovery rates in each group were: FBT = 44/106 or 41.5% (unchanged); SyFT = 21/79 or 26.6% (vs. 27.8% when including hospitalization weight gain); AFT = 6/33 or 18.2% (vs. 21.2% when including hospitalization weight gain).

Weight Change

Hospitalization impact on weight outcomes for the entire sample differed depending on the type of outpatient treatment: hospitalization contributed most to EOT weight outcomes in AFT where 7.2% of EBW was attributable to hospital weight gain (**Table 2**). For SyFT and FBT, hospital weight gain did not contribute to EBW at EOT. The differences in percent EBW at EOT after removing hospital weight gain (i.e., "adjusted EBW") differed between treatment arms with large effect sizes, with AFT < SyFT: Mann-Whitney $U = 773.5$; SRD = 0.40 and AFT < FBT: Mann-Whitney $U = 901.5$; SRD = 0.48.

Timing of Hospitalization

For FBT and SyFT more than half of all hospitalizations occurred within the first 5 weeks of treatment. In FBT, 54% of the sample was hospitalized within the first 5 weeks ($n = 14/26$) and in SyFT, 57% of the sample was hospitalized within the first 5 weeks ($n = 11/19$). In contrast, in AFT, only 29% ($n = 13/42$) of hospitalizations occurred within the first 5 weeks of treatment. Additionally, 50% ($n = 8/16$) of hospitalized participants in AFT had multiple admissions, whereas 29% ($n = 5/17$) in SyFT and 25% ($n = 5/20$) in FBT had multiple admissions.

DISCUSSION

These results support our first exploratory hypothesis that weight gain attributable to medical hospitalization would have little impact on EOT weight restoration, regardless of outpatient treatment type. This is an important finding because it supports the view that outpatient treatment is the most salient factor in overall weight restoration for adolescent AN. This is not to suggest that medical hospitalization is not necessary for the safe treatment of adolescent AN, but rather to recognize that the effects of such treatments on weight restoration are circumscribed. These results are aligned with prior literature (3), reporting medical stabilization alone when followed by FBT was as effective and less costly than longer term hospitalization aimed at full weight restoration.

Consistent with our second exploratory hypothesis predicting differing impacts of hospitalization according to treatment type, the data show that hospitalization weight gain had the greatest benefit for those treated using AFT relative to SyFT and FBT. AFT relies on helping the adolescent with AN learn to manage their eating and weight gain as opposed to parental management, thus hospitalization is likely to be needed more often to mitigate health risks as the adolescents themselves are learning to make necessary behavioral changes.

There are important limitations to consider. This secondary data analysis is exploratory in design, intended to generate hypotheses for further examination rather than conduct significance testing. The sample size, especially for AFT, is limited because the data is not available; to address the disproportionate sample sizes between groups, non-parametric statistics are reported. Although differences in hospitalized and non-hospitalized participants were not apparent at baseline, the data support existing literature that hospitalization is sometimes

TABLE 2 | Hospitalization outcomes[†].

Entire sample	**AFT (*N* = 33)**	**SyFT (*N* = 79)**	**FBT (*N* = 106)**	**SRD[‡]**
% of total sample hospitalized	49%	22%	19%	
Number of admissions	42	19	26	
Number of patients with repeat admissions	8 of 33	5 of 79	5 of 106	
Weight gained in treatment (kg)	5 (1.6–7.9)	4.9 (2.3–8.7)	5.9 (3.5–10.2)	
% EBW EOT	89 (79.6–93.9)	89 (84.1–95.3)	92.6 (86.2–98.1)	
% EBW "adjusted" (hospital weight gain removed)	81.8 (75.9–92.9)	88.9 (84.1–95.4)	92.6 (86–96.9)	AFT<SyFT: 0.40
				AFT<FBT: 0.48
% change in EBW attributable to hospitalization	7.2%	0%	0%	
Number of patients ≥95% EBW	7	22	44	
% of total sample weight restored	21.2%	27.8%	41.5%	
Number of patients ≥95% EBW (after removing hospital weight gain)	6 (vs. 7)	21 (vs. 22)	44 (vs. 44)	
Adjusted % of total sample weight restored	18.2%	26.6%	41.5%	
Hospitalized Sample	**AFT (*N* = 16)**	**SyFT (*N* = 17)**	**FBT (*N* = 20)**	**SRD[‡]**
Median number of days hospitalized	6 (4–14)	23 (15–31)	9.5 (5–16.8)	SFT>FBT: 0.54
				SFT>AFT: 0.69
Weight gained in treatment (kg)	3.9 (2–5.7)	3.5 (2–5)	3.1 (1.5–6.6)	
% EBW EOT	88 (77.8–94.9)	83.7 (80.1–94.2)	92 (79.7–101.2)	
% EBW "adjusted" (hospital weight gain removed)	78 (71.3–89.74)	78.9 (73.7–92.4)	92 (73.3–96.7)	

[†] All statistics are reported medians (Mdn) and interquartile range (IQR) unless otherwise specified. [‡] Effect size used is success rate difference (SRD) given the use of pairwise comparisons of treatments with unequal variances. Here, SRD = 0.1, 0.3, 0.4 can be interpreted as small, medium, and large effect sizes, respectively (18).

necessary to stabilize adolescents for outpatient care. For this subset of patients, it is possible that hospital admissions helped correct the course of treatment by allowing patients to stabilize vital signs and resume outpatient therapy. The outcome assessed is only related to weight restoration at EOT; while predictive of overall recovery at follow-up, it remains a limited outcome variable (6). Hospitalization in this study was restricted to medical necessity and the findings should not be extended to the use of psychiatric or behavioral hospitalization for adolescent AN or to other countries, health systems, or programs that use hospitalization for different indications in AN. There was a slight difference in treatment length and duration in the FBT treatment studies (24 sessions over 12 months vs. 16 sessions over 9 months), but this difference likely had little impact on hospital use, as almost all hospitalizations in FBT occurred early in treatment regardless of overall number of sessions or duration of treatment. While medical hospitalization criteria were consistent across sites and treatments, these criteria have not been systematically examined to determine their validity and reliability in preventing or limiting the medical sequelae of adolescent AN. Further, not all participants were admitted to the same medical hospitalization program; thus, it is possible that inpatient programming may differ across hospitalization sites and lead to differences in rate of weight gain. Across the seven sites, average hospitalization length of stay ranged from M = 7.6, SD = 2.1 to M = 21, SD = 2.The study's small sample size limited further investigation into site-related differences. The study's small sample size limited further investigation into site-related differences. Additionally, while all participants in this study were hospitalized consistent with published medical guidelines, we do not have data specific to the circumstances which preceded each hospitalization. Sex differences between treatment groups did not reach statistical significance (p = 0.14); however, it is possible that the distribution of sex across groups may have differentially impacted weight outcomes. Lastly, no hospitalized participants identified as American Indian or Alaska Native, and Native Hawaiian or Other Pacific Islander, which may limit generalizability of findings to these minority groups.

The results of this exploratory study suggest that further investigation of the role of medical hospitalization for adolescent AN is warranted. Additionally, clinicians providing AFT, FBT, and SyFT should be confident that these outpatient approaches, though varying in overall rates of recovery, do not obtain their respective treatment effects based on weight restoration as a result of medical hospitalization.

DATA AVAILABILITY STATEMENT

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

ETHICS STATEMENT

The studies involving human participants were reviewed and approved by the appropriate Institutional Review Boards at

each institution. Written informed consent to participate in this study was provided by the participants' legal guardian/next of kin.

AUTHOR CONTRIBUTIONS

ND: formal analysis, conceptualization, and writing. BM: conceptualization, writing, review, and editing. DL: funding acquisition (R01-MH-070620), writing, review, and editing. HB: funding acquisition (MH 076254), writing, review, and editing. BW: funding acquisition (MH 076252), writing, review, and editing. KH: funding acquisition (MH 076251), writing, review, and editing. DW: funding acquisition (MH 076255), writing, review, and editing. JL: funding acquisition (R01-MH-070621), supervision, conceptualization, and writing. All authors contributed to the article and approved the submitted version.

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Motivation-Enhancing Psychotherapy for Inpatients With Anorexia Nervosa (MANNA): A Randomized Controlled Pilot Study

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Patients with anorexia nervosa (AN) are frequently characterized by an unstable readiness to change and high ambivalence toward treatment. Enhancing readiness to behavioral change therefore plays an essential role for adherence to treatment especially for severely ill patients treated in inpatient settings. Therefore, a novel 10 week program for the individual psychotherapy sessions was designed using elements from motivational interviewing to be applied within the multidisciplinary inpatient treatment for patients with AN. In a randomized controlled pilot trial, $N = 22$ patients with AN received either the new intervention or treatment as usual in one of two recruiting university hospitals. Readiness to change, eating disorder pathology, therapeutic alliance as well as acceptance and feasibility of the new intervention were measured from patients and therapists in week 1, 5, and 10 of inpatient treatment. Results confirm acceptance and feasibility of the MANNA intervention as evaluated by patients as well as therapists. Patients receiving the new intervention completed their inpatient treatment significantly more often on regular terms than patients receiving treatment as usual. No differences between the groups could be found concerning therapeutic alliance during and at the end of treatment and readiness to change. Absolute numbers of BMI increase indicate a larger increase in the intervention group albeit not significant in this pilot study sample. Limitations of the study such as the small sample size as well as possible adaptions and advancements of the intervention that need to be examined in a larger clinical trial of efficacy are discussed. This phase II study is registered with the German Clinical Trials Register (DRKS) under the trial number DRKS00015639.

Keywords: anorexia nervosa, inpatient treatment, psychotherapy, readiness to change, ambivalence, therapeutic alliance

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INTRODUCTION

Anorexia nervosa (AN) is an eating disorder characterized by significantly low body weight, an intense fear of weight gain or becoming fat and body image disturbances [DSM-5; (1)]. Due to their low weight, patients are at risk for somatic complications such as cardiovascular complications, impairment of the gastro-intestinal tract or osteoporosis (2). Psychological sequelae such as

depressed mood, social isolation, and a low quality of life are also highly prevalent (2–4). Taken all of these risks together, AN is known to be the mental disorder with the highest mortality rate in young females (5). Despite the seriousness of the disorder, patients with AN frequently experience an unstable readiness to change and high ambivalence toward treatment due to the ego-syntonic nature of the eating disorder (6).

This is especially relevant for severely ill patients who need high intensity treatment in inpatient settings due to potentially life-threatening stages of the disease. Patients with severe AN are usually admitted to inpatient therapy under difficult conditions such as very low body weight with acute malnutrition including e.g., disturbed serum minerals and the risk of refeeding-syndrome. They might have experienced failure of multiple other treatment approaches in varying settings in the past and may experience emotional pressure from families/friends to seek therapy. Still, patients with AN often display insufficient comprehension of the severity of their medical situation and might even oppose weight gain. The therapeutic structures however usually include contingency contracts for controlled weight gain as one of the main goals of treatment. They often foster ambivalence since patients with AN often may want to "overcome" the eating disorder but are reluctant to any weight gain (7, 8).

In Germany, inpatient treatment for patients with AN is advised if the body mass index (BMI) is below 15 kg/m^2, rapid weight decrease happened (<20% in 6 months) or if there are severe other eating disorder symptoms, psychological, familial, or social factors that make success in outpatient or partial hospitalization settings unlikely (9). In addition to somatic monitoring and treatment, patients with AN routinely receive high doses of individual psychotherapy (2–3 sessions per week) as well as group psychotherapy, nutritional counseling, body-oriented therapy, and art or music therapy. The inpatient treatment is usually provided by a multidisciplinary treatment team consisting of physicians, psychologists, specialized nurses, nutritionists, physiotherapists, and other specialized therapists.

Despite efforts to improve outcomes through the described multidisciplinary treatment settings, about one third of patients did not show a significant response to inpatient therapy in a study by Schlegl et al. (10). Their results from analyzing a sample of over 400 patients with AN however emphasize the relevance of high internal motivation as a predictor of good outcome in therapy at the time of discharge (10). They therefore suggest the utilization of techniques for enhancing motivation and increasing patients' readiness to change such as motivational interviewing (MI).

MI according to Miller and Rollnick (11) is an approach for helping people to change their thinking and behavior. It was initially developed for the areas of substance abuse and health-related problems (e.g., smoking cessation) and has since been applied and shown promise for behavior change in various medical care settings such as dangerous drinking, dental caries, smoking abstinence, quality of life, and self-monitoring as well as psychotherapy (12, 13). Especially in psychotherapy, MI is frequently not used as a "stand-alone treatment" but integrated as the framework or stance under which psychotherapeutic interventions are conducted (14).

Due to the primary goal of resolving ambivalence and increasing intrinsic motivation to change, integrating MI into the treatment of patients with AN seems promising (15, 16). A review found mixed results but some promise of MI interventions in the field of eating disorders (17). For the treatment of AN specifically, more recent studies also show support for MI in enhancing treatment adherence and building a good therapeutic alliance between patients and therapists (18, 19).

Considering these aspects, we aimed at developing an intervention for the inpatient treatment of severely ill patients with AN. This intervention integrates MI into established inpatient intervention modules/techniques in the treatment of AN to enable incremental adaptation of treatment settings in case of the success of the trial. The aim is to increase intrinsic motivation to change in patients with AN, improve adherence to treatment (reduce dropouts) and strengthen therapeutic alliance.

For the development of the novel treatment manual, structural guidance was taken from Carroll and Nuro (20) with regard to developing a stage I psychotherapy manual suitable for pilot and feasibility testing. The authors provide advice on the general outline of such manuals in terms of elements to be included [see Table 2 in (20)], elements critical to this stage of development and suggest a model for delineating treatments. This guided approach enables the development of a "clinician-friendly" manual that can facilitate its implementation into clinical practice.

The objective of the present pilot study was to investigate the newly developed manual for inpatient treatment of patients with AN in comparison to the usual treatment concerning its acceptance and feasibility as well as impact on treatment adherence and therapeutic alliance. Our hypotheses were: (1) The investigated intervention is acceptable and feasible for patients as well as therapists, (2) Patients receiving the new intervention show a higher motivation to change, better treatment adherence as well as a stronger therapeutic alliance than patients receiving the treatment-as-usual, (3) Patients receiving the new intervention show greater weight gain and improvement in eating disorder associated psychopathology than patients receiving the treatment-as-usual (exploratory analysis). Additionally, one important aim of this study was to gain insight into (subjectively) needed improvements and adaptions to the intervention as suggested by patients and therapists.

MATERIALS AND METHODS

The MANNA Intervention

The therapeutic style used in MANNA is that of MI according to Miller and Rollnick (11) as described in the introduction. Two experienced experts performed training sessions with all study therapists on the theoretical background and structure of MI, different techniques as well as conducting practice exercises. Emphasis in the training was put on the therapeutic stance of MI as well as basic skills.

Basic skills in MI are represented by the OARS acronym. O thereby refers to asking open questions, A refers to using affirmations, R to reflective listening and S to summarizing.

Additionally giving information and advice is a basic skill used to prevent the therapist from adopting the role of "the expert" and providing uninvited advice to the patient (e.g., "You really should quit…," "I would...") (14).

Core of the intervention materials and orientation over the course of treatment are worksheets that are worked on (often after the patient has started the worksheet on his/her own as a homework) at a mean frequency of one worksheet per week. This mean frequency was chosen to account for the structured environment of inpatient setting on one hand and allow for the need for flexibility to address the patients' individual needs and potential comorbidities by the therapist on the other hand. An overview and brief descriptions of the worksheets of the MANNA intervention can be found in **Figure 1**.

The MANNA intervention was designed for the first 10 weeks of inpatient individual psychotherapy sessions in the multidisciplinary treatment of severely ill patients with AN. The manual is based on the principles of motivational interviewing and the related therapeutic techniques and it contains elements of the Maudsley Model of Anorexia Nervosa Treatment for Adults [MANTRA; (21)]. Furthermore, the manual includes interventions that have been successfully integrated in in the treatment of eating disorders before (such as letter to the eating disorder as a friend/foe, or explicit therapy goals for the time of inpatient treatment).

Each worksheet exists in a patient version that is to be distributed to the patient as well as a therapist version. The therapist version consists of three sections: (1) a summary of purpose and goals of the worksheet, (2) instructions/reflections for the use of motivational interviewing for discussing this particular worksheet with the patient, and (3) helpful phrases for the therapist, considerations for different motivational stages or potential "therapeutic traps." This version also functions as a summary of the most important aspects of the present worksheet that can help the therapist to orientate himself/herself within the MANNA intervention on quick glance before a therapy session in the frequently time-limited inpatient setting.

The course of individual therapy on the MANNA intervention is divided into three phases. Phase 1 (weeks 1–4) is about getting to know the patient and building a therapeutic relationship and the working alliance, exploring reasons for undergoing inpatient therapy, exploring short- as well as long-term goals of the patients and identifying how the AN disorder seems to help or where it hinders to achieve these life-goals of the patient. Biographical aspects and other factors that contributed to the development of AN are discussed. All provided worksheets in this phase are obligatory.

To provide some flexibility to therapists, week 4 contains a selection of four alternative worksheets all addressing pros and cons of AN and beliefs associated with AN in different ways. This enables the therapist to choose the worksheet that seems most suitable to the patient at the present moment (e.g., choosing a narrative task vs. a cognitive-rationale task). Additionally, the alternative worksheets can further be used in case ambivalence remains very high at this stage and needs further exploring and developing discrepancies between the status quo and wishes/goals for the future.

In transition to phase 2 (starting in week 5), readiness and confidence rulers are used to visualize the motivational standpoint of the patient and planning steps for the further course of treatment. This involves the selection and prioritization of focal treatment topics by the patient together with her therapist. A variety of potential topics are given on worksheet 6, representing topics patients with AN frequently struggle with including self-esteem (22), identity (23), relationships/social interactions (24), body image (25) as well as emotions, and needs (26). Patients can add own topics and therapists can bring in own worksheets accordingly as long as they are discussed in the therapeutic style of motivational interviewing.

Phase 3, the end of the MANNA therapy, entails a central worksheet called "motivational map" on which significant parts of the last 10 weeks of treatment are integrated: Patients principles and values, long-term goals in different areas of the patients life, consequences of the eating disorder and what motivates the patients to move forward with regard to their recovery from AN as well as the next goals in treatment and focal topics for further (outpatient) treatment. This enables a reflection of the past individual therapy sessions, visualizes the patients current motivational stance, and can be a summary that facilitates transition into a setting of partial hospitalization or outpatient care.

Sample

Patients with AN being admitted to one of the two university hospital study sites for specialized inpatient treatment were invited to participate in this study over a period of 1 year. Inclusion criteria consisted of a minimum age of 18 years and full-syndrome AN according to the DSM-5. Exclusion criteria were a BMI below 12 kg/m^2 since continuous attendance of individual psychotherapy sessions cannot be guaranteed below that weight due to probable cognitive impairments or somatic complications. Further exclusion criteria were: comorbidities of schizophrenia spectrum disorders, bipolar disorder as well as current substance abuse. Notably, although being female was not an inclusion criterion, only female patients with full-syndrome AN presented at the recruiting sites during the study period.

Measures

The following measures and questionnaires were presented to all participants.

Diagnostic and Clinical Interviews (SCID-I, EDE Interview)

The German version of the Structured Clinical Interview for DSM-IV [SCID-I; (27)] was administered and adopted to fit DSM-5 criteria (the SCID interview for DSM-5 was not yet available in German). It is a semistructured interview guide for administering valid diagnoses according to DSM-5 and was used to assess comorbidities in the present sample. For verification of the AN diagnosis and exploration of eating disorder pathology, the Eating Disorder Examination Interview [EDE-I; (28)] was administered.

Phase of therapy	Week	Worksheet	Purpose and goal
1 Motivational positioning	1	My journey into therapy	Establishing a relationship, exploring where patients are coming from (barriers/resources)
	2	Therapy goals	Setting up the treatment framework and goals
	3	Wishes for life domains	Developing discrepancies between the future and the current situation (eating disorder)
	4	*Choose at least 1 of 4* Decisional balance sheet Letter to the eating disorder Imagining extremes Implications of chronic AN	Exploring pros and cons concerning AN, strengthening reasons for change
	5	Ready, willing and able	Visualizing the current motivational standpoint with readiness and confidence rulers
2 Working on focal topics	5-9	My most important topics *Focal topics in no particular order* Guiding principles Personal strengths and what I like about me House of self-esteem Relationships Body image Emotions My feelings Emotions and needs	Reflecting and prioritizing topics for further inpatient therapy Exploring personal principles and values, developing discrepancies Strengthening facets of identity not associated with AN Stabilizing and strengthening self-esteem Exploring social relationships and planning desired changes Exploring and adapting cognitions and attitudes towards the body Recognizing and distinguishing between different emotions Getting in touch with frequent own emotions Exploring emotions as signaling of needs
3 Summary and prospects	10	Motivational map	Reflecting past weeks of treatment, reasons for change and future goals

FIGURE 1 | Overview of the MANNA intervention.

Sociodemographic and Closure Questionnaires

At the beginning of the diagnostic interview, patients filled in a demographic questionnaire with basic information such as gender, age, living situation, education as well as year of initial diagnosis of AN and former treatments (if any). Height and weight were measured in the inpatient unit at admission (and regularly during the course of treatment) and were extracted from the patients' clinical file.

At the end of inpatient treatment or at the end of the study period (week 10), therapists filled in a closure questionnaire for each participating patient that documented the date of discharge from inpatient treatment and kind of discharge (e.g., regular treatment termination, dropout of treatment, need to transfer the patient to another department or another hospital) as well as other characteristics of the treatment course such as changes of therapists.

Psychiatric Status Rating (PSR) for AN

The German version of the Psychiatric Status Rating [PSR; (29)] is a rating completed by the therapist to evaluate the patient's current psychopathological state and indicates the severity of the disorder (i.e., AN). It consists of 6 stages ranging from 1 (no symptoms of AN) to 6 (severe symptoms of AN) whereof the ratings 5 and 6 refer to full-syndrome AN according to the DMS-5.

University of Rhode Island Change Assessment—Short (URICA-S)

The University of Rhode Island Change Assessment—Short [URICA-S; (30)] is a self-report measure for assessing the four stages of change according to the transtheoretical model [TTM; (31)]. A total of 16 items are rated on a 5-point likert scale from 0 (do not agree at all) to 4 (agree very strongly) which can computed into the four subscales precontemplation, contemplation, action, and maintenance. Internal consistencies in the present sample proved to be good with Cronbachs α between 0.562 and 0.850 for the contemplation, action and maintenance scales. A floor effect for the precontemplation scale could be observed which was however to be expected. Since all of the patients decided to attend inpatient therapy for their AN, precontemplation was expected to be very low. Otherwise the decision for receiving treatment would likely not have been made by the patients.

Helping Alliance Questionnaire (HAQ)

The Helping Alliance Questionnaire (32) is an instrument assessing the therapeutic alliance in therapy. 11 items are rated on a 6-point likert scale (0 not at all −5 very much) that are computed to the two subscales "relation to the therapist" and "satisfaction with therapeutic outcome" which can be combined to a total score of therapeutic alliance. The HAQ can be used in a self-report version (e.g., patients' perspective) as well as a third-party assessment (e.g., rated by the therapist). Both versions were used in the present study and proved to be reliable measures with Cronbachs $\alpha = 0.585$ −0.919.

Eating Disorder Pathology (EDE-Q)

The Eating Disorder Examination—Questionnaire (33) is the questionnaire version of the Eating Disorder Examination Interview used for diagnostics and was used as an indication of eating disorder pathology in the course of treatment. Twenty-four items are computed to the four subscales "restraint," "eating concern," "weight concern," and "shape concern." Internal consistencies of the EDE-Q proved to be excellent in the present study with Cronbachs $\alpha = 0.730$ −0.989.

Acceptance and Feasibility Questionnaire

A self-administered questionnaire was used for assessing acceptance, feasibility and benefits from the patients' perspective on a 5-point likert scale as well as free text for comments and suggestions for improvement. Therapists that had patients in the intervention group also gave feedback on acceptance and feasibility of the MANNA intervention as well as a rating of benefits and possible improvements of the individual worksheets of the MANNA treatment.

Procedure

Patients were informed about the study and invited to participate consecutively upon presentation for inpatient treatment at one of the two participating university hospitals. If they consented to participate, patients were randomly assigned to the intervention, or the control group according to predefined randomization lists. The patients' individual psychotherapist was informed about the inclusion of the patient into the study and her allocation to the intervention or control group. An appointment for the diagnostic interview with an independent interviewer (not the individual therapist) was scheduled before or within the first days of inpatient treatment. Patients underwent the diagnostic interview and received the MANNA treatment in individual psychotherapy sessions (intervention group) or the treatment-as-usual (control group). Questionnaires were filled in in week 1, 5, and 10 of inpatient treatment by the patient as well as the individual psychotherapist. For all patients, (regular or irregular) end of treatment as well as changes in psychotherapists and other events were documented.

This study was carried out in accordance with the recommendations of good clinical practice. The protocol was approved by the ethics committee of the medical faculty of the University of Tuebingen (No. 148/2018BO1) as well as the ethics committee of the medical faculty of the University of Duisburg-Essen (No. 19-8653-BO). All participants gave written informed consent in accordance with the Declaration of Helsinki. The study was registered with the German Clinical Trials Register (DRKS) under the trial number DRKS00015639.

Analyses

All statistical analyses were performed in IBM SPSS Statistics (version 27). The level of significance for all analyses was set at $\alpha = 0.05$. Means, standard deviations and percentages are reported for sample descriptions. Kolmogorov-Smirnov tests were used to assess variables for normal distribution. *T*-tests were used for normally distributed variables and Mann-Whitney-*U*-tests for not normally distributed variables to assess differences between

the two study groups at baseline and at the end of treatment. For all single comparisons, Cohens *d* is reported as a measure of effect sizes. According to Cohen (34), $d > 0.2$ thereby indicates a small effect, $d > 0.5$ a medium effect and $d > 0.8$ a large effect. For the comparison of the distributions of AN subtypes in the two study groups at baseline, a chi-squared test is used. To assess treatment adherence, Fishers exact test and the subsequent calculation of an odds ration including a confidence interval are reported.

RESULTS

A total of 27 patients initially agreed to participate in the study. After omitting data sets of patients that did not hold up with their diagnosis of full syndrome AN during the diagnostic interview or were scheduled but not admitted to inpatient therapy, a total of $N = 22$ females participated in the study.

Descriptive Statistics

An overview of the demographic and clinical characteristics of the participants at baseline can be found in **Table 1**.

Unfortunately, there was a significant difference at baseline concerning the HAQ sum score in the self-report version between the intervention and the control group with patients in the intervention group rating the therapeutic alliance to be better (indicated by a higher score) than patients in the control group. There were no other significant differences of both groups at baseline.

Acceptance and Feasibility

Overall acceptance and feasibility of the MANNA intervention was rated high to very high by patients as well as therapists concerning nearly all investigated aspects. The individual ratings can be found in **Table 2**.

Concerning the question of "missing topics in the first weeks of treatment," the low average ratings in this regard indicated that patients were satisfied with the topics addressed in phase 1 and no essential topics were missing in the MANNA intervention from a patients perspective. As for comments on potential useful additions to the intervention, patients indications were mainly related to worksheet 2 (goals for inpatient therapy) for which one patient wished to shorten this process of writing down inpatient therapy goals and defining steps toward achieving them. Whereas, another patient wished to discuss inpatient therapy goals in more detail and would like to add a more creative approach (such as visual or narrative accounts). Another useful addition might be a designated worksheet to explore more about the family background, as suggested by a patient as well as a therapist. Finally, compiling the worksheets in a therapy folder and/or incorporating accompanying tasks such as small homework or therapy diary task was suggested by a patient.

Readiness to Change, Treatment Adherence, and Therapeutic Alliance

Concerning treatment adherence, patients of the intervention group completed inpatient treatment on regular terms significantly more often than patients of the control group who dropped out or were transferred or discharged before the intended end of treatment more often. The odds ratio indicated that patients of the control group were nearly eight times more likely to drop out of treatment although the confidence interval indicates a very large possible range.

There were no significant differences concerning readiness to change as measured in the URICA-S at the different measurement time points between the intervention and the control group in this pilot sample of patients. For a detailed account of the single comparisons, see **Table 3**.

TABLE 1 | Demographic and clinical characteristics of the study population at baseline ($N = 22$).

Variable	Intervention group ($n = 11$) *M (SD)*	Control group ($n = 11$) *M (SD)*	Analysis
Age	31.5 (9.5)	31.9 (12.6)	$U = 56.50$, $p = 0.797$, $d = 0.11$
BMI	15.6 (1.3)	15.3 (1.5)	$t(19) = -0.51$, $p = 0.614$, $d = -0.22$
Illness duration in years	10.9 (8.6)	7.2 (5.9)	$t(17) = -1.09$, $p = 0.290$, $d = -0.50$
No. of comorbidities	1.1 (1.0)	2.0 (1.9)	$U = 38.00$, $p = 0.393$, $d = 0.41$
AN subtype			$\chi^2(1) = 0.19$, $p = 0.665$
- restrictive	45.5 %	36.4 %	
- binge-purge	54.5 %	63.6 %	
EDE-Q			
- restraint	4.4 (2.0)	4.6 (1.6)	$U = 59.50$, $p = 0.949$, $d = 0.03$
- eating concern	3.4 (2.0)	3.7 (1.5)	$t(20) = 0.51$, $p = 0.617$, $d = 0.22$
- weight concern	4.1 (1.6)	4.5 (1.4)	$t(20) = 0.66$, $p = 0.519$, $d = 0.28$
- shape concern	4.4 (1.6)	5.0 (0.8)	$U = 51.50$, $p = 0.562$, $d = 0.25$
- sum score	4.1 (1.7)	4.5 (1.2)	$U = 56.00$, $p = 0.797$, $d = 0.13$
PSR	5.2 (0.6)	5.6 (0.5)	$U = 35.00$, $p = 0.173$, $d = 0.65$
URICA-S			
- precontemplation	0.6 (0.5)	0.4 (0.4)	$U = 41.50$, $p = 0.217$, $d = 0.55$
- contemplation	3.2 (0.5)	3.2 (0.9)	$t(20) = 0.15$, $p = 0.884$, $d = 0.06$
- action	3.3 (0.6)	2.7 (1.0)	$t(20) = -1.68$, $p = 0.109$, $d = -0.72$
- maintenance	2.9 (1.0)	2.0 (1.4)	$t(20) = -1.80$, $p = 0.088$, $d = -0.77$
HAQ sum score			
- self-report	44.3 (9.1)	35.3 (7.0)	$t(19) = -2.56$, $\mathbf{p = 0.019}$, $d = -1.12$
- therapist report	33.5 (5.2)	33.8 (7.2)	$t(18) = 0.11$, $p = 0.916$, $d = 0.05$

AN, Anorexia nervosa; BMI, body mass index (kg/m²); EDE-Q, Eating Disorder Examination-Questionnaire; HAQ, Helping Alliance Questionnaire; PSR, Psychiatric Status Rating; URICA-S, University of Rhode Island Change Assessment – Short.

TABLE 2 | Evaluation of acceptance and feasibility of the MANNA intervention.

Evaluation	Patients ($n = 9$) *M (SD)*	Therapists ($n = 9$) *M (SD)*
Personal/Patients overall benefits from the MANNA intervention	3.3 (1.1)	3.6 (0.7)
Overall satisfaction with the worksheets	4.7 (0.7)	4.2 (0.8)
Comprehensibility of the worksheets	4.6 (0.7)	4.4 (0.5)
Usefulness of the worksheets	3.7 (1.4)	3.9 (0.9)
Logical sequencing of worksheets	3.8 (0.8)	4.1 (0.6)
Balance of worksheets and space for emerging topics	3.9 (1.1)	3.9 (1.1)
Essential topics in the first weeks of treatment were missing	2.2 (1.2)	1.6 (0.9)
Usefulness of therapists instruction sheet		4.3 (0.5)

Ratings were given on a 5-point likert scale (1–5) with higher values indicating higher acceptance or satisfaction.
Bold values indicate significant results.

Contrary to our hypothesis, no significant differences of the therapeutic alliance ratings in self-report as well as therapist report could be found between the intervention group and the control group for the different measurement time points except for the difference between groups in the self-report version at baseline. Potential reasons for this difference are examined in the discussion section.

Exploratory Analyses of Weight Gain and Psychopathology

Exploratory completer analyses were performed for differences in increase in BMI and decrease in eating disorder psychopathology at the end of the MANNA intervention. Mean BMI increase in the intervention group from baseline to the end of the MANNA intervention was higher than in the control group (1.79 vs. 1.26). This indicates a larger BMI increase in the intervention group albeit not significant in this small pilot study sample. Details of these comparisons are also reported in **Table 3**.

Concerning eating disorder psychopathology, absolute numbers indicate a lower EDE-Q sum score in the intervention group than the control group at the end of inpatient treatment but no significant differences between emerged concerning any scales of the EDE-Q. The PSR as rated by the respective therapists also indicated no differences between the intervention and the control group at the end of treatment.

DISCUSSION

This pilot study of the novel MANNA intervention for inpatients with AN examined acceptance, feasibility and outcomes in German inpatient settings as well as its effects on treatment adherence and therapeutic alliance compared to treatment as usual. The MANNA intervention thereby proved to be very well-accepted and feasible according to its evaluations by patients as well as therapists, thus confirming the first hypothesis.

TABLE 3 | Single comparisons between the study groups at week 5 (t1) and at the end of treatment (t2).

Variable	Intervention group $n = 11$* *M (SD)*	Control group $n = 11$* *M (SD)*	Analysis
READINESS TO CHANGE, TREATMENT ADHERENCE AND THERAPEUTIC ALLIANCE			
URICA-S t1			
- precontemplation	0.3 (0.4)	0.2 (0.2)	$U = 34.00$, $p = 0.633$, $d = 0.25$
- contemplation	3.1 (0.7)	3.4 (0.6)	$t(16) = 1.06$, $p = 0.307$, $d = 0.50$
- action	3.3 (0.5)	3.2 (0.7)	$t(16) = -0.23$, $p = 0.818$, $d = -0.11$
- maintenance	2.4 (1.3)	2.5 (0.9)	$t(16) = 0.18$, $p = 0.861$, $d = 0.08$
URICA-S t2			
- precontemplation	0.2 (0.3)	0.4 (0.4)	$t(7) = 1.10$, $p = 0.307$, $d = 0.74$
- contemplation	2.9 (0.6)	3.2 (0.9)	$t(7) = 0.61$, $p = 0.563$, $d = 0.41$
- action	3.4 (0.5)	3.3 (0.8)	$t(4.5) = -0.20$, $p = 0.854$, $d = -0.14$
- maintenance	2.3 (0.6)	2.6 (0.9)	$t(7) = 0.51$, $p = 0.625$, $d = 0.34$
Irregular treatment termination^{+}	2	7	Fishers exact test **$p = 0.040$**, OR = 7.88, CI [1.11; 56.12]
HAQ sum score t1			
- self-report	45.0 (5.6)	40.5 (8.7)	$t(16) = -1.33$, $p = 0.202$, $d = -0.63$
- therapist report	35.9 (9.0)	35.6 (7.3)	$U = 34.00$, $p = 0.633$, $d = 0.25$
HAQ sum score t2			
- self-report	45.5 (4.2)	43.8 (5.6)	$t(6) = -0.50$, $p = 0.633$, $d = -0.36$
- therapist report	37.5 (3.5)	36.4 (6.3)	$t(7) = -0.31$, $p = 0.766$, $d = -0.21$
WEIGHT GAIN AND PSYCHOPATHOLOGY AT THE END OF INPATIENT TREATMENT (EXPLORATORY ANALYSES)			
BMI **t2**	16.6 (1.0)	16.5 (1.5)	$t(7) = -0.12$, $p = 0.906$, $d = -0.08$
BMI gain **t0 to t2**	1.79 (0.9)	1.26 (0.8)	$t(7) = -0.95$, $p = 0.375$, $d = -0.64$
EDE-Q t2			
- restraint	1.3 (0.9)	2.5 (2.4)	$t(3.7) = 0.90$, $p = 0.425$, $d = 0.66$
- eating concern	1.6 (1.3)	2.8 (2.0)	$t(7) = 1.11$, $p = 0.304$, $d = 0.74$
- weight concern	2.2 (1.0)	2.8 (1.9)	$t(7) = 0.61$, $p = 0.559$, $d = 0.41$
- shape concern	2.9 (1.5)	3.9 (1.6)	$t(7) = 0.98$, $p = 0.360$, $d = 0.66$
- sum score	2.0 (1.0)	3.0 (1.0)	$t(7) = 1.00$, $p = 0.352$, $d = 0.67$
PSR **t2**	4.8 (0.4)	4.6 (1.1)	$U = 11.50$, $p = 0.841$, $d = 0.13$

*BMI, body mass index (kg/m^2); CI, confidence interval; EDE-Q, Eating Disorder Examination-Questionnaire; HAQ, Helping Alliance Questionnaire; OR, Odds ratio; PSR, Psychiatric Status Rating; t1, week 5 of treatment; t2, week 10 of treatment; URICA-S, University of Rhode Island Change Assessment—Short; *n refers to the sample size at baseline (week 1), $^{+}$irregular treatment terminations consisted of dropouts, transfers to another clinic/department or termination by the treatment team. Bold values indicate significant results.*

Beyond its acceptance and feasibility, patients receiving the MANNA intervention completed their treatment significantly more often on regular terms compared to patients receiving treatment as usual that terminated treatment irregularly more often (through dropout, transfer to another clinic/department or termination by the treatment team). This indicates a higher treatment adherence of patients in the intervention group and confirms our second hypothesis about the positive influence of the MANNA intervention on treatment adherence. Since treatment dropout can be seen as one of the major risks in early stages of therapy for inpatients with AN (35), this effect can be seen as a very promising finding toward the potential effects of the novel approach of the MANNA intervention.

The other part of our second hypothesis however, concerning the MANNA intervention improving therapeutic alliance could not be confirmed in this pilot sample. There were no differences of patients' perception of the therapeutic alliance with their individual psychotherapist during or at the end of inpatient treatment between the intervention and the control group. At baseline, patients in the intervention group indicated a stronger subjective therapeutic alliance than patients in the control group. This difference could originate in several reasons.

On one hand, the small sample size could have produced this difference in therapeutic alliance ratings by chance. The effect would subsequently diminish in a larger sample size. As another possibility, a bias by therapist could have the difference although we tried to control for therapists influence on treatment effects by randomizing patients. Therefore, participating therapists had patients in the intervention group as well as patients in the control group which makes the assumption of a therapist effect less likely.

On the other hand, the difference in therapeutic alliance ratings at baseline might have been an early product of the MANNA intervention. Since the baseline questionnaires were frequently given out by the individual therapist, patients might have already had some interactions with their individual therapists (e.g., admission session). They therefore came in contact with the MANNA intervention and the therapeutic stance of motivational interviewing, possibly resulting in the initiation of a stronger early therapeutic alliance. This effect might have dissolved over the course of treatment when patients in the control group got to know their individual therapists better and rated their respective therapeutic alliance comparable to the intervention group.

In the literature, we could not find valid evidence for the impact of MI on early therapeutic alliance, therefore neither supporting nor weakening this assumption. There was one therapists' report about building up a good therapeutic relationship in a MI-based treatment of patients with AN from the MOSAIC trial (18). This process evaluation did however not specifically address early therapeutic alliance.

Apart from the direct effect of MI on early therapeutic alliance, evidence could be found for the effect of motivation to change. A study with inpatients with AN by Marzola et al. (36) shows the importance of motivation to change as a prerequisite or a moderator of early clinical improvement and the formation of a strong therapeutic alliance. Since strengthening motivation to change is one of the key goals and effects of MI, this finding might also apply to MI.

Assuming therapists utilization of MI in the treatment of inpatients with AN strengthens early therapeutic alliance implies other possible effects: A cohort study about adolescent patients with AN showed that a higher rating of early therapeutic alliance was associated with reaching the target weight faster irrespective of the treatment setting (37). Another study with adult outpatients with AN however showed no impact of early therapeutic alliance on changes in weight but in parts of eating disorder pathology (namely restraint and shape concern) (38). Although at this time these are speculative assumptions that should be examined in future studies, the utilization of MI such as in the MANNA intervention might strengthen early therapeutic alliances which positively affect the outcome of treatment and/or changes in eating disorder pathology.

Only partial support could be found in the present pilot study for the third exploratory hypothesis. Patients in the intervention group did show greater BMI increase and improvement in eating disorder associated psychopathology at the end of inpatient treatment compared to the control group in absolute numbers. However, these differences did not turn out to be statistically significant. This probably originates in the small sample size at this measurement time point (four and five patients, respectively), therefore a larger sample could examine the validity of these differences.

Concerning further development of the treatment manual of the MANNA intervention, there are some advances that can be made for a stage II manual for a phase III MANNA study. According to Carroll and Nuro (20) these may lay in the explication of procedures and standards for therapist selection, in further elaborating the training and supervision of therapists conducting the intervention as well as in implementing guidelines for troubleshooting. From the experience with therapist trainings in the current study, especially the training of therapists might be further improved.

Therapist training in the current study contained an overview of MI and all of its aspects as well as training of different techniques. From the feedback of the trained therapists, it might be of benefit to keep the overview part to a minimum in favor of focusing on the core techniques to be used in the intervention. The focus can thereby be put on the training of basic MI skills such as the OARS techniques and giving information and advice. For further development of the therapist training, we would add a focus on techniques for rolling with resistance since therapists identified these as especially useful with patients with AN.

Another suggestion by therapists to the MANNA intervention was the inclusion of significant others and families. Outpatient interventions such as the MANTRA treatment (21) routinely incorporate significant others and dedicate a whole part of their treatment manual to this topic, thus emphasizing its importance. For our inpatient manual however, since sessions with significant others and relatives are an inherent part of the multidisciplinary treatment approach and not exclusive to individual psychotherapy, we did not dedicate a specific worksheet to this. It might be useful in the future however, to either offer an optional

worksheet that can be used at any given time in the intervention or at least provide some information on MI and the inclusion of significant others and relatives into the treatment.

The current study contains some limitations that need to be mentioned. First of all, the sample size was small for a comparative study in this pilot phase of the evaluation of the new manual. Potentially due to the even smaller sample at the end of treatment, some of the utilized measures did not reach a satisfactory reliability at the last measurement time point. Although significant differences in e.g., dropout rates were found, this results in a wider variability and therefore a large confidence interval for this finding. The replication of these findings in a larger sample should therefore be aimed for.

Another limitation resulting from the small sample size is the lack of subgroup analyses as well as analyses of potentially confounding variables such as therapist effects that could not be investigated in the context of this study. These analyses enable tailoring the MANNA intervention to specific subgroups and help differentiate cases in which other/additional interventions are needed for example due to cognitive impairments of patients due to the severe state of malnutrition. A future, fully powered RCT on the concept will add to the evidence base through more in-depth statistical analyses (e.g., survival analysis) but also minimize risk of biases through e.g., rater votings of therapist behaviors with the Motivational Interviewing Skill Code (39) that was not possible in this pilot study setting.

In conclusion, this pilot study confirms high acceptance and very good feasibility of the newly developed MANNA intervention for the treatment of inpatients with AN. Although the sample size was relatively small and no significant differences concerning stages of change and treatment outcomes were found, patients receiving the MANNA interventions finished treatment on regular terms significantly more often than patients in the control intervention, thus pointing at potential benefits in crucial dimensions of the therapy of AN.

DATA AVAILABILITY STATEMENT

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

ETHICS STATEMENT

The studies involving human participants were reviewed and approved by the ethics committee of the medical faculty of the University of Tuebingen and the ethics committee of the medical faculty of the University of Duisburg-Essen. The patients/participants provided their written informed consent to participate in this study.

AUTHOR CONTRIBUTIONS

KZ, KK, SB, GR, KEG, SZ, and FJ contributed to the conception and design of the study. KZ, NR, SB, E-MS, and MT substantially contributed to the acquisition of data for the study. KZ performed the statistical analysis and wrote the first draft of the manuscript. All authors contributed to manuscript revision and read and approved the submitted version.

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BRIEF RESEARCH REPORT
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Discharge Body Mass Index, Not Illness Chronicity, Predicts 6-Month Weight Outcome in Patients Hospitalized With Anorexia Nervosa

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Proposed treatments for severe and enduring anorexia nervosa (SE-AN) focus on quality of life, and psychological and social functioning. By de-emphasizing weight restoration as a priority, however, premature diagnosis of SE-AN may reduce potential for recovery. The present study assessed the effect of weight restoration, illness duration, and severity on treatment outcome 6 months after discharge from an intensive, meal-based behavioral treatment program. Participants included hospitalized adult women ($N = 191$) with AN or underweight other specified feeding and eating disorder (OSFED). Participants were characterized as short-term (ill < 7 years; $n = 74$) or long-term ill (ill ≥ 7 years; $n = 117$). Compared with short-term ill, long-term ill patients were older, had lower lifetime body mass index (BMI), more prior admissions, and exhibited greater depression and neuroticism. Long-term vs. short-term ill patients gained weight at the same rate (~2 kg/wk) and were equally likely to be weight restored by discharge (>75% reached BMI ≥ 19 kg/m^2 in both groups). At 6-month follow-up ($n = 99$), both groups had equivalent self-reported BMI, and depression, drive for thinness, body dissatisfaction, and bulimia scores. The only predictor of BMI ≥ 19 kg/m^2 at follow-up was discharge BMI. The likelihood of a BMI ≥ 19 kg/m^2 at follow-up was 5-fold higher for those with discharge BMI ≥ 19 kg/m^2. Few studies of long-term ill inpatients with AN have examined the impact of full weight restoration on short-term outcomes. This study supports the therapeutically optimistic stance that, regardless of illness duration, hospitalized patients with AN benefit from gaining weight to a BMI ≥ 19 kg/m^2.

Keywords: inpatient, severe and enduring anorexia nervosa, treatment, outcomes, weight-restoration

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INTRODUCTION

Treatment of anorexia nervosa (AN) presents particular challenges to clinicians. Treatment is expensive, access is limited, and patient anxiety and ambivalence toward weight gain and behavior change can make treatment psychologically burdensome (1, 2). Furthermore, illness severity varies, from adolescents with recent onset AN, to adults disabled by the scar effect of many years of progressive functional impairment, physical morbidity, cognitive problems,

and social isolation (3, 4). Protracted illness combined with multiple past treatment attempts and severe eating and weight control behaviors, can erode the hope of patients, family members, or clinicians, undermining future treatment expectations or recovery. Understanding factors that affect treatment outcome for the chronically ill patient with AN is thus of vital importance, especially in view of recent long-term follow-up studies that suggest recovery is possible even after decades of illness (5, 6).

Recovery from AN requires attainment of a healthy weight, and significant reduction or elimination of eating disordered behaviors and cognitions (7, 8). Attainment of a healthy weight is thus necessary if not sufficient for full recovery from AN, and low BMI at discharge from intensive treatment is the strongest known predictor of relapse and readmission for adults with AN (9–11). Even in outpatients, an analysis of five randomized controlled treatment trials for eating disorders, found weight restoration to a BMI > 19 kg/m^2 the most efficient predictor of recovery at 1-year, for both adolescent and adult patients (12). Attainment of BMI $\geq$ 19 kg/m^2 has been proposed as a threshold for full recovery from AN (7).

Several other factors across studies have been associated with outcome in AN, including illness duration, depressive and eating disorder psychopathology, motivation for treatment, interpersonal functioning, and early weight gain and behavior change in treatment (13). However, the findings with respect to these factors tend to be more mixed. In terms of illness duration, for example, some studies have found an association with outcome (14, 15), while others find no association of illness duration with outcome (16–18).

Illness duration has a central role in the construct of "severe and enduring" AN (SE-AN). Definitions of SE-AN vary, however most include measures of both illness duration and severity, as well as participation in past evidence-based treatments (4, 19–21). An early randomized controlled trial categorized patients with at least 7 years of illness as SE-AN (22), though a recent systematic review captures the lack of diagnostic precision and the breadth of terms applied to describe this group of patients (23). What level of chronicity equates to "severe and enduring" is unclear, and as few as 3 or as many as 10 years of illness have been used (3, 20, 24).

How to best measure illness severity in SE-AN is also unclear. Factors often considered include clinical characteristics, such as age, admission BMI, lifetime nadir BMI, number of hospitalizations, behaviors (e.g., purging), measures of eating disorder psychopathology, quality of life, or social and occupational functioning (13, 18). However, the one study that attempted empirical modeling of the SE-AN construct using a variety of clinical characteristics, including duration of illness and number of previous hospitalizations, found that these were not empirically useful in grouping patients (25).

The present descriptive study seeks to compare short- and long-term ill patients with AN on markers of severity and clinical course. We examined the effects of illness duration, illness severity, and weight restoration to a BMI $\geq$ 19 kg/m^2, on the short-term (6-month) weight outcome of women with AN hospitalized in an integrated eating disorders inpatient-partial hospital behavioral program. Our primary hypothesis was that attainment of a BMI in the normal range at discharge would predict weight outcome at 6-month follow-up. In addition, we hypothesized that markers of severity, including illness duration, number of hospitalizations, and depressive and eating disorder psychopathology would predict weight outcome at 6-month follow-up.

METHODS

Study Population

The study was approved by the Institutional Review Board of the Johns Hopkins University School of Medicine. All consecutive female first admissions to the Johns Hopkins Eating Disorders Inpatient-Partial Hospitalization Program between February 2003 and March 2015 with either AN or underweight other specified feeding and eating disorder (atypical AN with admission BMI < 19; abbreviated OSFED) were invited to participate in a longitudinal study of treatment outcomes ($N = 303$). Participants ($N = 191$) provided verbal consent and completed a battery of self-report questionnaires at admission and 6 months after discharge. Institutional Review Board approval was also obtained for a chart review and abstraction of limited de-identified data on non-participants ($n = 112$) to establish whether there were significant demographic, diagnostic, or clinical course differences between participants and non-participants. Participants were diagnosed at hospital admission by trained raters using the Structured Clinical Interview for DSM-IV-TR (26). Diagnoses were recoded by master's level raters using DSM-5 criteria following its publication in 2013 (27). Patients in the underweight eating disorder not otherwise specified group were recoded as AN or as OSFED according to DSM-5 criteria. Non-participant diagnoses were established by chart review using DSM-5 criteria.

The participant sample was divided into short-term (illness duration <7 years; $n = 74$) and long-term ill (illness duration ≥ 7 years; $n = 117$) groups consistent with early definitions of SE-AN and other investigations (18, 22).

Eating Disorder Protocol

The Johns Hopkins Eating Disorder Program includes an integrated step- down inpatient-partial hospitalization program. Treatment is delivered by a psychiatrist led, multidisciplinary team and employs a structured behavioral modification protocol described in detail elsewhere (28, 29) and in the **Supplementary Material**.

Procedure

Clinical data collected for both participants and non-participants included: length of stay in the inpatient and partial hospital components of the program, admission and discharge weight, height, number of days spent on weight gain, and target weight range. Daily gowned weights were obtained by nursing staff before breakfast and after voiding.

Clinical and Psychological Measures at Admission

Participants completed self-report questionnaires on admission, including demographic, historical, and behavioral information.

Illness duration was calculated based on the question "At what age did your eating problems start to interfere with other activities?" Past intensive treatment reflective of illness severity was assessed by the number of prior eating disorder hospitalizations, general psychiatric hospitalizations, and medical hospitalizations for an eating disorder, as ascertained by the answers to the questions: "Prior to this admission, how many times have you been an inpatient on a specialized Eating Disorders Unit?"; "Prior to this admission, how many times have you been an inpatient on a general psychiatric unit (not a specialized eating disorder unit) for an eating disorder?"; "Prior to this admission, how many times have you been hospitalized on a medical unit (not a specialized eating disorder unit or general psychiatric unit) for an eating disorder?"

Three subscales of the Eating Disorders Inventory-2 were used to measure the severity of eating disorder psychopathology: drive for thinness, body dissatisfaction, and bulimia [EDI-2, (30)]. The EDI-2 is a commonly used scale that assesses eating disordered cognitions and behaviors and has good construct validity (31). Internal consistency was good to excellent ($\alpha = 0.87–0.92$) in the current sample. In addition, we assessed target weight discrepancy (TWD), the difference between the patient's target weight and their desired weight. Desired weight was assessed in response to the question, "How much would you like to weigh?" Higher TWD indicates a desire to lose or maintain weight below a minimally acceptable threshold. Participants additionally completed the Beck Depression Inventory [BDI, (32)] and the NEO Five Factory Inventory [NEO-FFI, (33)]. The BDI is a widely used, 21 item self-report rating scale measuring characteristic attitudes and symptoms of depression, with good reliability and validity (34). Internal consistency for this sample was excellent ($\alpha = 0.91$). The NEO-FFI is a 60-item personality inventory yielding scores in five personality domains: Neuroticism, Extraversion, Openness, Agreeableness, and Conscientiousness. The NEO-FFI has acceptable construct validity (35). Only the Neuroticism subscale was utilized in this study, as it has been positively associated with higher scores on the EDI-2, duration of illness, and length of stay (36). Internal consistency for the Neuroticism subscale in this sample was good ($\alpha = 0.87$). Finally, we calculated weight suppression as the difference between the highest lifetime weight and the weight at admission (37). Weight suppression has been correlated with measures of eating disorder psychopathology (37).

Outcomes at 6-Month Follow-Up

Participants were contacted by electronic mail 6 months after final program discharge with a link to a confidential survey asking, among other items, for their current weight. Additional assessments at follow-up included whether the patients had been rehospitalized, as well as the EDI-2 subscales and the BDI.

Statistical Analyses

SPSS (38) and Microsoft Excel (39) software were used to perform statistical analyses. For demographic and clinical data, range, mean, standard deviation (SD), and N's are reported. Proportions are reported using raw numbers and percentages. Where short and long-term ill were compared, we employed chi-square tests for categorical variables and *t*-tests and analyses of covariance (ANCOVAs) for continuous variables, controlling for age. Repeated measures ANCOVAs were used to examine change in EDI-2 and BDI scores from admission to 6-month follow-up by illness duration group (short vs. long-term ill).

Potential predictors of BMI at 6-month follow-up were selected based on previous research indicating these variables were associated with poorer outcomes in patients with AN (9, 13, 18, 36). Bivariate correlations were used to assess whether age, clinical characteristics (admission and discharge BMI, diagnostic subtype [restricting vs. purging], length of inpatient stay, lifetime nadir BMI, total weight gained in treatment, and weight suppression), and markers of severity (illness duration, number of previous general, medical, and specialized eating disorder hospitalizations, and scores on the BDI, EDI-2, and Neuroticism subscale of the NEO-FFI) were correlated with BMI at 6-months follow-up (**Supplementary Table 1**). To reduce the risk of Type 1 error in this series of analyses, the threshold for statistical significance was set to $p < .003$ (.05/17 potential predictors).

The three variables that were significantly correlated with 6-month weight outcomes were entered as predictors in binary logistic regression models: admission BMI, discharge BMI, and lifetime nadir BMI. An additional variable, illness duration, was added because of strong a priori interest in this predictor, despite its lack of correlation with BMI at 6-month follow-up. The outcome variable for binary logistic regressions was coded based on BMI at 6-month follow-up, i.e., 6-month BMI of 19 kg/m^2, entered as 0 = no, 1 = yes. Finally, to assess whether a specific BMI threshold might predict outcome, a model was built using BMI at program discharge as a predictor variable, coded based on whether or not a participant reached a discharge BMI of 19 kg/m^2 (0 = no, 1 = yes). A binary threshold for BMI as a predictor variable was chosen because many treatment programs set a specific target weight or BMI, and based on prior literature (7, 9, 12), 19 kg/m^2 was selected as an appropriate target BMI to examine. Alpha was set at 0.05 for the logistic regression analyses.

RESULTS

Comparison of Participant and Non-participant Patients

To ascertain whether the participant sample was representative of the underweight clinical population hospitalized in the program, we compared the 191 patients who consented to participate in our full outcomes study with the 112 who declined to complete questionnaires (but from whose medical records we were permitted to abstract clinical data including demographics, diagnosis and hospital course). There were no differences in age; diagnosis; admission BMI; length of stay; total weight gained; or inpatient discharge BMI after controlling for admission BMI (all p's > 0.05; **Supplementary Table 2**). Participants compared with non-participants gained weight more quickly [mean (SD) kg/week = 2.0 (0.87) vs. 1.8 (0.77); $p = 0.017$] and were more likely to attend the partial hospital component of treatment (74.4 vs. 51.79%; $p < 0.001$), and therefore had a slightly but significantly higher final program discharge BMI [mean (*SD*) kg/m^2 = 20.0 (1.84) vs. 19.3 (2.26); $p = 0.046$]. These results are consistent with our previously reported findings that the effect

TABLE 1 | Clinical and psychometric measures at admission in short-term (<7 years) and long-term (≥7 years) ill patients with anorexia nervosa.

Clinical characteristics	Total sample ($N = 191$)			Long-term ill ($n = 117$)		Short-term ill ($n = 74$)		Sig
	Mean	*SD*	Range	Mean	*SD*	Mean	*SD*	
Illness duration, years	13.15	11.58	(<1–53)	19.70	10.26	2.80	2.09	<0.001
Age, years	32.55	12.29	(18–73)	37.60	11.33	24.57	9.15	<0.001
Lifetime nadir BMI[a,b], kg/m^2	14.40	2.20	(8.7–20.2)	13.95	2.30	15.12	1.86	<0.001
Eating disorder hospitalizations[b,c]	2.35	3.64	(0–20)	3.34	4.11	0.78	1.9	<0.001
General psychiatric hospitalizations[b]	1.34	2.80	(0–20)	2.03	3.38	0.28	0.76	<0.001
Medical hospitalizations[b]	1.48	3.31	(0–20)	2.05	4.00	0.58	1.34	<0.001
Admission BMI[a], kg/m^2	16.21	2.10	(9.9–20.2)	16.30	1.98	16.09	2.21	0.499
Demographics	***N***	**%**		***N***	**%**	***N***	**%**	
Caucasian	166	88.77		106	92.98	60	82.19	0.462
Diagnosis[d]								
AN-Restricting	62	32.46		35	29.91	27	36.49	0.086
AN-Purging	104	54.45		63	53.85	41	55.41	
OSFED	25	15.06		19	17.92	6	10.00	
Psychological measures	**Mean**	***SD***	**Range**	**Mean**	***SD***	**Mean**	***SD***	
EDI-2 drive for thinness[e]	12.73	6.86	(0–21)	13.06	6.60	12.20	7.28	0.435
EDI-2 body dissatisfaction[e]	15.99	8.25	(0–27)	16.89	8.19	14.53	8.20	0.072
EDI-2 bulimia[e]	3.35	4.84	(0–21)	3.26	4.91	3.49	4.75	0.763
BDI depression[f]	28.97	12.94	(2–60)	31.57	12.64	25.05	12.49	0.002
NEO-neuroticism[g]	32.14	8.87	(7–48)	34.10	8.16	29.25	9.14	<0.001
Target weight discrepancy, pounds[h]	17.68	13.14	(−26–60)	19.75	12.90	14.43	12.95	0.008

[a] *BMI, body mass index.*
[b] *Analysis controlling for age.*
[c] *ED hospitalizations, number of prior hospitalizations on a specialty eating disorder unit.*
[d] *DSM-5 Diagnoses: AN, anorexia nervosa; OSFED, Other Specified Feeding and Eating Disorder.*
[e] *Drive for Thinness, Body Dissatisfaction, and Bulimia subscales of the Eating Disorders Inventory-2.*
[f] *Depression, Beck Depression Inventory, total score.*
[g] *Neuroticism subscale of the NEO Five Factor Inventory.*
[h] *Target weight discrepancy (TWD) is the difference between the participant's target weight range and her desired weight. Positive TWD expresses a desire to be thinner than is healthy.*

sizes of differences between participants and non-participants in our outcomes research project are small (40).

Baseline Characteristics

Sample characteristics are shown in **Table 1**. The cohort covered a wide age and BMI range, and was representative of a long-term ill sample. Mean illness duration in the long-term ill group was nearly 20 years (see **Supplementary Figure 1**). The mean lifetime nadir BMI for the sample as a whole was 14.4 kg/m^2 consistent with the DSM-5 extreme range (27). More than half the sample had been previously admitted to at least one other specialty eating disorder treatment facility.

After controlling for age at admission, long-term ill patients reported lower lifetime nadir BMI, and higher number of specialty eating disorder, general psychiatric hospital, and medical admissions. Admission BMI did not differ between groups. For the psychological measures, EDI-2 drive for thinness, body dissatisfaction, and bulimia did not differ; however, long-term ill compared to short-term ill participants had higher neuroticism and reported greater depressive symptomatology on the BDI, with the average score of the long-term ill group falling in the "severe" range for depression, [30–63; (41)]. Long-term ill patients also had greater TWD, endorsing a desired weight farther below a medically healthy weight than did the short-term ill patients.

Response to Hospital-Based Behavioral Weight Restoration

Patients in both groups responded well to treatment (**Table 2**), gaining about 2 kg per week as inpatients. Though discharge BMI, rate of weight gain, and total length of stay (inpatient plus partial hospitalization) did not differ between groups, long-term ill compared with short-term ill patients stayed nearly 8 days longer in the inpatient component of the program.

Despite patients' severity of illness, nearly 90% of patients attained a BMI of 18 or greater by program discharge, and four out of five patients attained a BMI of at last 19 kg/m^2. A majority, nearly two-thirds, attained a BMI of at last 20 kg/m^2 at program discharge.

TABLE 2 | Response to treatment in short-term and long-term ill patients with anorexia nervosa.

	Long-term ill		Short-term ill		Sig
Treatment ($n = 191$)					
N	117		74		
	Mean	***SD***	**Mean**	***SD***	
Inpatient length of stay, days	34.99	23.72	27.14	19.69	0.018
Total program length of stay, days	59.68	33.29	52.57	29.83	0.136
Rate of weight gain, kg/wk	2.02	1.00	1.98	0.69	0.752
Final program discharge BMI[a]	20.06	1.93	19.93	1.69	0.648
	%		**%**		
Discharge BMI[a] $\geq$ 18	88.03		89.19		0.808
Discharge BMI[a] $\geq$ 19	81.20		77.03		0.486
Discharge BMI[a] $\geq$ 20	64.10		60.81		0.647
6-month follow-up ($n = 99$)					
N	63		36		
	%		**%**		
Response rate to follow-up questionnaire	53.85		48.65		0.484
6-month follow-up BMI[a] $\geq$ 18	68.25		58.33		0.321
6-month follow-up BMI[a] $\geq$ 19	58.73		52.78		0.565
6-month follow-up BMI[a] $\geq$ 20	33.33		36.11		0.779
Rehospitalized within 6 months	20.63		30.56		0.268

[a]*BMI = body mass index, kg/m^2.*

Outcomes at 6-Month Follow-Up

Follow-up data were available for 99 patients (52% of participants; see **Table 2**). There was no difference between groups (short-term vs. long-term ill) in the proportion of patients who responded to follow-up, and no difference in the proportion of patients reporting BMIs of 18, 19, or 20 kg/m^2 at 6-month follow-up. Although most patients lost some weight after discharge, this is not unexpected and has been previously reported following intensive treatment (42, 43); however, average weight lost was <3 kg and a majority remained above a BMI of 19 kg/m^2. Rehospitalization rate between discharge and 6-month follow-up was 24% and did not differ between groups. There was no association between attainment of a BMI $\geq$ 19 kg/m^2 and rehospitalization [$\chi^2_{(1,N=99)} = 0.183$, $p = 0.669$]. Follow-up BMI remained significantly higher compared to admission BMI (by at least 2.6 points; see **Table 3**). Measures of psychological distress including eating psychopathology and depression all decreased significantly between admission and follow-up (see **Table 3**).

Binary logistic regression using BMI at program discharge as a continuous predictor, along with illness duration, admission BMI, and lifetime nadir BMI, revealed that BMI at program discharge was the only significant predictor of maintaining at least a BMI of 19 kg/m^2 at 6-month follow-up (**Table 4**). This was also the case when using BMI $\geq$ 19 kg/m^2 as a dichotomous predictor variable. In addition, reaching a BMI of $\geq$ 19 kg/m^2 at discharge was associated with 5-fold increased odds of being at a BMI of 19 kg/m^2 at 6-month follow-up [$\chi^2_{(1,N=93)} = 5.33$; $p = 0.021$, OR = 5.70].

DISCUSSION

Experienced clinicians who treat individuals with AN inevitably encounter patients inured to treatment, who have been through multiple treatment programs, without escaping the gravitational pull of their illness. We found that, despite greater psychopathology, lower lifetime BMI, and a higher number of prior hospitalizations in the long-term ill compared to the short-term ill, the majority of long-term ill patients responded well to treatment. Short and long-term ill participants were equally likely to meet a BMI $\geq$ 19 kg/m^2 by program discharge and to maintain weight at follow-up. Duration of illness was not associated with a BMI $\geq$ 19 kg/m^2 at follow-up. Both groups showed sustained improvements in eating psychopathology and depressive symptomatology at 6-month follow-up, however discharge BMI was the only significant predictor of BMI at 6-month follow-up. We also found that a BMI of $\geq$19 kg/m^2 at program discharge, a target met by a majority of patients in this study, was associated with a 5-fold higher likelihood of reporting a BMI $\geq$ 19 kg/m^2 at 6-month follow-up.

It should be noted that follow-up data were available for 52% of participants and 32% of the entire cohort admitted during the time period examined. Outcome data on the 99 participants who responded to the outcome survey may not be representative of the full sample. While this response rate is not ideal, obtaining high response rates at follow-up from a naturalistic treatment study is challenging, especially in the U.S. where the health care system is highly fragmented. The lack of a difference in participation rate at 6-month follow-up

TABLE 3 | Changes in body mass index and psychological variables from admission to 6-month follow-up in short-term and long-term ill patients with anorexia nervosa.

	Group	Admission		6-Month follow-up		Within-group		Between group	
		Mean	*SD*	Mean	*SD*	*F*	Sig	*F*	Sig
BMI[a]	Short-term	16.30	1.98	18.92	2.24	129.842	<0.001	0.084	0.773
	Long-term	16.09	2.21	19.03	2.54				
Drive for thinness[b]	Short-term	12.20	7.28	9.92	6.66	21.441	<0.001	0.052	0.821
	Long-term	13.06	6.60	9.60	7.13				
Body dissatisfaction[b]	Short-term	14.53	8.20	14.73	8.42	4.298	0.041	0.006	0.938
	Long-term	16.89	8.19	14.57	8.09				
Bulimia[b]	Short-term	3.49	4.75	2.06	2.85	4.153	0.045	0.001	0.979
	Long-term	3.26	4.91	2.09	4.27				
Depression[c]	Short-term	25.05	12.49	20.62	12.29	12.739	0.001	0.264	0.612
	Long-term	31.57	12.64	18.86	15.62				

[a] *BMI = body mass index, kg/m^2.*
[b] *Drive for Thinness, Body Dissatisfaction and Bulimia subscales of the Eating Disorders Inventory-2.*
[c] *Depression, Beck Depression Inventory, total score.*

between the short-term and long-term ill, suggests that illness chronicity did not systematically bias results for participants. Additionally, the mean discharge BMI of non-participants was also above 19 kg/m^2; suggesting their hospital course, at least with respect to weight restoration, was similar to that of participants. We have previously shown that differences between participants and non-participants in our longitudinal treatment study are likely to exert at most small effects on outcome (40).

The integrated inpatient-partial hospitalization program described herein is designed to achieve rapid weight restoration, and we cannot exclude that some patients actively seek this aspect of treatment, however we have previously reported high levels of perceived coercion regarding hospitalization endorsed by patients at program admission with one third denying the need for hospitalization (44, 45). Despite ambivalence regarding admission, patient satisfaction with treatment at program discharge is high and may reflect therapeutic engagement and mastery over behavior change (29).

The finding that attainment of a BMI threshold of ≥19 kg/m^2 predicts weight outcome is consistent with previous studies showing better outcomes with higher discharge weights (10, 11) and attainment of a BMI ≥19 kg/m^2 predicting good outcome in AN (9, 12). This threshold may help explain why illness duration is commonly understood to be a poor prognostic factor. Studies frequently fail to distinguish partial from full weight restoration and vary in the definition of a good weight restoration outcome. Indeed, many studies define good outcome at 15% below ideal weight, arguably an anorectic weight (46).

In studies in which weight restoration to a BMI ≥19 kg/m^2 is not achieved, low discharge BMI almost certainly confounds the effect of chronicity and severity. For example, in one study in which illness duration was a predictor of poor outcome, the mean discharge BMI was 15.5 kg/m^2 (14). The same concern applies to most studies of outpatient interventions for adults with AN who often have long duration of illness and generally achieve limited weight gains (12, 18, 47).

TABLE 4 | Binary logistic regression model predicting BMI ≥ 19 kg/m^2 at 6-month follow-up using continuous discharge BMI as a predictor variable ($n = 91$).

Predictor	*B*	S.E.	Wald	*df*	Sig.	Exp(B)	95% C.I. for Exp(B)	
							Lower	Upper
Admission BMI[a]	0.070	0.170	0.173	1	0.678	1.073	0.770	1.496
Discharge BMI[a]	0.470	0.187	6.332	1	0.012	1.600	1.110	2.307
Illness duration	−0.003	0.023	0.017	1	0.897	0.997	0.954	1.042
Lifetime nadir BMI[a]	0.206	0.188	1.203	1	0.273	1.229	0.850	1.775

The model overall is significant (chi-square = 22.30; $p < 0.001$).
[a] *BMI = body mass index, kg/m^2.*

The weight restoration rates reported here are high compared to most intensive treatment programs. For example, a recent systematic review of outcomes following residential treatment assessed nineteen open-label studies and found that only nine of these reported BMI outcomes for patients with AN (48). Of these, only one study reported mean end of treatment BMI > 18.5, corresponding with the DSM-5 diagnostic threshold for AN (49).

Time to follow-up also affects outcome. We chose to study 6-month outcome to focus on the effects of intensive treatment and avoid confounding outcome with the effects of diverse aftercare or life events that impact intermediate or longer-term risk of relapse. Six months allows for assessment of retained benefits of treatment and is consistent with data suggesting that relapse risk following inpatient weight restoration is highest in the first 3–12 months post-discharge (16). It is sobering that, even within this relatively brief follow-up period, 24% of our patients report rehospitalization, a proportion similar to the percentage who relapsed at 6-month follow-up in Carter et al.'s study (16). Discharge BMI was not however associated with

likelihood of readmission in this study; reasons for readmission were not available.

The current paper joins others calling for caution in defining the construct of SE-AN. Calugi et al. (17) demonstrated that both SE-AN and non-SE-AN inpatients responded equally well to inpatient treatment, and, having attained a BMI of 19 kg/m^2, lost a small amount of weight which was then maintained at 6- and 12-month time points. Raykos et al. (18) found that illness duration and severity of pretreatment eating psychopathology did not predict response to enhanced cognitive behavioral therapy. Wildes et al. (25) assessed the constructs underlying SE-AN in a group of patients with AN, and found that factors that most distinguished SE-AN from non-SE-AN included health-related quality of life, emotional well-being, and eating behaviors, especially binge-eating and vomiting.

The current paper extends these findings in two ways: first, by including several measures of illness severity, including state and trait psychological measures, in comparisons between short-term and long-term ill, and using measures that were correlated with outcome in a predictive model of treatment response; and second, by demonstrating that weight restoration to a BMI of at least 19 kg/m^2 is the only significant predictor of weight outcome at 6-month follow-up. In contrast to others, purging behavior did not predict treatment outcome (16, 25).

Several study limitations in addition to the percentage of participants evaluated in follow-up require consideration.

First, weight at follow-up was self-reported. There is no evidence to suggest that illness duration would exert a bias in weight reporting, and patients with AN have been shown to provide reliable estimates of BMI, though modest (1 kg) overestimations of weight and height are frequently observed (50).

Second, the short-term 6-month follow-up interval means that participants were still potentially within the window during which risk of relapse remains relatively high (10, 16). Longer-term research assessing relapse risk is needed. Third, for reasons of statistical power, the present study was limited to adult women, and most of these were Caucasian, so it is unclear how generalizable these findings are to other socio-demographic groups.

Further research should confirm and extend understanding of the optimal threshold BMI for discharge and focus on quality of life and social and occupational functioning as indicators of illness severity, as these may have more prognostic value. That these aspects of recovery color patients' hopefulness, or lack thereof, is becoming increasingly clear. Parsing the construct of illness severity will be key to providing clinicians with the tools they need to combat the hopelessness of our most ill patients.

DATA AVAILABILITY STATEMENT

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

ETHICS STATEMENT

The studies involving human participants were reviewed and approved by Johns Hopkins School of Medicine IRB. Written informed consent for participation was not required for this study in accordance with the national legislation and the institutional requirements.

AUTHOR CONTRIBUTIONS

GR, CS, and JC were primarily responsible for the statistical analyses. All authors contributed to the ideas in the paper, edited the drafts, and approved the submission.

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The Supplementary Material for this article can be found online at: https://www.frontiersin.org/articles/10.3389/fpsyt.2021.641861/full#supplementary-material

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The Renfrew Unified Treatment for Eating Disorders and Comorbidity: Long-Term Effects of an Evidence-Based Practice Implementation in Residential Treatment

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Background: The Renfrew Unified Treatment for Eating Disorders and Comorbidity (UT) is a transdiagnostic, emotion-focused treatment adapted for use in residential group treatment. This study examined the effect of UT implementation across five years of treatment delivery.

Methods: Data were collected by questionnaire at admission, discharge (DC), and 6-month follow-up (6MFU). Patient outcomes were measured by the Eating Disorder Examination-Questionnaire, Center for Epidemiologic Studies-Depression Scale, Brief Experiential Avoidance Questionnaire (BEAQ), Anxiety Sensitivity Index, and Southampton Mindfulness Scale. Data were analyzed for $N = 345$ patients treated with treatment-as-usual (TAU), and $N = 2{,}763$ treated with the UT in subsequent years.

Results: Results from multilevel models demonstrated a significant interaction between implementation status (TAU vs. UT) and time, both linear and quadratic, for the depression, experiential avoidance, anxiety sensitivity, and mindfulness variables. Patients treated with the UT showed more improvement in these variables on average, as well as more rebound between DC and 6MFU. Results from multilevel models examining eating disorder outcome showed no significant difference between the TAU and UT for the full sample, but a significant three-way interaction indicated that the UT produced more improvement in the EDE-Q relative to the TAU particularly for patients who entered treatment with high levels of experiential avoidance (BEAQ score).

Conclusion: This long-term study of a transdiagnostic, evidence-based treatment in residential care for eating disorders and comorbidity suggests implementation was associated with beneficial effects on depression and emotion function outcomes, as well as eating disorder severity for patients with high levels of baseline emotion regulation problems. These effects did not appear to diminish in the 5 years following initial implementation.

Keywords: eating disorder, evidence-based practice, residential treatment, implementation research, emotion intolerance, sustainability

INTRODUCTION

Eating disorders (EDs), including anorexia nervosa (AN), bulimia nervosa (BN), binge eating disorder (BED), and "otherwise specified" eating disorders (OSFED), range widely in presentation and severity (1–3). Treatment options exist on a continuum of care, including outpatient, intensive outpatient, partial hospital, and residential treatment, with residential treatment recommended for individuals with severe, complex, and treatment-resistant symptoms (3, 4).

The number of private residential programs in the United States has increased in recent years; (5–8) however, outcome data regarding evidence-based practices (EBPs) in residential treatment for EDs remain scarce (6, 7, 9, 10). A recent review located only $N = 19$ discrete studies of any residential treatment outcomes (10). Among the noted limitations, most studies lacked controls and less than half included follow-up data; when reported, follow-up response rates were low (5, 10). No randomized, controlled comparisons of manualized residential treatments have been reported (10).

There are many obstacles to full implementation and controlled research for EBPs in residential ED programs. Patients in intensive settings typically struggle with two or more co-morbid psychiatric disorders (11), and residential treatment providers suggest that existing manuals for EDs do not adequately address comorbidity (12). In addition, residential programs provide individual and group therapy many times throughout the week, yet EBPs are typically designed to be delivered once or twice per week and lack guidance for adaptation. Furthermore, residential programs provide intensive structural regulation and staff oversight to eliminate ED behaviors such as restriction, binge eating, and purging, while behavioral regulation is a primary focus of most manualized treatments (13, 14).

In addition to interventions that directly address ED behaviors and cognitions, investigators have highlighted the possible importance of emotion regulation as a treatment target in psychotherapy for EDs (15). One recent review concluded that both AN and BN had demonstrated consistent associations with particular emotion regulation difficulties, including lack of awareness of emotions, lack of acceptance of emotions, negative beliefs about emotions or coping, and avoidance/suppression of emotions. While EPBs for EDs that address both ED symptoms and emotion regulation have demonstrated benefits for individuals with EDs (14, 16, 17), additional research is needed to establish whether emotion regulation interventions demonstrate significantly better outcomes than other interventions for EDs, and/or benefits are observed particularly for individuals with higher levels of emotion regulation problems.

Our research group conducted one preliminary study of an integrative EBP for EDs and transdiagnostic emotion functioning in residential care, which compared outcomes from patients who were treated in the first year following implementation to patients who received treatment-as-usual (TAU) prior to implementation (17). The multi-modal, evidence-based residential treatment, adapted from the Unified Protocol developed by Barlow and colleagues (18), is now known as the Renfrew Unified Treatment for Eating Disorders and Comorbidity (19, 20), or Unified Treatment (UT). The UT is a manualized, transdiagnostic approach, with structured groups that address EDs and comorbid disorders using integrative emotion-focused cognitive, behavioral, and experiential interventions. UT modules and research to support their use with EDs are presented in **Table 1**. In that preliminary study, analyses indicated that patients treated with the UT showed more improvement in dimensions of psychopathology directly addressed in the UT manual as putative mechanisms—experiential avoidance, anxiety sensitivity, and mindfulness—relative to patients in TAU (17). Treatment effects for ED and depression treatment outcomes were large in both UT and TAU groups, and did not differ by group (17).

EBP implementation research has increasingly focused on "sustainability." Compared to the step-wise changes that characterize the early stages of implementation, (e.g., adoption, initial implementation) (54, 55), sustainability can be defined as the consistent usage of key program components demonstrating continued achievement of intended outcomes over an extended period of time (56, 57). Extensive implementation research suggests that even when the challenges of implementing EBPs with fidelity have been surmounted, it is difficult to maintain consistent use, as well as intended effects, over longer periods of time (56).

This community case-report focuses on the sustainability of the effects of the Renfrew UT in residential ED care across two sites, over 6 years of observation. This study aimed to investigate whether: (1) significant differences in effect of the UT and TAU at discharge and 6-month follow-up were observed across 5 years of treatment delivery, (2) there were specific effects of the UT relative to TAU for individuals with higher levels of emotional intolerance, and (3) the large treatment effect sizes for outcomes that were observed one-year post-implementation were still observed multiple years after the initial implementation.

METHODS AND MATERIALS

Treatment Approach and Implementation Process

Patient-participants were in residence and received treatment between admission and discharge (DC). Daily therapeutic interventions included: structured daily activities; dietitian-prescribed and staff-supervised meals and snacks; 3–4 therapeutic group sessions per day; and individual meetings with psychotherapists, dietitians and psychiatrists. The frequency and intensity of all types of treatment (e.g., group therapy, individual therapy) and discipline (e.g., psychotherapy, psychiatry, nutrition) remained consistent across time.

The UP was selected for adaptation and implementation based on many considerations. In residential treatment, food intake and behavioral symptoms are regulated, limiting the application of several common outpatient empirically-supported treatments for EDs (e.g., CBT and FBT). Common manualized treatments for EDs do not fully address common and severe comorbidities, including social anxiety disorder, obsessive-compulsive disorder,

TABLE 1 | Unified treatment common elements, techniques, and eating disorder research examples.

Common elements	Techniques	Basic Supporting Research (Examples)	Treatment research (Examples)
Motivation enhancement	Identification of "pros" and "cons" of change; identification of goals and immediate steps for change	Individuals with EDs show low motivation to change; motivation and readiness predicts outcome in EDs (21)	Motivational Interviewing increases motivation in EDs (21) and is part of CBT-E, (13) ICAT. (14)
Function of emotions	Understanding of adaptive functions of emotions; 3-component model (thoughts, behaviors, sensations); antecedents, responses, and consequences of emotions	Individuals with EDs lack emotion awareness and show negative beliefs about emotion (22, 23). Negative affect is an ED risk factor (24–26)	Mindfulness exercises benefit patients with EDs and are included in ICAT, CBT-E, DBT, (27) EABT, (16) and ACT for EDs (28)
Emotion awareness training	Development of nonjudgmental, present-focused awareness	EDs are associated with lack of emotion awareness, lack of emotion acceptance, negative beliefs about emotion, poor mindfulness and high emotion non-acceptance (29–31)	Mindfulness exercises show benefit for patients with EDs (32, 33) and related components are included in DBT, ICAT, EABT, and ACT
Cognitive appraisal & reappraisal	Identification of subjectivity and emotional influence on cognition; probability over-estimation and catastrophizing; core negative appraisals (downward arrow technique)	Negative cognitions such as thin-ideal internalization are associated with the development and maintenance of behavioral EDs (23, 26, 34); negative cognitions associated with food, eating, perfectionism, exercise, body image, are components of eating disorders	Cognitive therapy shows benefit for shape and weight concerns, (35, 36) and related components are included in CBT-E, EABT, and ACT
Avoidance and emotion-driven behaviors	Identification of maladaptive emotion avoidance and emotion-driven behaviors; promotion of adaptive alternatives	EDs are characterized by avoidance of emotion, (23, 31, 32) as well as checking (37, 38) and other rituals (39)	Related interventions or components are included in DBT, EABT, ICAT, ACT, and IPT (40)
Interoceptive awareness & tolerance	Engagement in exercises which evoke physical sensations similar to those of strong emotions (i.e., interoceptive exposure)	EDs are associated with low interoceptive awareness (41–46)	Interoceptive practices, such as appetite awareness training, have shown benefit for individuals with EDs (47, 48)
Emotion exposures	Construction of a hierarchy of avoided and distressing situations; planning and engagement in exposures	EDs are characterized by avoidance of emotion (31, 49), avoidance of viewing or revealing the body (38, 50) and avoidance of feared foods (13)	Related components are included in CBT-E (e.g., weighing and introduction of feared foods), EABT & ACT, and AN-EXRP (51–53)

CBT-E, cognitive behavior therapy-enhanced; ICAT, integrative cognitive-affective therapy; DBT, dialectical behavior therapy; EABT, emotion acceptance behavior therapy; IPT, interpersonal psychotherapy. Elements of this table are included in Thompson-Brenner et al. (20).

and post-traumatic stress disorder. Previoiusly, residential treatment programs had incorporated elements of different empirically-supported treatments for EDs (e.g., DBT and ACT groups), but in an eclectic rather than integrated fashion, (10) which the Renfrew team felt was difficult to unify across sites and levels of care.

Training provided prior to implementation, as well as to all new employees, is program-wide and mandatory for all members of the clinical staff across disciplines at both sites. At the time of implementation, the training department conducted on-site three-day didactic and experiential training in the UT that was based on the training provided to clinical leadership by UP trainers. New staff from all clinical disciplines participate in onboarding training during their first weeks of employment, consisting of 8 hours of interactive web-based training with trainers certified in the UP. The training provides in-depth exploration and application of the theoretical principles in the UT, including experiential exercises based on the exercises completed during UT groups. Additional discipline-specific training (e.g., therapy, nutrition, psychiatry/medical/nursing) more specifically focuses on application of UT principles and interventions in various roles. Staff performance is continuously monitored following training through the review of audio-recorded group therapy sessions by supervisors and trainers resulting in substantive feedback and coaching. [See **Table 2** for a brief comparison of UT and TAU treatment and training; see Thompson-Brenner et al. (20), (17) for in-depth description of the UT emotion-focused approach including the adaptation and implementation processes].

The implementation date at each residential site was the date at which the clinical staff completed intensive training, adopted the manual, and provided UT supervision. Fidelity to the UT protocol was assessed by external raters, across sites and groups, in the year following implementation; fidelity

TABLE 2 | Comparison of unified treatment and treatment-as usual.

	Unified Treatment	Treatment-As-Usual
Treatment: frequency and intensity	Daytime, Overnight, and Weekend Milieu Supervision	Yes
	5-6 Group Therapy sessions per day	Yes
	3 Individual Therapy sessions per week	Yes
	1 Family Therapy session per week	Yes
	Nutrition & Psychiatry Counseling, Nursing checks	Yes
Treatment: content	Manualized Unified Treatment; adapted from Unified Protocol for ED use in residential programs, structured interventions for motivation, emotion awareness and acceptance, cognition and behavior change	Eclectic and idiosyncratic, developed by practitioners and approved by program, informed by principles of feminist-relational theory
	Based on evidence-based common elements	Some *ad hoc* Acceptance and Commitment Therapy and Cognitive Reprocessing Therapy
	Daily and weekly structured symptom monitoring	No
Training: frequency and intensity	Weekly on-site supervision of practitioners	Yes
	Centralized supervision of supervisors	No
	Manualized Fidelity Ratings	No
	Yearly Clinical Retreat	Yes
	Introductory 8 h of training and supervision on treatment model	No
	Unified manuals and materials for disciplines and treatment types	Eclectic guidance and structure for disciplines and treatment types
Training: content	Training in the Unified Treatment	Eclectic topical training

was established to be adequate (17). In subsequent years between the initial implementation period and the end of data collection in this report, training, supervision and manual materials were assessed and adjusted in an iterative process, and components of the multi-modal treatments (e.g., nutrition counseling, family therapy, expressive therapies) were adjusted to improve congruence with the UT.

Patient Assessments and Procedures

The study period ran from 2014 through 5 years post-implementation. Admission data for the TAU group were collected from February 2014 until implementation date (October 2014 at one site, and March 2015 at the other). Admission data from the UT group were collected from implementation date until November 2019. Throughout the study period, residential patient-participants completed standard admission procedures, including screening and psychiatric interview assessment of EDs, co-occurring diagnoses, and medical/behavioral stability. All routinely presenting patients completed a standard battery of computerized self-report assessments for internal outcome monitoring purposes at admission and DC. Patients who had completed at least one survey were contacted via email and provided a secure web link for remote completion of the 6MFU assessment. Patients received $30 Amazon gift cards for completion of 6MFU. All research activities were approved by institutional review boards at The Renfrew Center and Drexel University.

Only patients consenting to have their data used for research ($N = 3775$; 95.2% of all patients) were considered for inclusion in the present study. Exclusions included: (1) previous admission during the data collection period ($n = 509$); (2) length of stay <7 days ($n = 117$); (3) admission date past the fifth year of implementation ($n = 41$). These exclusions yielded a final sample size of 3,108 eligible for analyses (TAU: $n = 345$; UT: $n = 2{,}763$) across two residential treatment sites.

ED Symptom Severity

The Eating Disorder Examination-Questionnaire (EDE-Q) (58) is a 28-item self-report measure. The global score was used to examine overall eating disorder severity, ranging from 0 to 6 with higher scores indicating more severe eating disorder symptoms (sample $\alpha = 0.87$).

Depressive Symptoms

The Center for Epidemiologic Studies Depression Scale (CES-D) (59) is a 20-item self-report assessment. Items on a Likert scale range from 0 (rarely or none of the time) to 3 (most of all of the time). The total score ranges from 0 to 60 and higher scores indicate more symptomology (sample $\alpha = 0.88$).

Experiential Avoidance

The Brief Experiential Avoidance Questionnaire (BEAQ) (60) is a 15-item self-report measure. The individual items closely match dimensions of emotion regulation problems observed to be elevated in EDs, such as lack of emotional awareness (e.g., "It's hard for me to know what I am feeling"); lack of emotion acceptance (e.g., "One of my big goals is to be free from painful emotions"); emotion avoidance (e.g., "I rarely do something if there is a chance that it will upset me"); emotion suppression (e.g.,

When unpleasant memories come to me, I try to put them out of my mind"); and negative beliefs about emotion (e.g., "The key to a good life is never feeling any pain"). Items are on a Likert scale from 1 (strongly disagree) to 6 (strongly agree). Scores can range from 15 to 60, with higher scores indicating more experiential avoidance (sample $\alpha = 0.84$). In prior research, the 62-item Multidimensional Experiential Avoidance Questionnaire (MEAQ) (61) was utilized; however, the brief version was highly correlated with the longer version and reduced participant burden. Participants who had completed the MEAQ had their scores re-coded using the 15 items of the BEAQ.

Anxiety Sensitivity

The Anxiety Sensitivity Index (ASI) (62) is a 16 item self-report measure that assesses negative attitudes toward the physical sensations of anxiety (e.g., "It scares me when my heart beats rapidly"). Items are on a Likert Scale from 0 (very little) to 4 (very much). The total score ranges from 0 to 64, with higher scores indicating more anxiety sensitivity (sample $\alpha = 0.87$).

Mindfulness

The Southampton Mindfulness Questionnaire (SMQ) (63) is a 16-item self-report measure of the goals of mindfulness training, including acceptance of emotion (e.g., "Usually when I experience distressing thoughts and images, I try to just experience the thoughts or images without judging them") and particular observations about emotion (e.g., "Usually when I experience distressing thoughts and images, I notice how brief the thoughts and images really are"). Items are on a Likert scale from 0 (disagree totally) to 6 (agree totally). The total score ranges from 0 to 96, with higher scores indicating more mindfulness (sample $\alpha = 0.87$).

Patient Diagnoses

Primary diagnoses were established via a two-step procedure. Trained assessors conducted intake interviews over the phone prior to admission, which included structured assessment of each diagnostic criterion for ED diagnosis. Co-occurring symptoms were assessed in the intake interview. Following admission, the ED and co-occurring diagnoses were confirmed by a semi-structured psychiatric interview administered by a psychiatrist. BMI was assessed at intake and DC using electronic medical scales. When new diagnostic criteria were added in DSM-V (e.g., for ARFID and OSFED), the rates of particular diagnoses changed in accordance with the new criteria.

Fidelity Monitoring

Ongoing supervision and monitoring was used to maintain fidelity to the UT. UT groups are digitally recorded and uploaded to an internal, secure server. Site supervisors, with established fidelity to the UT method, randomly select one recording per week from each supervisee's recordings, listen to the entire recording, and complete the fidelity measure, giving a score from 0–100% adherence based on the presence or absence of required group content. The supervisor then uses the adherence rating, as well as observations about clinician skills (e.g., group engagement and cohesiveness, warmth, empathy and understanding), to provide overall ratings of adherence and quality. This assessment forms the basis of targeted, substantive feedback in supervision. Additionally, each week one of the supervisor-reviewed recordings is rated by a member of the Training Department. The ratings and feedback of the trainer and supervisor are compared and discussed in a weekly "supervision of supervision" session and the training department uses information from ongoing review of group recordings to inform training initiatives for the organization to maintain fidelity of the UT.

External researchers rated a limited set of fidelity ratings for a separate study in 2019 (31). Observer-rated adherence was in the excellent range, with scores ranging from 80–100% across all rated sessions ($M = 96.99\%$, $SD = 0.07$). Observer-rated quality and competence were also good, with all individual item means for adherence items falling within the "high quality" to "very high quality" range and all individual item means for the competence items falling within the "good" to "excellent" range (64).

Statistical Plan

Effect of UT Implementation

Multilevel models were used to analyze whether change in outcome over the course of treatment and follow-up (i.e., admission to DC to 6MFU) varied as a result of UT implementation. Growth curves were modeled with second-order orthogonal polynomials and fixed effects of UT status on all time terms. The Pre-UT condition was treated as the baseline, and parameters were estimated for the Post-UT condition. Time was modeled continuously in units of 6-months (i.e., dividing number of days by 183, the number of days in 6-months), with each participant's admission coded as 0, to promote convergence across all models. Comparison of model fit using ANOVA revealed that a random effects structure allowing variation in each participant's baseline score and quadratic trajectory over time resulted in best model fit, across all outcomes. The fixed effects of time (linear and quadratic) and their interaction with UT status were added sequentially, and effects on model fit were also evaluated using ANOVA. Finally, the moderating effect of baseline experiential avoidance (i.e., BEAQ admission scores) on UT status in relation to outcome was investigated in an exploratory manner. BEAQ score was of particular interest because the treatment approach, which focused on awareness of emotion and the reduction of emotion avoidance, might be hypothesized to be of particular relative benefit to individuals with higher levels of emotional avoidance at baseline. Additionally, because the UT and TAU groups significantly differed in their number of comorbidities and frequency of AN-R diagnoses at baseline, these variables were included as time-varying (linear and quadratic) covariates. All multilevel analyses were carried out in RStudio version 1.2, (65) using the lme4 and lmer packages.

Implementation Sustainment

Effect sizes (Cohen's *d*) for calculated separately for subsamples of patients who were admitted in each calendar year across the study time period. All sustainment analyses were conducted in SPSS, v.27 (66).

RESULTS

Response Rates

Response rates across timepoints and years of implementation are shown in **Table 3**. Rates of completion at admission were consistently high, while response rates for DC and 6MFU varied across years. To assess for response bias, chi-square tests were used to examine response rates across the TAU and UT groups, and ANOVAs were used to examine whether (1) TAU v. UT and (2) 6MFU completers v. non-completers, significantly differed on scores at admission.

Chi-square analyses revealed different response rates for the TAU and UT groups, at admission, discharge, and follow-up. Response rates were significantly higher in the UT phase at admission (UT: $n = 2{,}739$, 99.1%; TAU: $n = 337$, 97.7%) and 6MFU (UT: $n = 1{,}680$, 60.8%; TAU: $n = 145$, 42.0%);

TABLE 3 | Patient characteristics.

Demographics	Pre-UT	1 year post	2 years post	3 years post	4 years post	5 years post
	***n* = 345**	***n* = 491**	***n* = 587**	***n* = 563**	***n* = 604**	***n* = 518**
Ethnicity (%)						
White	78.3	79	82.8	80.1	79.6	80.1
Hispanic	5.8	4.9	5.5	6.6	7.1	6.4
African-American	1.2	1.8	1.4	2.1	2.2	3.1
Asian/Pacific Islander	1.4	2.6	2.4	2.1	2	2.5
Multiracial	2.6	2.4	3.4	4	3.8	3.9
Other	2	1.4	2.4	2.5	2.8	1.9
Declined to respond	8.7	7.3	1.9	1.8	1.8	1.7
Age						
Range	14–63	13–66	13–69	13–75	14–65	14–73
M ± SD	26.3 ± 11.0	24.5 ± 13.0	25.8 ± 11.3	25.1 ± 10.9	24.2 ± 10.2	26.2 ± 12.3
Adolescents (%)	20.6	23	22	23.6	26.5	22.4
Adults (%)	79.4	77	78	76.4	73.5	77.6
LOS (M ± SD)	32 ±14	30 ± 13	32 ± 13	33 ± 16	33 ± 15	32 ± 13
ED diagnosis (%)						
AN-R	25.8	26.3	26.8	19.7	23.8	23.6
AN-BP	11	16.5	14.3	21.8	21.4	22.2
BN	31.6	31.4	28.3	29.8	24.7	23
BED	2.3	5.9	5.3	4.8	4.5	6.9
EDNOS	29	1.8	–	–	–	–
OSFED	0.3	15.3	22.7	21.3	24.2	21.6
ARFID	–	1.6	1.2	1.1	1.5	2.5
UFED	–	1.2	2.1	1.4	–	0.2
Comorbidity (M ± SD)	2 ± 1	2 ± 1	2 ± 1	2 ± 1	2 ± 1	2 ± 1
Site (%)						
Northeastern US	64.9	70.5	61.5	67.9	68	63.3
Southeastern US	35.1	29.5	38.5	32.1	32	36.7
Admission BMI (M ± SD)	22.2 ± 9.3	21.8 ± 7.6	22.4 ± 7.9	23.0 ± 9.3	22.4 ± 7.8	23.0 ± 9.0
Baseline scores (M ± SD)						
EDE-Q	4.1 ± 1.4	4.0 ± 1.5	4.0 ± 1.5	4.0 ± 1.4	4.0 ± 1.4	4.1 ± 1.4
CES-D	36.7 ± 12.3	37.3 ± 12.5	37.4 ± 12.3	38.7 ± 11.8	37.5 ± 11.3	37.9 ± 11.8
BEAQ	57.3 ± 12.9	57.7 ± 12.3	57.8 ± 13.5	59.6 ± 13.4	59.2 ± 12.0	59.5 ± 13.3
ASI	31.6 ± 12.5	31.8 ± 12.5	33.1 ± 13.9	32.0 ± 13.2	31.8 ± 13.0	31.9 ± 12.9
SMQ	31.4 ± 16.5	34.1 ± 16.7	32.6 ± 17.1	30.0 ± 17.2	29.2 ± 16.0	30.8 ± 16.3
Response rates (%)						
Completed ADM	97.7	99.8	98.6	99.3	99.5	98.5
Completed DC	96.8	99.4	88.9	88.1	84.6	84.4
Completed 6MFU	42	47.3	59.8	65	68.2	61.6

LOS, length of stay; ED, eating disorder; AN-R, anorexia nervosa-restricting subtype; AN-BP, anorexia nervosa-binge eating/purging subtype; BN, bulimia nervosa; BED, binge eating disorder; EDNOS, eating disorder not otherwise specified; OSFED, other specified feeding and eating disorder; ARFID, avoidant/restrictive food intake disorder; UNFED, unspecified feeding or eating disorder; ADM, admission; DC, discharge; 6MFU, six month follow-up.

TABLE 4 | Multilevel models examining the effect of UT status on outcomes, from admission to follow-up.

	EDE-Q (n = 2,632)		CES-D[a] (n = 2,665)		BEAQ (n = 2,624)		ASI (n = 2,617)		SMQ (n = 2,619)	
	β	SE	β	SE	β	SE	β	SE	β	SE
Main effects of time										
Time (linear)	−3.18***	0.44	−58.37***	7.34	−29.01***	5.96	−1.96†	1.06	36.39***	8.72
Time (quadratic)	2.95***	0.41	44.62***	6.13	22.12***	4.96			−28.14***	7.44
UT effect over time										
UT × linear time			−25.62*	10.22	−26.64***	5.65	−47.97***	6.88	44.19***	12.76
UT × quadratic time	−0.30	0.17	18.31*	8.55	19.69***	4.69	38.94***	5.61	−32.06**	10.76
Moderating effect of BEAQ on UT effect over time										
UT × Time (L) × BEAQ	−0.04***	0.01	0.21	0.12			0.33**	0.11	−0.19	0.16
UT × Time (Q) × BEAQ	0.04***	0.01	−0.15	0.10			−0.29**	0.09	0.13	0.13
Covariate effects over time										
AN-R diagnosis LCOT	2.73***	0.26	20.07***	3.35	14.79***	3.34	10.45***	3.01	−19.73***	4.44
AN-R diagnosis QCOT	−2.65***	0.23	−19.21***	2.76	−13.58***	2.72	−9.56***	2.43	17.79***	3.64
Comorbidities LCOT	−0.34***	0.09	1.69	1.17	1.11	1.15	0.25	1.00	−4.85**	1.55
Comorbidities QCOT	0.29***	0.08	−1.05	0.98	−0.64	0.95	0.06	0.82	3.80**	1.29

All models included the following random effects structure: (1 + time^2 | ID). In determining the best fitting model for EDE-Q, the inclusion of an (UT × linear time) interaction term did not improve model fit; therefore, it was dropped from the model.

UT, unified treatment; AN-R, anorexia nervosa-restricting subtype diagnosis; BEAQ, brief experiential avoidance questionnaire; LCOT, linear change over time; QCOT, quadratic change over time; Model n's change for each outcome, as at least two timepoints. were required to calculate the multilevel models and rates of completion differed for each questionnaire.

[a]*Model for CES-D included a main effect of UT, β = 1.47, SE = 0.94, p = 0.12. *p<0.05, **p<0.01, ***p<0.001.*

however, the TAU phase demonstrated higher response rates at discharge (UT: n = 2,453, 88.8%; TAU: n = 334, 96.8%). Chi-square analyses further revealed that response rates differed in subsequent years of UT implementation (all p's>0.05). Therefore, we conducted analyses to examine whether any differences were observed between responders and non-responders at baseline. No differences on any outcome measures at admission were observed comparing either discharge completers vs. non-completers or 6MFU completers v. non-completers (all p's>0.05).

Patient Demographics

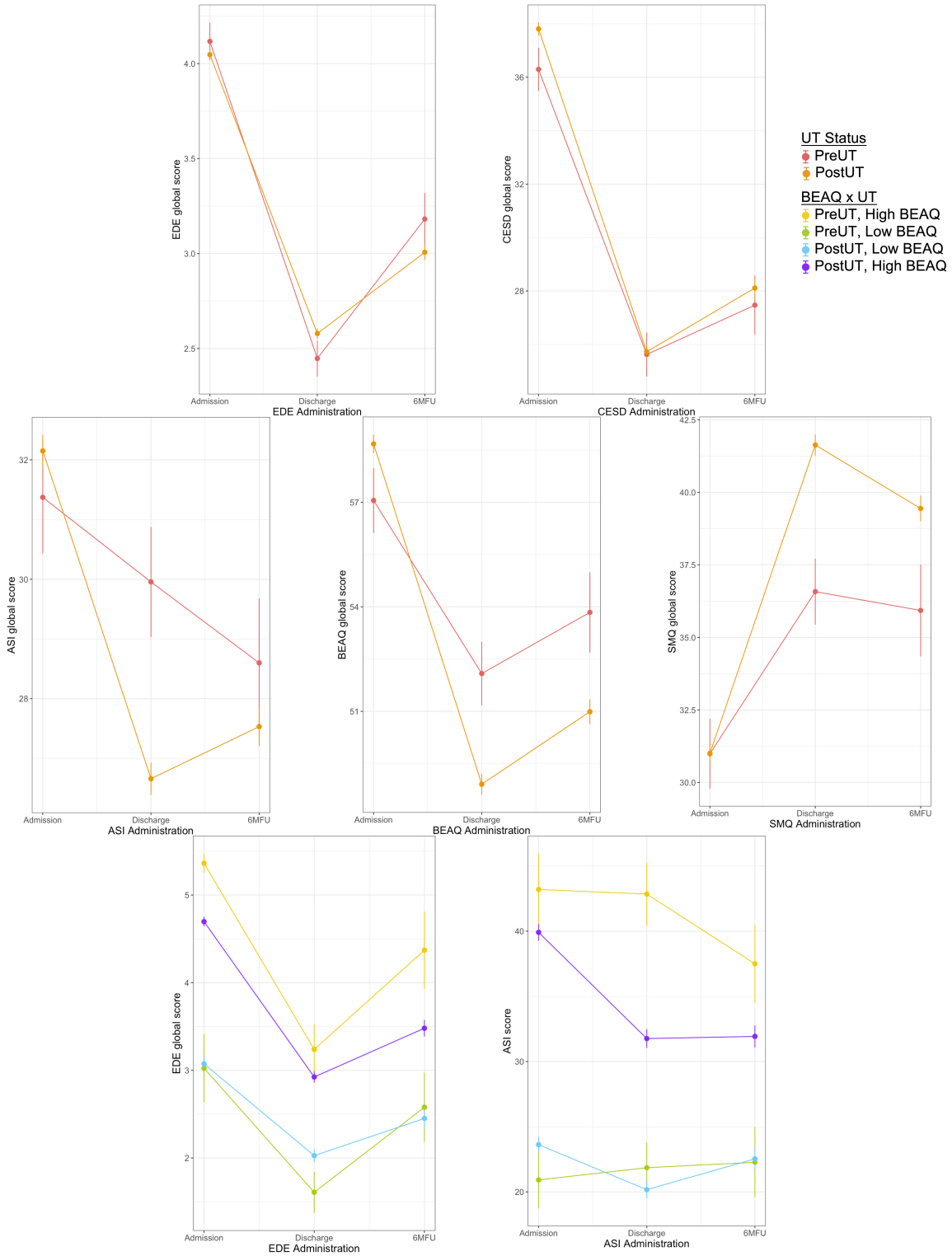
Patient characteristics are reported in **Table 3**. Age ranged from 13 to 75 years (M = 25; SD = 0.19). The majority of the sample was White (n = 2492; 80.1%), and the most common ED diagnosis was bulimia nervosa (n = 865; 27.7%). The majority of the sample was diagnosed with at least one comorbid disorder (n = 2,909; 93.5%), and the most common comorbidities were mood disorders (n = 2507; 80.7%) and anxiety disorders (n = 996; 32.0%).

Multilevel Model Results

Model parameters for growth curve analyses investigating the UT's effect on outcome are summarized in **Table 4**. All models included [1 + time (2) | ID] as the random effects structure. In determining the best fitting model for EDE-Q, the inclusion of a fixed (UT × linear time) interaction term did not improve model fit; therefore, it was dropped from the model. Similarly, the inclusion of a fixed (quadratic time) main effect did not improve model fit for the ASI; therefore, it was dropped from the model. Differences in baseline CES-D scores across the UT and TAU groups were controlled for by including a main effect of the UT (i.e. a variable reflecting differences in baseline scores in the TAU group relative to the UT group). The UT and TAU groups demonstrated comparable scores at baseline on all other outcomes; therefore, the UT main effect was not included in these models. Outcomes from multilevel models are presented in **Table 4**; graphs of change in outcome variables at DC and 6MFU in pre-implementation vs. post-implementation are presented in **Figure 1**.

EDE-Q

Significant linear [$\beta = -3.18$, $t(4{,}324.45) = -7.30$, $p < 0.001$] and quadratic [$\beta = 2.95$, $t(4{,}672.92) = 7.26$, $p < 0.001$] effects of time on EDE-Q were observed. The negative linear time effect indicates a decrease in EDE-Q global scores over time on average regardless of UT status, while the positive quadratic time effect indicates a general rebound in EDE scores over time, regardless of UT status. There was no significant interaction between UT status and quadratic time. As noted, the interaction between UT status and the linear time component did not improve model fit, and was not included. These results indicate that the UT was



Graphs of change to discharge and follow up, in Pre-Implementation and Post-Implementation phases, including experiential avoidance moderation effect for EDE and ASI outcomes.

FIGURE 1 | Change in outcome variables discharge to 6MFU in pre-implementation vs. post-implementation. Graphs of change to discharge and follow up, in pre-implementation and post-implementation phases, including experiential avoidance moderation effect for EDE-Q and ASI Outcomes.

not associated with more improvements in EDE-Q relative to the TAU group.

In three-way interactions, baseline BEAQ scores showed a significant moderating effect on the relationship between UT implementation and EDE-Q linear change over time [$\beta = -0.04$, $t(4,520.62) = 6.22$, $p < 0.001$], and quadratic change over time [$\beta = 0.04$, $t(4,867.61) = 6.02$, $p < 0.001$], indicating that for individuals with higher baseline BEAQ scores, the implementation of the UT was associated with a greater decrease in EDE-Q scores relative to TAU at discharge, and lesser rebound in EDE-Q scores relative to TAU between discharge and follow-up. This suggests that the UT implementation showed a greater positive effect on EDE-Q scores relative to TAU specifically for those individuals with higher experiential avoidance scores at baseline (see **Figure 1**).

The covariate reflecting a baseline diagnosis of AN-R showed a positive relationship to linear change over time in EDE-Q score [$\beta = 2.73$, $t(4,464.95) = 10.71$, $p < 0.001$], and a negative relationship to quadratic change over time [$\beta = -2.65$, $t(4,631.23) = -11.38$, $p < 0.001$], indicating those participants with AN-R showed less steep EDE-Q change from admission to discharge, and less rebound between discharge and follow-up relative to the group with other ED diagnoses. The covariate reflecting the number of co-occurring diagnoses at baseline showed significant negative relationship with linear change over time [$\beta = -0.34$, $t(4,426.19) = -3.68$, $p < 0.001$], and significant positive quadratic change over time [$\beta = 0.29$, $t(4,577.81) = 3.49$, $p < 0.001$], indicating that the presence of more comorbid diagnoses predicted a steeper change in EDE-Q score by discharge, and steeper rebound between discharge and follow-up.

CESD

Significant linear [$\beta = -58.37$, $t(3,479.79) = -7.96$, $p < 0.001$] and quadratic [$\beta = 44.62$, $t(3,723.18) = 7.28$, $p < 0.001$] effects of time on CESD outcome were observed. The negative linear time effect indicates an average decrease in CESD scores over time while the positive quadratic time effect indicates a general rebound in CESD scores over time, regardless of UT status. As noted in **Table 4**, the main effect of UT status on CESD was included to control for differences in baseline scores between the UT and TAU groups, but this effect was not significant at the $p < 0.05$ level in the final model. UT status showed significant interactions with linear change over time [$\beta = -25.62$, $t(4,321.03) = -2.51$, $p = 0.01$] and quadratic change over time [$\beta = 18.31$, $t(4,420.07) = 2.14$, $p = 0.03$] suggesting that the implementation of the UT was associated with larger decrease in CESD scores overall, as well as larger rebound in CESD scores between discharge and follow-up.

In three-way interactions, baseline BEAQ did not significantly moderate the relationship between UT status and linear or quadratic change over time. The covariate reflecting a baseline diagnosis of AN-R showed a positive relationship to linear change over time [$\beta = 20.07$, $t(5,323.75) = 6.00$, $p < 0.001$], and a negative relationship to quadratic change over time [$\beta = -19.21$, $t(4,886.84) = -6.95$, $p < 0.001$], indicating those participants with AN-R showed lesser CES-D change from admission to discharge, and lesser rebound between discharge and follow-up relative to the group with other ED diagnoses. The covariate reflecting the number of co-occurring diagnoses at baseline did not show significant relationships to linear or quadratic change in CES-D scores over time.

BEAQ

Significant linear [$\beta = -29.01$, $t(5,600.38) = -4.87$, $p < 0.001$] and quadratic [$\beta = 22.12$, $t(5,150.61) = 4.46$, $p < 0.001$] effects of time on BEAQ outcome were observed. The negative linear time effect indicates an average decrease in BEAQ scores over time, while the positive quadratic time effect indicates a general rebound in BEAQ scores over time, regardless of UT status. There were significant interactions between UT status and both the linear [$\beta = -26.64$, $t(5,749.05) = -4.72$, $p < 0.001$] and quadratic time components [$\beta = 19.69$, $t(5,066.31) = 4.20$, $p < 0.001$]. The negative linear interaction indicates a steeper decrease in BEAQ scores over time for the UT group, compared to TAU; while the positive quadratic interaction indicates greater rebound in BEAQ scores over time in UT group compared to TAU.

The covariate reflecting a baseline diagnosis of AN-R showed a positive relationship to linear change in BEAQ score over time [$\beta = 14.79$, $t(5,545.31) = 4.42$, $p < 0.001$], and a negative relationship to quadratic change over time [$\beta = -13.58$, $t(4,942.91) = -4.99$, $p < 0.001$], indicating those participants with AN-R showed less steep BEAQ change from admission to discharge, and less rebound between discharge and follow-up relative to the group with other ED diagnoses. The covariate reflecting the number of co-occurring diagnoses at baseline did not show significant relationships to change in BEAQ scores over time.

ASI

The main effect of time on ASI trajectories was significant only at the trend level ($p = 0.06$; see **Figure 1**). There were, however, different patterns of change over time relative to UT status. UT status demonstrated a significant interactions with both the linear time component [$\beta = -47.97$, $t(5,104.04) = -6.98$, $p < 0.001$] and the quadratic time component [$\beta = 38.94$, $t(4,626.93) = 6.94$, $p < 0.001$], indicating that there was steeper decrease in ASI scores over time for the UT group compared to TAU, as well as a greater rebound in ASI scores over time, compared to those in the TAU group.

In three-way interactions, baseline BEAQ score was a significant moderator of the linear relationship between UT status and ASI scores [$\beta = 0.33$, $t(5,127.63) = 3.05$, $p = 0.002$] and also the quadratic relationship between UT status and ASI score [$\beta = -0.29$, $t(4,476.39) = -3.18$, $p = 0.002$] indicating that individuals with higher BEAQ scores at admission, relative to those with lower BEAQ scores, showed greater overall comparative improvement in ASI scores in UT group relative to TAU group. As shown in **Figure 1**, individuals with higher BEAQ scores in the UT showed greater improvement in ASI scores by discharge, and virtually no rebound, compared to those with high BEAQ scores in the TAU, who showed only a moderate decline in ASI scores by discharge, and additional decline in ASI scores by 6MFU.

The covariate reflecting a baseline diagnosis of AN-R showed a positive relationship to linear change in ASI score over time [$\beta = 10.45$, $t(5,177.20) = 3.47$, $p < 0.001$], and a negative relationship to quadratic change over time [$\beta = -9.56$, $t(4,555.24) = -3.93$, $p < 0.001$], indicating those participants with AN-R showed more ASI change from admission to discharge, and more rebound between discharge and follow-up relative to the group with other ED diagnoses. The covariate reflecting the number of co-occurring diagnoses at baseline did not show significant relationships to change in ASI scores over time.

SMQ

[1]Significant linear [$\beta = 36.39$, $t(4,955.47) = 4.17$, $p < 0.001$] and quadratic [$\beta = -28.14$, $t(4,919.48) = -3.79$, $p < 0.01$] effects of time on SMQ outcome were observed. The positive linear time effect indicates an average increase (i.e., improvement) in mindfulness scores over time, while the negative quadratic time effect indicates a general rebound in mindfulness scores over time, regardless of UT status. Results also indicated significant interactions between UT status and both the linear [$\beta = 44.19$, $t(5,322.19) = 3.46$, $p < 0.001$] and quadratic time components [$\beta = -32.06$, $t(4,973.79) = -2.98$, $p = 0.003$]. The positive linear interaction indicates a steeper increase (i.e., improvement) in SMQ scores over time for the UT group compared to TAU, while the negative quadratic interaction indicates greater rebound in SMQ scores over time in UT group compared to TAU.

In three-way interactions, baseline BEAQ did not moderate the effect of the UT implementation on SMQ scores. The covariate reflecting a baseline diagnosis of AN-R showed a negative relationship to linear change over time in SMQ score [$\beta = -19.73$, $t(5,400.16) = -4.44$, $p < 0.001$], and a positive relationship to quadratic change over time [$\beta = 17.79$, $t(4,774.16) = 4.89$, $p < 0.001$], indicating those participants with AN-R showed less SMQ change from admission to discharge, and less rebound between discharge and follow-up relative to the group with other ED diagnoses. The covariate reflecting the number of co-occurring diagnoses at baseline showed a significant negative relationship with linear change over time [$\beta = -4.85$, $t(5,430.71) = -3.12$, $p = 0.002$], and significant positive quadratic change over time [$\beta = 3.80$, $t(4,812.25) = 2.94$, $p = 0.003$], indicating that a greater number of comorbid diagnoses was associated with a slower rate of improvement in mindfulness scores from admission to follow-up, and a significant decelerating (negative) trajectory from discharge to follow-up.

Sustainment

Figure 2 shows graphs of effect sizes on each outcome variable at DC and 6MFU, across each year of data collection. Visual inspection of observed benefits for most outcome variables were maintained over time, particularly between DC and 6MFU in the first year following implementation of the UT relative to (a) TAU, and (b) subsequent years of the implementation (years 2–5). In several graphs, the improvement effect continues to increase in additional early years of implementation, and returns to slightly more moderate levels in the last two years.

DISCUSSION

This study investigated the effect of the implementation of the Renfrew Unified Treatment for Eating Disorders and Comorbidity (UT) (19) across a multidimensional residential treatment program at two sites in the United States, between 2014 and 2019. Overall, results demonstrate support for the effectiveness of the UT, for patients at discharge and 6-month follow-up, that was not diminished across multiple years following the initial implementation effort.

Analyses of the ED-specific outcome did not detect a significant difference in effect for individuals treated in the pre-implementation TAU phase and those treated with the UT over 5 years of data collection. These results were similar to those reported in a prior report that examined 1 year of post-implementation data (17). However, in three-way interactions, the baseline level of experiential avoidance moderated the relationship between implementation and EDE-Q change: individuals with higher baseline BEAQ scores showed a greater decrease in EDE-Q score over time in the UT relative to the TAU, whereas those with lower baseline BEAQ scores did not show this relative benefit for the UT on EDE-Q score. This finding suggests that the UT shows relative benefit in ED symptoms for those patients who have one form of emotional dysregulation (i.e., emotional avoidance or intolerance). It is important to note that observed EDE-Q effect sizes were already quite large in treatment-as-usual, and may have demonstrated ceiling effects. Additional analyses are required, however, to ascertain what additional interventions could provide relative benefit for patients whose symptoms are severe and intractable, but do not have emotion avoidance.

Analyses of depression outcome, as well as experiential avoidance, anxiety sensitivity, and mindfulness, all indicated that individuals treated in the UT phase showed greater improvements relative to patients treated prior to the implementation in the TAU phase. In the model of anxiety sensitivity, there was also a significant moderating effect of baseline experiential avoidance, suggesting that this relatively larger benefit of the UT on ASI score was more pronounced among those individuals who had higher BEAQ admission scores. This finding again supports the supposition that an emotion-focused transdiagnostic intervention, such as the UT, addresses the co-occurring emotion dysfunction that is characteristic of a large proportion of patients who enter residential treatment.

Findings regarding the effects of the treatment for patients specifically with AN-R were unexpected and require additional investigation. Patients who entered treatment with an AN-R diagnosis reported lesser decrease in eating disorder symptoms,

[1]Note that the direction of the Southampton Mindfulness Questionnaire is different from the other outcome measures, and improvement is indicated by higher scores/increases rather than lower scores/decreases.

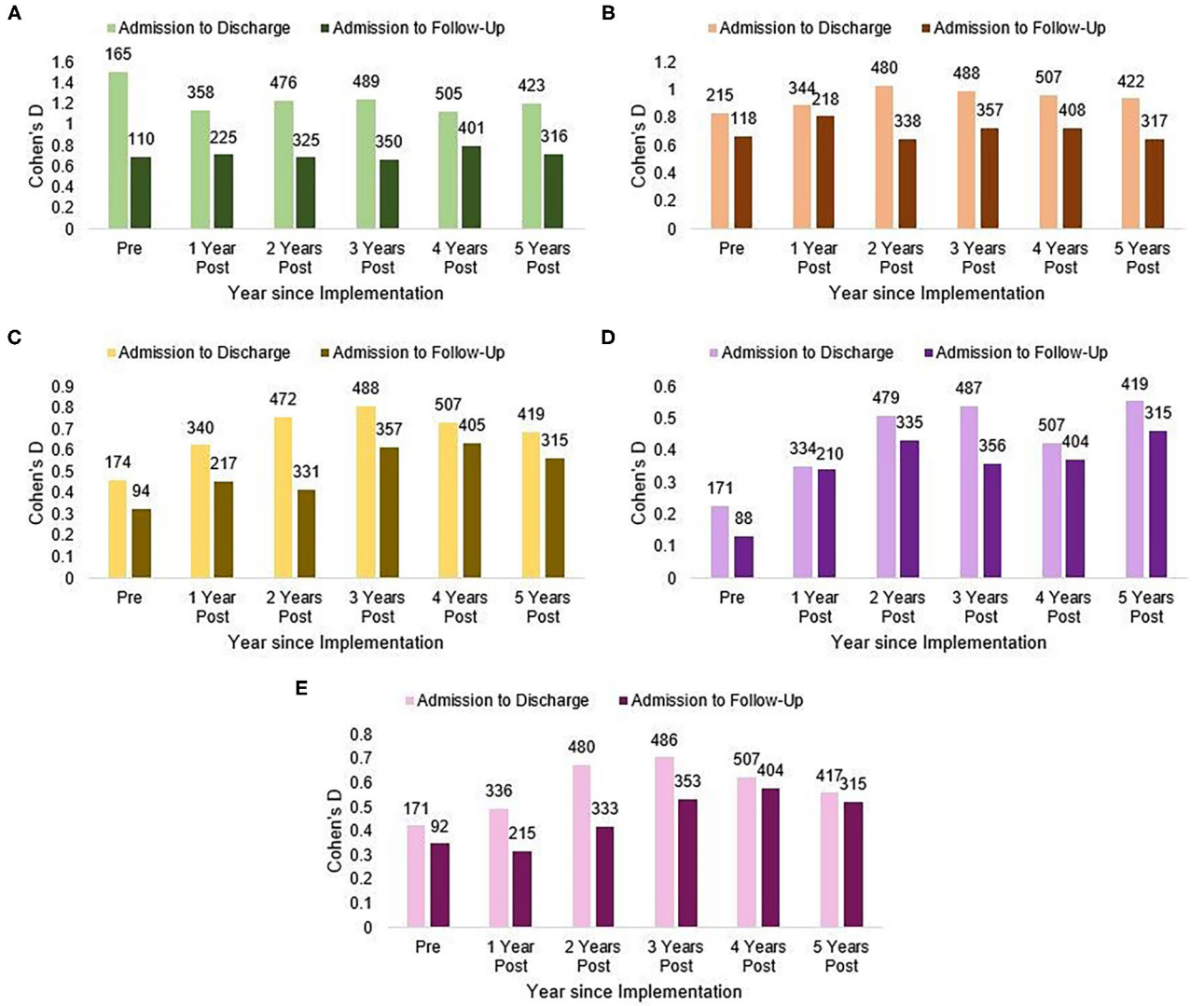


FIGURE 2 | Sustainment of implementation effect over 5 years. **(A)** EDE-Q, **(B)** CES-D, **(C)** BEAQ, **(D)** ASI, and **(E)** SMQ. Number above each bar indicate the total n. EDE-Q, Eatting Disorder Examination-Questionnaire; CES-D, Center for Epidemiologic Studies Depression Scale; BEAQ, Brief Experiential Avoidance Scale; ASI, Anxiety Sensitivity Index; SMQ, Southampton Mindfulness Questionnaire.

depression, experiential avoidance, and mindfulness from intake to discharge; however, AN-R was associated with *greater* change in anxiety sensitivity from intake to discharge. These findings concerned the subsample with AN-R relative to all other patients, and were not specific to treatment type. This pattern is not easy to explain, and requires deeper analysis of baseline differences between diagnostic groups, the relationship between change in these variables and change in weight during residential treatment for individuals with AN, and the general question of treatment-resistance. Individuals with AN-R are observed to have reduced awareness of emotions, though comparisons between individuals with active AN-R and recovered individuals, individuals with AN-binge/purge type, and individuals with other ED diagnoses are complex and require additional study (67). This study did not investigate body mass index or ideal body weight as an outcome, in part due to the limitations of our self-reported follow-up measurements. Further research is needed to investigate these important questions.

Visual inspection of treatment effect sizes for all variables calculated by year indicated that the effects observed in the immediate full implementation period were largely sustained across subsequent years. Although descriptive, the observed trends reflect consistency over time. This is notable given the complexity of residential care and the routine variability in staff over time in such settings. Previous implementation work has warned that "drift" overtime is commonplace (56); at the very least, the pattern of effect sizes indicates the absence of a worsening trend over a 5 year period.

It is important to keep in mind that treatment only occurred between intake and discharge and, in general, it was expected that the larger the observed effect was at the time of discharge, some degree of rebound would occur between discharge and follow-up. Some degree of relapse is common post-discharge (67), as well as the likelihood of regression to the mean. Nonetheless, in many cases there was still a significant benefit to the UT at 6MFU, particularly for experiential avoidance, anxiety sensitivity, and mindfulness. These reflect aspects of emotional functioning that were directly addressed in the UT, as well as unique improvements in ED symptoms for those who entered treatment with a high level of experiential avoidance.

This study had several limitations. As a community case example that included a wide-scale EBP implementation across a complex system of care, there were many changes associated with the implementation as well as the passage of time that were not directly measured or isolated. As such, we cannot determine which specific elements of sustainment effort are associated with maintenance of treatment fidelity or patient outcomes. Because patients were not randomized or treated in concurrent time periods, it is possible that cohort differences or other changes in treatment associated with the passage of time accounted for observed differences. We tried to include covariates that reflected any variable that did seem to differ across time periods, but many potential covariates were not measured. Notably, response rates differed over time; as research procedures in the programs improved over time, the response rate went up. We examined whether there were systematic differences associated with response rate, and importantly, no differences on any outcome measures at admission were observed between completers and non-completers.

The study's limitations regarding the race and gender of the participants deserve additional comment. The underrepresentation of non-Caucasian participants in the sample reflects the underrepresentation of people of color across mental health treatment and research. The elimination of these disparities must be a high priority for providers, policy makers, and researchers. These problems may be exacerbated in residential/inpatient treatment programs, which are often private and costly, and therefore engage issues of intersectionality and structural racism. Furthermore, residential treatment programs are *de facto* communities, where racial/ethnic and gender minorities may feel the effects of discrimination or marginalization in unique ways. The Renfrew Treatment Center has undertaken research to understand the experience of patients who identify as minorities in terms of their race/ethnicity, gender, or sexuality, and we are committed to making substantial effects to identify and rectify any problems at every level.

Despite these limitations, the substantive data collected across multiple years of treatment suggest that the implementation of an EBP at two residential treatment programs was associated with stronger effects in intended outcome areas, in some cases particularly for patients who had higher levels of emotional intolerance, which the EBP was intended to address. These complex patients typically have co-occurring emotional disorders and are regularly treated in higher levels of care such as residential treatment. The results from this study suggest that it is possible to implement an integrative EBP protocol to address both eating disorder and emotion functioning symptoms, and to sustain that effect over multiple years.

DATA AVAILABILITY STATEMENT

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

ETHICS STATEMENT

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

AUTHOR CONTRIBUTIONS

All authors listed have made a substantial, direct and intellectual contribution to the work, and approved it for publication.

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Clinical and Cognitive Functioning Changes After Partial Hospitalization in Patients With Anorexia Nervosa

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Introduction: Anorexia nervosa is usually associated with emotional and cognitive difficulties. Little knowledge is available about the changes in cognitive functioning in patients undergoing treatments. The aim of the present study was to longitudinally assess the impact of partial hospitalization on clinical and cognitive functioning in anorexia nervosa.

Materials and Methods: 56 women with anorexia nervosa according to DSM-5 criteria and 58 healthy women were enrolled in the study. At baseline, all participants underwent clinical, diagnostic and neuropsychological assessment (T0). Patients were also assessed at the end of the treatment program (T1; $n = 56$).

Results: BMI improved significantly throughout treatment. At baseline, patients showed significantly poorer executive abilities and less specific autobiographical memory. After the day-hospital program, decision-making abilities improved significantly. Response to treatment was predicted by BMI at admission and duration of illness, but neuropsychological performance did not contribute to the prediction model.

Discussion: Cognitive difficulties, mostly regarding executive functions, resulted differently affected by clinical improvement. In particular, while cognitive monitoring and cognitive inhibition appear to be mostly stable trait-like characteristics, decision-making is both more state-dependent and sensitive to clinical status. None of the cognitive variables added information about the response to day hospital treatment; patients with short duration of illness and a rapidly decreasing BMI would benefit more from intensive interventions than less "acute" patients. These observations, if confirmed by future studies, have important clinical implications in order to understand the impact of malnutrition on cognitive functioning and to provide individualized effective treatment for patients with anorexia nervosa.

Keywords: anorexia nervosa, cognitive functioning, executive functions, partial hospitalization, DH treatment, longitudinal assessment, follow-up

INTRODUCTION

Eating disorders are very complex psychiatric manifestations characterized by an over-appraisal of food, eating, body weight and shapes, along with an extreme need for control over these aspects (1). Studies on the effectiveness of psychological treatments for eating disorders, especially for anorexia nervosa, found no superiority of a specific approach (2, 3) and, for adolescent patients, family-based interventions are the dominant model. Following the international clinical guidelines, a higher intensity of care (i.e., day hospital and/or hospitalization) in both adolescents and adults is indicated when there is a high medical risk or a lack of response to outpatient treatment (4). More intensive interventions appear effective in gradually improving nutritional status and controlling dysfunctional behaviors (i.e., binging, purging, hyperactivity, other manifestations of impulsivity), although they are also associated with a high risk of subsequent relapse. Ambivalence and poor motivation are important aspects of the disorder and may be associated with several factors including neurocognitive difficulties, such as cognitive rigidity, difficulties in global thinking, and emotional/social difficulties.

In recent years, based on these clinical observations, researchers have started to systematically assess cognitive functioning in eating disorders, not only in terms of body weight and shape distortions or overvaluation of food and eating, but specifically with regard to the way in which patients think and how they cope with difficulties. This has led research interest to be extended to a broad cognitive and neuropsychological profile of these complex disorders (5, 6). The neuropsychological phenotype of anorexia nervosa consists of cognitive rigidity, set-shifting difficulties, high involvement in rigid and repetitive habits that obstructs the ability to infer environmental changes and the need for new response strategies (leading to perseveration), poor central coherence (i.e., higher detail-focused information processing despite global thinking), poor foresight in decision-making, and a sort of context-dependence in adaptive decision-making, along with difficulties in stopping automatic (hyper-learned) responses in place of more creative and adaptive answers (7–11). Some of these aspects appear to persist after recovery and have been detected, albeit more subtly, also in unaffected sisters (9, 12–14). Nevertheless, some evidence has been provided that the morbid process, in terms of illness duration, illness state and illness severity, negatively impacts cognitive performance (8). Furthermore, there is some evidence which suggests differential neuropsychological alterations underlying the spectrum of eating disorders (restrictive vs. binge-purging extremes), especially with regard to executive functions (in particular, set-shifting and decision-making) (15, 16). The real impact of malnutrition and being underweight on cognitive functions and the effective role of neurocognitive alterations toward clinical expressions and outcome have not yet been defined (5). For these reasons, there is a need to carry out longitudinal studies in order to better clarify these aspects (e.g., their state/trait nature of cognitive alterations in anorexia nervosa), in particular, given the relevance of cognitive abilities as factors involved at different levels and in several aspects (i.e., vulnerability, maintaining factors, treatment motivation and adherence, treatment outcome and prognosis). Moreover, the impact of care not specifically oriented toward cognitive rehabilitation on clinical and cognitive improvement remains to be clarified. Treatments directly targeting cognitive alterations (e.g., cognitive remediation therapy) do not seem to improve clinical outcomes and the data on their efficacy on cognitive functions are mixed (17). The main aim of the present study was to evaluate the longitudinal changes of clinical, psychopathological and cognitive characteristics in a group of patients with anorexia nervosa who were admitted to an intensive semi-residential treatment program as a step of their therapeutic pathway. We also aimed to explore the predictive role of clinical and cognitive characteristics in treatment outcomes.

METHODS

In the first part of the study, we performed a cross-sectional comparison between a group of adolescent and young adult female individuals with anorexia nervosa who completed a partial-hospitalization treatment (T0) and a group of healthy women of similar age and education. Then, we conducted a longitudinal study with the same patients, who were also assessed at the end of the treatment (T1) and, in a small subgroup, at 1-year follow-up (T2). Given that both data collection is still in progress and this subgroup has a small sample size (N 19), we focus analyses on the data pertaining to the first two times (T0 and T1).

Participants and Treatment

Fifty-six patients with anorexia nervosa, according to the DSM-5 criteria (18), and 58 healthy controls were included in the study. We considered eligible for the study all patients consecutively admitted to the day-hospital (DH) treatment program at the Eating Disorders Unit of the Padova University Hospital (Italy), from July 2014 to July 2020. Inclusion criteria for patients were: admission to our Unit's DH treatment for anorexia nervosa, more than 14 years of age, written informed consent, by the patients or parents (in patients under 18 years of age) for participation in the study. Exclusion criteria were: prior or current traumatic brain injury, lifetime history of any neurological, systemic and/or severe psychiatric illness in comorbidity with AN (suicidality, alcohol/substance use, psychotic features), drop-out from treatment, need for acute admission to a medical ward, admission for bulimia nervosa. The exclusion criteria for controls, recruited from the general population, were body mass index (BMI) below 18, having a first-degree relative with a lifetime eating disorder, prior or current traumatic brain injury, any neurological, psychiatric, or systemic illness and use of psychoactive medication. In the 6 years considered in the study, 122 patients were admitted to the DH. Seventy-one patients were excluded for the following reasons: 12 were admitted with a bulimia nervosa diagnosis, 14 dropped out, 20 were admitted to the DH only to manage acute medical complications or while waiting for admission to a full-day hospital program, three were males, three were pregnant, three were still in treatment, 11 because of other exclusion criteria.

In our ED Unit, admission to day-hospital has to be considered one step of a multi-disciplinary treatment that is indicated: (1) when outpatient treatment is not effective; (2) when patients need urgent assistance in order to stop weight loss; (3) for patients who need intensive support for particular situations (pregnancy, waiting for admission to a full-day intensive program). The DH-treatment program is a 5-day per week treatment offered between Monday and Friday from 9:30 am to 4:30 pm. The duration of the treatment is flexible and tailored on the specific needs of patients. The program is cognitive-behaviorally oriented, and during the DH treatment each patient has both individualized and group psychotherapy sessions. The nutritional program is also individualized and discussed with an expert dietician who follows the patient throughout the course of the treatment. The main activities in DH are assisted meals, "Monday clinical meetings" of the patient with the psychotherapist and the dietician, individual psychotherapeutic sessions twice a week and, usually, group psychotherapy once a week; a group about the "rules" of the day-hospital program is also conducted every 2 weeks; psychoeducation and other activities, such as relaxation training, are also included in the program. Patients are regularly monitored by an expert internal medicine physician during the whole treatment.

All participants to the study were assessed by means of a clinical, psychopathological and neuropsychological test battery. Participants were weighed and measured in height, and underwent an adapted version of the eating disorders section of the Structured clinical interview for DSM-5 (19), and a semi-structured interview to collect sociodemographic and clinical information. The neuropsychological assessment was administered during the morning in a quiet and comfortable room in a 90 min session. Computerized tasks were administered using a 15″ notebook and test presentation was counterbalanced across all participants. For patients, data were collected at DH admission (T0, within the 1st week of admission) and at discharge (T1). The Edinburgh Handedness Inventory (20) was administered to assess hand lateralization. The study was approved by the Ethical Committee of the Padova University Hospital.

Improvement was based on both BMI normalization and the clinical judgement of the two therapists who evaluated and followed the patients during the day-hospital treatment. In particular, we considered the following items as a sign of improvement, if present together: (1) an increase in BMI by at least three percentile points; (2) a general improvement in eating patterns in terms of pace, amount, and variety of foods accepted and regularly taken; (3) a significant modification in global functioning (i.e., restoration of school/work attendance, if previously interrupted, resumption of social relationships and exchanges); (4) a reduction in depressive and anxious symptoms as detected by self-reported assessment, but also as reported by both the patient him/herself and significant others.

Self-Reported Measures

The State Trait-Anxiety Inventory (STAI) (21) was administered only at T0 to assess state and trait anxiety, while the following questionnaires were administered at both T0 and T1: the Hopkins Symptom Checklist (HSCL-58) (22) to assess psychiatric symptoms, the Eating Disorder Inventory (EDI) (23) to detect eating psychopathology, and the Body Attitude Test (BAT) (24) to investigate body image experience of one's body.

Cognitive Assessment

A broad neuropsychological assessment (9, 11) covering several cognitive settings was administered to both patients and controls.

The tasks used only at T0 were:

- the Brief Intelligence Test (TIB) (25), the Italian version of the National Adult Reading Test, to measure premorbid general cognitive abilities;
- the Wisconsin Card Sorting Task (WCST) (26, 27), which is a widely used abstract thinking, set-shifting and cognitive flexibility task (9);
- the Rey-Osterrieth Complex Figure Test (ROCFT) (28) is a task involving both perceptive and executive (planning) abilities (9).

The tasks administered at all the assessments were the following:

- the Iowa Gambling Task (IGT) (29), which is a well-known and previously described computer task investigating decision-making under risk (11, 30);
- the Cognitive Bias Task (CBias) (31), which measures adaptive decision-making in terms of a balance between context-independent (based on preexisting internal representations) and context-dependent (based on the current features characterizing that specific scenario) decision-making (see previous descriptions of the task in 11);
- the Stop-Signal Task (SST) (32), which is a paradigm developed to measure cognitive monitoring and response inhibition (10);
- the Mittenecker Pointing Test (MPT) (33), which is a random-motor-generation task examining two components of cognitive flexibility (inhibition of prepotent responses and memory monitoring/updating). Participants are instructed to press nine unlabeled keys irregularly distributed over the computer board following an acoustic signal (1.2/s) which monitors the response production rate (i.e., one key pressed for each sound). The task demands pressing keys in the most random order possible and is in contrast with our innate tendency to produce repetitive sequences, so a continuously high control effort is required to inhibit automatically developing routines. The total responses are 180 and the outcome variables are two quantitative measures of deviation from randomness: Context Redundancy (CR) and Symbol Redundancy (SR). CR assesses the inhibition of developing routines (response sequences) and SR gives a measure of the memory component (memory monitoring/updating) of random sequence generation. Both values range from 0 to 1. Low CR and SR values are associated with high cognitive flexibility.
- the Autobiographical Memory Task (AMT) (34), which assesses the ability to retrieve specific episodes from one's own life, by means of cue-words varying in their emotional valence (i.e., positive, negative, neutral). The task consisted in orally

presenting 12 cue-words and participants were instructed to recall a specific episodic memory (with a limited space-time location) from their life, that had happened more than a week before (not a current episode). Outcome measures considered were: the total specific memories retrieved, over-general memories (categorical + extended memories), recent memories (specific episodes pertaining to the last 3 months), omissions (failure to respond in 30"), time to complete the task and the emotional valence of memories retrieved regardless of cue-word valence.

Practice Effect

In order to reduce the risk of a learning effect of the task, which should always be considered in planning a longitudinal study (35), we adopted, where possible, alternative versions of the same task. In particular, for the IGT, we changed the output of the different decks (with regard to the magnitude and the frequency of losses). For the AMT, we adopted three alternate versions of the task, two proposed by Williams (34) and the third derived from cues adopted by other autobiographical memory tasks proposed by the same group of researchers. For the CBias, the SST and the MPT we did not expect any practice effect. In the SST, the outputs are in terms of reaction times and parameters (i.e., the frequency and time of the stop-signal) change stochastically. The CBias and the MPT are covert tasks, where a participant does not know exactly what he/she is doing, and it is difficult for participants to learn anything or understand the rationale of the task.

Statistical Analyses

Non-parametrical statistics were used to compare not normally distributed groups. In particular, the U Mann-Whitney test was used for non-parametric comparisons between two independent groups. The Wilcoxon rank sum test for two paired groups was employed to test longitudinally data. Associations between variables were tested by means of the Spearman Rho. The General Linear Model with age as covariate was used to compare more than two groups. Multivariate logistic regression models were used to assess the predictive role of clinical, psychopathological and neuropsychological variables on clinical outcome. In order to control the multi-comparison bias, the Bonferroni correction was used, and only p-values equal to or lower than 0.003 were considered significant. All statistical procedures were conducted by means the SPSS, version 26 (IBM, 2019).

RESULTS

Treatment Outcome

In the whole sample ($n = 56$), the average duration of the day-hospital program was 23.0 weeks (SD = 11.3), corresponding to 78.0 days of treatment (SD = 39.1). All patients completed assessment at T0 and T1. Most patients belonged to the restrictive subtype ($n = 48$; 86%) and 20 were taking antidepressant drugs at the time of admission (36%). The average BMI was 15.6 (SD = 1.5; range 12.4–18.2) at admission and 17.3 (SD = 1.7; range 14.5–22.7) at discharge.

Out of the 56 patients enrolled in the study, 16 (29%) showed no improvement during the program. Patients ($n = 40$) who improved during the partial hospitalization program had a BMI of 15.3 (SD = 1.5; range 12.4–18.2) at admission and 17.6 (SD = 1.8) at discharge. All patients who did not improve during the day-hospital program were referred for more intensive treatment. Out of those patients who improved during the day-hospital program, four decided to undergo a full-day intensive treatment and the others to complete their treatment in an outpatient setting.

Patients vs. Healthy Women

Table 1 summarizes the clinical and general characteristics of patients with anorexia nervosa and healthy women, including hand lateralization, depressive symptoms and state/trait anxiety. Patients with AN showed significantly higher scores ($p < 0.001$) than healthy women on all the subscales of the EDI and the H-SCL.

Patients and controls did not differ in estimated intelligence quotients investigated by means of the Brief Intelligence Test (103.6 ± 4.2 vs. 105.5 ± 4.3; $z = 1.77$; $p = 0.083$). **Table 2** reports the comparison between patients and controls in the neuropsychological tasks.

The patients of our study showed altered executive functioning (**Table 2**) and trends for difficulties in decision-making, autobiographical memory, and they took longer to complete the direct copy of the ROCFT. On the AMT patients showed a poorer ability to retrieve their own life episodes, needed more time to retrieve memories ($F = 5.12$; $p = 0.026$) and reported a higher number of general memories than specific autobiographical episodes ($F = 6.87$; $p = 0.010$), compared to healthy controls. Moreover, in response to positive cues patients reported significantly fewer memories ($F = 11.03$; $p = 0.001$) than controls.

The comparison between patients of the restrictive subtype ($n = 48$) and those of the binge eating/purging type ($n = 8$) showed differences on both the number of perseverative responses (20.9 ± 17.5 vs. 6.7 ± 2.5; $F = 5.00$; $p = 0.03$) and the global score (56.1 ± 40.8 vs. 21.4 ± 16.9; $F = 5.38$; $p = 0.024$). Restrictive patients were also both significantly more underweight at baseline (BMI: 15.4 ± 1.5 vs. 16.9 ± 1.2; $F = 7.89$; $p = 0.007$) and less depressed (1.67 ± 0.89 vs. 2.66 ± 0.84; $F = 8.34$; $p = 0.006$).

Table 3 shows baseline characteristics of patients with good and poor treatment outcome. Patients who improved during the day-hospital program did not differ from those who did not with regard to neuropsychological performance at T0 (only a trend for reduced visual memory at the ROCFT was observed in the non-improved group: 16.6 ± 4.1 vs. 20.0 ± 5.5; $F = 4.44$; $p = 0.040$). However, the improved group was more underweight at baseline (BMI: 15.3 ± 1.5 vs. 16.4 ± 1.4; $F = 6.03$; $p = 0.017$) and showed a trend for a shorter duration of illness (19.4 ± 19.1 vs. 36.7 ± 38.6 months; $z = 1.97$; $p = 0.049$).

Longitudinal Changes

Table 4 summarizes clinical (BMI) and psychopathological changes in patients at admission and at discharge. At discharge, patients showed a significative improvement in BMI and in the scores of self-reported questionnaires. The improvement in BMI significantly correlated with the duration of the day-hospital

TABLE 1 | Clinical and general characteristics of patients (at admission) and controls.

	Anorexia nervosa ($n = 56$) Mean (SD)	Healthy women ($n = 58$) Mean (SD)	*Z*	*p*
Age (years)	19.6 (5.2)	19.5 (4.9)	−0.14	ns
Education (years)	12.0 (2.3)	11.9 (2.3)	−0.31	ns
BMI (kg/h^2)	15.6 (1.5)	21.3 (2.2)	−9.03	0.000
Minimum BMI	15.5 (1.6)	19.6 (2.1)	−8.20	0.000
Age of onset (years)	16.4 (3.6)	—		
Illness duration (months)	23.9 (26.0)	—		
N° previous treatments	1.02 (1.23)	—		
Hand lateralization (Edinburgh score)	57.1 (29.9)	66.8 (25.1)	−1.87	0.061
Trait anxiety (STAI)	56.1 (13.4)	41.4 (9.6)	−6.045	0.000
State anxiety (STAI)	48.5 (13.2)	34.7 (7.1)	−5.894	0.000
Depression (H-SCL)	1.82 (0.9)	0.68 (0.6)	−5.566	0.000

STAI, State Trait Anxiety Inventory; H-SCL, Hopkins Symptoms Checklist.

TABLE 2 | Neuropsychological tasks in patients with AN and healthy controls.

	Anorexia nervosa ($n = 56$) Mean (SD)	Healthy women ($n = 58$) Mean (SD)	ANOVA* $F_{(1,112)}$	*p*
WCST Global score	51.0 (40.1)	37.8 (27.5)	3.94	0.050
WCST number of categories	4.8 (1.9)	5.8 (1.0)	10.20	0.002
WCST correct answers	66.5 (9.9)	70.6 (8.2)	5.47	0.021
WCST perseverative responses	18.9 (17.0)	12.8 (9.7)	5.08	0.026
IOWA net score	2.0 (30.8)	13.4 (20.8)	5.79	0.018
CBias raw scores	173.6 (29.3)	180.4 (31.9)	1.66	0.200
CBias converted scores	30.0 (22.6)	37.6 (22.7)	3.51	0.064
Rey copy trial	27.9 (3.1)	28.6 (3.8)	1.26	0.264
Rey copi CCI	1.01 (0.45)	1.03 (0.42)	0.12	0.730
Rey memory trial	19.0 (5.3)	19.1 (4.5)	0.003	0.953
Rey total time	201.5 (87.2)	159.1 (45.8)	9.95	0.002
Stop-signal reaction time	243.2 (45.9)	253.5 (46.3)	1.22	0.272
MPT_CR	0.28 (0.17)	0.26 (0.14)	0.16	0.691
MPT_SR	0.03 (0.05)	0.03 (0.08)	0.04	0.847
MPT_Lateral preference	−0.08	−0.1	0.47	0.490
AMT total score	8.9 (2.1)	9.9 (2.2)	5.62	0.020

**Age was included as a covariate. According to the Bonferroni correction p should be considered at <0.003.*
WCST, Wisconsin Card Sorting Task; CBias, Cognitive Bias Task; Rey copy CCI, Rey copy Central Coherence Index; MPT_CR, Mittenecker Pointing Task Context Redundancy; MPT_SR, Mittenecker Pointing Task Symbol Redundancy; AMT total score, Autobiographical Memory Task total specific memories.

treatment both in terms of days spent in day-hospital (rho = 0.56; $p < 0.001$) and in terms of total time in treatment (rho = 0.36; $p = 0.006$).

Neuropsychological performance showed few changes between the two time points: a significant improvement in the IGT (**Figure 1**) and slightly higher CBias raw scores (**Table 4**).

Using a multivariate logistic regression model to predict the negative outcome at discharge from the DH program we found the following predictors (Model chi-square = 15.41; d.f. = 4; $p = 0.004$; 77% of correct prediction): BMI at admission (T = 0.69; ES = 0.27; Wald = 6.31; $p = 0.012$; OR = 2.00, 95% CI, 1.16–3.43), duration of illness (T = 0.03; ES = 0.01; Wald = 4.15; $p = 0.042$; OR = 1.03, 95% CI, 1.01–1.05), diagnostic subtype (T = 1.90; ES = 1.11; Wald = 2.91; $p = 0.088$; OR = 6.69, 95% CI, 0.75–59.36), and depressive symptoms (T = 0.80; ES = 0.43; Wald = 3.41; $p = 0.065$; OR = 2.22, 95% CI, 0.95–5.18). The inclusion in the model of any other clinical and neuropsychological variable did not improve the predictive ability.

DISCUSSION

The current longitudinal study complements and strengthens findings from previous studies on the impact of clinical changes on cognitive functioning in anorexia nervosa. It has been hypothesized that cognitive difficulties, especially regarding executive functions and visuospatial information processing, might contribute to maintaining the disorder, both by hindering therapeutic thinking and by reducing illness awareness (36, 37). However, the literature on cognitive changes after clinical improvement is highly conflicting (5). Conspicuous evidence

TABLE 3 | Clinical and general characteristics of patients with good and poor outcome at admission.

	Anorexia nervosa Good outcome ($n = 40$) Mean (SD)	Anorexia nervosa Poor outcome ($n = 16$) Mean (SD)	*Z*	*p*
Age (years)	19.1 (4.6)	20.7 (6.4)	−0.96	ns
Education (years)	12.0 (2.2)	12.1 (2.5)	−0.92	ns
BMI (kg/h^2)	15.3 (1.5)	16.4 (1.4)	−2.33	0.020
Minimum BMI	15.4 (1.7)	15.9 (1.4)	−1.19	ns
Age of onset (years)	16.5 (4.0)	16.0 (2.2)	−0.14	ns
Illness duration (months)	13.4 (14.1)	20.6 (32.5)	−0.32	ns
N° of previous treatments	1.1 (1.2)	0.7 (1.2)	−1.50	ns
Menarche	12.1 (1.0)	12.3 (1.4)	−0.33	ns
Age at first diet	14.6 (2.0)	14.4 (1.5)	−0.95	ns
Hand lateralization (Edinburgh score)	56.5 (29.3)	58.5 (32.2)	−0.16	ns
Trait anxiety (STAI)	55.9 (11.7)	59.9 (8.7)	−0.96	ns
State anxiety (STAI)	48.0 (13.7)	49.3 (11.9)	−0.55	ns
Depression (H-SCL)	1.7 (0.97)	2.13 (0.86)	−1.35	ns
	Frequencies	**Frequencies**	χ^2	*p*
AN restrictive subtype	34/40 (85%)	14/16 (87,5%)	0.58	ns

TABLE 4 | Clinical and psychopathological variables across two longitudinal assessment time points.

	T0 At admission ($n = 56$) Mean (SD)	T1At discharge ($n = 56$) Mean (SD)	Wilcoxon *Z*	*p*
BMI	15.6 (1.5)	17.3 (1.7)	5.93	<0.0001
Drive for thinness (EDI)	13.2 (7.3)	7.8 (7.6)	3.80	<0.0001
Body attitudes (BAT)	56.4 (15.7)	48.1 (23.9)	2.18	0.029
H-SCL total score	1.20 (0.49)	0.84 (0.54)	3.15	0.002
H-SCL depression	2.19 (0.81)	1.55 (1.03)	3.47	0.001
IOWA net score	2.3 (29.4)	19.1 (33.8)	3.41	0.001
CBias raw scores	174.7 (29.5)	181.7 (30.4)	2.58	0.010
CBias converted scores	31.0 (22.6)	37.5 (22.7)	1.65	ns
Stop-signal reaction time	243.2 (45.9)	250.7 (95.4)	0.73	ns
MPT_CR	0.28 (0.18)	0.26 (0.14)	0.73	ns
MPT_SR	0.03 (0.06)	0.03 (0.02)	0.59	ns
MPT_Lateral preference	−0.08	−0.08	−1.1	ns
AMT total score	8.9 (2.1)	8.5 (2.3)	0.89	ns
AMT Recent memories	2.4 (1.8)	3.2 (2.6)	1.93	0.054

**According to the Bonferroni correction, p should be considered at <0.003.*

EDI, Eating Disorder Inventory; BAT, Body Attitude Test; H-SCL, Hopkins Syptoms Checklist; CBias, Cognitive Bias Task; MPT_CR, Mittenecker Pointing Task Context Redundancy; MPT_SR, Mittenecker Pointing Task Symbol Redundancy; AMT, Autobiographical Memory Task.

supports the association between anorexia nervosa and executive function alterations. One of the main conceptualizations of executive functions supports their division into three separate key sub-functions moderately related to each other: cognitive shifting, information updating and monitoring and the ability to inhibit automatic responses (38). In our sample we investigated all of these three aspects, firstly cross-sectionally, comparing patients to a group of healthy controls, and then longitudinally, comparing cognitive performances at admission to a DH treatment program and at the end of this program. According to the literature on cross-sectional studies (39), our patients showed poor task-switching and abstract thinking abilities, indicative of cognitive rigidity compared to controls. Differently from some studies (40), but in line with others (39) we observed a greater executive impairment in restrictive patients, compared to those with binge eating/purging symptoms. Updating refers to the ability to check incoming information and to regulate the load of working memory according to the current behavioral goals. This specific aspect has been scarcely investigated in the cognitive research of eating disorders. To our knowledge, this is the first study to apply the MPT, a motor random generation task based on responses which are neither hyper-learned nor linked to academic skills (i.e., counting or spelling), to the anorexia nervosa population. Patients and controls showed very close

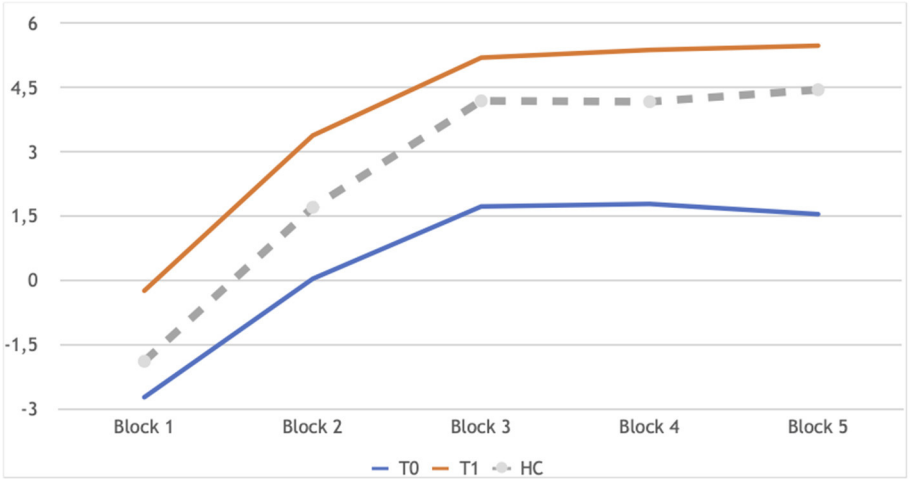

FIGURE 1 | IGT learning profile of patients in longitudinal assessment: T0 and T1 in comparison. Block 1: Z −2.44, *p* 0.014; Block 2:Z −2.73, *p* 0.006; Block 3: Z −2.58, *p* 0.010; Block 4: Z −2.86, *p* 0.004; Block 5: Z −2.68, *p* 0.007. In gray the performance of controls at T0, as a reference, not included in the analyses reported here.

scores at both indexes (i.e., context and symbol redundancy) and we did not observe specific changes in longitudinal assessments indicating a certain stability and independence from clinical status. One possible reason may be that the CR index taps not so much high-order repetitive behaviors (i.e., compulsions), and narrow interests (the narrowness of focus, inflexibility and perseveration in interests and activities) as low-order repetitive behaviors (simple repetitive motor behaviors) (41). In both cross-sectional and longitudinal assessments patients showed the same pattern exhibited by controls (i.e., higher preference for the right hemispace in both groups) and no differences across time. Finally, we assessed the third sub-executive function, the ability to inhibit or ignore the automatic or dominant tendency to produce a specific (usually hyper-learned) response by the Stop-signal paradigm. Patients investigated here showed no significative differences in SSRT compared to controls. In the longitudinal study, cognitive monitoring and response inhibition did not show an early (T1) appreciable change, indicating a certain independence from the clinical and nutritional status. It may be that BMI normalization is not sufficient to impact response inhibition abilities. The literature on the Stop-signal task in anorexia nervosa lacks longitudinal assessments, and the few cross-sectional neuroimaging studies led to quite mixed results (42). Moreover, one study carried out on recovered anorexia nervosa women (43) and another on adolescent acute anorexia nervosa patients (44) both reported differences in brain activation that were not supported by task performance. In the literature, the few longitudinal studies about decision-making in anorexia found discordant results. In one study patients improved their IGT performance after weight gain especially at one-year follow-up and in the case of complete remission (45), while in the other two studies patients did not improve at all (46, 47). Both the IGT and the CBias in our study showed improvements after treatment, demonstrating greater foresight in making choices (IGT) and greater balance between internal information and context features in adaptive decision-making conditions (CBias). These two tasks assess different kinds of decision-making and our data are compatible with the hypothesis that veridical decision-making abilities are more strictly dependent on physiological and nutritional status, while the adoption of a more adaptive decision-making style appears somewhat related to a more general (both clinically and psychologically) state of well-being. Furthermore, veridical decision-making abilities appear to differentiate patients from controls to a greater extent than adaptive decision-making ability does.

Autobiographical memory, closely linked to superior executive functions, consists in crucial personal memory representations, which set the content of the self and define not only who we are, but also who we have been and who we will become (48). In anorexia nervosa, it is not so rare to clinically observe that, despite the great benefits gained by patients after recovery from the illness, in the case of relapse they have strong difficulty remembering these benefits. Our findings are closely in line with the literature: AN patients, in comparison to controls, retrieved fewer specific memories and more "general" autobiographical ones, a phenomenon called "overgeneral autobiographical memory" (OGM) (49). The hypothesis proposed by the literature is that these general memories have a protective function, allowing patients to diminish the affective impact of life experiences, reducing affective involvement and distress. The Autobiographical Memory Task is considered "a bridge task" between cold and hot cognition. Our patients took longer to complete the task (showing once again a slowness in performing cognitive and emotional tasks) and reported fewer specific memories in response to positive cue-words compared to controls, in line with some literature data which reported a general impairment in access to emotional memories

(both positive and negative) (50–52). In the longitudinal assessment, AMT performance appeared to be quite stable, with a trend for a higher number of specific recent episodes (i.e., episodes referring to the last 3 months) at discharge. To our knowledge, this is the first longitudinal study on the AMT in anorexia nervosa.

Concerning the clinical outcome, we found that patients who improved during the DH treatment showed significantly lower BMI along with shorter illness duration. Though it is well-known that a short duration of illness represents a predictor of a positive outcome, the finding about BMI was somewhat unexpected, although not new (53). In the literature about long-term outcome of patients with anorexia nervosa, a lower BMI (or nadir BMI) usually represents a negative predictive factor (54, 55). However, our sample was made up of patients for whom intensive treatment has been indicated and it is possible that our data simply reflect the fact that for more "acute" patients (in terms of both shorter duration of illness and lower BMI) the DH treatment might be more effective and appropriate. A prompt treatment of anorexia nervosa cases is recommended in the literature (56) and early stages of the disorder probably represent a "critical window" within which to act to increase treatment efficacy (57). Our data support the idea that patients with short duration of illness and a rapidly decreasing BMI would benefit more from intensive interventions than less "acute" patients. With the exception of BMI, our findings emerged using a multivariate analysis, with response to treatment as the dependent variable, are in line with the literature, according to which longer duration of illness, the presence of depression, higher age of onset, lower nadir BMI, the presence of bulimic symptoms, and a longer need for in-patient treatment, all are factors associated with a worse outcome (54, 58). We should carefully take into consideration these clinical factors during the diagnostic evaluation, in order to plan individualized and more effective therapeutic projects. It might be the case to recommend partial hospitalization even in patients with short duration of illness and in the presence of low BMI, considering however the importance of depressive and binge eating/purging symptoms as possible barriers to care and potential indications for a full-day intensive approach.

Interestingly, none of the cognitive variables seems to add information about the response to treatment in a partial hospitalization setting. It is possible that an intensive treatment might reduce the importance of cognitive difficulties as possible barriers for an effective treatment. Studies considering other clinical settings should be conducted to better explore this issue. It is also possible that the importance of some cognitive difficulties might be "masked" by those clinical variables that have an impact on cognitive functioning (i.e., decision making). Studies on larger samples are needed to address this point and to confirm our observation of an improvement of some cognitive functions along with an improvement of clinical and nutritional status.

CONCLUSIONS

In summary, the current longitudinal study provides further evidence regarding the presence of cognitive difficulties in patients with anorexia nervosa in their acute stage, with some difficulties persisting despite clinical and nutritional improvement. Executive functioning and autobiographical memory alterations tend to persist beyond clinical recovery and their role as possible vulnerability and maintaining factors needs to be better understood. Decision-making abilities, both veridical and adaptive, were both more state-dependent and sensitive to clinical status changes: their alterations may act as an exacerbation factor in very acute patients.

All these observations, if confirmed by future studies, have important clinical and scientific implications in order to understand the impact of malnutrition on cognitive functioning and to provide individualized effective treatment for patients with anorexia nervosa.

DATA AVAILABILITY STATEMENT

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

ETHICS STATEMENT

The studies involving human participants were reviewed and approved by Ethical Committee of the Padova University Hospital.

AUTHOR CONTRIBUTIONS

ET collected, analyzed the data and wrote the paper. EC analyzed the data and wrote the paper. VM, PM, EB, TZ, and AV, collected data and wrote the paper. AF analyzed data and supervised all steps of the project. ET and EC are the principal investigators of the research, developed the study protocol and supervised the team. All authors contributed to the article and approved the submission version.

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REVIEW
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Adolescent Eating Disorder Day Programme Treatment Models and Outcomes: A Systematic Scoping Review

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Background: Adolescent eating disorder day programmes (DP), or partial hospitalization programs, are becoming increasingly widespread worldwide. They typically function as an alternative to inpatient care and/or a step up or down in treatment intensity. There has been an increase in the number of publications within the last 5 years investigating DP outcomes. While there are now numerous programmes operating internationally, there is large variability in the content, structure and theoretical underpinnings of each programme. This makes it difficult to compare programme outcomes, and the impact the therapeutic model may have.

Aims: To review existing literature on adolescent eating disorder DP treatment models and outcomes.

Methods: A systematic scoping review was conducted. Four databases (PsychInfo, EMBASE, Medline, CENTRAL) were searched for relevant peer-reviewed journal articles and book chapters investigating adolescent eating disorder DPs that function as alternatives to inpatient treatment. No restrictions on study methodology were imposed. Studies were first mapped by location, study characteristics and day programme treatment characteristics, then narratively synthesized.

Results: Forty nine studies were included in this review. All used a quantitative methodology. One study also included qualitative methods. The majority of studies included describe DPs in the USA (69%). Seventy-six percent of the studies described DPs that operate 5-days per week and most (57%) either only admit or only report on outcomes for restrictive eating disorders. Two-thirds (69%) reported on DPs that had a family focused treatment model, the remainder had a more integrated treatment model informed mostly by individual psychotherapeutic models. Generally, DP treatment is associated with weight gain and improvements in eating disorder and comorbid psychopathology. The studies that include follow-up data (27%) reveal improvements are usually maintained from 3 months to 2 years post-treatment. Early weight gain, early psychological change and early therapeutic alliance are associated with improved end of treatment outcomes. Findings regarding other potential predictors of outcome are mixed.

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Conclusions: Current evidence suggests day programmes are an effective alternative to inpatient treatment that lead to sustained improvements. DPs tend to either be young-person-only with a family-focused treatment model or all age with a more integrative model. Controlled, empirical investigations into the impact of the therapeutic model on outcomes are needed, as are investigations into treatment mechanisms and the individual and parent experience of day programme treatment.

Keywords: adolescant, young adult, day program, partial hospitalization program, intensive outpatient program, intensive treatment program

INTRODUCTION

In this article, we provide a review of adolescent eating disorders day programmes (DP), focusing on theory, structure, process and outcomes. There have been significant advances in the field of adolescent eating disorder treatment over the past 50 years. Family therapy has emerged as the current first-line recommended treatment (1), with individual and multi-family therapy also demonstrating promise (2–7). Despite these advances and the increase in treatment options, full remission rates at the end of treatment remain modest for both anorexia nervosa (20–50%) and bulimia nervosa (∼40%) (8). Historically, inpatient treatment was considered for this group, however, outcomes following hospitalization are mixed (9, 10) and the benefit of inpatient care beyond medical stabilization disputed (11–13).

A range of higher levels of care are now emerging as alternatives to inpatient treatment (14, 15). These programmes aim to reduce the need for inpatient admissions and better meet the needs of this group of young people and their families (16, 17). These programmes go by several different names, including DPs, partial hospitalization programs, intensive treatment programs, etc., but share some key similarities. They all offer increased treatment intensity relative to outpatient treatment, include supervised meal support, revolve around a group-based therapeutic programme and offer treatment multiple times per week for several hours per day. Some programmes specify different levels of intensity within the one programme, with young people and their families moving between them based on need and stage of treatment. When multiple levels exist, the higher level of care is typically referred to as a partial hospitalization program, whereas the lower level of care is referred to as an intensive outpatient program.

For the purposes of this review, the term DP is used to refer to any treatment programme that acts as an alternative to inpatient treatment where the young person does not stay overnight at the treatment facility (as per inpatient). Studies investigating intensive outpatient treatments only (half-days and <5 days per week, or not positioned as alternatives to inpatient treatment) or adjunctive multi-family therapy groups are not included in this review. Programs that report outcomes for combined inpatient and DP treatment are also excluded [e.g., (18–21)] as they do not typically function as alternatives to inpatient treatment. Rather they often act as step-down transition programmes between inpatient units and the community and typically aim to reduce admission lengths and readmission rates. Furthermore, outcomes for the specific DP component are also rarely reported on, making it difficult to ascertain its unique contribution.

DPs are generally considered to be preferable to inpatient treatment as they are less costly and attendees can stay connected to their family, peers and lives more generally during treatment (22, 23). Staying connected to day-to-day life is important for several reasons. Firstly, new skills developed can be immediately applied to real-life situations. Secondly, there is greater opportunity to access and build supports in the home and social environment (23). All of this can be difficult during inpatient or residential treatment, where the young person is in the facility 24-h per day and may be quite far geographically from home, family, peers and school. This is important as eating disorders may disrupt psychosocial functioning and are associated with altered patterns of responding to interpersonal stress (24, 25). Without exposure to the challenges of everyday life, the transition from hospital back to home can be difficult and may increase the risk of relapse.

Evidence is now emerging that DPs support physical and psychological improvements for young people with eating disorders and have similar outcomes compared to inpatient care (22, 26). Nevertheless, beyond sharing an increase in treatment intensity, no two DPs are identical. They vary substantially in treatment length, amount of treatment offered per day/week, the model(s) of treatment offered, the population treated and programme aims (23, 27). This can make comparing outcomes between programmes very difficult. Furthermore, potential moderators and mediators can be difficult to identify as programmes target different things and numbers in research studies are relatively small. This leaves the field relatively blind with regard to who responds best to DP treatment and who does not.

To better understand the differences in DP treatment models and how this may impact outcome this review aims to:

a) examine differences in DP treatment models
b) review available outcome data

From this review potential targets of future research and DP design can be targeted.

METHOD

A systematic scoping review methodology (28) was used to explore the existing research into DPs for adolescents with eating disorders. This was identified as the most appropriate

methodology given the heterogeneity of existing research and the broad aims of this review. Current scoping review guidelines (29) and the PRISMA guidance (30) were used to conduct this review.

Search Strategy

Four databases (PsycInfo, Embase, Medline, CENTRAL) were searched using variations of the terms "eating disorder" and "day programme" and "adolescent" on 17th December 2020 (see **Supplementary Material** for exact search terms). Additional hand-searches of articles, reference lists and the internet were also performed.

Selection Process

Eligibility criteria for this review were determined a priori (see **Table 1**). After completing the initial search, duplicates were deleted and the remaining titles and abstracts reviewed by JB and MS. The remaining full-text citations were screened for eligibility by both authors before reaching consensus at the included papers in this synthesis (see **Figure 1** for PRISMA flowchart). Zotero software was used in this process.

Data Charting and Categorization

All included articles were charted according to two main categories: programme characteristics and study methodology characteristics. Program characteristics included location, treatment model, age range included, eating disorder diagnoses treated, and amount of contact per week. Study design characteristics included the year of publication, sample size, and study methodology. Each programme was then categorized as being family-focused or more individually focused. Programmes were categorized as family focused if they named a family therapy treatment model as primary, or if significant family involvement was required during treatment (see **Supplementary Material** for full coding criteria). The data-charting form was jointly developed by JB and MS to determine which variables to extract. This was then completed by both authors via an iterative process in repeated consultation. This information was used to inform the narrative synthesis of eligible studies.

RESULTS

Study Selection and Characteristics

Three-hundred-and-fourteen papers were initially identified through the systematic literature search. Screening was performed according to the eligibility criteria outlined in **Table 1**. Forty-nine studies were determined to be eligible for this review (**Figure 1**). Full details and characteristics of all included studies are presented in **Table 2**.

The field of adolescent DPs has changed significantly in the last 3–5 years. The vast majority ($n = 43$, 88%) of papers were published in the last decade and nearly half ($n = 22$, 45%) within the last 2 years. The majority of included studies were from the USA ($n = 34$, 69%) and used uncontrolled case series or retrospective chart review designs ($n = 47$, 96%). One qualitative study and one randomized controlled trial (RCTs) was identified. The latter compared DP treatment to inpatient treatment (26).

Sample sizes of the included studies varied considerably. Nearly a quarter ($n = 12$, 24%) had a very small sample size of 30 participants or less. Fifteen (31%) had a sample size larger than 100.

Approximately two-thirds of published papers reported on programmes whose treatment model was family focused ($n = 34$, 69%). Several treatment centers published multiple papers on different aspects of the same DP. Eighteen (37%) included studies appeared to be produced by two centers; one in Michigan, the other in Pennsylvania.

Across all 49 studies, the combined total sample reported on was 5,594 (mean age = 17.7 years, 93% female). Anorexia nervosa was the most common diagnostic group ($n = 3{,}056$, 57%), followed by unspecified eating disorders ($n = 1{,}243$, 23%). Importantly, this number is likely inflated as several studies reported on different aspects of the same programme and potentially used the same, or similar samples across different published studies. Programme and study characteristics are presented in **Table 2** below.

Twenty-six (53%) of the studies reviewed included the assessment of symptoms of anxiety and/or depression. Twenty-one (43%) reported rates of comorbid diagnoses, which ranged from 14% (72) to as high as 70–80% (37, 60). Only two studies reported comorbidity rates < 30% (68, 72).

Narrative Synthesis

Adolescent Eating Disorder Day Program Design

One of the key differences between the DPs reviewed was their design and theoretical framework. Most DPs offer a combination of individual, family, multi-family and group-based interventions, which are often combined into a structured daily timetable. Clear rules and expectations regarding participation, symptom management and weight gain/maintenance depending on individual presentation are also typically established before treatment commences. All programmes offer meal support several times per day, which is a core component of any DP. However, beyond this structure large variability existed in terms of the age range, diagnoses treated and treatment models informing practice. See **Table 2** for details.

Population: Age, Presentation, and Diagnosis

Full details of each programme are presented in **Table 2**. The majority of studies ($n = 31$, 63.3%) exclusively report on children and adolescents up to 19 years of age. Ten (20.4%) focus on adolescents and young adults together. The remainder ($n = 8$, 16.3%) mix all ages across the lifespan. Rarely did a programme admit primary school-age children, although children as young as six (33), seven (59), and eight (49) have been included in some studies.

Similarly, there is variability in the diagnostic mix of young people who attend eating disorder DPs. Many programmes provide treatment to young people with any eating disorder diagnosis ($n = 21$, 43%), although the literature indicates that even in mixed diagnostic samples the majority who attend DPs are diagnosed with anorexia nervosa or eating disorders that are primarily characterized by restriction and weight loss (see **Table 2**). Four (8%) describe or report outcomes for

TABLE 1 | Scoping review eligibility criteria.

	Included	Excluded
Publication type	- Peer-reviewed journal articles - Book chapters	- Conference abstracts - Unpublished dissertations
Language	- English	- non-English language
Study objectives	- Explicit focus on theoretical models and outcomes of adolescent day program treatment for eating disorders - Focus on programs that are alternatives to inpatient treatment	Explicit focus on day program treatment for adult day programs - Explicit focus on inpatient or outpatient treatment, - Explicit focus on intensive outpatient program only (<5 days per week, <half day per contact) - Integrated program where the day program component is not explicitly reported on - Medication focused
Methodology	- Quantitative - Qualitative - Mixed methods	- Review articles - Meta-analyses
Design	- Any	- None
Sample	- Child and adolescent - Mixed child, adolescent and adult	- Adult only - Age 16 and over (without separate reporting on adolescent sample)

young people with Avoidant/Restrictive Food Intake Disorder (ARFID) exclusively.

Day Programme Admission and Discharge Criteria

There was large variability in the admission and discharge criteria described for DP treatment in the studies reviewed. The majority reported admitting people due to a lack of progress in outpatient treatment and/or high clinical acuity ($n = 31$, 63%). Medical stability was explicitly stated as an admission criterion by eleven (23%) studies. Two (4%) studies mention a specific weight criterion for entry into their study. Of these one required a minimum weight of 80% of the individual's goal weight or higher (63), while the other included adolescents with an estimated body weight of 85% or less (31). Only two (4%) studies refer directly to national guidelines when describing admission criteria and a quarter ($n = 12$, 24%) did not report on admission criteria.

Regarding reported DP treatment aims and discharge criteria, large variability between studies also exists. Twelve studies (24%) report a specific weight target or weight range (from 90 to 100% of the individualized target weight) for participants to reach before discharge. More commonly, discharge occurs following some clinical improvement and/or progress toward established goals, with readiness for outpatient treatment decided with the clinical team. One study (2%) described insurance constraints regarding treatment length. Eleven (22%) did not specify discharge criteria (see **Table 2** for details). Some programmes also offer an additional tier of intervention between DP and outpatient care. In the USA particularly it has been common to offer both a partial hospitalization program (more intensive) and an intensive outpatient program (less intensive), within the same treatment center [e.g., (34, 37, 39, 40, 53)], which may be partially influenced by insurance requirements.

Day Programme Intensity and Length

Most studies describe operating 5 days per week ($n = 37$, 76%). Only a small number offer fewer ($n = 2$, 4%) or more days ($n = 6$, 12%), and four (8%) studies did not specify the number of days. Similarly, the number of treatment hours per day is typically six to eight ($n = 30$, 61%), but some programmes offer up to 11 (68) or 14 h per day (74, 75).

Treatment length is difficult to compare across all studies due to reporting differences. Twenty-five (51%) studies report length of stay in number days, whereas 15 (31%) reported it in weeks, one (2%) in months, and eight (16%) did not report a mean length of stay. Of those programs that reported length of stay in days, the majority ($n = 15$, 60%) reported a mean length between 25 and 40 days. For those that reported weeks or months, most ($n = 12$, 75%) reported a mean length of stay between 10 and 16 weeks, or ∼3 months. In summary, the length of stay ranges from a month or less (37, 51, 76) to 6 months or more (62, 63). Only one study reported a fixed length of stay [10 weeks; (72)], and one reported a minimum stay [2 months; (67)]. See **Table 2** for details.

Treatment Models and Responsibility for Change

Several DPs describe themselves as being either exclusively or predominantly based in one particular treatment model, such as family based treatment (FBT) or cognitive behavior therapy (CBT). Alternatively, some programmes mix two or more treatment models offering more integrative treatment. Others do not report on the specific treatment model(s) used, rather only report on the format of the treatment delivered (e.g., individual, group, family, multi-family, etc.). See **Table 2** for details. Regardless of the model described, due to the large amount of contact time in DP treatment, it is rare for a programme to exclusively operate according to only one treatment model.

Perhaps the most important thing to consider regarding treatment model is the conceptualization of whom primarily holds the responsibility for change, the young person or the family. Given the adolescent developmental stage, almost all adolescent DPs include some family or parental involvement, however, their role varies. It ranges from being placed completely in charge of early change in treatment to taking a much more peripheral and supportive role throughout. A recent conceptual comparison of two specific adolescent eating disorder treatments, family based treatment [FBT; (77)] and enhance cognitive behavior therapy [CBT-E; (78)], highlighted fundamental differences in the two treatment approaches. Lock and Le Grange (77) state that family and parental involvement in the adolescent's therapy is necessary for treatment success. The family is viewed as a great resource in the treatment of their child.

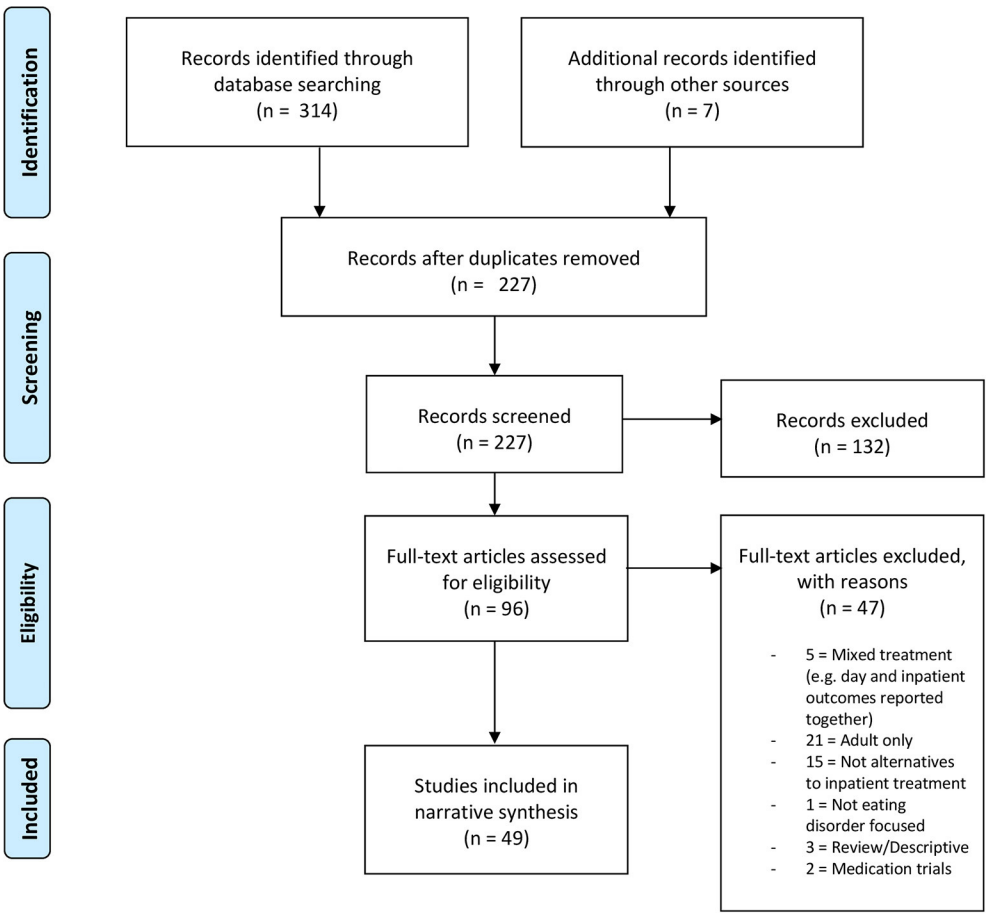

FIGURE 1 | PRISMA flowchart.

Conversely, the CBT-E model posits the illness belongs to the individual, who holds the responsibility for change (2).

These theoretical differences filter down into the way specific treatment models have been adapted for DP treatment. Hoste's (40) description of a FBT-informed DP in the USA heavily emphasizes the importance of the parents by placing them in charge of meals, encouraging parental persistence in the face of their child refusing food, not offering meal replacements and the less-directive role staff play to ensure they do not disempower parents. Alternatively, CBT-E based programmes prioritize involving the young people in decision making throughout the process, emphasizing the voluntary nature of the programme, with the view that this empowers the young person to take control over the process (18).

Not all adolescent eating disorder treatments or DPs hold such dichotomous views about the process of recovery. Engaging the adolescent and family are both formulated as essential to the recovery process in the broader form of family therapy for anorexia nervosa [FT-AN; (79)]. Programs that integrate family models with other treatment models offer intervention targeted at both individual and family factors, implying that both have some responsibility for change.

Day Program Outcomes

Physical Health

It is now well-established that DP treatment is associated with improvements in weight for underweight adolescents. Every study reviewed that investigated weight gain reported a mean increase from assessment to discharge (see **Table 2**). This appears to be consistent internationally across programmes regardless of the treatment model or eating disorder diagnosis. Bryson et al. (55) found no difference in weight gain for adolescents with ARFID compared to anorexia nervosa. For adolescents attending all age DPs both groups appear to respond similarly. In two studies that included mixed adolescent and adult samples, no differences were found in the amount of weight gain for adolescents and adults by the end of treatment (35, 50). Nevertheless, no comparison of treatment response between adolescent and all-age programs has been made to date.

Eating Disorder and Comorbid Psychopathology

It is also widely reported that following DP treatment young people report reductions in a range of core eating disorder symptoms and cognitions, such as drive for thinness, shape and weight concerns and body dissatisfaction (see **Table 2**). Similarly,

TABLE 2 | Study characteristics, programme details and outcomes.

References	N (%F)	Study design	Mean age in years (SD, range)	Diagnosis	^Admis. criteria/ referral source	^Aims/ disch. criteria	Therapeutic model(s)	Treatment intensity	Mean length of stay (SD, range)	Baseline data mean (SD)	Discharge outcome data mean (SD)	Follow-up outcome data months (n, % baseline sample) & mean (SD)
California, USA												
Brown et al. (31)	99 (97%)	Uncontrolled case series	15.8 (1.56, 11–19)	AN (100%)	W (≤85% EBW)	WG (100% EBW), AWT, R	Family focused [FBT, DBT]	6–10 h/d 6 days/wk	92.9 days (NR, 29–281)	%EBW: 79.2 (NR) EDE-Q(G): 3.1 (NR)	%EBW: 94.2 (NR)*** EDE-Q(G): 1.8 (NR)***	6 months ($n = 41$, 41%) %EBW: 94.3 (NR) *ns*§ EDE-Q(G): 1.8 (NR) *ns*§ *(FU weight self-report)*
Parks et al. (32)	29 (%NR)	Qualitative	16.6 (2.2, 12–21) *[all <18 during treatment]*	AN-R (34%) AN-BP (21%) BN (27.8%) OSFED (17.2%)	NR	NR	Family focused [FBT, DBT]	10 h/d 6 days/wk	NR	NR	NR	NR
Reilly et al. (33)	59 (49%)	Sample description	10 (NR, 6–12)	ARFID (100%)	MS, S	AWT, G	Family focused [FBT, DBT]	6 h/d 5 days/wk	NR	%IBW: 85.4 (7.0) [SE group] 86.8 (8.5) [FOC group] 82.8 (5.2) [LA group] ED symptoms NR	NR	NR
Reilly et al. (34)	265 (93%)	Uncontrolled case series	15.7 (1.71, 11–21)	AN-R (58%) AN-BP (13%) BN (14%) ARFID (6%) BED (1%) OSFED (7%)	MS, S, NG	AWT, I, R	Family focused [FBT, DBT]	6–10 h/d 6 days/wk	73.1 days (NR, NR)	%EBW: 87.5 (10.3) [AN group] EDE-Q(G): 3.2 (1.8)	%EBW: 99.7 (9.1)*** [AN group] EDE-Q(G): 2.0 (1.6)***	6 months ($n = 93$, 35%) %EBW: 98.2 (11.1) *ns*§ [AN group] EDE-Q(G): 2.0 (1.6) *ns*§ 12 months ($n = 77$, 29%) %EBW: 99.1 (10.1) *ns*§ [AN group] EDE-Q(G): 1.7 (1.6) *ns*§ *(FU weight self-report)*
Georgia, USA												
Freudenberg et al. (35)	151 (100%)	Uncontrolled case series)	22.5 (8.4, 13–57)	AN (49%) BN (51%)	NR	NR	Non-family focused [CBT, Psychod., DBT, MI, ACT, FT]	6 days/wk	13.7 weeks (9.5, 2–57) [AN group] 13.1 weeks (10.4, 1–45) [BN group]	99.4lbs (11.0, NR) [AN group] EDI-2: 7.6 (4.0) [AN group] 9.6 (6.8) [BN group]	108.9lbs. (13.1, NR)** [AN group] EDI-2: 3.2 (2.9)** [AN group] 3.9 (3.7)** [BN group]	NR
Schaffner and Buchanan, (36)	77 (100%)	Uncontrolled case series	21.4 (6.7, 14–40)	*Eating disorders*	NR	NR	Non-family focused [CBT, Psychod., DBT, Art therapy, social skills, FBT for ado. AN]	3.5–7.5 h/d 6 days/wk	12.8 weeks (8.5, 1-43)	117.7lbs (33.3) EDI-2: 8.1 (3.8)	124.5lbs (30.1)*** EDI-2: 3.05 (2.8)***	NR
Schaffner and Buchanan, (36)	196 (98%)	Uncontrolled case series	22.6 (7.8, 13–51)	AN (%NR) BN (%NR) EDNOS (%NR) [purging: 81.5% bingeing: 77.4%]	NR	G	Non-family focused [CBT, BT, Art therapy, social skills]	3.5–7.5 h/d 6 days/wk	13.6 weeks (10.3, 1–60)	Weight NR EDI-2: 8.4 (3.9)	Weight NR EDI-2: 3.5 (3.2)***	NR

(Continued)

TABLE 2 | Continued

References	N (%F)	Study design	Mean age in years (SD, range)	Diagnosis	^Admis. criteria/ referral source	^Aims/ disch. criteria	Therapeutic model(s)	Treatment intensity	Mean length of stay (SD, range)	Baseline data mean (SD)	Discharge outcome data mean (SD)	Follow-up outcome data months (n, % baseline sample) & mean (SD)
Illinois, USA												
Hayes et al. (37)	1,200 (93%)	Uncontrolled case series	21.2 (10.8, 11–68)	AN (19%) BN (12%) BED (12%) OSFED (56%)	S	NR	Non-family focused [CBT-E, DBT, ACT]	6 h/d 5 days/wk	19.2 days (12.4, NR)	zBMI: = −1.39 (0.95) [<20 yrs, AN group] BMI: 17.5 (2.2) [>20 yrs, AN group] EDE-Q(G): 3.5 (1.5)	zBMI: −0.089 (0.84)*** [<20 yrs, AN group] BMI: 18.6 (2.0)*** [>20 yrs, AN group] EDE-Q(G): 2.3 (1.5)***	NR
Michigan, USA												
Berona et al. (38)	102 (92%)	Uncontrolled case series	16.4 (2.9, 11–24)	AN (77%) "subthreshold AN" (23%)	NR	NR	Family focused [FBT]	6 h/d 5 days/wk	27.8 days (4.7, NR)	BMI: 16.3 (1.4) [rapid gain grp] 17.4 (2.1) [mod. gain grp] 18.1 (2.5) [slow gain grp] EDE-Q(G): 2.9 (1.6)	Lbs. gained +16.7 (3.4) [rapid gain grp] +8.6 (3.0) [mod. gain grp] +3.1 (2.2) [slow gain grp] EDE-Q(G): NR	No FU
Homan et al. (39)	113 (92%)	Uncontrolled case series	14.4 (1.7, NR) [ado.] 19.6 (1.57, NR) [YA]	AN (79%) EDNOS (21%)	MS	AWT	Family focused [FBT, CBT, DBT, CRT]	6 h/d 5 days/wk	21.8 days (12.9, NR)	BMI: 17.6 (2.2) EDEQ (global): 2.9 (1.8)	Means NR (Authors report both adolescents and young adults show improvements in symptoms during DP)	3 months (n, % NR) *DP led to symptom improvement that was maintained at follow up for adolescents, but not for young adults. Means NR.*
Hoste (40)	28 (89%)	Uncontrolled case series	16.6 (3.5, 8–24)	AN (71%) EDNOS-R (29%)	PP/SD	WG (90–95% EBW)	Family focused [FBT]	6 h/d 5 days/wk	31.7 days (13.9, 13–76)	%EBW: 82.1 (9.6) EDE-Q(G): 3.2 (1.9) %EBW: 81.6	%EBW: 93.1 (6.5) *** [completers ($n = 21$)] EDE-Q(G): 1.9 (1.4)**	No FU
Rienecke (41)	53 (%NR)	Uncontrolled case series	"adolescents" (M, sd, range NR)	AN (67.9%) ARFID (13.2%) OSFED (18.9%)	PP/SD	AWT	Family focused [FBT]	6 h/d 5 days/wk	25 days (10.9, NR)	NR	NR *[no change in parental marital satisfaction during DP treatment]*	No FU
Rienecke (42)	87 (91%)	Uncontrolled comparison study (dropout [$n = 19$] vs. completers [$n = 68$])	14.1 (1.7, 10–18) [ado.] 19.6 (1.6, 19–24) [YA]	AN (100%)	PP/SD	AWT	Family focused [FBT]	6 h/d 5 days/wk	25.1 days (12.9, 1–74)	%EBW: 84.96 (7.7) [ado.] BMI: 17.54 (1.7) [YA] EDE-Q(G): NR	Completers: %EBW: 99.2 (10.7) [ado.] BMI: 19.8 (1.0) [YA] Dropouts: %EBW: 89.1 (10.3) [ado.] BMI: 18.9 (1.6) [YA] EDE-Q(G): NR	No FU
Rienecke (42)	3 (33%)	Case study	10.7 (3.1, 8–14)	ARFID (100%)	PP/SD	AWT	Family focused [FBT]	6 h/d 5 days/wk	20 days (1.7, 19–22)	BMI: 15.4 (1.3) ED measure NR	BMI: 16.7 (1.5) ED measure NR	No FU
Rienecke and Ebeling (43)	26 (89%)	Uncontrolled case series	15.5 (2.2, 12–19)	AN (46%) EDNOS-R (54%)	PP/SD	AWT	Family focused [FBT]	6 h/d 5 days/wk	27.6 days (10.9, NR)	%EBW: 88.1 (12.6) EDE-Q(G): 2.3 (1.6)	%EBW: 101.5 (14.8)*** EDE-Q(G): 2.0 (1.4) (ns)	No FU
Rienecke and Richmond (44)	26 (96%)	Uncontrolled case series	16.6 (3.2, 11–22)	AN (77%) EDNOS-R (23%)	PP/SD	WG (90–2% EBW), AWT	Family focused [FBT]	6 h/d 5 days/wk	28.2 days (14.6, NR)	%EBW: 80.9 (6.2) EDE-Q(G): 3.3 (1.7)	%EBW: 92.8 (5.1)*** EDE-Q(G): 1.8 (1.4)**	3 months ($n = 25$–26, 96–100%) %EBW: 97.7 (5.0)**§ [$n = 25$] EDE-Q(G): 1.5 (1.5) *ns*§ [$n = 26$] *(FU weight self-report)*
Rienecke et al. (45)	56 (93%)	Uncontrolled case series	15.8 (2.9, 12–24)	AN (73%) EDNOS-R (27%)	PP/SD	WG (90% EBW), AWT	Family focused [FBT]	6 h/d 5 days/wk	27.6 days (12.1, NR)	%EBW: 82.6 (7.4) EDE-Q(G): 3.4 (1.7)	93.0% EBW (5.2)*** EDE-Q(G): 2.2 (1.4)***	No FU

(Continued)

TABLE 2 | Continued

References	N (%F)	Study design	Mean age in years (SD, range)	Diagnosis	^Admis. criteria/ referral source	^Aims/ disch. criteria	Therapeutic model(s)	Treatment intensity	Mean length of stay (SD, range)	Baseline data mean (SD)	Discharge outcome data mean (SD)	Follow-up outcome data months (n, % baseline sample) & mean (SD)
Smith et al. (46)	51 (94%)	Uncontrolled case series	13.94 (NR, 9–17)	AN-R (70.6%) AN-BP (7.8%) A-AN (21.6%)	PP/SD	WG (90–95% EBW), AWT	Family focused [FBT, CBT, DBT, CRT]	6 h/d 5 days/wk	35.6 days (11.94, NR)	%EBW: 82 (6) EDE-Q(G): 2.4 (1.7)	%EBW: 93 (3)** EDE-Q(G): 2.1 (1.5) (ns)	No FU
Van Huysse et al. (47)	70 (91%)	Uncontrolled case series	15.5 (2.6, 10–19)	AN (100%)	PP/SD	WG (>95%), R	Family focused [FBT]	6 h/d 5 days/wk	29.6 days (10.6, 10–74)	%mBMI: 80.0 (5.7) EDE-Q(G): 2.0 (1.5)	%mBMI: 91.9 (5.9)** EDE-Q(G): 1.6 (1.3)*	No FU
Missouri, USA												
Fewell et al. (48)	423 (95%)	Uncontrolled case series	23.7 (9.5, 11–60)	AN (62.2%) BN (15.6%) BED (2.4%) ARFID (1.2%) OSFED (6.6%) EDNOS (12%)	NR	NR	Non-family focused [CBT, DBT, art therapy, music therapy, some FT]	NR	49.5 days (27.1, 7-120 days)	BMI: 17.7 (0.2) [AN group] EDE-Q(G): 4.0 (1.5)	BMI: 20.4 (0.2)*** [AN group] EDE-Q(G): 2.6 (1.5)***	12 months (n = 65, 15%) BMI: 20.61 (0.18) *ns*§ [AN group] EDE-Q(G): 2.9 (1.4)*§ *(sig. increase from discharge to FU)*
New Jersey, USA												
Huryk et al. (49)	326 (%NR)	Uncontrolled comparison study (FBT-DP [n = 138] vs. non-FBT-DP [n = 188])	15.7 (2.1) [FBT-DP] 15.9 (2.1) [DP] Range total sample 8–21	AN (74%) BN (6%) OS/ UFED (20%) ARFID (0.6%)	NR	NR	Family focused [FBT, DBT, yoga, art, body image group]	40 h/wk	29.4 days (18.9) [FBT-DP] 33.0 days (14.6) [non-FBT-DP] total: 31.44 (16.39, NR)	%EBW: 82.9 (9.5) [FBT-DP] 87.0 (13.4) [non-FBT-DP] (84.6 (11.5) [total sample])	NR	No FU
New York, USA												
Dancyger et al. (50)	82 (100%)	Uncontrolled comparison study (orthodox [n = 8] vs. modern [n = 74] Jews)	16.0 (2.3) [orthodox group] 18.0 (2.5) [other] Range total sample 12–18	AN (63%) BN (20%) EDNOS (17%)	PP/SD	G, AWT	Non-family focused [Integrative MDT approach]	8 h/d 5 days/wk	15.3 weeks (NR) [orthodox group] 10.4 weeks (NR) [modern group]	%IBW: 94% (NR) [orthodox group] 92% (NR) [modern group] EDI-2(DT): 18.2 (5.2) [orthodox group] 14.3 (6.2) [modern group]	%IBW 102% (NR) [orthodox group] 95% (NR) [modern group] EDI-2(DT): NR	No FU
Dancyger et al. (50)	82 (98%)	Uncontrolled case series	17.9 (NR, 12–30)	AN (63.4%) BN (19.5%) EDNOS (17.1%)	PP/SD	AWT	Non-family focused [Integrative MDT approach]	8 h/d 5 days/wk	15 weeks (16.9, NR)	%IBW: 87 (NR) [AN group] 93 (NR) [EDNOS group] 112 (NR) [BN group] EDI-2(DT): 15.4 (5.7) [AN group] 16.8 (5.7) [EDNOS group] 10.5 (6.5) [BN group]	%IBW (sd NR): 91 [AN group] 98 [EDNOS group] 110 [BN group] EDI-2(DT): NR	No FU
deGraft-Johnson et al. (51)	198 (96%)	Uncontrolled case series	17.7 (NR, 12+)	AN (53%) BN (8%) EDNOS (39%)	PP/SD	AWT	Non-family focused [Integrative MDT approach]	8 h/d 5 days /wk	2.6 weeks (NR, 1–8)	17.8 BMI (NR)	Kg: +0.95 [all] Kg: +1.15 [AN group] (BMI, sd NR)	No FU

(Continued)

TABLE 2 | Continued

References	N (%F)	Study design	Mean age in years (SD, range)	Diagnosis	^Admis. criteria/ referral source	^Aims/ disch. criteria	Therapeutic model(s)	Treatment intensity	Mean length of stay (SD, range)	Baseline data mean (SD)	Discharge outcome data mean (SD)	Follow-up outcome data months (n, % baseline sample) & mean (SD)
Wisotsky et al. (52)	65 (100%)	Uncontrolled case series	18 (3.3,12-27)	AN (65%) BN (18%) EDNOS (17%)	NR	NR	Non-family focused [Integrative MDT approach]	8 h/d 5 days/wk	Mean NR (range 4–394 days)	NR	NR	No FU
Ohio, USA												
Martin-Wagar et al. (53)	87 (92%)	Uncontrolled case series	14.9 (NR, 12–18)	AN-R (71%) AN-BP (29%)	PP	WG (>95%EBW), AWT	Family focused [FBT, CBT, DBT]	8 h/d 5 days/wk	7.4 weeks (4.7, 0–22.5)	%EBW: 82.83 (6.89) EDE-Q(G): 3.3 (1.8)	%EBW: 98.0 (9.3) EDE-Q(G): NR	No FU
Pennsylvania, USA												
Bustin et al. (54)	30 (87%)	Uncontrolled case series	12.8 (2.0, NR) *"adolescents"*	AN (33%) BN (7%) EDNOS (60%)	NR	NR	Family focused [As per Ornstein et al. (57)]	6-8 h/d 5 days/wk	33.3 days (9.9, NR)	%IBW: 86 (NR) ChEAT (total): 24.7 (NR)	%IBW: 96 (NR)*** ChEAT (total): 11.8 (NR)***	No FU
Bryson et al. (55)	62 (89%)	Uncontrolled comparison study (ARFID vs. AN in DP with FU)	11.4 (1.6) [ARFID group] 14.1 (1.5) [AN group] (range 7–17)	AN (68%) ARFID (32%)	S	AWT	Family focused [FBT, CBT, BT, ERP]	8.5 h/d 5 days/wk	Weeks: 6.8 (3.7) [ARFID group] 11.2 (5.3) [AN group]	%mBMI: 84.9 (7.9) [ARFID group] 81.6 (8.9) [AN group] ChEAT (total): 17.6 (14.2) [ARFID group] 9.2 (11.9) [AN group]	%mBMI:*** 94.0 (8.2) [ARFID group] 95.5 (6.9) [AN group] ChEAT (total):*** 33.6 (16.4) [ARFID group] 12.2 (11.5) [AN group]	30 months ($n = 59$, 95%) %mBMI: 95.1 (8.6) *ns*§ [ARFID group] 97.9 (11.1) *ns*§ [AN group] ChEAT (total): 5.8 (3.2)*§ [ARFID group] 9.0 (8.7)*§ [AN group]
Lane-Loney et al. (56)	81 (74%)	Uncontrolled case series	10.9 (2.2) [fear group] 13.1 (2.1) [appetite group] 11.5 (2.0) Co-primary group]	ARFID (100%)	MS, PP	AWT	Family focused [FBT, CBT]	5 days/wk	Days: 28.5 (11.0, NR) [FOC group] 22.9 (8.4, NR) [LA group] 29.9 (15.9, NR) [co-primary]	%mBMI: 88.3% (15.03) [FOC group] 85.6 [10.9] [LA group] 79.9 (89.6) [co-primary group] ChEAT(OC): 7.3 (3.7) [FOC group] 7.1 (5.5) [LA group] 7.35 [co-primary group]	%mBMI:** 97.3 (14.3) [F0C group] 95.3 (10.1) [LA group] 79.9 (89.6) [co-primary group] ChEAT(OC)**: 3.7 (4.0) [FOC group] 5.5 (4.0) [LA group] 4.2 (3.3) [co-primary group]	No FU
Nicely et al. (57)	173 (92%)	Descriptive	13.5 (2.03, 7.2–16.9)	AN (53.8%) BN (11.6%) ARFID (22.5%) OS/UFED (12.1%)	NR	NR	Family focused	6-8 h/d 5 days/wk	NR	%mBMI 87.1 (13.0) [ARFID group] 82.6 (9.2) [AN group] 108.1 (19.5) [BN] 93.2 (6.8) [OS/UFED group] ChEAT (total): 14.9 (2.1) [ARFID group] 27.5 (17.3) [rest of group]	n/a	No FU
Ornstein et al. (58)	30 (87%)	Uncontrolled case series	12.8 (2, 8–16)	AN (33%) BN (7%) EDNOS (60%)	S, PP	AWT	Family focused	6-8 h/d 5 days/wk	33.3 days (13.4, NR)	%IBW: 86 (10) ChEAT (total): 20 (NR)	%IBW: 96% (7)*** ChEAT (total): 9.0 (NR)***	No FU

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TABLE 2 | Continued

References	N (%F)	Study design	Mean age in years (SD, range)	Diagnosis	^Admis. criteria/ referral source	^Aims/ disch. criteria	Therapeutic model(s)	Treatment intensity	Mean length of stay (SD, range)	Baseline data mean (SD)	Discharge outcome data mean (SD)	Follow-up outcome data months (n, % baseline sample) & mean (SD)
Ornstein et al. (59)	130 (92%)	Uncontrolled comparison study (ARFID vs other EDs in DP)	13.5 (2.1, 7–17)	AN (52.3%) BN (11.5%) ARFID (24.6%) OS/UFED (11.5%)	S, PP	AWT	Family focused [FBT, CBT, BT]	6-8 h/d 5 days/wk	Weeks in DP: 7.0 (3.4, NR) [ARFID group] 11.9 (4.2) [AN group] 8.9 (3.6) [BN group] 9.2 (3.7) [OS/UFED group]	%mBMI: 86.2 (10.0) [ARFID group] 82.9 (8.0) [AN group] 110.7 (21.1) [BN group] 93.4 (7.2) [OS/UFED group] ChEAT (total): 14.2 (12.8) [ARFID group] 30.5 (14.8) [AN group] 39.6 (19.1) [BN group] 25.0 (18.6) [OS/UFED group]	%mBMI:*** 95.5 (8.0) [ARFID group] 95.2 (5.5) [AN group] 109.2 (17.4) [BN group] 98.4 (5.2) [OS/UFED group] ChEAT (total):*** 9.8 (10.5) [ARFID group] 11.6 (10.5) [AN group] 13.9 (13.0) [BN group] 14.0 (12.0) [OS/UFED group]	No FU
Zickgraf et al. (60)	83 (76%)	Descriptive	11.38 (NR, 8–17)	ARFID (100%)	S	NR	Family focused [FBT, CBT, BT, ERP]	8.5 h/d 5 days/wk	NR	%MBW 95.2 (28.7) [SE group] 83.5 (11.4) [LA group] (16.1) [FOC group] 80.1 (9.6) [co-primary] Selective: 95.23%mBMI (28.71) ED sympt. NR	n/a	No FU
Wisconsin, USA												
Bean et al. (61)	16 (88%)	Uncontrolled comparison study (FBT-DP [$n = 9$] vs. non-FBT-DP [$n = 7$])	15.4 (2.6, 12–20)	AN-R (100%)	NR	AWT	Family focused [FBT, CBT, IPT]	2–6 h/d 5 days/wk	Weeks: 11.6 (5.6, 5–24) [FBT-DP] 11 weeks (5.2, 4–18) [non-FBT-DP]	BMI: 16.9 (NR) [FBT-DP] 16.2 (NR) [non-FBT-DP] EDE-Q(G): 3.8 (NR) [FBT-DP] 2.6 (NR) [non-FBT-DP]	BMI:* 19.6 (NR) [FBT-DP] 19.2 (NR) [non-FBT-DP] EDE-Q(G): 1.6 (NR)* [FBT-DP] 1.3 (NR) (ns) [non-FBT-DP]	No FU
Canada												
Girz et al. (62)	17 (100%)	Uncontrolled case series	16.1 (1.0, 13–18)	AN-R (24%) BN (35%) EDNOS-R (35%) EDNOS-BP (6%)	PP/SD, MS	AWT	Family focused [FBT]	5 days/wk	149.76 days (30.34, NR)	%IBW: 88.0% (NR) EDI-3(DT): 49.2 (12.6)	%IBW: 16/17 reached 100% EDI-3(DT): 31.1 (13.1)*	No FU
Grewal et al. (63)	65 (94%)	Uncontrolled case series (completers [$n = 38$] vs. non-completers [$n = 27$])	15.6 (1.4, 13–18)	AN-R (60%) AN-BP (14%) BN (11%) BED (3%) EDNOS (12%)	W (> 80% GW), SD	WG (100% GW)	Family focused [FBT]	5 days/wk	200.4 Days (109.8, 42–517)	%GW: 91.7 (6.1) ED sympt. measure NR	%GW: 101.8 (7.7)* [restrictive group only] ED sympt. measure NR	No FU
Henderson et al. (64)	65 (100%)	Uncontrolled case series	15.0 (1.3, 11–17)	AN (64%) BN (10%) EDNOS (26%)	SD	WG (≥19 BMI), AWT	Family focused [FBT]	10 h/d 5 days /wk	14.8 weeks (6.0, NR)	BMI: 18.7 (2.4) EDI-2(DT): 16.1 (6.0)	BMI 20.5 (2.0)*** EDI-2(DT): 11.6 (7.4)**	6 months ($n = 43$–61, 66–95%) BMI 19.8 (2.2) ***^ [$n = 61$] EDI-2(DT): 11.72 (7.3)***^ [$n = 43$]

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TABLE 2 | Continued

References	N (%F)	Study design	Mean age in years (SD, range)	Diagnosis	^Admis. criteria/ referral source	^Aims/ disch. criteria	Therapeutic model(s)	Treatment intensity	Mean length of stay (SD, range)	Baseline data mean (SD)	Discharge outcome data mean (SD)	Follow-up outcome data months (n, % baseline sample) & mean (SD)
Ngo and Isserlin (65)	49 (100%)	Uncontrolled comparison study (completers [$n = 14$] vs. failures [$n = 35$])	15.3 (1.2, 13–17)	AN-R (69.4%) AN-BP (30.6%)	NR	WG (≥92.5% IBW)	Non-family focused [CBT, art therapy, may have FT]	8 h/d 4 days/wk	81.9 days (61.7, NR)	%IBW: 84.1 (4.5) ED sympt. Measure NR	%IBW: 89.9 (5.4) ED sympt. Measure NR	No FU
Pennell et al. (66)	24 (96%)	Uncontrolled case series	15.4 (1.3, 13–17)	AN-R (42%) AN-BP (25%) BN (4%) EDNOS (21%) ARFID (8%)	PP/SD, S	G, AWT	Family focused [FBT, DBT]	6–10 h/d 5 days/wk	8.8 weeks (6.6, 2–35)	%IBW: 94.8 (8.2) ED sympt. Measure NR	IBW: 99.5 (8.0)88 5/7 abstinent from binge-purge behaviors	No FU
Spain												
Lazaro et al. (67)	160 (94%)	Uncontrolled comparison study (AN-r [$n = 116$] vs. BN-r [$n = 44$])	15.5 (1.2, 13–18)	AN (59%) BN (18%) EDNOS (23%)	PP/SD, S	AWT	Non-family focused [CBT, BT]	6. 5 h/d 5 days/wk	3 months (NR)	BMI: 18.3 (1.2) [AN-rd group] 20.3 (3.3) [BN-rd group] EAT-40: 49.9 (26.0) [AN-rd group] 50.9 (18.1) [BN-rd group]	BMI: 19.2 (NR) [AN-rd group] 20.6 (NR) [BN-rd group] EAT-40 NR	No FU
Serrano-Troncoso et al. (68)	77 (94%)	Uncontrolled case series	14.4 (1.6, 11–17)	AN-R (94%) AN-BP (6%)	MS, NG (NICE, 2017)	WG (≥90% EBW), AWT	Non-family focused [CBT, BT, parenting elements]	11 h/d 5 day/wks	28.9 days (18.5, NR)	BMI: 17.2 (NR) ED symptom measure NR	BMI: 17.9 (NR)*** ED symptom measure NR	12 months ($n = 70$, 91%) BMI: 19.3 (NR)***^
UK												
Baudinet et al. (69)	130 (95%)	Uncontrolled case series	15.0 (1.5, 11–18)	AN-R (84%) AN-BP (5%) A-AN (5%) OSFED (6%)	PP/SD, S, MS	AWT	Family focused [FT-AN, RO-DBT, CBT, CRT]	6 h/d 5 days/wk	13.4 weeks (5.9, 1–30)	%mBMI: 82.4 (8.5) EDI-3(DT): 18.3 (8.5)	%mBMI: 89.5 (8.6)*** EDI-3(DT): 15.2 (8.9)*	No FU
Pretorius et al. (70)	24 (96%)	Uncontrolled case series	15.6 (1.4, 12–17)	AN (71%) EDNOS (29%)	PP/SD, S, MS	AWT	Family focused [FT-AN, DBT, CBT, CRT]	6–8 h/d 5 days/wk	NR	%mBMI: 78.5% (9.9) ED symptom measure NR	%mBMI: 82.6 (9.4)	No FU
Simic et al. (71)	105 (95%)	Uncontrolled case series	15.5 (1.5, 11–18)	AN-R (91%) AN-BP (1%) ARFID (5%) OSFED (3%)	PP/SD, S, MS	AWT	Family focused FT-AN, DBT, CBT, CRT]	6 h/d 5 days/wk	28.4 days (13.6, NR)	%mBMI: 79.9 (8.69) EDE-Q(G): 3.6 (1.4)	%mBMI: 85.0 (9.10)*** EDE-Q(G): 2.6 (1.5)***	6 months ($n = 86$, 82%) %mBMI: 88 (10.6)**§ EDE-Q(G): NR
Germany												
Herpertz-Dahlman et al. (26)	172 (100%)	RCT (DP [$n = 87$] vs. IP [$n = 85$] after 3 weeks of IP)	15.2 (1.5, 11–18)	AN-R (82%) AN-BP (18%)	S, PP, MS	AWT	Non-family focused [CBT, BT, some FT]	8.5 h/d 5 days/wk	Weeks: 16.5 (7.0) [DP] 14.6 (6.0) [IP]	%EBW: 74.4 (7.0) [DP group] 75.4 (6.2) [IP group] EDI-2 (global): 248.8 (58.2) [DP group] 272.5 (59.4) [IP group]	%EBW:*** 89.0 (3.8) [DP group] 88.1 (4.7) [IP group] EDI-2 (global): NR	12 months (post-randomization) ($n = 142$–161, 83–94%) %EBW:***^ [$n = 161$] 89.0 (3.8) [DP group] 88.1 (4.7) [IP group] EDI-2 (global): [$n = 143$] 248.2 (71.1) [DP group] 256.2 (78.2) [IP group]

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TABLE 2 | Continued

References	N (%F)	Study design	Mean age in years (SD, range)	Diagnosis	^Admis. criteria/ referral source	^Aims/ disch. criteria	Therapeutic model(s)	Treatment intensity	Mean length of stay (SD, range)	Baseline data mean (SD)	Discharge outcome data mean (SD)	Follow-up outcome data months (n, % baseline sample) & mean (SD)
Australia												
Goldstein et al. (72)	28 (100%)	Uncontrolled case series	15 (12–18)	AN (79%) EDNOS (21%)	MS, SD	Fixed length	Non-family focused [CBT, narrative therapy, distress tolerance]	3.5 days/wk (18 h/wk)	10 weeks fixed length	%IBW: 81.6 (7.7) EDI-3(DT): 13.8 (9.1)	%IBW: 84.2 (10.0)** EDI-3(DT): 10.1 (8.3)**	6 months ($n = 17$–20, 61–71%) %IBW: 88.6 (12.1)**^ [$n = 20$] EDI-3(DT): 5.88 (6.85)** ^ [$n = 17$]
Green et al. (73)	42 (100%)	Uncontrolled case series	16.7 (2.9, 12–24)	AN-R (83%) AN-BP (17%)	MS	AWT	Non-family focused [CBT]	5.75 h/d 5 days/wk	22 weeks (NR, 0–52)	BMI: 17.0 (1.5) EDI-3(DT): 57.1 (28.8)	BMI: 18.9 (1.7)** EDI-3(DT): 31.0 (26.0)***	No FU
Israel												
Danziger et al. (74)	32 (97%)	Uncontrolled case series	14.5 (2.0, 10–17.5)	AN (100%)	S	WG (within 1 kg of IBW)	Family focused MDT approach	14 h/day	NR	38 kg (6.0) ED symptom measure NR	47.25 kg (6.2) body image disturbance disappeared for 19/45	9 months ($n = 32$, 100%) 27/31 retained IBW
Danziger et al. (75)	45 (93%)	Uncontrolled comparison (psychotherapy [$n = 21$] vs. not [$n = 24$] in first 2 months of DP)	14.7 (2.0,10-17.5)	AN (100%)	S	AWT	Family focused MDT approach	14 h/day	NR	37.4 kg (6.8) [therapy group] 39.1 kg (5.3) [no therapy group] ED symptom measure NR	42.8 kg (7.8) [therapy group] 46.4 kg (5.8) [no therapy group] (no therapy sig > therapy group**)	13.5 months (n, % NR) +10.4 kg (4.3) [therapy group] + 11.0 kg (5.50) [no therapy group]

*$p < 0.05$; **$p < 0.01$; ***$p < 0.001$.

^Codes for admission and discharge criteria: AWT, agreement with team; G, reaching goals; I, insurance constraints; MS, medically stable; NG, as per a national guideline; PP, poor progress; R, remission; S, severity/acuity; SD, step-down from inpatient care; W, weight cut/off; WG, weight goal.

$^{+}$ Significance testing for baseline to follow up difference.

§ Significance testing for discharge to follow up difference.

NR, not reported.

ACT, acceptance and commitment therapy; ado., adolescent; AN, anorexia nervosa; AN-rd, anorexia nervosa and related disorders; ARFID, avoidant/restrictive food intake disorder; Ax, assessment; BED, binge eating disorder; BMI, body mass index; BN, bulimia nervosa; BN-rd, bulimia nervosa and related disorders; BT, behavior therapy; CBT, cognitive behavioral therapy; ChEAT, Children's Eating Attitudes Test; ChEAT(OC), oral control subscale of ChEAT; CRT, cognitive remediation therapy; DBT, dialectical behavior therapy; DP, day program; Dx, diagnosis; EAT-40, Eating Attitudes Test; ED, eating disorder; ED-Rs, restrictive eating disorders; EDE-Q, Eating Disorder Examination Questionnaire; EDI, Eating Disorder Inventory; EDNOS, eating disorder not otherwise specified; EDNOS-R, eating disorder not otherwise specified characterized by restriction; EOT, end of treatment; FBT, family based treatment; FOC, feat of aversive consequences; FT-AN, family therapy for anorexia nervosa; FU, follow up; IBW, ideal body weight; IOP, intensive outpatient program; IP, inpatient; LA, limited appetite or lack of interest in eating; MDT, multi-disciplinary team; MI, motivational interviewing; OSFED, other specified feeding and eating disorder; OSFED-R, other specified feeding and eating disorder characterized by restriction; PHP, partial-hospitalization program; PMM, predictors, moderators or mediators; Psychod., psychodynamic psychotherapy; RO-DBT, radically open dialectical behavior therapy; SE, selective eating due to sensory properties; UFED, unspecified feeding and eating disorder; UK, United Kingdom; YA, young adult.

for those with binge/purge behaviors at assessment, reductions are reported by end of treatment (34–36, 58).

From the available data, it has been consistently reported that DP treatment is associated with improvements in symptoms of depression (35–37, 48, 56, 58, 62, 64, 69, 73), as well as anxiety and worry (36, 48, 58, 59, 62, 71, 73). There are some individual differences between studies in the pattern of improvements. For example, Henderson et al. (64) found that anxiety did not significantly improve during DP treatment itself but did significantly improve during the 6-month follow-up period. These findings are encouraging as comorbidity is high across the studies reviewed (typically ∼30–70%) and the data suggests broader, more holistic recovery may be supported in DP treatment.

Psycho-Social Functioning

Some studies have also investigated broader change beyond psychopathology. Several programmes investigated more general psychosocial functioning, such as global functioning, social and school functioning, psychosexual adjustment, etc. Regardless of the aspect of functioning investigated or instrument used, all reported improvements during DP treatment (26, 37, 48, 73).

Similarly, adolescents report improvements in emotion regulation, emotional expression, cognitive flexibility, attachment relationships and social functioning at end of treatment (69, 71), although cognitive flexibility did not improve after a brief 4-week cognitive remediation group offered within the DP context (70). Significant improvements in self-esteem have been reported (67, 71). Lázaro et al. (67) specifically investigated change in self-esteem, social functioning and social skills during their DP treatment that included groups specifically targeting these domains. They found that adolescents generally improved in these domains over the course of their DP (mean duration = 3 months). However, there were differences in responding depending on diagnostic grouping. Adolescents with bulimia related disorders reported lower self-esteem and social skills at assessment but improved more during treatment compared to those with anorexia nervosa and related difficulties. All these factors are hypothesized to be core difficulties for people with eating disorders and may contribute to the maintenance of symptoms and impaired functioning.

Quality of Life and Motivation

Evidence is now suggesting that DP treatment is associated with improved quality of life and motivation to recover. After both brief and longer DP treatment adolescents report significant improvements in quality of life (37, 71). Furthermore, motivation and readiness to change improve across DP treatment, regardless of the treatment model (54, 72, 73). Higher motivation at assessment also predicted the amount of weight gain in one small ($N = 42$) Australian study (73).

Family Factors and Outcome

Compared to individual adolescent factors, relatively little attention has been given to parent, caregiver and family factors. Fourteen studies (29%) measured parental factors and no study included siblings or wider family members. The only qualitative study in the review reported that adolescents and families are initially unsure about family involvement in DP treatment, but this improves during treatment and most say that it is an important part of treatment upon reflection (32).

Family functioning was reportedly very poor at entry into one DP (52). Poorer functioning was also associated with increased eating disorder psychopathology (52). However, parental marital satisfaction, another marker of family functioning, was not associated with baseline illness severity or treatment dropout in another study (41).

Parental self-efficacy and readiness for change have also been investigated. Parental self-efficacy improved and caregiver burden reduced during treatment in one study (62). The authors noted that the timing of changes in perceived burden coincided with physical and psychological improvements for the adolescent (62). With regard to readiness for change, one study found that parents and adolescents report similar levels initially, but by the end of treatment adolescents are more ready for change than their parents (54).

Lastly, parental expressed emotion has also been investigated, although the data are mixed. Maternal expressed emotion reduced between baseline and discharge in one study (44), while paternal expressed emotion was reported to either stay the same (44) or reduce (39) across treatment. Whether this interacts with outcomes is not reported, although higher expressed emotion has been associated with a slower weight gain trajectory (38). Expressed emotion may also impact upon therapeutic alliance. In one study, higher maternal hostility toward their child was associated with poorer therapeutic alliance with the team/clinician, although this did not impact outcomes (45).

Outcomes at Follow-Up

Increasingly, follow-up data are now being published (see **Table 2** for details). Thirteen (27%) studies included follow-up data at different time intervals, including 3 months (39, 44), 6 months (31, 33, 34, 64, 71, 72), 9 months (75), 1 year (26, 34, 48, 55) and beyond (55, 75).

Three-Month Follow-Up

Treatment improvements are reported to be maintained between discharge and 3-month follow-up (39, 44). This includes maintenance of weight, eating disorder symptomatology and mood. In one study adolescent shape concerns continued to improve over this period (44). For parents, self-efficacy improvements were maintained or improved upon and emotional over-involvement reduced (44).

Six- and Nine-Month Follow-Up

At 6-month follow up outcome reporting is more varied. Two studies found that adolescents continue to gain weight during the 6- (71, 72) and 9-month follow-up periods (74). However, two other studies report a reduction in remission rates between discharge and 6-month follow-up (31, 34).

12-Month Follow-Up and Beyond

At 12-month follow-up many adolescents continued to do well-physically and psychologically. Regarding weight, four studies reported that adolescents maintained their weight at 12 months or more post-discharge (34, 48, 55, 75) and one reported that

weight continued to increase (68). DP treatment has also been shown to be equivalent to inpatient treatment for weight gain at 12 months from the start of treatment (26). By the 2.5 year mark from the start of treatment those who received DP treatment had higher BMI and significantly fewer relapses and admissions to hospital than those who received inpatient treatment (22), although the magnitude of these difference have not been specifically reported. Bryson et al. (55) also found that adolescents with restrictive eating disorders (anorexia nervosa and ARFID) maintain their weight at longer-term follow-up (mean length to follow up 30 months).

The pattern of change in eating disorder symptomatology beyond weight is more varied. Two family-focused, adolescent-only DPs reported that improvements were either maintained (34) or significantly improved upon at 12-month or more follow-up (55). Conversely, Fewell et al. (48) found a significant worsening of eating disorder symptoms, despite weight maintenance, at 12-months post-treatment in their all-age DP. Regarding comorbidity, Reilley et al. (34) reported that symptoms of depression and anxiety continued to improve at 6- and 12-month follow-up. Lastly, maternal and paternal expressed emotion (both criticism and emotional over-involvement) significantly reduce between admission and 12-month follow-up (80).

It is important to note substantial amounts of missing data in some studies at longer follow-up time points. One study reported 63.4% and 70.9% missing data at 6- and 12-month follow-up, respectively (34), while another reported 85% missing at 12 months (48). Furthermore, Bryson et al. (55) report that of those eligible for their follow-up study, only 45.3% consented to participate, highlighting the difficulty of obtaining complete follow-up data.

Treatment Drop-Out and Non-completion

Treatment completion, drop-out and treatment non-completion are defined very differently depending on the service. Some studies report on the rates of "non-completers," which usually means there is disagreement between the individual, family and clinical team about readiness for discharge. This term, or "treatment failure," is also used in some studies to refer to adolescents who do not meet a specified weight target by the end of treatment [e.g., (65)]. Others report on the number of people who are referred to inpatient treatment or higher levels of care as markers of poor outcome.

From the data available, most adolescents who start DP treatment will go on to complete it. Non-completion rates range from 8.9 (45) to 41.5% (63), although are most commonly reported at ∼20% (26, 42, 58, 59).

Referral to Higher Levels of Care and Readmission Rates

When reported, rates of admission to inpatient from DP treatment range from ∼5–35% (42, 49, 50, 54, 55, 59, 65, 68, 69, 71, 72) and readmission rates to DP range from ∼3–20% (49, 66, 68, 69, 71). Huryk et al. (49) observed that the readmission rate to their DP significantly reduced from 12 to 3% after the integration of FBT principles into their DP.

Predictors, Moderators, and Mediators of Day Program Outcomes

Age and Outcome

Age did not impact upon treatment outcome or need for higher levels of care in two adolescent family-focused DPs (39, 58). However, the picture is more mixed in all age programmes. Hayes et al. (37) found that younger participants had poorer outcomes in their large study ($N = 1{,}200$). In a smaller study ($N = 82$), however, this was not replicated (50).

Diagnosis and Outcome

Most studies do not have adequate numbers to explore differences in outcomes between different diagnostic groups. All adolescent, regardless of diagnosis, have been shown to benefit from treatment (35). However, participants diagnosed with anorexia nervosa (as opposed to bulimia nervosa or eating disorder not otherwise specified [EDNOS]) had worse outcomes in one very large ($N = 1{,}200$) study (37). In a much smaller study ($N = 82$) there were no differences in outcome according to diagnosis (50).

Within the cluster of restrictive eating disorder diagnoses (anorexia nervosa, ARFID, EDNOS-restrictive) the only available data are from family-focused DPs. Adolescents with ARFID have similar improvements in physical and psychological outcomes to those with anorexia nervosa (55, 59). This has not been investigated in all age programmes.

Eating Disorder Severity and Outcome

Several studies have investigated whether certain markers of eating disorder illness severity are associated with outcomes at the end of treatment. Some found that eating disorder symptom severity measured using self-report questionnaires (and other markers of illness severity, such as length of illness at assessment, presence of binge/purge behaviors, amount of weight loss at assessment) is associated with poorer outcomes at discharge from FBT-informed programmes (31, 53, 58, 63) and an all-age programme (48). Conversely, Ornstein et al. (58) found that eating disorder severity did not predict physical or psychological improvements in their family-focused DP. Additionally, Ngo and Isserlin (65) found that low body weight at admission (<85% ideal body weight) was not associated with poorer outcomes. Lastly, Homan et al. (39) found that most factors they investigated did not impact upon change in eating disorder psychopathology by end of treatment, including previous hospitalization or previous treatment.

One small study also demonstrated that adolescents who have very low desired ideal body weight targets (one marker of greater cognitive distortion) reported higher levels of restriction at the end of FBT-informed DP treatment (43). Furthermore, cognitive improvements in eating disorder symptoms were associated with reduced mealtime anxiety over the course of treatment in another study (46).

Comorbidity at Assessment and Outcome

Again, the data here are mixed. Two studies explored whether comorbidity at assessment impacts treatment outcome in FBT-informed programmes. Ornstein et al. (58) found that the

severity of mood and anxiety symptoms at assessment was not associated with psychological or physical improvements at discharge. Homan et al. (39), however, noticed different patterns of responding depending on diagnosis. Adolescents with anorexia nervosa, compared to those with EDNOS, demonstrated greater treatment gains regardless of the level of depression at assessment. Adolescents with EDNOS showed treatment gains only at moderate or high levels of depression.

Within all-age programmes, inconsistent findings are also reported. Fewell et al. (48) found that severity of comorbid depression and worry symptoms were associated with worse outcomes in their programme. Conversely, Hayes et al. (37) found that those who were more depressed did better in their programme. It is important to note the large difference in programme length between these two programmes (49.5 vs. 19.2 days, respectively), as this may limit the comparability of these findings.

Family Factors and Outcome

Very little has been investigated regarding family factors and how these potentially impact upon DP treatment outcome. Ornstein et al. (58) found that neither intact families nor parental level of education predicted outcome in their programme. It has also been reported that parental engagement (therapeutic alliance) is not predictive of adolescents' eating disorder symptomatology or weight at the end of treatment (45). High parental expressed emotions have, however, been associated with a slower weight gain trajectory (38).

One interesting finding is that low levels of parental empowerment at entry into a FBT-informed DP predicted greater weight restoration at the end of treatment (53). While this finding may initially appear counterintuitive, one way to interpret this finding is that FBT-informed DPs are empowering and containing for parents.

Early Changes in Treatment and Outcome

Early change in three factors have been shown to predict improved outcomes in family-focused DPs; early weight gain, early cognitive change and early therapeutic alliance. Weight gain within the 1st month of DP treatment has been shown to predict discharge weight (31, 53). It has also been shown to predict remission defined broadly (47), although this was not replicated in a another study that used a more stringent remission criteria (31). With regard to eating disorder psychopathology, greater cognitive change within the 1st month (31) and stronger therapeutic alliance by week two (45) were both associated with end of treatment cognitive symptom improvement.

In the latter study, Rienecke et al. (45) note that early therapeutic alliance was also associated with lower symptom severity at admission, suggesting that this group may have had better outcomes because they were less severely unwell upon entry to their programme. Interestingly, therapeutic alliance with either parent did not predict improvements in eating disorder psychopathology or weight gain for the young people. Furthermore, therapeutic alliance appeared to form early (week 2) and did not significantly change over the rest of treatment for adolescents, mothers or fathers. Again, the first few weeks of treatment appear crucial. Early change has not been specifically investigated in all age programmes.

Therapeutic Model and Outcome

Two uncontrolled studies to date have directly examined whether the therapeutic model used within DP treatment impacts outcome (49, 61). After 3 years of operation, Huryk et al. (49) restructured their DP to be FBT-informed. They compared readmission rates to their programme before and after this change ($N = 326$) and found a significant reduction since the integration of FBT principles (11.7 vs. 2.9%). They also noted that since FBT was integrated, adolescents who attended their programme had a lower admission weight, had been ill for a shorter duration and were more likely to have anorexia nervosa as opposed to other types of eating disorder diagnoses.

Bean et al. (61) conducted a similar comparison on a much smaller sample ($N = 16$) of adolescents and young adults (12–20 years) with anorexia nervosa. They found that those who received FBT-informed DP treatment demonstrated significant improvements in weight, eating disorder symptoms and mood, whereas those who participated in a non-FBT informed DP only demonstrated weight improvements. While encouraging, this study is very small and the groups differed in clinical severity at baseline, which was not accounted for in statistical analyses.

One other study referred to potential improvements in outcomes due to a change in treatment model. In their discussion, Baudinet et al. (69) noted that after changing the therapeutic group programme from being predominantly informed by Dialectical Behavior Therapy (81) to Radically Open Dialectical Behavior Therapy (82) they had far fewer referrals to inpatient treatment (18 vs. 5%).

DISCUSSION

From this systematic scoping review of the adolescent eating disorder DP literature there are a few key findings that can be reported. Most commonly, studies are from North America (80%), report on programmes that operate 5-days-per-week (76%) and include predominantly adolescents or adolescents and young adults (84%) with restrictive eating disorders only (57%). Most studies have a model of treatment that is family focused (69%), although there is considerable variation in how much each programme adheres to one particular model vs. integrates multiple models. Even when a programme was described as being primarily informed by one treatment (e.g., FBT), it was common for other treatment modalities (e.g., CBT, DBT) to inform individual or group components of the treatment.

This review identified two main types of DPs currently operating. The first is typically for younger people only and informed by family-based treatment models. Typically, this type of DP is treating and/or exclusively reporting outcomes for underweight young people with restrictive eating disorder presentations. The second type of DP appears to be much more mixed with regard to age, type of presentation and the treatment modality, which appears to be more influenced by individual psychotherapy models with less or no emphasis on integrating family elements. Given the vastly different role the

adolescents and parents play in the recovery process in these two types of programmes, it could be expected that the factors that will influence outcomes may vary depending on the type of programme. In the first type of programme parental factors may play a much bigger role in outcome and are potentially more modifiable given the level of parental involvement required during treatment. Conversely, individual factors such as illness severity, functional impairment and motivation may impact outcome more in the latter type of DP, as the onus of change and recovery is placed much more on the individual.

The only data directly comparing the impact of DP models on outcomes suggests being family-focused reduces DP readmission rates (49). It may also be associated with better weight and mood outcomes (61), although the latter findings are from a very small study ($N = 16$) with methodological limitations. Being more focused on specific personality predispositions associated with restrictive eating disorders may also reduce the need for inpatient treatment for this particular group (69). In addition, the largest study included in this review ($N = 1{,}200$) reported that younger people may have worse outcomes in all age, non-family focused DP treatment (37). This could suggest the need for age-, diagnosis- and model-specific DP treatments. However, not enough data is currently available to support or refute this. More data and direct comparisons of outcomes according to treatment model are needed.

An important consideration is also the impact of local healthcare and insurance systems. While insurance was only mentioned in one study, these systems will directly shape the admission and discharge criteria for all DPs, which population they target, the length of treatment and aims. The cost, availability and proximity of outpatient and inpatient treatment also needs to be considered, as it will directly influence the scope and length of DP treatment. If no other treatment is locally available or covered by insurance companies, programmes could potentially aim for full remission, rather than just clinical improvement. Eleven of the 13 studies that described weight targets for discharge were in North America, as were the three that report remission or partial remission rates. This suggests cultural and system differences in the aims and scope of DP treatment.

The use of a weight criterion at admission, as opposed to just medical stability, also highlights potential cultural and system differences in the scope and aims of DP treatment. This could differentiate those that act as a true alternative to inpatient treatment (for medical stabile adolescents), as opposed to being positioned as a higher intensity outpatient treatment (weight criterion). Further clarity and consistency in reporting of admission and discharge criteria, as well as healthcare system requirements, are needed to properly understand this.

Regarding outcomes, this review highlights DP treatment for adolescent eating disorders has non-inferior outcomes to inpatient care after brief stabilization (26) and may even be superior to inpatient treatment at longer term follow up (22). It is now relatively well-established that inpatient treatment beyond medical stabilization or containment of acute risk has limited benefit (13, 37). This review highlights that DP treatment is robustly associated with weight gain (for those who are underweight), reduced eating disorder symptoms, improvements in symptoms of comorbid depression and anxiety, as well as improvements in general functioning and quality of life. These improvements are generally maintained in the short- and medium-term, although some deterioration of symptoms, but not weight, is reported by some studies at 12-month follow-up.

It also appears that the initial few weeks of treatment are important for the treatment outcome. In family-focused adolescent and young adult only programmes early weight gain, early cognitive change, and therapeutic alliance within the first few weeks of treatment have been shown to predict outcome (31, 45, 47, 53). In all-age DPs, relatively fewer papers are published investigating predictors, moderators or mediators. Available data demonstrate that age, eating disorder diagnosis, motivation, symptoms of depression and worry at baseline have all been shown to influence outcomes by the end of treatment (37, 48, 73). Some studies report that eating disorder and comorbid symptom severity are associated with poorer outcomes, whereas others have not found these associations. The data are less clear regarding other individual factors and their association with outcome at discharge and follow-up.

Only 14 (29%) of the included studies report on parent/family factors. Interestingly, low parental empowerment at assessment was associated with better outcomes in one study (53). The additional support and intensity offered in a DP may help to instill hope in recovery and reactivate parents in ways that outpatient treatment might not be able to achieve. This may enable them to execute greater level of agency and effectiveness in their parental role. The way in which parental agency interacts with a relational containment of the adolescent, and how these factors impact outcome is yet to be fully understood. In the outpatient treatment context, relational containment is reportedly an important part of promoting recovery (83). It is possible that multi-disciplinary DP team offers relational containment to each family as a whole within the unique DP context. The findings on family factors highlight that multiple processes are occurring at the individual and family level in DPs, which require further exploration.

This will be important to consider in future research, particularly when examining more closely for whom DP treatment is appropriate and effective. There is a very limited data available regarding DP treatment response for young people with increased psychiatric complexity and risk e.g., trauma, abuse or neglect, emerging personality disorder traits, self-harm and those living in less typical family constellations, such as foster care or out-of-home care. Only three studies reported comorbid emerging personality disorder features within their sample and rates were very low (66, 68, 73). Furthermore, no study discusses considerations needed for those with trauma, abuse or more complex family circumstances. One study describe the careful considerations required for those with comorbid self-harm and increased risk (66).

The type of DP treatment may be particularly important to consider for this group of young people. The role of family involvement, when family relationships may be more complex and/or family supports limited, needs careful consideration. It is possible that the intensive relational containment offered within family-focused day programs may be beneficial for some, however, it may also be very unhelpful and distressing for others.

In those circumstances, programmes informed by DBT may be more appropriate.

The mixed and sometime contradictory findings regarding predictors and mediators of DP treatment outcome are unsurprising in many ways. This review has shown that DPs have very different designs, treatment lengths and treatment philosophies. Furthermore, there is great variability in the quality of studies, sample size included and a marked dearth of controlled trials. The lack of consensus in defining outcome and recovery in the field of eating disorders generally complicates this matter even further (84). For all of these reasons, it is impossible to confidently compare the results of different adolescent DP studies. Rather, only trends can be highlighted.

Another key finding from the current review is that the physical and psychological aspects of recovery follow different trajectories in DP treatment (31, 48, 58). This suggests that the process and mechanism of change may also be different. Weight gain for those who are underweight is unsurprising in some ways, given it is often a compulsory requirement of DP treatment and contracted at assessment. Adolescents who do not gain weight are often quickly referred to higher levels of care or discharged. What is less clear, however, are the processes and mechanisms via which psychological change occurs. Most DPs offer a combination of several, often multi-model group-based, interventions that target specific psychological factors associated with eating disorders. The specific impact these interventions have on the psychological factors they are designed to target remains unknown. Furthermore, the way in which DP treatment model and structure, group process factors and family-focused interventions influence psychological (and physical) changes are also unknown. Investigating psychological factors and interventions that target them in future research is important given that both physical and psychological factors are essential for recovery (84) and may require different and specific treatment components.

Most studies reported a mean length of stay well below the typical outpatient treatment length of 6–12 months. The majority also state that the aim of DP treatment is clinical improvement, rather than remission. As such, the amount of expected change, particularly cognitive change, is likely to be modest, even in the most effective programmes. Behavioral change is often a precursor to cognitive change (85), and may be a sufficient treatment target for DP treatment, so long as it occurs within a continuum of care. Offering brief, intensive DP treatment followed by outpatient treatment may be the most appropriate model of care. It is likely to be the least restrictive and most cost-effective treatment pathway.

Limitations

Several limitations are apparent from this review. Firstly, only English language and no gray literature was reviewed (conference abstracts, dissertations, etc.). Regarding the papers reviewed, most notable are the small sample sizes reported on, the uncontrolled nature of study methodologies and the lack of consistency in outcome reporting.

Only one RCT directly compared DP and inpatient treatment. Only two uncontrolled studies, one of which was very small, directly compared outcomes for different types of DP treatment. This makes it difficult to confidently say whether DPs do actually function as a true alternative to inpatient treatment.

With regard to sample size, 69% of the studies reviewed had sample sizes below 100 participants and 24% had 30 participants or less. This might suggest that many of the studies were underpowered, making the majority of conclusions very tentative. Several papers appear to be reporting different outcomes of roughly the same participant group, meaning the literature base may appear inflated compared to the actual current evidence base. Increased consistency in outcome reporting that includes independent effect sizes for both weight and cognitive-based AN symptomatology (86) and more detailed descriptions of the treatment models would also greatly improve the clarity of findings and comparability of studies. Additionally, consistency in how remission is defined and greater detail in reporting of what happens during follow up periods (e.g., details of ongoing treatment engagement and treatments received) is needed.

Lastly, from the current review, it is very hard to determine DP treatment response for young people with bulimia nervosa, binge eating disorder and other presentations not predominantly characterized by dietary restriction. The majority of data reports on outcomes for young people with restrictive eating disorders. Research focused on the aforementioned group would also clarify whether it is important to separate or mix diagnostic groups in treatment.

FUTURE DIRECTIONS

The current review highlights several areas for future research into adolescent DPs for eating disorders. The voice of adolescents and parents is noticeably missing from the current literature. Similarly, therapeutic model and programme structure are both hypothesized to be important and powerful treatment mechanisms; however, few studies have directly investigated their direct impact on outcome.

Broadly, the field would benefit from:

a) Increased consistency in outcome reporting, including the inclusion of independent effect sizes for both physical and health markers of recovery.
b) Replication studies regarding the non-inferiority comparison of DP to inpatient treatment with respect to outcomes, patient and family satisfaction and costs.
c) Further investigation into whether certain individual or family factors indicate the appropriateness of DP over inpatient setting.
d) Controlled studies investigating whether specific DP's treatment content or therapeutic models lead to improved outcomes and for which group in regard to their age, diagnosis and family composition.
e) Qualitative investigations of DP treatment change processes and mechanisms.

Together these would help deepen our understanding of when and for whom DPs can be offered as an alternative to inpatient care. A subgroup of young people currently treated in inpatient units may not require such intensity.

Understanding the characteristics of this subgroup and clarifying questions raised regarding DP treatment model, length and intensity will ensure all young people are treated in the least restrictive and most cost-effective ways possible.

AUTHOR CONTRIBUTIONS

JB and MS were involved in all aspects of this research. All authors contributed to the article and approved the submitted version.

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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.2021.652604/full#supplementary-material

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BRIEF RESEARCH REPORT
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Long-Term Outcome of Adolescent Anorexia Nervosa: Family Treatment Apartments Compared With Child Psychiatric Inpatient Treatment

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Introduction: The family is rarely involved in treatment when the patient with anorexia nervosa (AN) is hospitalized. Family treatment apartment (FTA) represents an intervention that includes the family in the intensive treatment of AN. This study compares the short- and long-term outcomes of adolescents treated in FTA with those who received inpatient hospital care. In FTA, the parents are responsible for providing meal support, whereas in hospital care, the staff is responsible.

Methods: Sixty-eight previous patients admitted during the period 1990–2009 participated in a follow-up, 43 from the FTA where the whole family is admitted for treatment and 25 from regular psychiatric inpatient care. The follow-up consisted of a personal meeting with structured interviews, measurement of height and weight, and self-rating questionnaires.

Result: Readmissions due to weight loss within 6 months from discharge were less common in the FTA group. At follow-up, 14.2 years after admission, there was no difference in eating disorder pathology between the groups. There were significantly lower scores on general psychiatric pathology and significantly higher scores on quality of life in the FTA group.

Discussion: The treatment in FTA aims to give the family the ability to handle AN when it is most challenging. FTA may thus provide a helpful context for treatment with a basic sense of security along with skills that could contribute to better general mental health at follow-up.

Keywords: anorexia nervosa, children and adolescence, follow- up study, family based treatment, in patient hospital treatment

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INTRODUCTION

When patients are seriously ill and in need of inpatient care, it is often the case that the family is not involved, and the family treatment ceases. It is well-established in treatment research that the family is a central resource for the young patient with anorexia nervosa (AN) to be able to recover, and family-based treatment (FBT) has demonstrated its superiority in repeated studies (1). These studies have mainly been conducted in outpatient care and with recent-onset cases. Knowing how to involve the family in a higher level of care is scarce, and the need to improve research has been underlined in a recent meta-analysis (2).

At the Center of Eating Disorders in Lund, Sweden, the family treatment apartment (FTA) model was developed in 1990. In FTA, the whole family is admitted for 5–6 weeks, and the treatment is based on the family therapy developed at the Maudsley hospital in London (3). FTA was developed as a high-intensity FBT serving as an alternative to psychiatric inpatient care when the patient was in such poor physical and psychiatric health that outpatient care was no longer sufficient.

Family-based programs in a higher level of care have recently come into focus for development. Descriptions of treatment programs involving families in a higher level of care have been published (4–6). Five recently published studies try to evaluate the effect of implementing family treatment in Family-Based Partial Hospitalization Programs (7–11). They all evaluate programs that engage parents in taking responsibility for the patient's food intake. One of the studies (7) has no follow-up, the other four have a 3- or 6-month follow-up. They all describe improvement during treatment, which is maintained at follow-up.

The use of family therapy for inpatients is not well-researched. We found five studies that examine inpatient programs that incorporate families to support the child with meals and the recovery process (12–16). The different treatment programs are similar in that the parents take responsibility for the meals. One difference between the program is the treatment setting. The treatment is usually integrated into the inpatient unit with the other patients, but in some programs, such as in FTA, the family has its own apartment.

One study from the eating disorders unit in Sydney (4, 12) describes a treatment model similar to the FTA model. The adolescent and his/her family had a 2-week family-based hospital admission at the outset of hospital treatment. In Fink et al. (12), the authors conclude that this treatment program provides struggling families with enhanced skills and a stronger foundation for outpatient FBT.

There are two Scandinavian studies on how to integrate family therapy components into the treatment of AN at inpatient units. The first study (13) is from the Regional Section of Eating Disorders (RASP) in Oslo and is a follow-up study after 4.5 years of 37 patients. One of the parents was present at the unit at all times; in two-thirds of the cases, both parents stayed at the unit initially. Siblings were also welcome, but in most cases, they stayed at home. The family treatment aimed to help parents establish clear, predictable frameworks for meals.

The second Scandinavian study (16) compared the family inpatient unit at Stockholm's Center for Eating Disorders (SCÄ) with an inpatient unit at an eating disorder unit in Copenhagen. The inpatient unit in Copenhagen did not include the family. They found shorter hospital stays and fewer readmissions at the family unit, which may indicate that when the family focuses on the treatment, the result is more durable. It can be difficult to assess the significance of this finding, as there may be different guidelines and traditions regarding criteria for admission and length of admissions in the two different countries.

In Matthews et al. (14), the patient and the family received an FBT intervention while the patient was hospitalized for medical complications of AN. The components of FBT (e.g., psychoeducation, illness externalization, minimizing guilt, and blame) were coupled with intensive caregiver meal coaching and parent-directed behavioral contracting. The authors compared the intervention group with a retrospective treatment-as-usual group at 3 and 6 months after discharge. The group that received FBT intervention gained significantly more weight.

In another study (15), the parents were asked to be present as much as possible throughout the admission. 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 the hospital and to plan for meals out of the hospital. This study demonstrated the feasibility of implementing FBT principles in an inpatient program.

All studies described improvement, but only two studies (14, 16) had a comparison group. Matthews et al. (14) compared with patients who had been treated before starting family therapy, and Fjelkegård et al. (16) compared with patients from inpatient care at another unit. Both studies conclude that the outcome of treatment seems more sustainable when the family is involved.

Although, we know that the long-term course for adolescent AN is protracted, it is not clear whether the family influences the illness course in the long term. Rydberg Dobrescu et al. (17) showed in their 30-year follow-up of a community-based sample that one in five had a chronic eating disorder, whereas, 64% were fully recovered. The long-term course for hospitalized children and adolescents may be worse compared with those who were followed up in the Rydberg Dobrescu study. The long-time follow-up studies have varying results (18–22). In these studies, the follow-up time varied (a mean value of 7.5–20 years). The age of the patients when admitted to treatment varied (between 9 and 22 years). The proportion of participants reaching full recovery varied between 41% (after 7.5 years) (21) and 75.8% (after 12 years) (18).

The risk for relapse and the need for rehospitalization are high during the first year after discharge. Andrés-Pepiñá et al. (22) followed up the participants for 12 months after discharge and found that 24.8% required readmission after complete weight recovery.

AIM OF THE STUDY

The study aims to investigate whether the long-term course differs between those who have been in FTA compared with those who have been in traditional inpatient treatment. We also wanted to investigate if the short-time course is affected if the family has been involved in the treatment when the patient was very sick. This retrospective cohort study aims to investigate the long-time and short-term course for patients who had been in FTA with patients with AN who had been treated during the same period in inpatient care at the Child and Adolescent Mental Health Service (CAMHS) in Malmö.

Research has shown that FBT has a superior effect on the short-term course, but the effect on the long-term course had not been demonstrated. Therefore, we hypothesized that there would be fewer readmissions to inpatient care in the short-term course for the group that had been in FTA, but no difference in the long-term course of AN except better psychosocial adaption in the FTA group.

METHODS

Participants

During the period 1990–2009, 185 patients with the AN diagnosis were admitted to either inpatient care at CAMHS or FTA, 115 to FTA, and 70 to CAMHS. The participants selected for the follow-up were required to have been admitted for at least 10 days, as a shorter period may not be meaningful to evaluate. Eighty-six families admitted to the FTA, and 63 patients admitted to the CAMHS stayed there for a period longer than 10 days. These 149 former patients were invited to participate in a follow-up. Of those, 68 persons consented, 43 from the FTA group, 3 boys and 40 girls, and 25 from the CAMHS group, 2 boys and 23 girls, as shown in **Figure 1**. The mean age at admission was 14.8 years for the whole group.

Treatment Programs

FTA was developed as an intensive family therapy alternative to psychiatric inpatient treatment specifically for AN (3). Patients and families are admitted to FTA when they are in a compromised medical state and with nationwide referrals. One family at a time lives in the apartment.

In the FTA model, the family is seen as a crucial resource in the process of the patient's recovery. The treatment focuses on strengthening the family's ability to challenge the AN during family meals, and therefore, the focus is on family meals as well as on family sessions—conjoint, separate, and individual. The focus of treatment in FTA is to strengthen parental cooperation and help them take responsibility for what the patient eats. The treatment also includes regular family therapy sessions, body awareness therapy, parental groups, and activities to normalize family life. The FTA is taking place in an ordinary apartment in a residential area in Lund. The families normally stay for approximately 5–8 weeks, of which a substantial part include home-leave to promote the transfer of acquired skills to the home setting. After discharge, the families are offered three follow-up sessions. Then, the local CAMHS takes responsibility for the treatment, and we do not know what treatment the patients receive.

The CAMHS is a traditional child psychiatric inpatient unit with a mix of diagnoses. The unit is not specialized in eating disorders (EDs). The patients are admitted mainly due to a compromised medical state, and all are drawn from the Malmö catchment area. One parent is encouraged to stay on the unit. Treatment focus is on weight gain, and most often, there is a weight goal for discharge. The treatment is not manualized, and no expected length of treatment has been formulated. The main intervention, stable over the years, is that the staff is responsible for the meals and that the parent can participate. After discharge, the local CAMHS reassumes responsibility for the treatment.

The main difference between the two treatment models is that the staff at the inpatient unit is responsible for the meal, whereas in FTA, the parents carry the meal responsibility, and the family lives in an ordinary housing apartment.

Assessment at Follow-Up

The follow-up consisted of a personal meeting with two structured interviews, Structured Clinical Interview for Diagnostic, and Statistical Manual of Mental Disorders, 5th Edition (DSM-5), I and a semi-structured clinical interview about their life situation and state of health.

The Structured Clinical Interview for diagnosis (Structured Clinical Interview for DSM-5) (23) is a diagnostic interview based on DSM IV (24). When the follow-up interviews were conducted, there was no upgraded version in relation to DSM-5 in Swedish.

The semi-structured interview developed for the follow-up (unpublished manuscript in Swedish, available on request to the corresponding author) aimed to gather information about the participants' life situation, family, studies, work situation, and state of health, both in relation to the current situation as well as covering the follow-up period.

The following self-rating questionnaires were used:

- Eating Disorders Inventory, 3rd edition (25), assesses both eating disorder symptoms and psychological problems associated with an ED and consists of two scales, Eating Disorder Risk Composite and General Psychological Maladjustment Composite. It has been validated for use in Sweden (25).
- Symptom Check List (26) assesses general mental health.
- Eating Disorder Examination—Questionnaire assesses eating disorder symptoms. It has been validated for use in Sweden (27).
- Body Attitude Test (28) assesses body image disturbances and body dissatisfaction.
- RAND 36 is a public version of SF-36 that assesses the quality of life. It has been validated for use in Sweden (29).
- Morgan–Russel Outcome Assessment Schedule (30). A well-established outcome instrument in AN research. Subscale D on sexuality aspects was omitted.

At the follow-up, weight and height were measured.

Statistical Analyses

Independent and paired *t*-tests were used to investigate differences between and within participants. All analyses were two-tailed. The alpha level was set at $p \leq 0.05$. Chi-square tests were used when categorical data were analyzed.

RESULTS

At admission, there was no difference in age, comorbidity, or body mass index between the two groups, as shown in **Table 1**.

The treatment duration in FTA was shorter than at CAMHS, and the discharge weight was lower for the FTA group. Readmissions due to weight loss within 6 months from discharge were less common for FTA than CAMHS [two participants in the FTA group (4.7%) compared to eight participants in the CAMHS group (32.0%); $p = 0.017$]. Readmissions within 12 months were similar [eight participants in the FTA group (20.9%) compared to eight participants in the CAMHS group (32.0%) $p = 0.174$].

Half of the participants were readmitted at some point during the follow-up period, with no difference between the groups.

At admission, all participants were diagnosed as AN restrictive type. At follow-up, we re-diagnosed the FTA group but not the CAMHS group because the information in the patients' files was too scarce. We found that 4 of 43 in the FTA group

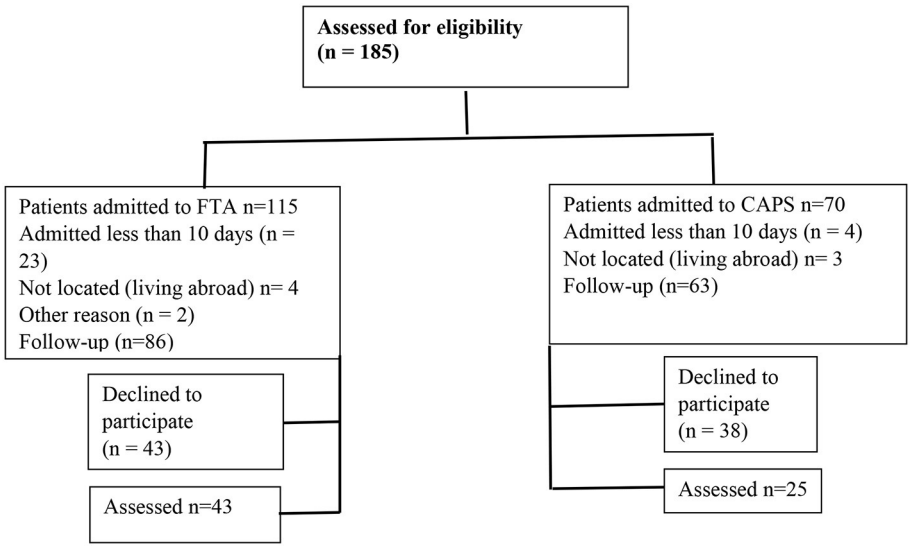

FIGURE 1 | Flowchart.

TABLE 1 | Participant characteristics of the sample during treatment.

	FTA		CAMHS		*p*
	Mean (SD)	**Range**	**Mean ± SD**	**Range**	
N	43		25		
Age at onset (years)	13.4 (2.1)	7.0–16.0	14.0 (1.6)	11.4–18.0	0.207
Age admission (years)	14.5 (2.1)	9.5–17.4	15.1 (1.6)	11.8–18.5	0.285
%EBW at admission	76.8 (9.8)	58.0–106.2	76.4 (10.2)	59.8–98.2	0.829
%EBW discharge	80.8 (10.0)	57.4–104.3	88.1 (11.8)	61.7–105.2	0.013
Duration of admission (days)	42.1 (20.4)	7–91	75.7 (66.4)	8–231	0.007
Weight gain (kg/week)	0.29 (0.63)	−0.70–3.34	0.69 (0.53)	−0.06–2.24	0.011
Weight gain (%EBW/week)	0.71 (1.7)	−1.45–10.8	1.33 (1.0)	−0.12–4.4	0.128

FTA, family treatment apartment; CAMHS, Child and Adolescent Mental Health Service; SD, standard deviation; %EBW percentage of expected weight.

fulfilled an avoidant/restrictive food intake disorder diagnosis at admission, two boys and two girls. At follow-up, one of the girls still fulfilled an avoidant/restrictive food intake disorder diagnosis, but the other three had no eating disorder. For all the participants, 32% had an eating disorder at follow-up, with no difference between the groups. The FTA group had fewer non-ED psychiatric diagnoses compared with the CAMHS group, but the difference was not significant (16.3 vs. 32.0% $p = 0.132$).

The follow-up took place on average 14.2 years after admission to treatment. The FTA group had a longer follow-up time than the CAMHS group, as shown in **Table 2**.

There was no difference in eating disorder pathology assessed by the Eating Disorder Examination Questionnaire and Eating Disorders Inventory Eating Disorder Risk Composite. There were no differences in body mass index.

According to Morgan–Russell Outcome Assessment Schedule, the FTA group had a better outcome on the average outcome score. The FTA group also had a better outcome on Symptom Checklist-90 and Eating Disorders Inventory General Psychological Maladjustment Composite, as shown in **Table 2**. The FTA group had a better quality of life score, as measured by RAND 36.

DISCUSSION

This study evaluates the long-term course of a group of patients who have been in family-based inpatient care and compares it with regular child psychiatric inpatient care. The general outcome is comparable between the groups and seems to be in line with what could be expected when compared with other studies. Full recovery in long-term follow-up studies of young people hospitalized varied between 41.5 and 75.8%. In our study, when we define full recovery as not fulfilling any eating disorder diagnosis or any other psychiatric diagnoses, 51.2% in the FTA group and 36.0% in the CAMHS group achieved full recovery. The FTA group seems to have a more favorable outcome. If the higher percentage of patients that met the criteria for a full recovery in the FTA group was due to family involvement or other factors is difficult to ascertain. The extent to which this relates to the initial eating disorder treatment, selection bias,

TABLE 2 | Participant characteristics at follow-up.

Follow-up	FTA		CAMHS		*p*
N	43		25		
	Mean ± SD	Range	Mean ± SD	Range	
Age at follow-up (years)	30.1 (5.4)	19.0–39.0	27.6 (5.2)	19.1–38.0	0.073
Follow-up time (years)	15.5 (5.0)	6.1–24.8	12.6 (4.0)	6.9–21.5	0.021
BMI (kg/m^2)	21.2 (3.3)	16.7–36.7	20.9 (3.3)	14.0–30.0	0.675
BAT	33.1 (24.6)	5–93	40.8 (18.8)	18–79	0.187
EDE-Q	1.30 (1.53)	0.0–4.9	1.59 (1.26)	0.0–4.3	0.442
EDI EDRC	110.6 (25.5)	84–187	115.7 (22.9)	91–165	0.412
EDI GPMC	366.5 (67.2)	253–509	424.6 (56.2)	333–557	0.001
SCL 90 GSI	0.54 (0.45)	0.0–1.7	0.89 (0.51)	0.15–1.94	0.005
MORGAN RUSSELL AO	9.8 (2.1)	4.4–12.0	8.6 (2.4)	3.2–12.0	0.027
RAND	585.0 (151.9)	240–783	484.3 (147.7)	271–733	0.012

FTA, Family Treatment Apartment; CAMHS, Child and Adolescent Mental Health Service; SD, standard deviation; BMI, body mass index; BA, Body Attitude Test; EDE-Q, Eating Disorder Examination Questionnaire; EDI EDRC, Eating Disorders Inventory Eating Disorder Risk Composite; EDI GPMC, Eating Disorders Inventory General Psychological Maladjustment Composite.

or other factors is challenging to estimate. In this study, we were unable to gather information about treatment during the follow-up period, which also may have influenced the results.

During the first 6 months after discharge, the FTA group had fewer readmissions due to weight loss, despite having shorter admissions, and poorer weight gain at discharge. Discharge from FTA was motivated by medical stability and that the parents have control over what the patient eats so that the treatment could continue at home. Discharge from the inpatient unit was motivated by a predetermined weight gain that sometimes could take a long time to achieve. The longer stay at the inpatient unit did not yield a better prognosis, which has also been shown in previous research (31). This indicates that intensive treatment to enhance parental control may contribute to a stabilized weight gain in the first 6 months after discharge.

At follow-up, there was no difference in eating disorder pathology or eating disorder diagnosis between the groups. The FTA group had a better outcome in regard to general psychiatric pathology and a better quality of life. Although, it is difficult to make firm conclusions about the effect of treatment after such a long time, there may be some possible links. The higher quality of life score in the FTA group is in line with the study hypothesis. Even at times of severe illness, FTA may help sustain normal family life, which may protect the patient's social skills and consequently improve quality of life. Similar mechanisms may also influence the difference in general psychiatric pathology.

Further, research is needed to understand whether FTA is a non-inferior treatment compared with inpatient care. Compared with inpatient care, FTA offers high treatment intensity with shorter treatment duration, less staff involvement, and superior family involvement.

LIMITATIONS

A major limitation of this study is that only 50% in the FTA group and 39.7% in the CAMHS group participated in the follow-up. A selection bias could influence the result. The lack of randomization also gives the possibility that the outcomes were influenced by selection bias. Specifically, in FTA, families had to agree to participate in treatment to be admitted, whereas, the inpatient group did not require family consent. Another possible bias or confounder may be geographical: FTA included patients from the entire country; the inpatient group had patients from the southern region of Sweden.

Another limitation is the long period during which the participant may have had different types of treatment that may impact the outcome. Another limitation is the differing follow-up time between the groups.

DATA AVAILABILITY STATEMENT

The original contributions presented in the study are included in the article/supplementary material, further inquiries can be directed to the corresponding author/s.

ETHICS STATEMENT

The studies involving human participants were reviewed and approved by Regional Ethic Review Board, Lund University. The patients/participants provided their written informed consent to participate in this study.

AUTHOR CONTRIBUTIONS

UW is responsible for the study and RH is responsible for the follow-up interviews. Both authors contributed to the article and approved the submitted version.

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Virtual Online Home-Based Treatment During the COVID-19 Pandemic for Ultra-Orthodox Young Women With Eating Disorders

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Background: With the outbreak of the COVID-19 pandemic, the need arose to maintain treatment continuity for religious Jewish Ultra-Orthodox young women with eating disorders (EDs) previously hospitalized in the ED department at the Ultra-Orthodox "Mayanei Hayeshua" medical center in Israel. This need led to the development of home-based online treatment channels, previously unfamiliar, and unaccepted in this population. The implementation of this model had to take into consideration many of the difficulties inherent in the use of online treatment in Jewish Ultra-Orthodox mental health patients.

Aims: We sought to investigate our online home-based treatment model implemented during the COVID-19 pandemic in previously hospitalized young Ultra-Orthodox women with EDs.

Method: We briefly review the literature on: (1) The Jewish Israeli Ultra-Orthodox culture; (2) Young women in Ultra-Orthodox society; and (3) EDs in Jewish Israeli Ultra-Orthodox women. We then present the inpatient ED department for Ultra-Orthodox young women and describe the online treatment model adapted to this population during the COVID-19 pandemic. We highlight the difficulties, dilemmas, and advantages of our online model with the description of three patients.

Findings: Online therapy can serve as a barrier to treatment in some cases, due to physical (lack of suitable online devices except phones), familial (over-crowded families), and religious circumstances, as well as because of the patients' reluctance to take part in this treatment. In other cases, virtual home-based treatment can lead to a positive change. This may be the case in patients who find the distancing online model suitable for them, and in parents who are committed to treatment, using their greater physical and emotional presence at home during the COVID-19 pandemic for the good if their ill-daughters.

Discussion: This paper highlights the difficulties and possibilities inherent in a virtual home-based treatment during the COVID-19 pandemic for Ultra-Orthodox young women

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previously hospitalized because of an ED. This model can be effective for some patients and families if undertaken by a multidisciplinary team that is not only knowledgeable about the treatment of EDs and the use of online strategies but also knowledgeable and culturally sensitive to the specific needs and codes of Ultra-Orthodox populations.

Keywords: anorexia nervosa, COVID-19, eating disorders, home hospitalization, online treatment, Jewish ultra-orthodox

INTRODUCTION

The incidence of eating disorders (EDs) and eating-related pathologies has risen over the past decades, primarily among adolescent girls and young women in modernized Western societies (1). Despite extensive research, the etiology of EDs is still unclear, described in terms of multi-causality, with diverse factors combining to generate and maintain the disorders. Despite the emphasis on genetic, physiological, and neurocognitive factors in the predisposition to an ED, researchers do relate to a culturally-dependent role in the etiology of these disorders (2–4). Moreover, the rate of EDs has also been rising in recent years in less modernized more traditional societies, and in minority groups within Western societies (5, 6).

One of the explanations for these changes in traditional societies is that they are undergoing rapid Westernization due to increasing exposure to Western values. This process is characterized by industrialization, urbanization, globalization, and heightened exposure to Western media in general, and to thin-body ideal messages in particular (7). These sociocultural shifts and the high degree of exposure to Western messages have been linked to growing awareness of weight body-image issues, likely increasing the risk of developing eating-related pathologies and full range clinical EDs (8).

A similar trend of rising rates of EDs in traditional populations has also been observed in Israel (4). Israel is a land of immigrants, home to people from a variety of cultures, religious groups, and ethnicities (9–12). The unique social structure of Israel is characterized by the juxtaposition of ancient traditions with cutting-edge technological development, and of reliance on the dictates of Jewish religion alongside an essentially modern and secular system of legislation. This complex country may offer, thus, an unusual opportunity to study the role of social, religious, and cultural factors amongst continuous stress conditions, in the predisposition to and maintenance of mental disturbances, including EDs.

The treatment of EDs is complex and challenging in view of potentially ambivalent cooperation, often stubborn resistance to treatment, and an inclination to deny the severity of the illness on the part of many young people with EDs (13, 14). The treatment of EDs in young *Haredi* (Ultra-Orthodox Jewish) women is all the more complicated, in that specific culture-dependent difficulties, related to the values and cultural norms of the Ultra-Orthodox Jewish society, are added to the typical denial and lack of cooperation. These include fear of social stigma, worries over impairment of marriage prospects, a preference for resolving problems within the family and community, a tendency to refrain from complaining, and avoidance of treatment in secular institutions to evade the risk of relinquishing the life of Orthodoxy (15). Further issues, related to the treatment itself, may arise from the encounter between modern, Western treatment and therapists and traditional Ultra-Orthodox religious-cultural viewpoints. This disparity may express itself in different models for the perception of sickness and healing, particularly concerning mental health. This tension is heightened by the aspiration of the Ultra-Orthodox community to remain separate from the Israeli secular majority, and by their view of mainstream society and its service providers as incapable of properly understanding and treating their problems (16). These issues may, inherently, pose a significant challenge for treatment (17).

In view of this complexity, a unique inpatient department has been established in 2018 at the Ultra-Orthodox Medical Center "Mayanei Hayeshua," located in the Ultra-Orthodox city of Bnei-Brak, for the treatment of adolescents and young women from the Haredi sector suffering from EDs. This department is adapted to the specific needs of this population, with the utmost adherence to its values, faith, religious customs, and behavioral codes.

With the outbreak of the covid-19 pandemic in Israel and the resulting imposition of the first of three lockdowns in March 2020, there was an emergent immediate unplanned need to find solutions to maintain the continuity of treatment in this department and preserve the achievements of inpatient care. The first COVID-19-related mandatory lockdown lasted for about 2 months (between 15/03/2020 and 15/05/2020), the second for about 4 weeks (13/09/2020–11/10/2020), and the third for around another 4 weeks (24/12/2020–20/01q2921. In the present study we describe the virtual online treatment in our center during the 1st lockdown. During this period, we treated around 20 patients and families.

Patients and parents rejected the idea of leaving the girls in full hospitalization without the option for family members to visit them or host them on weekends, while the Health Ministry restrictions made a day-hospital format impossible. This necessity led the treatment team of the department to find channels for long-distance online treatment, which has been completely unfamiliar to this population in general, and specifically not accepted in mental health care. In view of the only minimal use of the Internet and any digital means in the ultra-orthodox population, aimed to prevent exposure to Westernized secular messages, the mere acceptance of any online therapy has represented a revolutionary shift. Families have been especially adamant about barring access to the Internet to their children, who are the most easily influenced. This prohibition is so severe

that the rule is to turn one's head away when any screen comes into view (18).

Thus, the ED department at the Mayanei Hayeshua Medical Center had to develop a unique innovative virtual model for online therapy adapted to this population. This model had to adhere to the religious values and rules of the society, to be accepted by the religious leaders of the communities (the Rabbis) and by the families.

The manuscript aimed to present this specifically developed online therapy model, highlighting the complexities and dilemmas inherent in this treatment, in ultra-orthodox society. The advantages and disadvantages of online therapy within this population are discussed, as a barrier or impetus to therapeutic progress. Three case studies are presented, to illustrate some of the difficulties and advantages of online therapy in young ultra-orthodox women. The concluding discussion summarizes the findings of the long-distance treatment of Ultra-Orthodox young women with EDs during the COVID-19 pandemic and resulting lockdowns. A new culturally sensitive online daycare is proposed for treating young women with EDs of traditional populations in general and Ultra-Orthodox Jewish Israeli communities in particular, during both times of crises such as the COVOID-19 pandemic and at regular times.

THEORETICAL BACKGROUND

Ultra-Orthodox Jewish Communities in Israel

There is a broad spectrum of religiosity among the Jewish population of Israel, ranging from absolute atheism to the highest devotion to the observance of religious law. The Ultra-orthodox (Haredi) society is a subgroup of the most observant segment along this continuum, with unique cultural, religious, and attitudinal characteristics (19). The ultra-orthodox way of life is reflected in a highly observant approach to religious (rabbinical) authority, a preference to reside in closed Haredi communities, a strict separation of the sexes with specific attitudes to the importance of the family and the highly different roles of men and women, and the limited place of the individual relative to the importance of the community and its values (18).

Jewish Ultra-Orthodox communities maintain their separate educational systems, focused on traditional religious studies, scrupulously avoiding the teaching of general secular core studies, and the exposure to secular media contents including home use of televisions, computers, and the Internet. Ultra-orthodox isolationism is expressed by traditional physical appearance (e.g., beards, sidelocks or head coverings by men, or long sleeves and dresses, as well as wearing wigs by married women), and by adherence to the strictest possible interpretation of the *Halakhah* (religious laws) in front of the secular Israeli law. Every step throughout life is governed by religious edicts and guidance, the purpose of which includes the preserving of a cohesive traditional religious-dominated sociocultural lifestyle. Diligent observation of religious commands and studying in Yeshivas (religious secondary education institutions for men) are spiritual mainstays not to be compromised. Women are expected to support men in achieving these ideals by caring for the household, raising children, and acting as breadwinners for the family. At the same time, women are to be modest—to maintain the principle that their "honor is all inside." The Ultra-orthodox society is further subdivided into different sects, factions, and "courts" (*hatzerot*), each of which constitutes a separate social structure within the Haredi community at large, with its codes of observance and conduct (17).

Eating Disorders and Eating-Related Issues in Jewish Ultra-Orthodox Young Women

Research evidence regarding EDs and eating-related issues in religious Jewish subgroups in Israel and elsewhere is meager, particularly concerning the Ultra-Orthodox. Among Jewish Israeli national-religious ("*dati leumi*") adolescent girls (less religious observance and greater connection to nationalistic Israeli values), higher levels of religiosity have been linked to lower levels of eating pathology (4). Similar findings have also been observed in young American Jewish religious women, in comparison to non-religious young women (20). Another study has found that young women with an internal religious tendency (religious beliefs motivated by inner faith) show lower levels of eating-related pathology in comparison to those with an external religious tendency (religious beliefs motivated by social factors and the wish to belong to the community) (21–23). In a further study, young Jewish American religious women relying more on religious coping patterns in stressful situations have shown reduced eating-related pathology (21).

Similar findings emerged in a recent review of studies that examined body image, attitudes toward eating, eating-related pathology, and dissatisfaction with the body among ultra-Orthodox populations compared to secular and national-religious. A study of body image and body satisfaction using various measurement tools found that ultra-Orthodox women indicated more positive attitudes toward their bodies and expressed less body dissatisfaction compared to secular and modern Orthodox (24). Handelzalts et al. also showed similar findings, in which ultra-Orthodox women had the most positive body image, then modern Orthodox, and at the end of the continuum were secular women (25). Alternatively, another study observed that the highest level of body dissatisfaction was actually among traditional women, compared to other groups, and no differences were found between ultra-Orthodox and secular women (26).

Examining attitudes toward eating and eating-related pathology, no differences were found in attitudes and levels of pathology between ultra-Orthodox, secular, traditional, and Orthodox women (27). As well as in the study of Frenkel et al., using the same tools, no differences were found in the level of eating-related pathology between ultra-Orthodox and national-religious women (28). In a study conducted among adolescent girls aged 14–16 years and from a variety of backgrounds (secular, Christian Arab, and ultra-Orthodox), as well as among control population that included adolescents suffering from anorexia nervosa (AN), the body image was examined using

body image Figure drawings (29). Examination indicated similar levels of body dissatisfaction among secular, ultra-Orthodox, and Christian girls, and a lower level compared to the control group of those suffering from AN.

In a study conducted in the United States, attitudes toward eating among ultra-Orthodox and modern Orthodox schoolgirls aged 13–19 years were examined, using the EAT-26 questionnaire. The ultra-Orthodox reported more symptoms of eating disorders, more social pressure (for matchmaking and marriage) compared to modern Orthodox girls. Moreover, the pressure to marry and matchmaking was the main and significant predictor for the onset of eating disorders symptoms (30). In a similar study, also conducted in the United States, EAT-26 examined attitudes toward eating as well as body image, this time among ultra-Orthodox adult women from three streams, modern Orthodox, conservative, and secular, aged 18–70 (31). Unlike the study results among adolescents, no differences were found among adult women in eating-related pathology and symptoms of eating disorders, and these were not found to be related to the level of religious stringency or modesty of dress.

A qualitative study, conducted on six ultra-Orthodox women in South Africa, investigated through semi-structured in-depth interviews thoughts and feelings about the body, as well as the impact of religiosity (32). The study raised five themes about attitudes toward eating, perceptions of body image, peer influence, the influence of the secular outside world, the influence of Judaism, and body image. In general, it was found that the preoccupation with the body and dissatisfaction with its size and features appeared in the same areas and contents as expressed among women from Western culture.

There has been little research among ultra-Orthodox populations in Israel and around the world, especially concerning content related to mental health. This is mainly due to the closure of the ultra-Orthodox communities to the research world, among other things in order not to expose the psychopathology of the population. Therefore, there is great care among the intellectuals who examine the knowledge that is published carefully.

In a recent review (33), all the studies and articles (∼180 articles) that were done on eating disorders among ultra-Orthodox society were reviewed, and it was found that most of them were descriptive, with only nine of them indicating quantitative Data. This, to identify culturally related risk factors and protective factors in this population. These examined the literature from 2009 to 2019 and made an in-depth analysis of the nine studies. Risk factors associated with ultra-Orthodox culture included the centrality given to food, low socioeconomic level, strict modesty codes, the importance of thinness for matchmaking and marriage, lack of self-fulfillment, and early marriage, as well as high expectations of a women's role (eshet chayil). The protective factors found included faith, halakhic laws related to awareness and mindful eating, as well as lows that encourages gratitude for food. Moreover, it has been found that covering the body is another protective factor, as part of modesty that reduces the objectification of the body.

These results are consistent with the inclination of Jewish Ultra-Orthodox groups in Israel to use less ED treatment services, relative to their proportional percentage of the population (34). Alternatively, this finding may reflect a lesser inclination of these groups to seek help for mental health-related issues (35). Thus, concealment of psychiatric disturbances is encouraged, aiming to solve the problem within the confines of the community; psychological treatment is to be avoided, especially in mainstream Israeli mental health services because of socio-cultural considerations (36).

Over the past two decades, Ultra-Orthodox young women seem to be experiencing a socio-cultural process of transition and change. As they are increasingly required to support their families financially, they have to seek alternative sources of training and income beyond the traditional teaching and secretarial roles. This has likely led them to greater exposure to mainstream Israeli Westernized messages, including greater exposure to weight-related appearance issues, and the yearning for personal self-actualization and freedom of choice (15). Being in a phase of transition may increase the risk for the development of mental health-related issues, including those related to disordered eating and EDs (37). Indeed, there is seemingly a trend toward rising numbers of adolescent and young Jewish Ultra-Orthodox women hospitalized in recent years in mainstream Israeli specialized ED-treatment departments, likely increasing the fear of their families and communities of greater exposure to secular non-religious influences. This has led to the development, in 2018, of an ED treatment center adapted exclusively to the need of the Ultra-Orthodox population in the "Mayanei-Hayeshuah" Medical Center in the Ultra-Orthodox city of Bnei Brak, Israel.

Description of the First Department in Israel for the Treatment of Ultra-Orthodox Young Women With EDs

The first Ultra-Orthodox ED department in Israel, located at the Ultra-Orthodox "Mayanei- Hayeshuah" Medical Center in Bnei-Brak, is the realization of the vision of the late director of the Medical Center, Dr. Moshe Rothschild. Realizing the increase in the number of patients with EDs in the Jewish Israeli Ultra-Orthodox population in recent decades, and the problems with secularization and drifting away from the Jewish religious tradition inherent in the hospitalization of young Ultra-Orthodox women with EDs in mainstream Israeli ED treatment departments, Dr. Rothschild decided to set-up in 2018 a specific department for these patients.

This department is specifically designed as a culturally sensitive environment for the treatment of young Ultra-Orthodox women with EDs (as a religious facility, this department does not hospitalize males). The multidisciplinary treatment team includes a child and adolescent psychiatrist (head of the department and the only male in the team), an adult psychiatrist; a pediatrician; psychotherapists (psychologists, social workers, drama, music and movement therapists) nursing staff, clinical nutritionists school staff, occupational therapists, spiritual therapists and support staff for the supervision of eating. Except for the director of the department who is secular non-religious, all other team members are either Jewish Ultra-Orthodox or National Religious. The service includes inpatient,

daycare, and ambulatory facilities, treating young women with EDs between the ages of 11–22.

The treatment protocol is based on a behaviorally oriented nutritional rehabilitation program with structured meal supervision Every inpatient receives two weekly individual psychotherapy sessions, a once-weekly family treatment/parental consultation, a once-weekly movement/drama therapy session, and the following group therapies: psychodynamic, cognitive-behavioral (CBT), movement, psychodrama, Jewish religious-spiritual treatment, nutrition, milieu, and parents' group. Adolescent patients have a full school program approved by the Israel Ministry of Education, and young adult patients receive a full rehabilitation program approved by the Israel Ministry of Social Welfare. Treatment for each patient takes into consideration her age and developmental stage.

Because of the Ultra-Orthodox religious orientation of the medical center, the use of smartphones is strictly forbidden, along with any exposure to internet content incompatible with Jewish religious values. Modesty rules apply to both staff and patients, consistent with and respectful of Ultra-Orthodox religious mores. During the course of the treatment, the staff maintains ongoing contact with the religious and spiritual leaders of the families and with the hospital's Rabbis and enlists their help and advice at important junctures. Food is eaten according to strict Ultra-Orthodox Kosher rules. Whereas, most therapies are similar in essence to those in the secular ED department in Israel, the Jewish religious-spiritual treatment group is specifically set up under the premise that enhancement of internal religious orientation (religious beliefs motivated by inner faith) may be associated with a reduction of ED-related pathology (21–23).

Treatment in the ED Department at the "Maaynei-Hayeshuah" Medical Center During the COVOID-19 Pandemic

The circumstances imposed by the COVID-19 pandemic in Israel with its subsequent mandatory lockdowns required substantial changes in the treatment of patients with EDs. Inpatients could not leave the departments, and visits from the outside were not allowed. Some patients and families preferred to stop inpatient treatment and return home until the end of the lockdown. This was the case in most of the patients treated at the ED inpatient department at the "Maaynei-Hayeshuah" Medical Center. Moreover, daycare and ambulatory services had to be closed, unless in specific conditions. Treatment had, thus, to shift rapidly to telemedicine, being often unfamiliar to Israeli treatment providers in general, not to mention Ultra-Orthodox metal health services. Nonetheless, with the blessing of the Rabbinical authorities, the decision was made to transition the inpatient treatment of patients with EDs to a virtual **home hospitalization** format. This approval was necessary to obtain permission to use an accepted "kosher" Internet system, to enable online therapy.

As noted, exposure to the internet was unfamiliar and often forbidden up to that point, for patients and families, making the provision of treatment with these means highly challenging. At the start, and for some patients throughout the entire COVID-19 period, most of the telecommunication follow-up was conducted with telephone calls; only later, were computer-based video calls and Zoom meetings added.

Treatment with telemedicine in our ED patients encompassed a broad scope of meal and weight measurement supervision, parent counseling, and online individual and group therapy. It was provided by the multidisciplinary staff, working from within the department or from their home. Parents of patients with AN were asked to weigh their daughters once weekly in the local community medical centers during the morning hour. If this was not possible, they were asked to purchase a scale and received guidance from the staff on weighing their daughters weekly, during the morning hours after first urination, with their daughters wearing T-shirt and tights, or a gown.

The virtual online home hospitalization routine consisted of: (1) A weekly online meeting of the entire team staff with the patient and parents, to discuss the achievements and problems of the past week and the goals and challenges for the coming week. (2) Daily monitoring by the department's nurse, to track pharmacotherapy, physiological and emotional condition, everyday functioning, and emerging difficulties. (3) Twice-weekly nutritional counseling, including guidance for patients and parents by the clinical nutritionist for the home-meal supervision. (4) Twice-weekly individual psychotherapy and once-weekly family therapy or parental guidance. (5) A once-weekly psychiatric evaluation. (6) Continuation of group treatment, including the provision of parents' groups. (7) Daily schooling by the educational staff for adolescent patients and continued rehabilitative care for young -adult patients by the occupational therapist and the social worker. The aim of the treatment was to continue with the patients' routine as much as possible, while at the same time to be prepared to manage unexpected crises. The essence of this virtual home hospitalization program enabled such flexibility, tailored to the specific need of each patient and family.

Two psychotherapies deserve a specific consideration. The inclusion of psychodynamic psychotherapy in the treatment regimen is designed to address intrapsychic and interpersonal developmental needs of adolescents often burdened with long-standing illness, in addition to the specific ED-related therapies administered (38). It is of note that other programs in patients with AN have used psychodynamic psychotherapy as their main treatment, showing favorable results (39). Young Ultra-Orthodox girls are usually unfamiliar with the psychotherapeutic language (15). Nonetheless, all psychotherapists were of religious background, thus forming a bridge between psychotherapy and Ultra-Orthodox background. Moreover, dynamic psychotherapy might be specifically required for Young Ultra-Orthodox girls with EDs, who face highly challenging developmental issues, including early settled marriages or a lack of their own self-fulfillment (15).

CBT is provided in this department either as an individual psychotherapy, or in a specifically group format (40), based on Fairburn's "classical" model (41). During the COVID-19 lockdown, each patient read her food monitoring sheets via the online, and other patients and therapists reacted. In this period,

group CBT assisted primarily in supporting and expanding the supervised ED-related protocol.

CBT by videoconferencing has been previously found to show good clinical efficacy for ED treatment (42), including in adolescents (43). For example, Waller and associates (44) interviewed 70 clinicians in the field of EDs about their experience with delivery of CBT-ED via telehealth during the COVID-19 period. Some of their tips were akin to our experience. These included the attempt to adhere to our protocol while making the necessary long-distance changes; taking care of privacy considerations as much as possible; discussing the patients' preferences and experimenting with what works best for them; continuing with monitoring; taking care of adequate meals-related supervision and of weighing at home or at the nearest local health services; and providing parental psychoeducational groups, and educating the treatment providers about the proper use of telemedicine.

The families and patients understood the importance of the continuation of treatment and engaged in the process of maintaining prior achievements and preventing regression. To the surprise of the staff, most patients and parents and patients adjusted rapidly to the transition to this hitherto unfamiliar treatment. Overall, most of the patients seemed to adapt to online methods more rapidly than their parents. Some patients responded happily to the invitation and adapted quickly to the change, even surprising the staff by forming a more open connection with their therapists in online sessions, vs. in-person therapy where they tended to remain silent.

Nonetheless, the transition to virtual treatment did not work for everyone, as creating a therapeutic environment at home was sometimes highly challenging. Some patients and families struggled to create this space, particularly when all members of often large families with many children were confined to often relatively small apartments, sharing a single computer, enabling less than optimal privacy. Parents were required to be available to the treatment staff and to clear the path for forming adequate therapeutic environments, maintaining privacy and confidentiality for their daughters, in often overcrowded and highly noisy conditions. Moreover, some patients felt constricted by online therapy and struggled to be open under the difficult conditions in their homes.

Virtual therapy also posted significant challenges for the treatment staff. More than ever, they relied on the parents to create the optimal conditions, under the circumstances, for the supervision of eating, and for the provision of an active presence throughout the day. These experiences and challenges faced by the patients, families, and staff in implementing online home-based therapy gave rise to two main themes: online therapy as a bridge for progress and breakthrough in treatment, and conversely, online therapy as a barrier and detractor from therapeutic achievement.

In the present study we present three case reports about virtual therapy of Ultra-Orthodox patients with EDs and their families during the COVID-19 pandemic and lockdown. Each has reacted differentially to the specific conditions of telemedicine. In this respect, we note that because of the nature of this case-report study, ethics approval was not required by the institution. The demographic and clinical details of the participants have been changed to prevent the identification of patients and families. Verbal and written consent have been obtained for publication from patients and parents.

CASE STUDY 1

"The Walls Have Ears"—Home-Based Virtual Therapy Under Impossible Conditions—Virtual Home Hospitalization as a Barrier to Treatment

The following case study illustrates a situation in which online therapy was a barrier to the progress of treatment. S. 13, diagnosed with AN-restricting type is the second of eight children from a Jewish Ultra-Orthodox family. She had a previous brief self-induced restricting eating and weight loss 2 years ago, which was successfully treated on an ambulatory basis. This time, she started complaining of stomachaches, dizziness, weakness, and feeling faint, and thus was taken by her parents to the local community pediatrician. On examination, it emerged that S. had started restricting her eating about a year earlier, losing a significant amount of her weight, unnoticed by those around her. She was immediately referred for pediatric hospitalization in the "Maaynei- Hayeshuah" Medical Center because of bradycardia and low weight. She lost her menstrual period 5 months before her hospitalization. Her weight when hospitalized was 37.250 kg, her height 1.58, and her body mass index (BMI) 15.02 kg/m^2. After stabilization of her physiological condition, she was referred to our ED department. S. had not been in therapy before. Slowly, she began to form a relationship with her therapist and share her feelings, with a commensurate improvement in her physical and emotional condition. During the COVID-19 crisis, S. was infected with the virus, and sent to isolation at her home, 6 weeks after her admission, where other family members also became ill later. Her weight at that time was 43.150 kg. For 2 weeks the parents put the food near her door, but could not supervise her eating. To maintain the continuity of treatment, the decision was made to transition to online home hospitalization treatment.

The parents, worried that the isolation and cessation of treatment would cause S. to regress, were fully committed to her treatment, allowing her to use their mobile phone devices for that purpose. She was weighed once a week at home, and continued with regular virtual long-distance dialethic nursing, psychiatric and psychological treatment, as well as with her school program. Nonetheless, S. found it difficult to adjust to the digital medium. She struggled especially with feeling safe in front of the video camera in the newly formed environment, being surrounded by her family. She was very tense, had trouble concentrating, and was distracted by the noise around her. S. was particularly concerned with protecting her privacy—"they must not hear," "they must not listen." She had to whisper, for fear of being overheard in the next room. She felt that her parents and siblings were eavesdropping on her treatment behind the closed door.

Therapy sessions with S. were continually interrupted. Several times a day, the sessions were cut short because one of her

younger brothers entered the room and stood in front of the camera. At other times, her parents came in to have a look despite being asked not to interrupt with the session.

Sometimes, situations of a pause in therapy because of technical problems allowed S. to think of an answer, or, conversely, to be able to avoid answering. S. used the camera in different ways, sometimes making steady, dreamy eye contact, and at other times avoiding eye contact by turning the camera at the ceiling or closet. Difficulties also emerged with her online nutritional management and parental meal supervision, reflected in losing weight, and in the return of maladaptive eating behaviors, already gone when being hospitalized.

During her 6 weeks stay at home because of the COVID-19 lockdown, S. gained only 550 gr. When realizing that online treatment was not improving the condition of S., the decision was made to return her to inpatient treatment, despite the continuation of the COVID-19 pandemic and lockdown. This allowed for better meal supervision and for the individual therapy to be carried out in a setting supporting her privacy and enhancing openness. S. was released from inpatient treatment after around 4 more months. She weighed at that time 48 kg (being in her required weight range), her height increased by 2 cm to 1.60 m, and her menstrual periods resumed after 8 months. It is of note that after her discharge, S. and her family chose to continue with virtual dietetic counseling, but individual psychotherapy continued on a face-to face-basis. In the next months S. slowly regained her weight. In regular conditions she was able to eat independently but felt that she had to had to remind her mother of all her meals. However, when things changed in her routine, for example when her mother had to be near an ill aunt and was not around S. during the day, she quickly and unintentionally "forgot" eating, and lost weight once again.

CASE STUDY 2

The Screen as a Safe Encounter: "Far From the Eye, Close to the Heart"—Virtual Online Home-Treatment as an Impetus for Progress and Breakthrough in Therapy

The following case study illustrates a situation in which online therapy may become an impetus for progress and breakthrough in treatment N., 15 years, diagnosed with AN-R, is the fifth of eight children from a Jewish Ultra-Orthodox family. She is an outstanding student, rigorous in her adherence to all religious rules, major and minor alike. As the first daughter after four sons, many of the family's household and caretaking duties were devolved to her, and she undertook these roles devotedly. Parents as well as teachers described her as a good girl, eager to please. Since childhood, N. had been plump, enjoyed eating and was a joyful child. Nonetheless, her weight drew teasing from her brothers.

In the seventh grade, she was weighed by a school nurse, who told her that she was overweight and should seek nutritional treatment. N. decided to lose weight on her own, with extreme restriction of eating. She reduced sugar and fat in her self-induced diet at first, and later also other carbohydrates and proteins. Sensations of emptiness and hunger gave her a feeling of self-control. She subsisted on around 600 calories a day, losing a substantial amount of her weight. Her menstrual cycles stopped at the age of 12.5, after only one period. She was treated in a secular outpatient service, but did not cooperate with her treatment. Eventually, she was hospitalized in an ED department in a mainstream general medical center, because of severe restriction and low weight.

Her weight on admission was 38 kg, her height 1.50 m, and her BMI 16.9 kg/m^2. N. refused to cooperate with her treatment, and had to be fed with a nasogastric tube. This reluctance was attributed by the department's staff, to a certain extent, to difficulties in the therapeutic encounter because of the gap between the outlook of the nonreligious staff and her Ultra-Orthodox religious mindset. N. was therefore referred to our Ultra-Orthodox department. To avoid the social stigma of full hospitalization, the family requested outpatient care.

On admission to outpatient at age 13.5, she weighed 43 kg; her height was 1.52 m, and her BMI 18.6 kg/m^2. She was diagnosed with AN-restricting type, with no comorbid psychiatric disorders. She did not gain any weight during ambulatory treatment and had continuous fights with her parents over her eating. Therefore, she was transferred to our daycare service, continuing with her school program. She gained around 2 kgs but was still uncooperative at home and did not eat at school. Consequently, she had to be admitted to inpatient treatment.

At the beginning of inpatient treatment, N. would remain defiantly silent during an entire session, sometimes resting her on the table, yawning, or giving only yes or no answers, rolling her eyes as if to say that she was bored and wished to stop the session. At other times she broke her silence to ask the therapist when the session would be over; still, at other times, she would simply stand up and leave the room, saying that she was tired of the physiotherapist's "digging." Moreover, N. never entered the room at the scheduled time, claiming that she had forgotten or made other plans. Otherwise, she hid in unexpected places in the department (behind the piano or couch, or under a pile of clothes, blankets, and coats). Time after time, sessions were cut short or canceled altogether. She did not speak with the treatment team during the nutritional counseling, except for short yes/no answers, communicating mainly via her parents.

Seeing that her therapy did not bring to any change, her parents repeatedly asked to change therapists, in the hope of reaching the one who could find her way to N's. heart, but this did not help either. With the other treatment staff, N. communicated only through her parents.

During inpatient treatment N. eventually agreed to receive psychotropic medications for her ED-related anxiety and obsessionally, and was treated with Fluoxetine up to 60 mg/day. Her weight gradually increased to 50,700 kgs being in the range of her target weight, her height increased to 1.56 m. She was still amenorrhoeic, and there was no improvement in her eating at home.

Then, on March 2020, N. tested positive for the COVID-19 and was sent into isolation in her parents' home. Her treatment became online. An initial attempt to conduct her therapy over

the telephone was unsuccessful. N. continued her pattern of long silences so that it was unclear whether she was still on the line. This led to the decision to transition to Zoom video calls. To the surprise of the parents and treatment staff, a turning point came at this stage. N. started to speak with the therapist slowly and hesitantly. She looked directly at her therapist for the first time while talking with her. This change was also evident in the different online group therapies, where N, was ready to read aloud her food monitoring sheets. There she expressed her inner struggles with food, weight, and her appearance. The transition to online treatment was accompanied by a significant improvement in N.'s emotional condition. N. She later shared with the team that the physical distance, coupled with the appropriate degree of closeness achieved with the camera, along with the control she gained over her exposure, while close to her family, created a safe, protective environment for her. This enabled N. to become more open to the therapists and her family. Therefore, N. continued with online multimodal treatment even after the release of the mandatory lockdown. In the next months she resumed her menstrual cycles, and was able to maintain her target weight range, but only with the close and active supervision of her parents.

CASE STUDY 3

A Family Comes Together to Care for Their Daughter With an ED During the COVID-19 Outbreak:—*"There's no place like home"*—Virtual Online Home Hospitalization as an Impetus for Enhancing Parental Collaboration

The third case study illustrates a situation in which online therapy may become an impetus for recruiting parents to collaborate in treatment. T., 16.5 years old, diagnosed with AN-purging type, with no comorbid psychiatric disorders, is the fifth of eight children from a Jewish Ultra-Orthodox family. T was admitted to inpatient treatment because of severe self-initiated weight loss. She was initially admitted to a pediatric department in a mainstream general medical center, but her family decided to transfer her to our department for religious considerations.

The family reported that the first signs of an ED began around a year ago at the past summer vacation, during the transition from junior high to high school.

T. decided to lose weight, together with some classmates. She cut back on carbohydrates and sugars, gradually reducing her eating to the point of about 500 calories daily. In her words, it was "a regular diet that went out of control." Eventually, she began to self-induce vomiting after eating. Her parents were helpless, anxious, exhausted, and despairing of the battles surrounding her eating at home, and referred her for inpatient intervention. She had her first menstrual period at about the age of 15. Her period stopped several months before hospitalization.

At admission to our department T. weighed 35.500 kg. Her height was 1.56 m. and her BMI 14.6 kg/m^2. She denied having any eating or body-image related problems, claiming that she lost weight because of stomach aches and constipation. She gained only around two kgs, and her cooperation with her individual psychotherapy was minimal. Moreover, her parents found it difficult to attend their own treatment because of the burdens of their everyday life.

At the outbreak of the COVID-19 crisis, about a month after T.s hospitalization, the decision was made to begin with online home-based hospitalization. In an earlier attempt to have T. return home for the weekends, her condition deteriorated severely. Nonetheless, both the parents and T. refused the idea of full hospitalization without family visits or being at home during the holy day of "Shabath." T. received online individual psychotherapy, nutritional, nursing, and psychiatric counseling as well as a full schooling program. The parents received psychoeducation about T.s illness and ongoing guidance and support on meal and post-meal supervision. T.'s parents understood the importance of their meal supervision and were highly committed by being fully present at home, both physically and emotionally. T. was offered the continuation of online individual psychotherapy, but she refused. Being all together at home because of the confinement, with the constant online support and assistance of the department's staff, enabled the parents to supervise T.'s eating behavior closely, making every effort not to be angry, frustrated, and judgmental. Gradually the physiological and emotional condition of T. improved, despite her refusal to receive any individual psychotherapeutic interventions. She was weighed weekly at home in the presence of her mother. When the mandatory lockdown was discontinued, around 6 weeks after its' initiation, T. gained around 4 more kgs, achieving the weight of 43.900 kg. Her period was still not resumed. T and her family decided to continue with online multimodal treatment even after the release of the mandatory lockdown During the next months T. continued to gain weight, and her menstrual period was eventually resumed. She was able to eat relatively independently, but still needed the presence of her mother for reassurance and support.

DISCUSSION

With the outbreak of the covid-19 crisis and the resulting lockdown, the need emerged to find solutions for the continuation of treatment in adolescents and young women with EDs (45–47). This need led to the adaptation of ED-related treatment to a long-distance online home-based telemedicine format (45–47).

The treatment of EDs, particularly AN is complex, and highly challenging, in view of many physical considerations, often ambivalent cooperation, stubborn resistance to treatment, and an inclination to deny the severity of the illness (13, 14). Treatment may become even more complicated in the case of Jewish Ultra-Orthodox populations, where additional factors related to social values and cultural norms intervene with the treatment. These include fear of social stigma, worries over future marriage prospects of patients and siblings, a preference for resolving problems within the family and close community, and a tendency to refrain from disclosing and complaining. Most importantly, Ultra-Orthodox communities tend to refrain from treatment in

Israeli non-religious institutions, to avoid exposure to the norms of mainstream Western secular culture, which might exert a negative influence on young patients and lead them to stray off the path of faith (15).

Further difficulties exist within therapy, in the encounter of Ultra-Orthodox patients and families with modern Western treatment, in that disparities may arise in perceptions regarding the causes for the illness and the ways to treat it (16). These issues pose a significant challenge for treatment in general (15, 17), and for online mental health care in particular. In view of the scant use of the Internet and of digital means in general among the Ultra-Orthodox population, aimed at preventing exposure to secular culture, online therapy, specifically in young women with EDs, represents a revolutionary shift.

The ED department at the "Mayanei-Hayeshuah" Ultra-Orthodox Medical Center in the city Bnei- Brak., Israel attempted to develop a treatment model for home-based virtual online therapy adapted to the specific needs and codes of Ultra-Orthodox populations. This program received the blessing of the parents, the hospital's rabbi, and the spiritual leaders of the families, because of its rigorous adherence to and respect for religious values and rules.

The objective of this paper was multifold: to highlight the complexities inherent in virtual online home-based hospitalization for Ultra-Orthodox adolescent and young women with EDS and their families; to describe the dilemmas, disadvantages, and advantages arising in this form of treatment for this population; and to examine whether online treatment did indeed achieve the goals of continuation of treatment and prevention of deterioration.

EDs During the COVID-19 Pandemic

Current studies indicate an exacerbation of both behavioral and emotional ED-related symptoms with the advent of the COVID-19 pandemic and subsequent lockdowns (46, 48). Patients face in these conditions difficulties related to greater involvement of their families with their eating, and having more unplanned free time, alongside changes in their sleeping routine and screen time, and decreasing outside physical activity (46, 49). These effects may be exacerbated when children are confined to their homes, causing them to have little contact with their peers (49). However, the specific changes in the routine in adolescents with EDs seem to differ from healthy youngsters, showing an increase in physical activity rather than the decrease shown in healthy youngsters, and restricting rather than an increase in the amount of food eaten (49).

Increased eating pathology may be viewed in these circumstances as a means of dealing with a reduced sense of control, in an attempt to regain control over their eating and weight (45, 46). Many patients also report greater anxiety and depression, deterioration in their quality of life, and severe feelings of uncertainty (45, 47, 50). Difficulties related to the necessary changes in a routine because of lockdown and unhelpful social messages may also become triggering (46). In contrast, the absence during the COVID-19 quarantine in youngsters with EDs of intense weight-related comparison driven by social contact, and the reduction in social stressors potentially increasing the social-related anxieties of girls with EDs (51) might reduce the overall distress of some girls.

In Israel, the detrimental effect of the COVID-19 pandemic and subsequent lockdown on the condition of young patients with EDs has been exemplified in the considerably greater number of patients with EDs treated in an ambulatory service in general medical center in Israel [5926 sessions in the first 10 months of 2020, vs. a mean of 4001 sessions in the 5 previous years (52)]. Nevertheless, this increase was accounted for, in part, to the possibility of carrying-out multi-professional telemedicine meetings, comprising of 37% of all sessions during the first 10 months of 2020, vs. no use during the respective period between 2015 and 2019 (52).

Similar to other studies (48, 50), our clinical impression suggests that the COVID-19 resulted in a deterioration of the ED-related condition also in young Ultra-Orthodox girls with EDs. More patients have been hospitalized in our department during 2020 vs. 2019 (35 vs. 25, respectively) and more patient have been hospitalized in the pediatric service in the Maaynei Hayeshuah Medical Center, in 2020 vs. 2019 (12 vs. 7, respectively). Although we have not done any statistical comparison, patients hospitalized in 2020 had ore sever ED-symptomatology, were more suicidal, and showed a greater exacerbation of sexual-trauma related complex post-traumatic stress disorder symptoms. Still it is also our impression that the greater familial support and intervention of Ultra-Orthodox girls with EDs may intervene with the detrimental effects of the COVID-pandemic. We are currently organizing a retrospective study comparing the findings of our ED patients in 2020 vs. 2020.

The impact of the COVID-19 pandemic on the treatment of patients with EDs has been found to vary across treatment facilities and countries. In some ED services, treatment has been either delayed, paused, reduced, or stopped. Therefore, patients have experienced a loss of the required treatment support (45). Other EDs services have been able to continue offering treatment using telehealth and virtual online therapy (49, 52). This has been likely the case also in Israel, where services have provided multidisciplinary long-distance interventions, for outpatient, daycare, and inpatient settings (52).

Telemedicine for Patients With EDs During the COVID-19

Telemedicine refers to the provision of remote clinical services, via real-time communication, between patients/families and healthcare providers, using electronic audio and visual means. Telemedicine services may expand access by reducing barriers such as travel time, competing responsibilities, or absence from work, and provide advantages for treatment providers and institutions, including schedule flexibility, increased productivity, and less clinic overhead (53).

Indeed, online therapy has been a recognized staple of medical and scientific practice in Western society for years, for mental health care in general and the treatment of EDs in particular, long before the pandemic. Moreover, there is evidence indicating that online treatment has good clinical efficacy for ED therapy

(42, 54, 55), including in adolescents (43) that is similar to that of traditional in-person therapy.

With the ongoing COVID-19 pandemic, telemedicine has become useful in decreasing emergency room visits and safeguarding healthcare resources, potentially reducing the spread of the virus (56). In the case of EDs, the role of online treatment has been further augmented with the appearance of the COVID-19 pandemic, in the case of inpatients becoming unable or unwilling to remain in the hospital with the new conditions of the mandatory lockdown (47).

Telemedicine for Patients With EDs During the COVID-19—The Jewish Ultra-Orthodox Experience

Studies suggest that although online therapy is suitable for many patients, it is of note that these patients are usually from Western cultures (45, 46). In this respect, virtual online treatment is unfamiliar, often unaccepted, and far removed from the realities and religious beliefs of Ultra-Orthodox communities. This may likely lead to unique problems for professionals treating patients in this population, raising difficulties on the level of ethics, Jewish law ("Halakhah"), and religious beliefs. These issues, being already present before the COVID-19 pandemic, when non-religious therapists have treated Ultra-Orthodox patients (15), have been amplified during the COVID-19 era.

Online home-based hospitalization considers that both patients/families and treatment providers are willing to prepare for a new reality, using the tools at their disposal to bring about successful treatment under the present conditions. Thus, patients, families, and therapists come to a shared understanding of the difficulties faced by the patient and agree on the best solutions for adapting therapy to the new conditions. When additional problems arise in connection with value-based prohibitions and restrictions related to the patients' cultural and religious background and beliefs, new unfamiliar treatment methods such as online therapy, with its inherent objective drawbacks, may falter.

Such conflicts are exceptionally complicated in the treatment of Ultra-Orthodox young women in Israel. Their society tends toward isolationism, reflected particularly in the system of rules applied to females. Connection to any form of media, and the Internet, in particular, is either absolutely forbidden, or permitted within severe restrictions to protect against exposure to corrupting "modern" content. The prohibitions on media use are so far-reaching that girls are forbidden to even look at a screen; they are required to turn their heads away if they encounter a screen, so that they are not even tempted to look. This attitude is so deeply ingrained, that any change means a transformation in behavior, beliefs, values, and emotions, potentiality entailing feelings of guilt, anxiety, and powerful resistance from the side of the girl, and especially her family.

Extensive effort is therefore invested in protecting girls who are admitted to inpatient treatment because of their ED from exposure to various forms of media, specifically smartphones, tablets, and any kind of Internet connection. At the same time, the therapeutic setting of our department has the potential to create a safe space for talking privately and revealing oneself in a measured way, without the sense that this constitutes gossip or disrespect of the parents.

After several months of experience with our long-distance treatment model (beginning on March 15th, 2020), two key themes emerged: hospital-based online therapy with Ultra-Orthodox young women might serve for some patients and families as a **barrier to progress in treatment** whereas for other as an **impetus for therapeutic progress and breakthrough**.

Online treatment as a barrier to therapy: Difficulties with long-distance treatment may emerge for some patients because of household-related and family-related conditions. Technical issues may arise as most Ultra-Orthodox homes do not have computers or Internet connections; if they do, there is just one computer, generally used by the parents for work. Physical issues may stem from the crowded conditions in most Ultra-Orthodox homes, not allowing intimate conversations and privacy. Family-related issues may involve opposing of online therapy for fear that it might be abused, leading to exposure to content that might lead their ill adolescent daughters, and potentially other children too, to stray to the secular mainstream "path of evil and temptation". Children, including adolescent ED patients, need their parents' permission to access the internet. The one e-mail address in use belongs to one of the parents and is the only way to send a link for a therapy session, with the parent's approval.

Indeed, the transition to online treatment during the COVID-19 outbreak likely increased the risk of upsetting the fragile therapeutic balance achieved in our department in some patients. For some girls, online treatment provided an outlet for withdrawal and lack of cooperation. Patients blamed their difficulties on online therapy, claiming technical problems with sound, cameras, or internet connections as barriers to the conversation, and intentionally ending sessions before the scheduled time. In other cases, the difficulties emerging seemed genuine associated with household-related difficulties.

These difficulties were partly reflected in case (1). Her patients' parents made a great effort to enable her to receive home-based online treatment. Understanding the importance of continuity of treatment during the COVID-19 lockdown, they were willing to breach the prohibition on the use of the Internet for young girls. Additionally, despite a crowded household, they set up a private corner in one of the rooms and asked the other children to go to another room during therapy sessions. Nonetheless, the struggle with being open and confident in front of the camera in the newly formed environment, unable to use online treatment for her benefit. Her condition deteriorated, eventually requiring her return to inpatient treatment.

By contrast, to the surprise of the multidisciplinary team, some patients with EDs and their families who were highly ambivalent about hospitalization, experienced some relief when offered online home-based hospitalization. Virtual online home hospitalization could be described in such families as an **impetus for recruiting the parents to collaborate in treatment.** Thus, despite the religious restrictions and prohibitions surrounding media use, and the need to care for their ill daughters at home, alongside unfavorable familial conditions, the online treatment option provided at the start a possibility for these

parents to refrain from the need to cope with the social stigma and later marriage problems associated with their daughter's hospitalization (36, 57, 58). In this respect, the online program forced by the COVID-19 in our department created a new reality for the family, significantly stimulating the parents' involvement in treatment, actively engaging them in meal supervision, and enabling them to help their daughters directly. Their intensive physical presence at home with their ill daughter, gaining control and flexibility in their availability, alongside the continuous online daily contact with the department's staff, and the immediate possible access to support and guidance, significantly boosted the involvement of the parents in treatment. It is of note that during regular times, the parents were mostly much less at home, unable to provide such a close continuous supervision. These considerations have been highly exemplified in case (3) in our study.

From a different perspective, the inclination of Ultra-Orthodox girls to obey their parents, rooted in the ancient Biblical Ten Commandments, assisted in the empowerment of the parents in the treatment of their ill daughter during the COVID-19 lockdown, rooted in the FBT paradigm (59). This positive change in the condition of young Ultra-Orthodox girls with AN during the lockdown stands in contrast to the deterioration in the ED condition of adolescent girls during the COVID-19 pandemic, even if under treatment, partly related to the greater presence of their parents at home (46). Nonetheless, It is of note that a study performed in Israel in secular female adolescents with EDs during the COVID-19 pandemic, has shown online treatment to be effective in families with positive relationships between the parents and between the parents and their children, but not in families with less favorable familial interrelationships (52). A recent large-scale multicenter study in Italy has also corroborate the contribution of the quality of family relationships on psychopathological changes in patients with EDs related to COVID-19 confinement (50).

In other cases, the online treatment has been found to serve as an **impetus** for progress in the individual psychotherapy of the Ultra-Orthodox adolescent ED patient. In these cases, the virtual treatment created a multifaceted screen in psychotherapy, at times functioning as an escape from exposure, a place to hide, and at other times as a way of controlling the degree of openness. The online screen offered in this respect for the girl a sense of protection and a safe space for the patient, as well las a novel means for an authentic expression.

The healing effects of online psychotherapy were reflected in the second case. N., who grew up with seven siblings, and who had always excelled and pleased everyone, felt, perhaps for the first time, that she had a space just of her own at home, that was safe and protected, allowing her to gain the best of both worlds,—Western modern technology alongside Ultra-Orthodox familiarity and safety. Until that time, she felt driven and managed by others; the only control available for her was to stubbornly resist treatment and entrench herself in the bubble formed by her illness. She "fired" therapists, remained silent during in-person therapy sessions and did everything in her power to bring her treatment to an impasse. The COVID-19 crisis created an unexpected opportunity for change for N., in being able, for the first time, to control the rules and closeness of her psychotherapy.

Nonetheless, one should take into consideration in this case two mitigating circumstances First, the strategic adaptations performed by the family, with the assistance of the treatment staff (60), increased the potential efficacy of online-home-based therapy. Second, there is a trend in recent among young Ultra-Orthodox girls and young women toward greater openness and exposure to modernity, sometimes in secret, including the exposure to various media. The legitimation of online media use because of the COVID-19 conditions, may serve as a release from guilt and shame, providing an opening for self-actualization and self-realization in therapy (15, 61).

Last, the three cases presented here showed different telehealth processes during the COVID-19 period, i.e., barrier to treatment, particularly individual psychotherapy in case (1), impetus to treatment in case (2), and impetus to parental commitment and involvement in case (3). Nonetheless, all shared a specifically high reliance on parental involvement, whether active supervision [case (2) and to a lesser extent case (3)], or passive support [case (1)], with difficulties in being independently responsible for the eating. Thus, the traditional inclination of adolescent Ultra-Orthodox girls, in these cases having an ED, to respect and obey their parents, might interfere with their ability to function independently in specific challenging conditions such as taking care of their ED. Future research in a larger number of patients is required to support this preliminary contention.

Several specific issues have to be considered in telemedicine treatment of young women with EDs. Thus, Rogers et al. (62) have found that video conferencing in these patients may exacerbate body image concerns by increasing their preoccupation with and focusing on their self-appearance. In contrast, there is the issue of the "disembodied environment," when only the patient's and therapist's faces, but not their bodies, appear on the screen, or when the patient prefers to converse in the session with the camera being closed. What is potentially missing in these cases is body-to-body communication, or the reading of body language (63).

Practical Considerations and Research Implications

The culturally-sensitive online home-based hospital for young Ultra-Orthodox women with EDs, developed during the COVID-19 pandemic at the "Mayanei Hayeshua" Medical Center, in Bnei-Brak, Israel, represents groundbreaking creative thinking and mutual flexibility on the part of spiritual Rabbinical leaders and the multidisciplinary treatment team of the department to allow for continuity of treatment, preserving progress, and reducing the risk for relapse. Despite the multiple obstacles associated with the use of online treatment in this population, in many cases the program made it possible for the treatment to continue; in some cases, it actually served to stimulate positive changes in treatments previously stalled.

The findings highlight that at least some patients and families found the online intervention acceptable, despite the unfamiliarity of this intervention and the many obstacles

described in its implementation. In this respect it is of note that a recent Israeli study (64) found mixed views of patients with EDs treated in a mainstream secular ambulatory service regarding the transition from face to-face to online treatment during the COVID-19 pandemic. This, the majority (68%) of the patients stated that they would not choose to continue online therapy given the option. Longer duration of treatment, stronger therapeutic alliance, and higher COVID-19 anxiety were linked with more positive views toward this transition.

The findings of our study also highlight the need to further develop our model, and to study its long-term effectiveness. In regular times, this format can also be used with Ultra-Orthodox populations finding it difficult and stigmatizing to come openly to a facility, and with families that struggle to cooperate with inpatient treatment because of the hardships and challenges of everyday life. It can also be tailored for young women with EDs who do not feel safe enough in an inpatient setting to disclose themselves; for these women, the virtual screen can serve as a safe privacy-enhancing environment.

We still face many challenges related to the use of online media with Ultra-Orthodox populations, due to their crowded living conditions, and their limited access to virtual communication. In view of the difficulties that have emerged in the online treatment of our patients, the further development of well-protected and easily managed online means is highly recommended. Coordinating this form of treatment with spiritual leaders and obtaining religious decrees is recommended, to avoid later problems and avert worries on the part of patients and their families, that may still consider online treatment as potentially contravening their norms and values.

As noted by several researchers, the use of online services in patients with EDs during and potentially also after the COVID-19 pandemic requires adherence to the guidelines provided by the respective treatment centers in the regular face-to face- management, with the necessary telemedicine-required adaptations (44, 65, 66). Along with their recommendations, we have established a program that takes care both of practical and clinical ethical-related considerations. Nurses daily and pediatricians and psychiatrists weekly, or whenever required, supervise with telehealth facilities (including telephone connections in families not using virtual online services) the medical and psychiatric condition of the patients, and invite them to the hospital whenever necessary. The nurses further assist the parents in the handling of the psychotropic treatment. The nutritionists may assist the parents in weighing and in meal supervision (our model does not advocate direct long-distance supervision of the eating and weighing of the patients by the department's team because of privacy-related considerations that are of particular importance in Ultra-Orthodox populations). We have been able to conduct during the COVID-19 lockdown online CBT groups and parents' psychoeducation groups, as well as individual psychotherapy and team meetings and supervision. All these services could continue, and indeed have continued whenever required, in the post three COVID-19 lockdowns in Israel, altogether lasting for more than a year.

Further quantitative and qualitative research is recommended, to examine the effectiveness of our treatment model over time, and to examine the experiences of patients and their families from their perspective. The importance of understanding the patients'/families' viewpoint vs. that of the treatment providers is linked to differing viewpoints in the perception of illness and healing, particularly concerning mental health. This tension still exists because of the aspiration of the Ultra-Orthodox community to remain differentiated, and by their view of mainstream society and its service providers as incapable of properly understanding and treating their problems (16).

Limitations

The suggestions of this study should take into consideration its limitations. At the start, it is a descriptive case report study, based on three cases, rather than a structured prospective longitudinal design. Second, the number of patients treated in our department during the COVID-19 period was too small to draw any ststistically-based conclusions about specific ED-related and general psychopathological aspects.

In conclusion, our study sought to investigate the complexities and dilemmas inherent in online home-based hospitalization of young Ultra-Orthodox women with EDs. The experience of this unique therapy for this population has demonstrated that online therapy can be a barrier to treatment in some cases, due to physical, familial, and religious circumstances, as well as because of the patients' reluctance to take part in this treatment. In other cases, virtual home-based treatment can lead to positive changes. This may be the case in patients who find the distancing online model suitable for them, and in parents who are committed to treatment, using their greater physical and emotional presence at home for the good of their ill-daughters. For such interventions to be successful, continuous multidisciplinary online supervision and treatment must be carried out by treatment providers who are not only knowledgeable about the treatment of EDs and the use of online strategies, but also knowledgeable and culturally sensitive to the specific needs and codes of Ultra-Orthodox populations.

DATA AVAILABILITY STATEMENT

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

AUTHOR'S NOTE

With the outbreak of the COVID-19 pandemic, there was a need to maintain treatment continuity for religious Jewish Ultra-Orthodox young women with eating disorders (EDs) that were previously hospitalized in a special ED department for Ultra-Orthodox. This need led to the development of home-based online treatment channels, previously unfamiliar and unaccepted in this population, with difficulties inherent in the use of online treatment.

The present paper aims to present the online home-based treatment model implemented and adapted to young Ultra-Orthodox women with EDs, during the COVID-19 pandemic and to highlight the difficulties, dilemmas, and advantages of this model.

Our findings showed that online home-based treatment can serve as a barrier to treatment due to physical (lack of online devices), familial (over-crowded families), and religious circumstances, or as a bridge for change, due to the distancing that this model provides, and the parent's commitment to treatment.

This paper highlights the difficulties and possibilities inherent in a virtual home-based treatment during the COVID-19 pandemic. Additionally, this model can be effective if undertaken by a multidisciplinary team, which is knowledgeable about the treatment of EDs, and the use of online strategies, and culturally sensitive to the specific needs and codes of Ultra-Orthodox populations.

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YL, EH, and DS contributed to the conception and design and were responsible for the organization of the article. RA, OA, SL, AB, TO, MS, and MU equally contributed to the manuscript. All authors contributed to the article and approved the submitted version.

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Improvements on Clinical Status of Adolescents With Anorexia Nervosa in Inpatient and Day Hospital Treatment: A Retrospective Pilot Study

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Introduction: Medical and psychiatric complications and treatment compliance are important considerations in determining the treatment program for patients with severe anorexia nervosa (AN). Clinical practice guidelines agree that an outpatient program is the first choice for the treatment of most eating disorders, but vary in supporting these programs for AN. However, inpatient care is known to be costly and the risk of relapse and readmission is high. This pilot study aimed to describe the first data on an Italian partial hospitalization care program for AN adolescents [high-level care treatment (HLCT)], evaluating its impact on patients' clinical status, average hospitalization time, and the hospital costs compared to inpatient treatment (IP).

Methods: For this retrospective pilot study, we have selected a group of 34 females with AN aged 11–18 years, divided between those who followed inpatient treatment and those who received HLCT treatment; they were matched for age and severity. We investigated the differences in treatment and outcomes between the two groups in terms of heart rate, length of treatment, weight gain, psychological characteristics, and hospital costs. Statistics for non-parametric distributions were used to compare the two groups.

Results: No differences between the two groups were found at admission. At discharge, patients in the HLCT group presented a lower number of in-hospital treatment days, a higher increase of weight, and a significant improvement in outcomes compared to the inpatient group. No significant differences were found in heart rate and hospital costs.

Conclusions: This study represents a first comparison between inpatient care and the HLCT treatment program, which suggests that day hospital treatment could represent a meeting point between inpatient and outpatient treatment, combining the merits of both forms of treatment. Further studies are needed in order to better investigate the different treatment programs for severe AN in adolescence.

Keywords: daily treatment, inpatient care, hospital care, partial hospitalization, anorexia nervosa, adolescence

INTRODUCTION

According to the most recent data published by the Italian Ministry of Health, anorexia nervosa (AN) is the most common problem among young people, with an estimated incidence of at least 8 new cases per 100,000 women in a year, and it is constantly growing in the male population (1). The International guidelines on clinical practice for eating disorders in childhood and adolescence (2–4) point out that the integrated multidisciplinary outpatient treatment model is the most suitable intervention for AN and guarantees adequate care response in 70% of cases. Outpatient treatment provides care in a non-restrictive setting: it preserves the patient's sense of autonomy, allowing for and improving their ability to maintain normal social and work activities, and is perceived as more syntonic, favoring patient compliance (5). Moreover, studies have shown that it is more effective and efficient in terms of time and cost of therapy compared to inpatient treatment (IP).

However, in cases of moderate to severe AN, or when outpatient treatment is not effective, impatient care (IP) could be the treatment of choice. Severe AN in adolescence is defined not only by clinical and laboratory data (BMI, hearth rate, blood pressure, etc.) but also by the rate of weight loss and the caloric intake (6).

Previous systematic reviews have compared different therapeutic treatment programs: outpatient, IP, and day patient (DP) for adolescent AN. They found no differences in outcomes as measured by changes in weight, eating disorder pathology, or lengths of treatment (7). Moreover, recent studies have underlined that IP presents substantial financial costs as well as leads to higher relapse and readmission rates than the other forms of treatment (8). DP treatment is considered to be the central treatment for subintensive psychiatric patients and for performing medical interventions or as an alternative to the IP setting (6). A recent study by Herpertz-Dahlmann et al. (9) have compared DP treatment following a short stay for inpatient care to continued IP. Their results have found the same efficacy for DP care compared to IP care for weight restoration and maintenance during the first year after admission, with less costs than a IP program.

Both care programs, inpatient and day hospital treatments, are usually multidisciplinary with a combination of health specialists, intensive medical and psychotherapy assistance, nutritional counseling, and supervised meals (10). Usually, the main difference is that in DP there is no overnight stay (9).

In IP and DP programs, the prolonged periods of care allow the team to directly control meals, quickly respond to psychiatric or physical emergencies, and provide psychological support, increasing adherence to the prescribed meal plan (10, 11). Moreover, greater frequency of therapy sessions leads to more rapidly acquired psychological knowledge and skills (4).

Based on the evidence available to date and in order to offer the most appropriate care program for patients' needs, the Bambino Gesù Children Hospital Unit of Anorexia Nervosa and Eating Disorders has implemented a day hospital care program named high-level care treatment (HLCT). This care model was created to address the riskiest situations without the use of hospital IP. Admission criteria use the same parameters as those for IP admissions, which exclude the most medically unstable patients. The HLCT program utilizes a treatment plan halfway between the high-frequency clinical monitoring and assistance with meals, characteristic of the IP program, and the possibility of maintaining social and family spaces, a characteristic of the 1-day-a-week DP program, multifocal integrated treatment (MIT), already in place in the hospital (12). The HLCT therapeutic program provides assistance from a multidisciplinary team consisting of a psychiatrist, psychotherapists, and a nutritionist. The treatment is organized 3 days a week, which includes nutritional assistance at lunch and one snack time as well as psychiatric and individual nutritional checks at every session. In addition, there are separate therapeutic groups for parents and patients, and psychoeducational multifamily groups, which are scheduled weekly. As in the IP program, where enteral nutrition is often activated in cases of medical needs, bolus administration can also be started in the HLCT program if the patient's clinical conditions require it. The hypothesis underlying this approach is that the skills learned by patients and parents during treatment can be more easily transferred into everyday life and that patients themselves may be able to maintain contact with their social networks, thus supporting social competence and experiencing treatment in a less restrictive way than in the IP approach. However, the actual effectiveness of partial hospital treatments, such as HLCT, compared with the IP programs and the differences in hospital costs in Italy were as yet unknown. This study aims to describe the first available data on an Italian partial hospitalization program—the HLCT treatment—in order to evaluate the impact on patients' clinical status (in terms of weight recovery and mental state), average hospitalization days, and hospital costs compared to the IP program for adolescents with AN.

Results will be useful to build a structured clinical trial, modeled on that previously done by Herpertz-Dahlmann et al. (9), which promotes a more in-depth investigation of the treatment indications for patients with severe AN in different types of treatment programs.

MATERIALS AND METHODS

Subjects and Study Design

The pilot study has an observational retrospective design, so there was no opportunity to work on the composition of the sample. To create two comparable groups, we have selected patients diagnosed with AN admitted from December 2019 to September 2020 to the Bambino Gesù Children Hospital at the Pediatric Unit for an IP treatment program. Inclusion criteria were as follows: male and female, all ages, and primary diagnosis of AN based on DSM-5 criteria. Patients with intellectual disabilities, pervasive developmental disorders, other neurological conditions, and a non-AN primary diagnosis were excluded. After a selection of patients from the IP group, we selected a second group of patients admitted at the Anorexia Nervosa and Eating Disorder Unit using the HLCT program, matched for age, BMI, and clinical status.

All the patients included in the present study underwent an evaluation for the diagnosis (T0) consisting of nutritional assessment and psychological and psychiatric assessment (12). Family history of anxiety, depression, or eating disorder was evaluated up to second-degree relatives.

The diagnostic assessment was made at the moment of referral by a trained psychiatrist (V.Z.), who first made the diagnosis through a routine clinical interview and then used the Italian version of the Schedule for Affective Disorders and Schizophrenia for School-Age Children/Present and Lifetime Version (K-SADS-PL DSM-5) (13) to confirm the diagnosis as well as other psychiatric comorbidities. The following clinical parameters were collected at the time of admission (T0) and at the time of discharge (T1): weight, height, percentiles of body mass index (pBMI) and heart rate (HR). pBMI shows how the child's weight compares to that of other children of the same age and sex and was determined using the 2,000 Center for Disease Control and Prevention growth charts (CDCP). A pBMI lower than the first percentile was defined in the analysis as 0.5, by convention. Outcomes at T1 were also evaluated with a specific assessment scale [Morgan–Russel Outcome Assessment Scale (MROAS)] (14, 15). Primary amenorrhea was defined as the absence of spontaneous menstruation by 15 years of age with normal development of secondary sexual characteristics (16).

The study was reviewed and approved by the Ethical Committees of the Bambino Gesù Children Hospital (2264_OPBG_2020). Written informed consent to participate in this study was provided by the participants' legal guardian/next of kin.

Psychological Measures

During the clinical assessment at T0, each patient received a package containing the psychometric battery of self-administered questionnaires and was asked to complete them. Later, psychologists scored all of the questionnaires. Emotional and behavioral characteristics and psychopathological dimensions were assessed with the Multidimensional Anxiety Scale for Children 2 (MASC 2) (17, 18), the Children Depression Inventory 2 (CDI 2) (19, 20), and the Youth Self-Report (YSR) (21, 22). Eating disorder psychopathology and the possible presence of dysmorphophobia were investigated using the Eating Disorder Inventory-3 (EDI-3) (23, 24) and the Body Uneasiness Test (BUT) (25), respectively. Family functioning was assessed with the Family Assessment Device (FAD) (26). Finally, the patients' clinical course was evaluated at T1 using the MROAS (14) in the version modified by Jeammet et al. (15). Considering the low sample size and the risk of imprecise estimates, we decided to not calculate the internal consistency for the self-report measures but to report the reliability coefficients of the validation studies.

Multidimensional Anxiety Scale for Children 2

The Multidimensional Anxiety Scale for Children 2 (MASC 2) is a questionnaire for the evaluation of the main dimensions of anxiety in children and adolescents from 8 to 19 years of age. The self-report form contains 50 items, which measure Separation/Fears, Generalized Anxiety (GAD) Index, Obsessions/Compulsions, Harm Avoidance, Social Anxiety (Humiliation/Rejection and Performance Fears), and Physical Symptoms (Panic and Tense/Restless). The Italian version of MASC 2 has shown excellent validity, like the original version, a good internal consistency, and test–retest reliability (18).

Children Depression Inventory 2

The Children Depression Inventory 2 (CDI 2) is a self-report questionnaire for the evaluation of the depressive symptoms of children and adolescents from 7 to 17 years of age. It is made up of sets of items, each containing three options that reflect the severity of the symptom, from 0 (absent) to 2 (defined, marked). From the self-report form, clinicians get a Total Score as well as scores on two different scales: Emotional Problems and Functional Problems. In addition, it provides scores for four further subscales, called Negative Mood/Physical Symptoms, Negative Self-Esteem, Ineffectiveness, and Interpersonal Problems. The set of statistical surveys highlighted the quality of the test items, their reliability, and the validity of the Italian version (19).

Youth Self-Report

To assess the adolescents' view of their behavior and socioemotional functioning, the Italian version of the YSR was used. This questionnaire has to be completed by an 11- to 18-year-old adolescent and contained 112 problem items, covering behavioral, emotional, and social problems that occurred during the past 6 months. The YSR can be scored on syndrome scales: Anxious/Depressed, Withdrawn/Depressed, Somatic Complaints, Social Problems, Thought Problems, Attention Problems, Aggressive Behavior, and Rule-Breaking Behavior. The Internalizing scale can be derived from the first three syndrome scales, and the Externalizing scale can be derived from the last two. This measure, in its validated Italian version, has demonstrated very good day test–retest reliability, cross-informant agreement, and success in discriminating between referred and no referred adolescents (22).

Eating Disorder Inventory-3

The Eating Disorder Inventory-3 (EDI-3) is a self-report instrument measuring psychological traits or constructs shown to be clinically relevant in individuals with eating disorders. This measure consisted of 91 items organized into 12 primary scales, three eating disorder-specific scales (Drive for Thinness—DT; Bulimia—B; Body Dissatisfaction—BD), and 9 general psychological scales (Low Self-Esteem—LSE; Personal Alienation—PA; Interpersonal Insecurity—II; Interpersonal Alienation—IA; Interoceptive Deficits—ID; Emotional Dysregulation—ED; Perfectionism—P; Asceticism—A; Maturity Fears—MF) that are highly relevant to, but not specific to, eating disorders. The reliability coefficients of the scales range from 0.83 and 0.90, and test–retest reliability coefficients for the various composite scales are between 0.84 and 0.87. The Italian version of EDI-3 (24) has demonstrated adequate indices of validity and reliability with reliability indices ranging from 0.90 and 0.97 calculated on the total sample of the Italian validation study.

Body Uneasiness Test

The Body Uneasiness Test was used for the clinical assessment of body uneasiness. The BUT-A consists of four subscales and a global severity index (GSI) that have been demonstrated to have good internal consistency and reliability: Weight Phobia (WP—fear of being or becoming fat), Body Image Concerns (BIC—worries related to physical appearance), Avoidance (A—body image-related avoidance behavior), Compulsive Self-Monitoring (CSM—compulsive checking of physical appearance), and Depersonalization (D—detachment and estrangement feelings toward the body). The Italian version of the instrument shows good reliability coefficients and a factorial structure congruent with the operative definition of the construct (25).

Family Assessment Device

The FAD is a 60-item self-report questionnaire for assessing participants' views of their family functioning. The FAD was administered to both parents and patients, but only the latter's versions were used for the present study. Scoring produced ratings on seven aspects of family functioning: problem-solving, communication, roles, affective responsiveness, affective involvement, behavior control, and general functioning. Lower scores indicate healthier functioning than higher scores. The Italian version of FAD has been shown to have good reliability coefficients (27).

Morgan–Russel Outcome Assessment Scale

The Morgan–Russell Average Outcome Score MRAOS is a scale for the biopsychosocial assessment of the treatment outcomes, compiled by the clinician at the end of treatment, based on information received from the patient or observed during treatment. The MROAS is derived from a guided interview assessing core clinical features of AN. The clinician rated each item with a score from 1 (satisfactory) to 6 (very unsatisfactory). Following this procedure, patients are divided into three groups, depending on their scores: good when at least eight items have been rated 1 or 2; intermediate, if four to seven items have been rated 1 or 2; poor if three items or less have a score of 1 or 2 (14, 15).

Cost Assessment

The cost assessment was performed using the Health Care Financing Administration-Diagnosis Related Group (HCFA-DRG) system, version 24 (28). In the Italian healthcare system, hospitalizations are reimbursed according to a system, which has a national reference and is adjusted on a regional basis. For this reason, in this study, the Lazio Region Tariff Nomenclature DRG of outpatient services was used. A specific DRG is applied to the discharge diagnosis of each patient, and corresponds to a specific cost. In case of IP, there is a fixed cost if the length of stay is below a threshold. In case of AN, the threshold is 41 days. If a patient has a length of stay over the threshold, the hospitalization costs are calculated, adding a daily rate for days exceeding the threshold. On the contrary, for the HLCT, costs are calculated on a daily basis.

Statistical Analysis

For the analysis, patients were divided into two groups according to the admission type (IP group and HLCT group) in order to compare their individual characteristics. The Shapiro–Wilk test was performed in order to evaluate variable distribution. The variables had both normal and skewed distribution, but due to the small sample size, a non-parametric analysis was performed. Data are represented as number and percentage in parentheses (%) for categorical variables, or median and interquartile range in square brackets [IQR] for continuous variables. The Mann–Whitney U test was performed in order to compare continuous and ordinal variables between the two groups, while the Chi-Square test was used for categorical ones. The Wilcoxon test was performed to investigate intragroup changes between T0 and T1. The effect size for non-parametric tests was calculated. The r proposed by Cohen was used for the Mann–Whitney U and the Wilcoxon tests, with small, medium, and large effects for $r < 0.3$, $0.3 \leq r < 0.5$, and $r \geq 0.5$, respectively (29). Cramer's V was used for the Chi-square test (30). Statistical analysis was performed through IBM SPSS Statistics V21.0.

RESULTS

Subjects

Sixty-four subjects were selected for this study: 23 were excluded for missing data, five were excluded for the presence of binge/purging behaviors, one for comorbidity with other organic diseases, and one for previous history of avoidant/restrictive food intake disorder. Finally, 34 patients were included in the analysis, 17 for each group. All of the patients hospitalized in the IP program (100%) accessed our hospital through the emergency room (ER) (Cramer's $V = 0.692$) while only six (35.3%) of those that were then sent to the HLCT program did. No difference was found between the two groups at T0 with respect to clinical and psychological variables, or other parameters such as length of illness, rate of weight loss, time of weight loss, and prior treatments (**Table 1**). Differences were found in the number of hospital treatment days, which were lower in the HLCT group (Mann–Whitney $U = 54.5000$, $p = 0.001$, $r = 0.533$), and in the use of fluid therapy and enteral nutrition, which were more frequent in the IP group ($p < 0.001$, Cramer's $V = 0.943$; $p < 0.001$, Cramer's $V = 0.600$), with a large effect size.

Anthropometrics

No difference was found in the clinical parameters between the two groups at T0 and T1 (**Table 2**). Both groups showed an increase in weight at T1 (Delta Weight in kg: IP = 1.40 [0.20–2.20], $p = 0.010$, $r = 0.443$; HLCT = 2.40 [1.70–3.90], $p < 0.001$, $r = 0.603$), with higher effect size values in the HLCT group compared to the IP group. Moreover, an increase in pBMI with a large effect size was detected only in the HLCT group ($p = 0.001$, $r = 0.546$).

Psychological Measures

Considering the psychological evaluations administered at T0, differences were found between groups for the CDI negative

TABLE 1 | Patients' characteristics in IP and HLCT groups.

	IP ($n = 17$)	HLCT ($n = 17$)	Effect size (r or Cramer's V)
Sex (Female)	15 (88.2)	16 (94.1)	0.104
Age (y)	15.28 [14.11–15.61]	14.35 [13.77–16.25]	0.027
Amenorrhea			0.349
Absent	1 (5.9)	1 (5.9)	
Pre-puberty	1 (5.9)	4 (23.5)	
Primary	2 (11.8)	0 (0.0)	
Secondary	11 (64.7)	11 (64.7)	
Length of illness (m)	9.00 [6.00–18.00]	8.00 [6.00–12.00]	0.080
Total weight loss (kg)	15.00 [8.00–20.00]	14.00 [10.00–20.00]	0.012
Time of weight loss (m)	8.00 [5.00–12.00]	6.00 [3.00–8.00]	0.252
Previous treatments			0.376
None	8 (47.1)	11 (64.7)	
Ordinary Hospitalization	0 (0.00)	2 (11.8)	
Other treatment	8 (47.1)	4 (23.5)	
Both	1 (5.9)	0 (0.00)	
Comorbidity			0.174
Depressive disorders	1 (5.9)	1 (5.9)	
Specific Learning Disabilities	0 (0.0)	1 (5.9)	
Family (United)	15 (88.2)	12 (70.6)	0.218
Family history			
Anxiety disorders	1 (5.9)	3 (17.7)	0.183
Depressive disorders	1 (5.9)	5 (29.4)	0.309
Eating disorders	2 (11.8)	1 (5.9)	0.104
Other	2 (11.8)	0 (0.0)	0.250
Length of treatment (d)	30.00 [27.00–36.00]	32.00 [19.00–51.00]	0.094
Number of in-hospital treatment days (d)	30.00 [27.00–36.00]	19.00 [13.00–27.00]**	0.533
Drug therapy (yes)	16 (94.12)	14 (82.35)	0.183
Drug type			0.381
SSRI	0 (0.0)	1 (5.9)***	
Atypical antipsychotics	4 (23.5)	6 (35.3)	
SSRI + Atypical antipsychotics	10 (58.8)	7 (41.2)	
Other	2 (11.8)	0 (0.0)	
Fluid therapy	17 (100.0)	1 (5.9)	0.943
Enteral nutrition	9 (52.9)	0 (0.0)***	0.600
Supplemental nutrition	14 (82.4)	13 (76.5)	0.073

*Data are presented as number and percentage in parentheses (%) for categorical variables, or median and interquartile range in square brackets [IQR] for continuous variables. The "length of treatment" refers to the total number of days between the admission and the discharge. Conversely, the "number of in-hospital treatment days" refers to the actual number of days patients accessed the hospital and the treatment. d, days; kg, kilograms; m, months; IP, inpatient care; HLCT, high-level care treatment; SSRI, selective serotonin reuptake inhibitor; y, years. Mann–Whitney and Chi-square tests were used to compare continuous and categorical variables, respectively. Statistical significance for $p < 0.05$. **$p < 0.01$, ***$p < 0.001$. Effect size was expressed as r or Cramer's V for continuous and categorical variables, respectively. Small, medium, and large effects for $r < 0.3$, $0.3 \leq r < 0.5$, and $r \geq 0.5$, respectively.*

self-esteem score, which was higher in the IP group (Mann–Whitney $U = 66.000$, $p = 0.011$, $r = 0.441$), and for the FAD problem solving score, which, in contrast, was higher in the HLCT group (Mann–Whitney $U = 143.000$, $p = 0.029$, $r = 0.421$). Both tests showed a medium effect size (**Table 3**).

The patients' clinical pathways have been checked at T1 with the MROAS. Differences, with medium to large effect size, were found for the following scales: eating difficulties (Mann–Whitney $U = 26.500$, $p < 0.001$, $r = 0.730$), mental state (Mann–Whitney $U = 75.000$, $p = 0.028$, $r = 0.437$), insight (Mann–Whitney $U = 38.500$, $p < 0.001$, $r = 0.635$), intimate relationships (Mann–Whitney $U = 58.000$, $p = 0.004$, $r = 0.523$), social contacts (Mann–Whitney $U = 60.000$, $p = 0.005$, $r = 0.509$), and occupation (Mann–Whitney $U = 36.500$, $p < 0.001$, $r = 0.687$). The Chi-square test performed on the MROAS groups confirmed an improvement in the HLCT group compared to the IP one, showing a large effect size ($p = 0.003$, Cramer's $V = 0.592$). **Table 4** summarizes the scores for each scale and the MROAS groups in both IP and HLCT patients.

TABLE 2 | Clinical parameters at T0 and T1 in IP and HLCT patients.

	IP		HLCT		Effect size (*r*)		
	T0	T1	T0	T1	IP vs. HLCT at T0[a]	IP T0 vs. T1[b]	HLCT T0 vs. T1[b]
Weight (kg)	36.00 [32.50–39.50]	37.90 [35.10–42.70]*	39.30 [36.20–41.00]	41.60 [38.80–43.50]***	0.162	0.443	0.603
Height (cm)	158.00 [150.00–162.00]	158.00 [150.00–162.00]	160.00 [151.00–162.50]	160.00 [152.00–163.00]	–	–	–
pBMI	0.50 [0.50–5.00]	3.00 [0.50–9.00]	2.00 [0.50–6.00]	10.00 [2.00–28.00]**	0.116	0.242	0.546
HR (pbm)	62.00 [50.00–74.00]	65.00 [62.00–70.00]	62.00 [60.00–74.00]	72.00 [68.00–83.00]	0.124	0.062	0.273

*Data are presented as median and interquartile range in square brackets [IQR] for continuous variables. Bpm, beats per minute; IP, inpatient care; HLCT, high-level care treatment. The Mann–Whitney test was used to compare continuous variables between the groups at T0. No difference was found. The Wilcoxon test was performed to investigate intragroup changes between T0 and T1. Statistical significance for $p < 0.05$. *$p < 0.05$, **$p < 0.01$, ***$p < 0.001$. Effect size (r) was calculated for the Mann–Whitney test[a] and the Wilcoxon test[b]. Small, medium, and large effects for $r < 0.3$, $0.3 \leq r < 0.5$ and $r \geq 0.5$, respectively.*

Hospital Costs

The IP group showed a median cost of € 2,267.00 [2,267.00–2,340.00] per patient, while in the HLCT group, it was € 3,240.00 per patient [2,106.00–4,374.00]. The Mann–Whitney test was performed in order to compare costs between the two treatments. No difference was found (Mann–Whitney $U = 163.000$, $p = 0.540$, $r = 0.111$).

DISCUSSION

This retrospective pilot study aimed to describe the first available data on an Italian partial hospitalization program—the HLCT treatment—in order to evaluate the impact on patients' clinical status (in terms of weight recovery and mental state), average hospitalization days, and hospital costs between the HLCT and IP treatments for adolescents with AN.

A first result indicates that patients from both groups share the same clinical parameters (weight, pBMI, and HR), illness characteristics (length of illness, rate of weight loss, time of weight loss, and prior treatments) and psychological problems: showing no difference in degree of disease severity at T0.

The only two differences, with a medium effect size, noted between the two groups was the higher reporting of negative self-esteem by patients in the IP group while there was a higher perception of difficulty in regard to parental problem-solving skills in the HLCT group. These results could be read within the different care contexts, where the more restrictive measures adopted in our IP treatment compared to the HLCT program may trigger greater feelings of guilt, ineffectiveness, and passivity in the patient with respect to their treatment path. On the contrary, in the HLCT program, the patient continues to eat meals, even at home, with all the difficulties in place, and this possibly could contribute to the child feeling greater parental difficulty in managing the food symptom alone.

While both groups started with the same initial clinical conditions, the HLCT group had a lower number of treatment days, less frequent use of fluid therapy and enteral nutrition needs and a faster attainment of conditions required for discharge than did the IP group. In our programs, discharge from both the inpatient and HLCT programs occurs when the medical parameters are stabilized, there is a constant increase in weight gain, and patients have begun to show a greater adherence to the dietary plan. Subsequently, they are referred to treatments with a lower weekly frequency, such as the MIT (12).

Patients in the HLCT group seems to present a greater increase in pBMI, with a large effect size, compared to the IP group, also showing a greater effect size in terms of weight recovery. When evaluating the patients at the end of their treatment programs using the MROAS, results with large effect size emerged for the HLCT group when compared to the IP group in terms of progress in several categories such as social contact, occupation (school), intimate relationships, insight, mental states, and eating difficulties. This may indicate that a faster constant weight gain, in terms of change in pBMI points, may also correspond to a greater openness to the psychological reflections underlying the eating disorder and to a less rigidity regarding nutrition. It seems useful to point out that these results could also derive from a selection bias, where, in the absence of randomization, HLCT patients were more compliant with meals, more motivated and not in a risk condition. However, the current literature (31) underlines that letting the patient maintain normal social and work activities favors patient compliance and accelerates the treatment process, not only in terms of weight recovery but also with respect to psychological characteristics, such as the ability to think about oneself and their illness. Obviously, AN treatment does not end with the discharge from the IP or HLCT programs, but continues and changes in intensity and type according to the treatment path. Hence, it becomes important to understand how to reduce hospitalizations or partial hospitalization times, in order to allow patients and families to access, as soon as possible, a treatment more focused on relational and intrapsychic difficulties rather than nutritional aspects.

Finally, we have calculated hospital costs for the IP and HLCT treatments. Results show no difference regarding the cost to the hospital between the two therapeutic approaches, with the median cost for the IP program being € 2,267.00 and 3,240.00 for the HLCT program. This result is not in line with our expectations or with the international published literature that underlines a lower cost for partial hospitalizations with respect to inpatient treatment programs (8). We hypothesize that the reason for this result is related to the method used for our calculations: the DRG system used in Italy considers the

TABLE 3 | Patients' psychopathological characteristics in IP and HLCT groups at T0.

	IP	HLCT	Effect size (*r*)
Internalizing problems (YSR)	64.00 [57.00–71.00]	60.00 [52.50–65.50]	0.242
Externalizing problems (YSR)	51.00 [42.00–56.00]	49.50 [46.50–55.50]	0.025
Total problems (YSR)	61.00 [54.00–63.00]	54.50 [47.50–60.00]	0.223
Affective problems (YSR)	66.00 [61.00–70.00]	62.00 [56.00–78.00]	0.207
Anxiety problems (YSR)	59.00 [55.00–63.00]	57.50 [52.00–61.00]	0.111
Somatic problems (YSR)	56.00 [51.00–56.00]	53.00 [52.00–60.00]	0.019
ADHD problems (YSR)	51.00 [50.00–54.00	51.00 [50.00–52.00]	0.109
Oppositional defiant problem (YSR)	52.00 [51.00–65.00]	52.00 [50.5–60.00]	0.083
Conduct problems (YSR)	50.00 [50.00–51.00]	50.00 [50.00–51.00]	0.059
Obsessive-compulsive problems (YSR)	63.00 [63.00–70.00]	56.50 [52.00–64.00]	0.334
Post-traumatic stress problems (YSR)	65.00 [52.00–70.00]	59.00 [52.50–63.00]	0.204
Positive qualities (YSR)	44.00 [38.00–48.00]	46.00 [40.00–54.50]	0.170
Total score (CDI 2)	62.00 [54.00–75.00]	54.50 [42.50–59.00]	0.336
Emotional problems (CDI 2)	69.00 [57.00–74.00]	56.00 [51.50–63.50]	0.333
Negative mood/physical symptoms (CDI 2)	65.00 [54.00–72.00]	58.00 [50.00–68.00]	0.154
Negative self-esteem (CDI 2)	67.00 [54.00–74.00]	50.00 [45.00–56.50]*	0.441
Interpersonal problems (CDI 2)	67.50 [52.50–76.50]	57.50 [53.00–61.00]	0.230
Ineffectiveness (CDI 2)	65.00 [42.00–68.00]	50.00 [44.50–57.50]	0.220
Interpersonal problems (CDI 2)	59.00 [47.00–66.00]	52.00 [41.00–59.00]	0.263
Total score (MASC 2)	58.00 [46.00–66.00]	55.00 [50.00–67.00]	0.015
Separation anxiety (MASC 2)	50.00 [42.00–60.00]	57.00 [40.00–60.00]	0.018
GAD index (MASC 2)	55.00 [47.00–63.00]	61.00 [48.00–65.00]	0.160
Social anxiety (MASC 2)	51.00 [44.00–59.00]	52.00 [45.00–59.00]	0.068
Humiliation/rejection (MASC 2)	44.00 [41.00–59.00]	53.00 [43.00–58.00]	0.030
Performance fears (MASC 2)	57.00 [46.00–64.00]	56.00 [46.00–60.00]	0.065
Obsessions & compulsions (MASC 2)	54.00 [46.50–61.00]	53.00 [43.00–61.00]	0.009
Physical symptoms (MASC 2)	59.00 [47.00–70.00]	56.00 [50.00–67.00]	0.009
Panic (MASC 2)	55.00 [42.00–69.00]	58.00 [53.00–64.00]	0.080
Tense/restless (MASC 2)	59.00 [46.00–66.00]	52.00 [42.00–67.00]	0.086
Harm avoidance (MASC 2)	54.00 [46.00–60.00]	54.00 [43.00–60.00]	0.047
Anxiety probability score (MASC 2)	1.00 [0.00–3.00]	1.00 [0.00–2.00]	0.003
Inconsistency index (MASC 2)	6.00 [5.00–7.00]	7.00 [6.00–8.00]	0.284
BUT (mean)	2.23 [1.65–3.38]	1.32 [0.69–2.39]	0.292
Drive for thinness (EDI-3)	14.00 [3.00–27.00]	13.00 [9.00–21.00]	0.019
Bulimia (EDI-3)	0.00 [0.00–4.00]	1.00 [0.00–6.00]	0.162
Body dissatisfaction (EDI-3)	20.00 [13.00–25.00]	19.00 [13.00–27.00]	0.015
Low self-esteem (EDI-3)	8.00 [4.00–13.00	8.00 [2.00–12.00]	0.080
Personal alienation (EDI-3)	7.00 [4.00–17.00]	7.00 [5.00–13.00]	0.077
Interpersonal insecurity (EDI-3)	12.00 [9.00–13.00]	10.00 [8.00–12.00]	0.254
Interpersonal alienation (EDI-3)	6.00 [4.00–12.00]	6.00 [3.00–10.00]	0.146
Interoceptive deficits (EDI-3)	12.00 [4.00–23.00]	10.00 [6.00–19.00]	0.069
Emotional dysregulation (EDI-3)	8.00 [2.00–12.00]	8.00 [4.00–14.00]	0.015
Perfectionism (EDI-3)	6.00 [4.00–10.00]	10.00 [5.00–14.00]	0.184
Ascetism (EDI-3)	5.00 [3.00–14.00]	6.00 [4.00–9.00]	0.012
Maturity fears (EDI-3)	12.00 [9.00–25.00]	12.00 [8–.00–17.00]	0.134
Eating disorder risk (EDI-3)	39.00 [22.00–54.00]	38.00 [23.00–44.00]	0.050
Ineffectiveness (EDI-3)	15.00 [7.00–31.00]	14.00 [8.00–24.00]	0.092
Interpersonal problems (EDI-3)	19.00 [14.00–24.00]	14.00 [13.00–21.00]	0.165
Affective problems (EDI-3)	18.00 [13.00–35.00]	20.00 [12.00–27.00]	0.042

(Continued)

TABLE 3 | Continued

	IP	HLCT	Effect size (*r*)
Overcontrol (EDI-3)	13.00 [8.00–24.00]	16.00 [11.00–23.00]	0.050
General psychological maladjustment (EDI-3)	84.00 [53.00–145.00]	77.00 [63.00–104.00]	<0.001
Problem solving (FAD)	1.83 [1.67–2.00]	2.00 [2.00–2.25]*	0.421
Communication (FAD)	2.33 [1.95–2.56]	2.61 [2.17–2.84]	0.260
Roles (FAD)	1.91 [1.73–2.14]	2.09 [2.00–2.14]	0.296
Affective responsiveness (FAD)	2.17 [1.92–2.60]	2.25 [2.00–2.59]	0.035
Affective involvement (FAD)	1.79 [1.57–1.93]	2.00 [1.72–2.29]	0.274
Behavior control (FAD)	2.00 [1.84–2.28]	2.22 [1.95–2.28]	0.177
General functioning (FAD)	1.88 [1.50–2.17]	2.04 [1.79–2.42]	0.312

*Data are presented as median and interquartile range in square brackets [IQR] for continuous variables. BUT, Body Uneasiness Test; CDI 2, Children depression inventory 2; EDI-3, Eating Disorder Inventory-3; FAD, Family Assessment Device; MASC 2, Multidimensional Anxiety Scale for Children 2; IP, inpatient care; HLCT, high-level care treatment; YSR, Youth Self-Report. Mann–Whitney test was used to compare continuous variables between the two groups. Statistical significance for $p < 0.05$. *$p < 0.05$. Effect size (r) was calculated for the Mann–Whitney test. Small, medium, and large effects for $r < 0.3$, $0.3 \leq r < 0.5$, and $r \geq 0.5$, respectively.*

TABLE 4 | MROAS at T1 in IP and HLCT patients.

	IP	HLCT	Effect size (*r* or Cramer's *V*)
MROAS scales			
Eating difficulties	3.00 [3.00–4.00]	2.00 [2.00–2.5]***	0.730
Menstrual state	4[a]	4.00 [4.00–4.00]	0.263
Mental state	4.00 [4.00–4.00]	3.00 [2.00–4.00]*	0.437
Insight	3.00 [3.00–4.00]	2.00 [1.00–2.00]***	0.635
Intimate relationships	4.00 [3.00–4.00]	2.50 [2.00–3.00]**	0.523
Family relationships	3.00 [3.00–3.00]	3.00 [2.00–3.00]	0.230
Social contacts	3.00 [3.00–4.00]	2.50 [2.00–3.00]**	0.509
Occupation	3.00 [3.00–3.00]	2.00 [2.00–2.00]***	0.687
Additive behaviors	1[a]	1[a]	0.000
MROAS groups			
Good	0 (0.0)	3 (17.6)**	0.592
Intermediate	2 (11.8)	8 (47.1)	
Poor	15 (88.2)	5 (29.4)	

*Data are presented as number and percentage in parentheses (%) for categorical variables, or median and interquartile range in square brackets [IQR] for continuous variables. HLCT, high-level care treatment; MROAS, Morgan–Russel Outcome Assessment Scale; IP, inpatient care. Mann–Whitney and Chi-square tests were used to compare continuous and categorical variables between groups, respectively. [a]Constant values. Statistical significance for $p < 0.05$. *$p < 0.05$, **$p < 0.01$, ***$p < 0.001$. Effect size (r or Cramer's V) was calculated for the Mann–Whitney test or the Chi-square test, respectively. Small, medium, and large effects for $r < 0.3$, $0.3 \leq r < 0.5$ and $r \geq 0.5$, respectively.*

average cost per diagnosis, and not the direct costs incurred for the individual interventions and procedures implemented for each patient the introduction of the HLCT program represents a meeting point between inpatient and outpatient treatment, combining the merits of both treatments. HLCT shows greater results both in terms of weight recovery and in terms of psychic and relational functioning for equivalent patient groups with equal costs to traditional treatment programs. It is clear that in cases of serious risk to life, ordinary hospitalization is inevitable, which however could be limited to the rebalancing of medical parameters, favoring a subsequent transfer into a care setting that allows, on the one hand, multidisciplinary and continuous assistance and, on the other hand, maintenance of social and relational activities. A further benefit would also be reducing the time of hospitalization and therefore a greater ability to accept new patients.

Our study, the first on the Italian adolescent population, is in line with the recent literature and confirms the need to deepen the investigation into the benefits of partial hospitalization vs. full hospitalization through a randomized clinical trial.

The work presented has several limitations. The study design was observational, retrospective, and non-randomized. Therefore, all patients admitted to the two different treatments were included in the analysis, according to the including/excluding criteria applied a posteriori. Despite the observational design, no difference in body weight, BMI, length of illness, prior treatments, weight loss, the time in which it occurred, and psychological characteristics at the admission was detected between the two groups. For this reason, a comparison between them at T1 (discharge from each treatment) was performed, sensing that there was a minor risk of bias. Moreover, the small sample size may have limited the ability to detect differences between IP and HLCT, and the short treatment period did not allow for the re-administration of the same battery of tests at T1, so the MROAS scale was used at T1, in order to assess the biopsychosocial outcomes. It is possible that most severe patients were more represented in the IP group, partially explaining the differences in outcomes. Moreover, psychological treatment in the IP program is less intensive compared to the HLCT program because, even if patients have daily clinical monitoring, psychotherapy sessions occur only once a week instead of twice as in the HLCT program. From a clinical point of view, this difference may represent a minor curbing of the patients' anxieties related to greater adherence to dietary indications, with a possible consequence of a slower process of treatment and development of compliance. Further prospective and randomized studies are needed in order to

better investigate the different treatment programs for severe AN in adolescence.

DATA AVAILABILITY STATEMENT

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

ETHICS STATEMENT

The studies involving human participants were reviewed and approved by Ethical Committees of the Bambino Gesù Children Hospital (2264_OPBG_2020). Written informed consent to participate in this study was provided by the participants' legal guardian/next of kin.

AUTHOR CONTRIBUTIONS

VZ and SV planned the study. MC, GC, MM, CC, and IC collected the data. SG performed the economic evaluation of the costs. GC and AT performed the statistical analysis. MC, MCC, AC, and IC analyzed the literature. VZ, MC, and GC wrote the manuscript. All authors contributed to the article and approved the submitted version.

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Post-hospitalization Daycare Treatment for Adolescents With Eating Disorders

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Background: There are several possible facilities for the treatment of eating disorders (EDs). Specifically, there is the issue of the use of specialized daycare and ambulatory services over inpatient settings and the place of daycare programs following inpatient treatment.

Aim: We sought to examine the contribution of post-hospitalization daycare program to the treatment of adolescents hospitalized with an ED.

Methods: We assessed 61 female adolescents hospitalized with an ED. All but three were diagnosed with clinical or subthreshold anorexia nervosa (AN). Three were diagnosed with bulimia nervosa. Thirty-seven patients continued with a post-hospitalization daycare program for at least 5 months, whereas 24 did not enter or were enrolled in the program for <5 months. Patients completed on admission to, and discharge from, inpatient treatment self-rating questionnaires assessing ED-related symptoms, body-related attitudes and behaviors, and depression and anxiety. Social functioning was assessed 1 year from discharge using open-ended questions. One-year ED outcome was evaluated according to the patients' body mass index (BMI) and according to composite remission criteria, assessed with a standardized semistructured interview. To be remitted from an ED, patients were required to maintain a stable weight, to have regular menstrual cycles, and not to engage in binging, purging, and restricting behaviors for at least eight consecutive weeks before their assessment.

Results: BMI was within normal range at follow-up, whether completing or not completing daycare treatment, and around 75% of the patients had menstrual cycles. By contrast, when using comprehensive composite remission criteria, less than a quarter of former inpatients not entering/not completing daycare program achieved remission vs. almost a half of the completers. In addition, a greater percentage of completers continued with psychotherapy following discharge. Fifty percent of both groups showed good post-discharge social functioning. No between-group differences were found in the BMI and the scores of the self-rating questionnaires at admission to, and discharge from, inpatient treatment.

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Conclusion: Adolescent females with EDs can maintain a normal-range BMI from discharge to 1-year follow-up, even if not completing daycare treatment. By contrast, completion of a post-hospitalization daycare program may improve the 1-year follow-up ED-related outcome of former ED inpatients.

Keywords: anorexia nervosa, bulimia nervosa, daycare, day-hospitalization, eating disorders, outcome, remission

INTRODUCTION

Eating disorders (EDs), in particular, anorexia nervosa (AN), are psychiatric illnesses with a serious impact, often causing severe distress to patients and families. Less than half of the patients demonstrate full recovery, and the percentages of severe and enduring illness are high (1, 2).

There are currently several possible facilities for the treatment of EDs. Specifically, there is the possibility of using newer forms of specialized daycare and ambulatory services over the more traditional inpatient settings (3). Inpatient treatment is currently suggested for patients with EDs, specifically AN, who are in imminent risk because of their poor physical condition or because of severe suicidal behavior, whose mental state impedes almost completely with their everyday functioning, and whose family, in these specific conditions, is not able to provide the required support (1, 4).

Inpatient care allows for constant supervision and intensive multidisciplinary treatment and, as such, is effective for rapid weight gain (5). Nonetheless, the distinct disadvantages of inpatient care are its high cost and the detaching of the ED patient from his/her family, friends, and school/work system (3, 4, 6, 7).

Indeed, because of these drawbacks, there has been a transition in the past two decades from inpatient to different forms of outpatient programs (1, 8, 9). This process has included the implementation of daycare programs, with a growing preference for daycare vs. inpatient treatment (1, 3, 10–13). This preference stems from both clinical and financial considerations (3, 14). Thus, the costs of daycare programs are less than those of inpatient treatment (3, 12, 15, 16). Two types of daycare treatment exist: halfway in programs, aiming to prevent or reduce the need for inpatient treatment for patients with less severe illness, and halfway out post-hospitalization programs, serving to shorten inpatient treatment and to facilitate the transition from the hospital to the community (5).

In the case of adolescents with EDs, daycare programs assist and maintain independence, support the internalization of skills acquired in therapy, and encourage the use of these skills in daily life (3). During their stay in daycare programs, adolescents can continue with their routines at school, and maintain their social and family roles (5).

Participation in daycare programs requires some degree of cooperation and personal responsibility from the adolescent for his/her own care (15). At the end of the program, the adolescent returns home, is required to cope on his/her own with the complexities of the illness, alongside the support of family, peers, and professionals. Indeed, the period following the discharge from daycare treatment is replete with challenges, including resuming functioning at school and socially, coping with eating, maintaining stable weight, and handling a multitude of emotional problems.

Previous research has mainly focused on the comparison of daycare and inpatient facilities in terms of therapeutic effectiveness and financial viability (10, 15). Only a few studies have specifically addressed the role of daycare programs following inpatient treatment (3, 12, 15, 16). The provision of halfway out daycare programs is highly important for adolescents completing inpatient treatment. First, it maintains a continuity of care and a protective and supportive therapeutic environment (12), allowing for a rapid identification of worsening in the patient's conditions.

Second, post-hospitalization daycare treatment incorporates characteristics of rehabilitation, consistent with psychosocial rehabilitation approaches in mental health care. The goal of psychosocial rehabilitation is to restore the adolescent's ability to live independently within his/her family, create an adequate learning and social environment, and organize effectively the management of his/her treatment. This approach requires a collaboration among patients, families, and treatment providers under the assumption that effective rehabilitation is built on the ability of the youngster to cope with his/her illness and its consequences, and to show at least some motivation for change, and some wish to recover (13, 17–20). In this respect, patients with EDs participating in daycare programs have been found to regard the goal of their treatment not only as reducing the symptoms of their illness, but also as making them capable of sustaining relationships and adopting more functional problem-solving strategies and modes of thinking (21).

Research defines the collaboration of patients with EDs in daycare programs in terms of their cooperation with their nutritional plan (22) and with the overall therapeutic program (23). Nonetheless, these patients may show considerable difficulties in preserving and cooperating with their treatment (19, 24). This is the case for both patients with AN and bulimia nervosa (BN), although the latter may show initial motivation for treatment, to stop their binge/purge behavior (24).

The aim of the present study was to assess the efficacy of a post-hospitalization halfway out daycare program for the treatment of EDs in adolescents. In a previous study of our group (25), assessing 88 female adolescent patients with EDs hospitalized between 2007 and 2012, 51 patients (58%) continued with a daycare program after discharge. Twelve of the 51 patients (23%) treated in this program were rehospitalized from discharge to 1-year follow-up, compared with 16/37 patients (43%) not treated in daycare conditions (difference not statistically

significant). These findings urged us to study the effect of post-hospitalization daycare attendance in another sample of female patients treated in our ED inpatient department.

The post-hospitalization halfway out daycare program in our medical center in Israel provides the continuation of nutritional, psychological, psychosocial, and psychiatric care to adolescents with EDs completing inpatient treatment. Participation in this program is voluntary, recommended by the inpatient treatment team to all patients and families who are willing to enroll in this treatment and who live close enough to our center (i.e., there are no specific inclusion and exclusion criteria).

The present study examined the contribution of post-hospitalization daycare treatment to remission from an ED at 1-year post discharge from inpatient treatment in adolescents continuing with the program for at least 5 months following their discharge from inpatient treatment. This group was compared with patients discharged from inpatient treatment who did not enter the program or continued it for <5 months. This cutoff point was chosen by the working team of the daycare program because of their clinical impression that the adherence of the adolescents to the different group treatments offered in daycare increased after that time, while the risk of leaving the program prematurely decreased. In addition, it was relatively similar to the mean duration of attendance to the daycare program in our previous study (6.2 ± 2.5 months; 25).

The following were our hypotheses:

1. More patients staying in daycare program for at least 5 months will be remitted from their ED according to the remission criteria of the present study, in comparison with patients not entering the program or completing <5 months of treatment.
2. In addition, patients completing the daycare program, in comparison with patients not entering the program or not completing it, would show at 1-year post-discharge follow-up higher body mass index (BMI), higher rate of menstruation, and better social functioning.
3. Patients choosing to cooperate with and complete our daycare program would be different from non-completers in showing less severe eating pathology and body image disturbances, less severe depression and anxiety, and higher BMI, at both admission to and discharge from inpatient treatment (the point of entrance to daycare), as well as shorter duration of inpatient treatment [all the parameters described in hypotheses (2) and (3) were previously shown to be associated with remission from an ED (25–30)].

METHODS

Population

The design of this study was prospective and longitudinal. The research population included 61 female adolescents hospitalized between 2013 and 2017 because of an ED, at the Pediatric Psychosomatic Department, Safra Children's Hospital, Sheba Medical Center, Tel Hashomer, Israel. They represented a different group of patients from that described in our previous study about factors associated with remission from EDs (25). All girls were offered by the department's treatment team to continue with the daycare program following their discharge from inpatient treatment. Thirty-seven girls continued with the daycare program for at least 5 months. Fourteen girls did not enter the program [either living in a too distant place in Israel to be able to visit the program regularly ($n = 8$) or choosing not to enter the program ($n = 6$)], and 10 girls stayed in the program for <5 months. No differences were found between the girls not attending and not completing the program in any of the study measures introduced. Thus, owing to the small number of participants in each subgroup, we combined them to one group of 24 non-completers. The exact description of the patients included in the study is found in our flowchart.

Criteria for inclusion in the study were (1) female gender, (2) over the age of 15 years, (3) the index hospitalization was the first in our setting, (4) a good understanding of the Hebrew language, (5) parents and patients agreeing to participate in the study, including in the follow-up assessment, (6) completing inpatient treatment, and (7) living near enough to the hospital to be able to continue with the day care program if they so wished. Exclusion criteria were lifetime or current schizophrenic spectrum disorders, bipolar disorder (it is the policy of this department not to hospitalize patients with these comorbid disturbances), organic brain disorder, intellectual disability, and lifetime or current medical illnesses that could potentially affect appetite or weight (e.g., diabetes mellitus or thyroid disorders).

Participants and parents, in the case of minors under the age of 18, signed a written informed consent, after being explained about the aims of the study. The study was approved by the Ethics Review Board of the Sheba Medical Center, Tel Hashomer.

Description of Inpatient and Post-Hospitalization Halfway Out Daycare Treatment in Our Facility

The pediatric ED treatment service at the Safra Children's Hospital, Sheba Medical Center, Tel Hashomer, Israel, includes inpatient, daycare, and ambulatory programs for children and adolescents between the ages 6 and 18 years with diverse ED types. Treatment is provided by a multidisciplinary team at varying levels of intensity, depending on the severity of the ED and comorbid disorders, and the overall functioning of the patient's family. The center is a "wrap-around" service, i.e., patients can move from one facility to the other, according to their condition.

During inpatient treatment, patients receive multimodal treatment interventions tailored for the treatment of the ED, comorbid psychiatric disorders, and different psychosocial difficulties. Upon discharge, patients are offered a daycare program in the afternoon hours, to allow for their reintegration into the school system. When considered stabilized, patients are referred to our ambulatory service.

The integrative treatment protocol in our service corresponds with other structured programs for adolescents with AN or BN (31, 32). The protocol includes the following: a behaviorally oriented nutritional rehabilitation program with structured meal supervision, either individual psychodynamically oriented psychotherapy or individual cognitive behavioral therapy (CBT;

depending on the specific illness and the aims of treatment), individual expressive movement therapy, family therapy [either family-based therapy (33) or systemic family therapies (34)] or parental consultation, psychodynamic group therapy, CBT group sessions ["classical" CBT (35) and cognitive–motivational treatment based on the Maudsley Model of Anorexia Nervosa Treatment for Adults (MANTRA) protocol (36)], group expressive movement therapy, and parents' group. The inclusion of psychodynamic psychotherapy in the treatment regimen is designed to address intrapsychic and interpersonal developmental needs of adolescents often burdened with long-standing illness, in addition to the specific ED-related therapies administered (37). It is of note that other daycare programs in patients with AN have used psychodynamic psychotherapy as their main treatment, showing favorable results (38). While inpatient treatment includes all these therapeutic modalities, daycare treatment includes only some of these interventions, as required, but nutritional consultation, individual psychotherapy family therapy/parental consultation, and different types of group therapies are usually maintained.

The daycare facility, located in the Safra Children's Hospital near the inpatient department, operates three times a week, during the afternoon hours, to enable school attendance. Patients eat two supervised meals, one in the daycare dining room and one in the hospital's cafeteria, to be familiarized with the normal eating of other customers. The staff of both inpatient and daycare programs includes child and adolescent psychiatrists, registered nurses, clinical nutritionists, clinical psychologists, movement therapists, psychology students supervising the meals, and a school program (only for inpatients).

Assessment

The diagnosis of AN, BN, and eating disorders not otherwise specified (EDNOS) and the diagnosis of comorbid psychiatric disorders (including depressive disorders, anxiety disorders, and obsessive–compulsive disorders) have been established according to the DSM-IV criteria (39), using the Structured Clinical Interview for DSM-IV Axis I Disorders—Patient Edition [SCID-I/P Version 2.0; (40)]. We have decided not to diagnose our patients according to the DSM 5 criteria (41) because the remission criteria used in our study are based on the DSM-IV (39). Highly experienced child and adolescent psychiatrists (DS, AY, and AEL) have assessed independently all patients. All diagnoses have been confirmed in clinical meetings of the department's team. Only patients for whom there has been a unanimous agreement of their ED diagnosis could enter the study. Baseline demographic data, admission and discharge BMI, and admission menstruation data, have been obtained from the patients' medical files.

Dependent Variables

Physiological Measures

BMI, defined as body weight in kilograms divided by height in meters squared, was assessed at admission to, and discharge from, inpatient treatment, as well as at 1-year follow-up from discharge. Amenorrhea, defined according to the criteria of the DSM-IV (39) as the absence of at least three consecutive menstrual periods following menarche, was assessed at 1-year follow-up according to self-report. All patients had evidence of amenorrhea either at admission or at some time before their admission to inpatient treatment.

Self-Rating Scales

1. Maladaptive eating-related parameters were assessed using the 26-item Eating Attitude Test-6 [EAT-26; (42)], previously shown to differentiate Israeli ED patients from non-ED controls (25). Scores $\geq$20 indicated the existence of disordered eating, whereas scores <20 were considered to indicate lack of disordered eating (42). The internal consistency of the EAT-26 in the present study was $\alpha = 0.90$.
2. Depression was assessed using the 21-item Beck Depression Inventory [BDI; (44)]. The BDI has been previously used in ED patients (43), including in Israeli samples (25, 29). Scores $\leq$19 indicated the absence of depression, whereas scores >20 indicated the presence of depression (44). The internal consistency of the BDI in this study was $\alpha = 0.87$.
3. Anxiety was assessed using the 40-item State–Trait Anxiety Inventory [STAI; (45)], measuring the severity of anxiety at the time of examination (STAI—State), and the general tendency to display anxiety (STAI—Trait). The STAI was previously used in ED patients (43), including in Israeli samples (25, 29). Scores $\leq$40 indicated the absence of trait and state anxiety, whereas scores >41 indicated the presence trait and state anxiety (45). The internal consistency of the STAI—State and STAI—Trait scales in this study was $\alpha = 0.92$ and $\alpha = 0.93$, respectively.
4. The Body Investment Scale [BIS; (46)] is a 24-item self-rating scale used to measure the degree of emotional investment in the body and body experience in four aspects (each containing six items): feelings and attitudes about the body (e.g., "*I hate my body.*"), comfort in physical touch (e.g., "*I feel uncomfortable when people get too close to me physically.*"), body care (e.g., "*I believe that caring for my body will improve my well-being.*"), and body protection (e.g., "*It makes me feel good to do something dangerous.*"). The final score of the BIS is calculated by summation of the four separate scales. A higher score indicates more positive feelings toward the body, greater comfort with touch, and greater body protection and body care. The BIS has been previously used in patients with EDs (47). Scores $\leq$12 indicate disturbances in body investment, whereas scores >13 indicate healthy body investment (46). The internal consistency of the different BIS scales in the present study has been $\alpha = 0.90$, $\alpha = 0.86$, $\alpha = 0.89$, and $\alpha = 0.91$, for feelings and attitudes about the body, comfort in physical touch, body care, and body protection, respectively. In the present study, we have used only the total BIS score, comprised of the sum of the scores of all individual BIS scales (46).

ED-Related Remission Criteria

We applied the remission criteria proposed by Strober (26) and Herzog (48) for AN, and by Herzog (48) and Keel (49) for BN. This replicated the criteria applied in our previous study of remission from EDs (25). Accordingly, to be remitted from AN-restricting type (AN-R), or EDNOS-restricting type (EDNOS-R), patients were required to maintain a stable weight of over

85% of ideal body weight (IBW), to have regular menstrual cycles, and not to engage in binging, purging, or restricting eating patterns for at least eight consecutive weeks prior to the assessment. For the assessment of IBW, we used the data of the Centers for Disease Control and Prevention (2000) Growth Charts (www.cdc.gov/growthcharts) found adequate also for Israeli children and adolescents (50). To be remitted from BN, patients were required to be abstinent from binging, purging, and restricting eating patterns for at least eight consecutive weeks prior to the assessment. To be remitted from AN-binge/purge (B/P) type, or from EDNOS-B/P, patients were required to fulfill both criteria for at least eight consecutive weeks prior to the assessment.

In line with previous recommendations (26), we have further divided the criteria for ED-related remission into complete and good remission. Accordingly:

1. Complete remission: All required behavioral remission criteria and participants do not demonstrate maladaptive eating-related preoccupations. This is defined as ED-related preoccupations occurring for not more than 30 min daily.
2. Good remission: All required behavioral remission criteria, but participants demonstrate maladaptive ED-related preoccupations. This is defined as ED-related preoccupations occurring for more than 30 min daily.

   The non-remitted patients have been divided into:
3. Intermediate outcome: For patients with AN or EDNOS-R: Weight is less than 85% of IBW, or menstrual cycles are irregular or absent, or there is evidence of maladaptive eating behaviors [i.e., not meeting DSM-IV (39) criteria for full-blown AN].

   For patients with BN and EDNOS-B/P: evidence of subsyndromal B/P behaviors [i.e., not meeting DSM-IV (39) criteria for full-blown BN].
4. Poor outcome: Participants meeting the DSM-IV criteria for full-blown AN, BN, or EDNOS.

For the purposes of this study, because of the relatively small number of participants, we combined patients belonging to criteria (1) or (2) to represent remission from an ED and patients belonging to criteria (3) or (4) to represent nonremission from an ED.

Social Functioning

In line with our previous study (25), social functioning at 1-year follow-up was evaluated with open questions. Poor social functioning was defined as having poor relations with family and/or peers, spending time mostly alone, with no motivation to renew old or create new friendships. Intermediate functioning was defined as some contact with family and/or peers, and some motivation to renew old or create new friendships. Good social functioning was defined as having good relations with family and/or peers, meeting friends occasionally, and having good motivation to renew old or create new friendships. Finally, very good social functioning was defined as having meaningful and fulfilling relationships with family and peers, old and/or new, spending a considerable amount of time with others, and/or being involved in a romantic relationship.

Social functioning was rated on a four-point scale, where (1) represented poor and (4) represented very good functioning. In keeping with the time duration required for the definition of remission from an ED, very good or good functioning was defined if present for at least eight consecutive weeks prior to the follow-up assessment. Otherwise, it was defined as intermediate or bad.

Procedure

Patients (and parents in the case of minors) were contacted around 1-year post-discharge. Those agreeing to participate in the follow-up assessment were included in the study. Remission from an ED according to Strober's criteria was assessed using the Eating Disorders Family History Interview (EDFHI) (51). This is a semistructured clinical interview designed to gather detailed information about weight and eating history previously used in studies of ED patients (52), including in Israeli samples (25, 29). The EDFHI allows for a detailed assessment of current, minimal, and maximal body mass index (BMI), menstrual history, lifetime, and current restricting, binging, and purging behaviors, and the extent of preoccupation with eating, weight, and body image-related issues and of maladaptive physical exercising.

Master's level psychology and social work students administered the EDFHI. All were blind to the ED diagnosis of the patients at admission, and whether the patients attended, or did not attend, the daycare program. These students were trained in psychiatric interviewing by the study's principal investigator (DS). The degrees of inter-rater reliability between these interviewers and the principal investigator for the EDFHI (according to the correlation coefficient procedure) was $r = 0.89–0.91$.

These students also distributed the self-rating questionnaires at admission, discharge, and 1-year follow-up, and assessed the patients' psychosocial functioning at follow-up with open-ended questions. Thereafter, they assessed with open-ended yes/no questions whether the patients entered the daycare program following their discharge from inpatient treatment. If the response was positive, they assessed the duration (in months) of daycare treatment. Patients were also asked with open-ended yes/no questions whether they continued with psychotherapy/pharmacotherapy following their discharge from inpatient treatment.

Weight and height were taken last in all participants by the registered nurse of the daycare program during the morning hours according to accepted criteria (53). Weight and height were similarly measured on admission to, and discharge from, inpatient treatment.

Statistical Analysis

Adolescents staying in the program for at least 5 months were compared with the adolescents who ether did not enter the program or did not complete at least 5 months of daycare treatment. The analysis of between-group differences in categorical variables at 1-year follow-up (Strober's remission criteria, regularity of menstruation, psychosocial functioning, and consistency of treatment) as well as of the type of ED

at admission was performed using a non-parametric chi-square test of independence. The analysis of between-group differences in continuous variables (BMI, EAT-26, BDI, STAI—State and trait, and BIS) at admission, discharge, and 1-year follow-up was performed using analysis of variance (ANOVA) with repeated measures. Between-group differences in age at admission, duration of illness before admission, and duration of inpatient treatment were assessed using *t*-tests for independent measures. We used the Statistical Package for Social Sciences software, version 21.0 for Windows.

RESULTS

Background Data

Table 1 summarizes the between-group differences in the background data. No differences were found for age and duration of illness and of inpatient treatment. **Table 2** summarizes the between-group differences in diagnosis and treatment at admission. No differences were found for type of ED, comorbid psychiatric diagnoses, and psychopharmacotherapy. Specifically, more than half of the patients were diagnosed with AN at admission to inpatient treatment. Moreover, all patients with EDNOS were diagnosed with subthreshold AN (39). Only three patients were diagnosed with BN. Around two thirds of the patients had evidence of a comorbid psychiatric disorder at admission, and around a half were treated at that time with psychotropic medications [mostly serotonin-specific reuptake inhibitors (SSRIs)].

Between-Group Differences at 1-Year Follow-Up

Table 3 summarizes the between-group differences for remission, social functioning, and consistency in treatment at 1-year post-discharge follow-up. Almost half of the patients completing

TABLE 1 | Between-group differences in background data.

	Adolescents staying in the daycare program for at least 5 months ($n = 37$)		Adolescents not entering the daycare program or not completing at least 5 months of treatment ($n = 24$)		$t(1, 60), p$
Variable	**M**	**SD**	**M**	**SD**	
Age (years)	16.35	1.35	16.53	1.50	$t = -0.486$, $p = 0.629$
Duration of illness prior to admission to inpatient treatment (years)	1.90	1.48	2.56	2.26	$t = -1.369$, $p = 0.176$
Duration of inpatient treatment (months)	10.31	15.71	6.55	3.19	$t = 1.108$, $p = 0.273$

TABLE 2 | Between-group differences in diagnosis and treatment at admission to inpatient treatment.

	Adolescents staying in the daycare program for at least 5 months ($n = 37$)	Adolescents not entering the daycare program or not completing at least 5 months of treatment ($n = 24$)	χ^2, p
Variable			
ED Diagnosis			$\chi^2(2) = 0.600$, $p = 0.741$
Anorexia nervosa	24 (64.70)%	14 (56.52%)	
Bulimia nervosa	2 (5.88%)	1 (4.35%)	
Eating disorders not otherwise specified (EDNOS)*	11 (29.42%)	9 (39.13(%	
Psychiatric comorbidity**			χ^2 (1) = 0.44, $p = 0.833$
Yes	24 (63.64%)	15 (60.87%)	
No	13 (36.36%)	9 (39.13%)	
Psychopharmacological treatment prior to admission to inpatient treatment			χ^2 (1) = 0.261, $p = 0.609$
Yes	20 (54.84%)	11 (47.62%)	
No	17 (45.16%)	13 (52.38%)	

*ED, eating disorder; *all patients with EDNOS were diagnosed with subthreshold anorexia nervosa; **comorbidity included depressive disorders, anxiety disorders, and obsessive-compulsive disorder.*

TABLE 3 | Between-group differences in ED outcome, the consistency of treatment and social functioning at one-year follow-up.

	Adolescents staying in the daycare program for at least 5 months ($n = 37$)	Adolescents not entering the daycare program or not completing at least 5 months of treatment ($n = 24$)	$\chi^2(1)$	p
Strober's remission criteria			3.98	$p = 0.046$
Not remitted from an ED	20 (54.1%)	19 (79.2%)		
Remitted from an ED	17 (45.9%)	5 (20.8%)		
Consistency in psychotherapeutic treatment[a]			6.01	$P = 0.014$
Yes	34 (91.67%)	16 (66.67%)		
No	3 (8.33%)	8 (33.33%)		
Consistency in psychopharmacological treatment[b]			0.14	$p = 0.907$
Yes	27 (72.22%)	17 (70.83%)		
No	10 (27.78%)	7 (29.17%)		
Social functioning				
Good functioning	18 (50%)	18 (50%)	0	$p = 1.00$
Bad functioning	12 (50%)	12 (50%)		

[a]*All patients were recommended psychotherapy at discharge from inpatient treatment.*
[b]*All patents were recommended psychopharmacotherapy at discharge from inpatient treatment.*
ED, eating disorder.

treatment in our post-hospitalization daycare center were considered remitted at 1-year follow-up according to Strober's criteria, compared with less than a quarter of patients not receiving full daycare treatment, this difference being significant. Social functioning was rated as good or very good [categories (3) and (4)] in about half of the patients of both groups, and bad or very bad [categories (1) and (2)], in the other half with no between-group differences.

All patients were treated with psychotropic medications (mostly SSRIs) at their discharge from inpatient treatment, and all were suggested at that time to continue with psychotherapy and pharmacotherapy. More than two thirds of the patients in both groups continued with pharmacotherapy at follow-up (mostly SSRIs), with no between-group differences (see **Table 3**). By contrast, we found a significant between-group difference with respect to psychotherapy. Specifically, almost all adolescents staying in the daycare program for more than 5 months continued with psychotherapy in comparison with around two thirds of the non-completers (see **Table 3**). Most of the patients in both groups were treated at follow-up with psychodynamic psychotherapy.

Table 4 summarizes the between-group differences in BMI at the three assessment points and in the self-rating scales at admission to, and discharge from, inpatient treatment. Whereas, all patients have responded to these questionnaires at admission and discharge, only about a half have completed them at follow-up, thus, not enabling the inclusion of the follow-up data in the multivariate analysis. Regarding the findings for the BMI, it is of note that while two of the 37 patients in the completers group and one of the 24 patients in the non-completers group have been diagnosed with BN (see **Table 3**), all other patients have been diagnosed with clinical or subthreshold AN according to the DSM-IV (39). This suggests that the findings for the BMI are likely meaningful.

According to **Table 4**, the BMI of the patients in both groups improved significantly between admission to, and discharge from, inpatient treatment, being maintained at 1-year post-discharge follow-up. Both groups showed at that time mean BMIs within normal range, i.e., BMI $= 19.82 \pm 1.61$ kg/m^2 in completers vs. BMI $= 19.35 \pm 1.72$ kg/m^2 in non-completers (see **Table 4**). No between-group difference was found for BMI. Similarly, no between-group differences were found in the presence of menstruation at follow-up [$\chi^2(1) = 0.65$, $p = 0.41$]. Specifically, 32 patients (86%) completing the daycare program reported regular menstruation in comparison with 18 patients (75%) not attending/not completing the program.

No between-group differences were found in ED-symptomatology, attitudes and behaviors toward the body, and depression and anxiety both at admission to, and discharge from, inpatient treatment. Nonetheless, an improvement in the scores of all scales except for BIS was found from admission to discharge (see **Table 4**). Despite this improvement, the means of the scores showed that the patients in both groups still showed at discharge symptoms compatible with disturbed eating on the EAT-26 (mean EAT-26 score of both groups >20), depression on the BDI (mean BDI score of both groups >19), elevated anxiety (state and trait) on the STAI, (means STAI scales scores for both groups >40), and disturbed attitudes and behaviors toward the body on the BIS (mean BIS score for both groups <11; **Table 4**). It is unfortunate that we did not have the findings for these scales at follow-up to see whether a normalization in these measures

TABLE 4 | Between-group differences in BMI, eating-related symptomatology, depression, anxiety, and body image at the different study time points.

	Adolescents staying in the day-hospital program for at least 5 months (n = 37)	Adolescents who did not enter the daycare program or did not stay in it for at least 5 months (n = 24)	Time*day-treatment interaction effect	Day-treatment main effect	Time main effect
BMI			$F_{(2, 59)} = 1.432$, $p = 0.237$	$F_{(2, 59)} = 0.045$, $p = 0.833$	$F_{(2, 59)} = 58.051$ $p < 0.001$
Admission to inpatient treatment	M = 16.56, SD = 2.02	M = 16.97, SD = 3.05			
Discharge from inpatient treatment	M = 20.12, SD = 0.81	M = 20.45, SD = 1.67			
One-year follow-up	M = 19.82, SD = 1.61	M = 19.35, SD = 1.72			
Eating attitudes test (EAT-26)			$F_{(1, 60)} = 0.608$, $p = 0.440$	$F_{(1, 60)} = 0.158$, $p = 0.693$	$F_{(1, 60)} = 8.219$ $p = 0.006$
Admission to inpatient treatment	M = 43.19, SD = 18.64	M = 38.83, SD = 15.87			
Discharge from inpatient treatment	M = 31.74, SD = 16.51	M = 32.28, SD = 27.06			
Depression (BDI)			$F_{(1, 60)} = 0.094$, $p = 0.760$	$F_{(1, 60)} = 1.024$, $p = 0.317$	$F_{(1, 60)} = 9.970$, $p < 0.003$
Admission to inpatient treatment	M = 30.68, SD = 14.64	M = 27.24, SD = 13.03			
Discharge from inpatient treatment	M = 24.97, SD = 14.18	M = 20.29, SD = 17.87			
State anxiety (STAI-State)			$F_{(1, 60)} = 1.637$, $p = 0.207$	$F_{(1, 60)} = .176$, $p = 0.677$	$F_{(1, 60)} = 5.337$ $p = 0.025$
Admission to inpatient treatment	M = 57.29, SD = 10.82	M = 54.74, SD = 11.32			
Discharge from inpatient treatment	M = 53.79, SD = 9.42	M = 49.68, SD = 14.15			
Trait anxiety (STAI-Trait)			$F_{(1, 60)} = 1.003$, $p = 0.321$	$F_{(1, 60)} = .394$, $p = 0.533$	$F_{(1, 60)} = 6.223$, $p = 0.016$
Admission to inpatient treatment	M = 56.24, SD = 11.18	M = 56.58, SD = 9.83			
Discharge from inpatient treatment	M = 53.47, SD = 9.74	M = 50.11, SD = 11.70			
Body investment scale (BIS)			$F_{(1, 60)} = 1.155$, $p = 0.288$	$F_{(1, 60)} = 0.653$, $p = 0.423$	$F_{(1, 60)} = 0.000$ $p = 0.991$
Admission to inpatient treatment	M = 11.90, SD = 2.51	M = 11.99, SD = 1.70			
Discharge from inpatient treatment	M = 11.56, SD = 1.81	M = 12.33, SD = 2.44			

BMI, body mass index; EAT-26, Eating Attitudes Test-26; BDI, Beck Depression Inventory, STAI, State Trait anxiety Inventory; BIS, Body Investment Scale.

would be found at that time and whether the improvement would be greater in the patients completing daycare.

DISCUSSION

The aim of the present study was to examine the contribution of daycare treatment, as an add-on follow-up program to inpatient care, to the post-discharge 1-year outcome of female adolescents hospitalized because of an ED. In keeping with our first hypothesis, more adolescents staying in the daycare program for at least 5 months, in comparison with those not entering the program or completing <5 months of treatment, were defined as remitted from their ED according to Strober's (26) criteria. Thus, almost half of the patients defined as completers vs. less than a quarter of the non-completers were able to maintain a stable weight of over 85% of IBW, to have regular menstrual cycles, and not to engage in binging, purging, or restricting eating patterns for at least eight consecutive weeks before the 1-year post-discharge assessment (see **Table 3**). By contrast, the second hypothesis was not confirmed, in that no between-group differences were found at follow-up for BMI, presence of menstruation, and psychosocial functioning. Only adherence to psychotherapy was found to differentiate between the two groups, with more than 90% of the patients

completing daycare treatment continuing with psychotherapy in comparison with two thirds of the non-completers (see **Table 3**). The third hypothesis was also not confirmed, in that no differences were found between patients completing and not entering/not completing our daycare program in BMI and severity of ED-related symptoms, body-related attitudes, and depression and anxiety, both at admission to, and discharge from, inpatient treatment.

Several aspects should be considered in the analysis of our findings. First, although relatively young, the female adolescents with EDs in both groups presented a relatively severely ill population with more than 2 years of illness prior to hospitalization, a high rate of psychiatric comorbidity at admission, likely requiring psychopharmacological intervention, and mean inpatient treatment of more than 6 months (see **Tables 1**, **2**). Second, there were no between-group differences in any of the prehospitalization or inpatient parameters assessed [i.e., age, duration of illness before admission, BMI, duration of inpatient treatment (see **Table 1**), type of ED, ED-related symptomatology, psychiatric comorbidity (according to both DSM-IV diagnoses and self-rating questionnaires), and psychopharmacological treatment (see **Tables 2**, **4**)]. Similarly, there were no between-group differences in BMI and the scores of the self-rating questionnaires at discharge from inpatient treatment (see **Table 4**). Contrary to our third hypothesis, these findings suggest that the patients' and/or their families' choice to complete, or not to enter or complete post-hospitalization daycare program, was not based on the severity of their ED and comorbid psychiatric condition at admission to, or discharge from, inpatient treatment (it should be noted that all patients were offered to continue with daycare treatment if possible by the team of the inpatient department).

Second, most patients in both groups have normal BMI and regular menstrual periods at follow-up. The increase in BMI is achieved during inpatient treatment and maintained at 1-year follow-up, regardless of completing or not attending/not completing daycare treatment. These findings, shown also in our previous study of a different cohort of inpatients (25), are in keeping with follow-up studies showing that the discharge of inpatients with AN when reaching their required weight is associated with lower rate of relapse and rehospitalization in comparison with patients released before reaching their target weight range (54, 55).

In addition, social functioning has been rated as good or very good by a half of the participants, and bad or very bad by the other half of both groups. This somewhat unfavorable finding is of importance, as difficulties in social adjustment may persist in patients remitted from their ED (26), likely interfering with their remission and their overall adjustment (26, 56). Thus, in our previous study, disturbed social functioning at follow-up has been associated with a lower rate of remission, and with higher rates of post-discharge psychiatric comorbidity and rehospitalization (25).

Our results of adequate BMI regardless of not completing daycare program might raise a doubt about the necessity of this treatment in adolescent patients with EDs following long-term inpatient treatment. However, clinical interviews (such as the EDFHI) have been found to be more accurate in the prediction of remission from AN than the sole measure of BMI (25–27, 57–59). Thus, in our study, when looking at a more composite description of remission, a significant difference has been found between former inpatients with EDs treated or not treated in a post-hospitalization comprehensive daycare program for at least 5 months. The finding that almost half of the former inpatients treated in this facility are considered remitted from their ED at 1-year post-discharge using the strict Strober's remission criteria is striking. Other studies assessing the outcome of adolescents with AN following inpatient treatment (as are most of our patients; only 3/61 have been diagnosed with BN), but not providing post-hospitalization daycare, have found a remission rate at 1–2 years follow-up of around 10–30% (8, 9, 26, 60). The findings of the present research add to our previous study, which showed a tendency toward lower rehospitalization rate at 1-year follow-up in those patients treated with daycare. They also add to a previous naturalistic study in adolescents with AN treated in an ambulatory setting, showing that patients terminating treatment prematurely show decreased likelihood of achieving remission (57).

It is of further note that the other variable distinguishing between patients completing and not entering/not completing daycare treatment at 1-year follow-up was the greater percentage of continuation of psychotherapy among the completers (see **Table 3**). This finding may suggest a greater overall motivation to recover and to receive treatment among the completers. It is consistent with the notion that the motivation to recover and the cooperation of adolescents with EDs with their daycare treatment is essential for their remission (13, 15, 20). Thus, Green et al. (61) have shown that high initial motivation to change in daycare-treated adolescents with AN is associated with greater increase in BMI. Moreover, De Jong et al. (62) suggest that ED patients with better recovery outcomes are less likely to drop out of psychotherapeutic treatment vs. more severely ill patients. This finding is of importance, as the inclination of adolescents with EDs is usually to be less cooperative with their treatment (19, 24). The individual therapy of most patients of both groups after discharge is psychodynamic psychotherapy, perhaps because it has been the main individual psychotherapeutic mode during inpatient treatment. It adds to the findings of other daycare programs in patients with AN using psychodynamic psychotherapy as their main treatment, with favorable results (38). Most of the patients not attending daycare also continued with nutritional counseling.

In addition, the continuation of psychotherapy might have been particularly required for those remitted patients included in Strober's category (2), i.e., that although being remitted behaviorally, have still demonstrated maladaptive eating-related preoccupations at follow-up (12 of the 22 remitted patients have been included in this category). This finding is crucial, as the presence of ED-related and body image-related concerns following remission may be associated with a greater risk of relapse (28, 63, 64). It is certainly of relevance in our patients that, although released from inpatient treatment with a normal range BMI, and despite the symptomatic improvement achieved from admission to discharge (except for BIS), have

still demonstrated eating-elated pathology (on the EAT-26) and disturbed attitudes and behaviors toward their body (BSI), as well as comorbid symptoms of depression (BDI) and anxiety (STAI; see **Table 4**). These comorbid symptoms have persisted, although most patients have been treated at discharge with SSTIs.

The overall symptomatic changes found from admission to discharge support the notion that improvement in ED-related symptoms may occur alongside a similar improvement in comorbid depressive and anxiety symptoms (26, 60, 65). Nonetheless, the continuation of both depressive and anxiety symptoms may interfere with the patients' later overall adjustment and increase the risk of ED-related relapse (25, 26, 60, 64, 65) and rehospitalization (66).

Whereas, a difference has been found between adolescents staying in the daycare program and those who have not in the consistency of psychotherapeutic treatment, no between-group difference has been found in the continuation of psychopharmacotherapy, with both groups showing high adherence. At the start, the fact that most adolescents have had evidence of comorbid depression and anxiety symptoms at discharge could have led the patients in both groups to continue with psychopharmacotherapy. Second, this finding is consistent with studies showing that most ED patients seeking treatment request psychopharmacological treatment, rather than psychotherapy (67). Nonetheless, in contrast to our findings, Halmi et al. (58) have found that patients with AN dropping out from treatment tend to abandon pharmacological treatment rather than psychotherapy.

Limitations and Advantages

The findings of the present study should be interpreted with caution and regarded as preliminary because of several limitations. At the start, the size of the sample was relatively small, not enabling us to evaluate whether different types of EDs (AN, BN, or EDNOS) would differentially benefit from post-hospitalization daycare treatment. Second, the noncompleting group represented a heterogenous population, consisting of patients not entering treatment, and other patients not completing 5 months in daycare. Third, as noted earlier, only about a half of the girls filled the self-rating questionnaires at follow-up, not enabling the inclusion of the follow-up data in the ANOVA with repeated measures analysis. Fourth, the study was naturalistic rather than controlled with respect to the patients continuing or not entering/not continuing with post-hospitalization daycare. Nonetheless, as such, it likely resembled real-life conditions of treatment. Fifth, in contrast to other studies (3, 8, 9), inpatient treatment was relatively long, likely influencing the condition of the patients also at the daycare facility. Moreover, the daycare program itself was relatively long in comparison with other studies (3, 13, 61, 68–70). Nevertheless, as such, it provided an opportunity to assess the merit of long-term structured highly supervised inpatient and daycare programs in increasing the overall favorable outcome of the ED in relatively severely ill adolescents. Furthermore, short-term daycare programs were found to be associated with only modest weight gain (13, 61, 70) in comparison with the increase and maintenance of a mean BMI of around 3.4 kg/m^2 from admission to 1-year follow-up. Sixth, the relatively long hospitalization period might have interfered with the social functioning of about half of our patients at follow-up, although both inpatient and daycare treatment were specifically geared toward its improvement. In addition, the follow-up period in our study was relatively short. Therefore, we plan to continue with a longer follow-up of our sample. Last, social functioning was assessed with open-ended questions rather than with a standardized tool, and we did not evaluate occupational functioning, as most of our patients in both groups returned to their school following discharge. This paradigm was also used in a previous study of our group (25).

Our study has, nevertheless, some important advantages. First, it adds to the limited literature about the clinical relevance of post-hospitalization halfway out daycare treatment for adolescent ED. Second, we have used a prospective longitudinal design, employing adequate clinical measures and structured follow-up assessment. Similar to some other studies (26, 27, 59), we have used comprehensive interview-based assessments of remission from an ED. Third, in contrast to many studies using self-report of weight, our patients have been weighed at the follow-up assessment. Last, all follow-up interviews have been conducted face to face.

Recommendations for Future Research

First, future research should be conducted in larger populations and for longer periods, to find out whether the favorable 1-year post-hospitalization outcome of adolescents with EDs treated in a model of long inpatient and daycare treatment would be replicated in a larger sample and be maintained also at longer follow-up. Nevertheless, as the long-term outcome of an ED in adolescents is usually more favorable than the short outcome (26, 57, 59), we can expect the continuation of the better outcome of our daycare patients also in the long-run. Second, this research should be controlled, rather than naturalistic, as has been the case in some other studies of post-hospitalization daycare program (3). Third, our findings suggest that despite the recommendations not to release adolescent inpatients with EDs before reaching and maintaining their target weight, and before becoming asymptomatic regarding their ED behaviors (54, 55), the use of an adequate post-hospitalization daycare program might enable an earlier discharge from inpatient treatment. This is line with Herpertz-Dahlmann et al. (3) and Hay et al. (71) suggesting that daycare program after short inpatient care in adolescent patients with non-chronic AN seems no less effective than inpatient treatment for weight restoration and maintenance during the first year after admission. Fourth, our findings suggest that post-hospitalization daycare programs should be focused also on the management of comorbid psychiatric disorders and overall psychosocial functioning. Last, previous studies have emphasized the impact of familial cooperation in daycare programs on treatment outcome (7, 68, 72). Thus, in a setting like an adolescent daycare program, which is likely less structured than inpatient treatment, cooperation with parents becomes even more critical and should be assessed in future studies. In this respect, parents in our setting have often stated that the most meaningful work for them has begun following the

discharge from inpatient treatment, when their daughters have returned home.

CONCLUSION

The aim of the present study was to examine the contribution of a halfway out daycare program to the treatment of adolescents hospitalized because of an ED. Our findings indicated that a good post-discharge 1-year outcome from the ED was achieved when using a single criterion such as weight, even in former patients not continuing with daycare treatment. By contrast, when using more comprehensive criteria for the definition of remission such as the Strober's criteria (26), relating, at least in part, also to ED-related preoccupations and attitudes, less than a quarter of former inpatients not entering/not completing daycare program achieved remission in comparison with almost a half of the completers. This difference might be attributed, in part, to a greater inclination of completers to continue with psychotherapy following discharge.

DATA AVAILABILITY STATEMENT

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

ETHICS STATEMENT

The studies involving human participants were reviewed and approved by Helsinki Committee, Sheba Medical Center, Tel Hashomer, Israel. Written informed consent to participate in this study was provided by the participants' legal guardian/next of kin.

AUTHOR CONTRIBUTIONS

LL-C, AY, and DS contributed to the conception, design of the study, and were responsible for the organization of the article. All authors contributed to the follow-up of the patients, the analysis of the data, read and approved the final draft of this article.

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Assessing Family Functioning Before and After an Integrated Multidisciplinary Family Treatment for Adolescents With Restrictive Eating Disorders

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The present study presents an investigation of family functioning in the families of adolescents with severe restrictive eating disorders (REDs) assessed before and 6 months after a multidisciplinary family treatment program that combined psychodynamic psychotherapy, parental role intervention, and triadic or family-centered interventions. Nutritional counseling and neuropsychiatric monitoring of the overall treatment and care process were also provided. Family functioning was assessed using the clinical version of the Lausanne Trilogue Play (LTPc), a semi-structured procedure for observing family dynamics, previously validated for this patient population. The LTPc is divided into four phases. In phase 1, the mother interacts with the patient while the father assumes the role of observer. In phase 2, the father plans an activity with the patient while the mother observes. In phase 3, all the family members interact. Finally, in phase 4, the parents talk while the adolescent observes. A significant change emerged in family functioning after the treatment, but only for the interactive phase 2, when the father is required to interact with the daughter while the mother silently observes. The results of this study suggest that a relatively brief multidisciplinary treatment program may significantly improve family functioning in the families of patients diagnosed with severe REDs. Although appropriate clinical trials are needed to further test the efficacy of this treatment, the results also reinforce the concept that treatment programs targeting the individual patient and both the parents should be a first-line approach in adolescents with severe REDs.

Keywords: adolescence, eating disorders, family functioning, Lausanne Trilogue Play, family therapy, multi-professional treatment

INTRODUCTION

Restrictive eating disorders (REDs) are a heterogeneous group of potentially severe psychopathological conditions that have shown an increased incidence among young people in recent years, especially in the high-risk group of 15- to 19-year-old girls (1–3). REDs are thought to have a multifactorial etiology involving individual vulnerability factors influenced by biological, psychological, environmental, and family-related factors (4–8).

Among the latter, previous research has highlighted that family relations are frequently dysfunctional in the families of individuals affected by REDs (9–11). Cerniglia and his group (12), for example, underlined difficulties in respecting interpersonal boundaries, poor tolerance of conflict, and low satisfaction. Use of the clinical version of the Lausanne Trilogue Play (LTPc) (13)—a semi-structured method for observing family dynamics—may help to identify specific characteristics of a family's triadic interactions that may be linked to the patient's clinical condition. Previous LTPc studies have in fact highlighted dysfunctional interaction patterns in the families of individuals with REDs (14–16). For example, fathers were found to experience specific difficulties in maintaining a scaffolding role in relation to their daughters' development, and in providing them with support and guidance (14, 15, 17). This is line with current literature (18, 19) showing that fathers tend to disengage from caregiving. Accordingly, it has been suggested that greater affective engagement and participation in the healthcare process on the part of fathers should be encouraged (20, 21). During the last decade, the focus of family functioning research in this specific area has shifted away from the role of family-related factors in maintaining REDs to enhancement of protective family factors that may improve interventions (22). In these families, parents often tend to adapt their own lives to the RED symptoms of their daughters; for example, they may accept meal rituals in order to avoid conflicts (23). Not surprisingly, therefore engagement of the whole family in the adolescent's treatment and care process is now recognized as a key prognostic factor (4, 7, 17, 24–29).

Family-centered approaches [e.g., family-based therapy (FBT)] (30, 31) are among the most effective (type I evidence) interventions for the psychiatric care of patients with REDs (20, 32); in particular, they are considered the first-line treatment for severe cases in adolescence (25, 33, 34). Recently, FBT has also been found to be effective in the treatment of avoidant/restrictive food intake disorder (ARFID) (35). Nonetheless, the efficacy may be partial when family members are not properly engaged in the treatment and care process (26, 27), and a significant number of patients may not respond well to FBT. Another family therapy approach that has shown good evidence of effectiveness is the psychodynamic model based specifically on intrafamily relationships developed by the French group at the Montsouris Institute in Paris (18). This model focuses more on psychological issues than on eating behavior symptoms. It has been shown to be effective in reducing feeding symptoms and improving general psychopathological functioning, as measured by the Morgan–Russell Outcome Assessment Schedule (MROAS) (36) adapted for adolescent patients (37). These results suggest that improving family functioning may be an intermediate goal, important in promoting better clinical outcomes in the adolescent herself (17, 38, 39). Individual approaches, such as adolescent-focused therapy (40), can also be effective when patients are affected by more severe psychopathological conditions and when their autonomy is severely compromised. Reinstating adaptive psychological development trajectories should be considered a pivotal aim to target within the recovery process (39, 41). However, when family relationships are highly dysfunctional, individual psychotherapy can achieve only partial results; dysfunctional parenting may negatively impact the treatment and care process of adolescents with REDs, and may represent a significant obstacle to the effectiveness of individual psychotherapy (18, 41).

On the basis of these premises, and with a view to identifying a suitable treatment for patients with severe REDs, a multidisciplinary family therapy approach integrating the models by Godart et al. (18) and Fitzpatrick et al. (40) was developed at two university tertiary care services in Italy. The treatment program we developed combines principles from various models of intervention (i.e., psychodynamic psychotherapy, parental role intervention, and triadic or family-centered interventions). We also provided nutritional counseling and neuropsychiatric monitoring of the overall process, including the effects of any pharmacological therapy. The aim of the present study was to look for significant pre-post differences in family functioning in the families of adolescent patients with severe REDs who underwent a 6-month (± two) multidisciplinary treatment program. Family functioning was assessed before and after the treatment using the LTPc procedure (13). Greater understanding of how family functioning may improve after a relatively brief multidisciplinary family treatment program may further inform effective interventions for these patients and their families. LTPc score changes are related to changes in family members' abilities to get involved in the game, to adhere to their assigned role in the different phases of it (and therefore, when necessary, to stand back), and to support others' ideas. Score changes may also be linked to greater emotional participation and exchange, as well as improved gaze triangulation.

MATERIALS AND METHODS

Population

Sixty-seven families of adolescent patients diagnosed with REDs were assessed for eligibility between July 2017 and October 2020 at the Child Neurology and Psychiatry Unit of the IRCCS Mondino Foundation (Pavia, Italy) and at the Child and Adolescent Neuropsychiatry Unit of the Bambino Gesù Children's Hospital (Rome, Italy). Patients were considered eligible for the study if they were 11–18 years old and if they had a diagnosis of RED (including restrictive and binge-eating/purging subtypes of anorexia nervosa, ARFID, atypical anorexia nervosa, other specified feeding or eating disorders with restrictive characteristics). Diagnoses were made according to the Diagnostic and Statistical Manual of Mental Disorders (DSM-5) criteria (42). Patients were excluded from the study if they presented at least one of the following: psychotic disorders, intellectual disability, neurological disorders (e.g.,

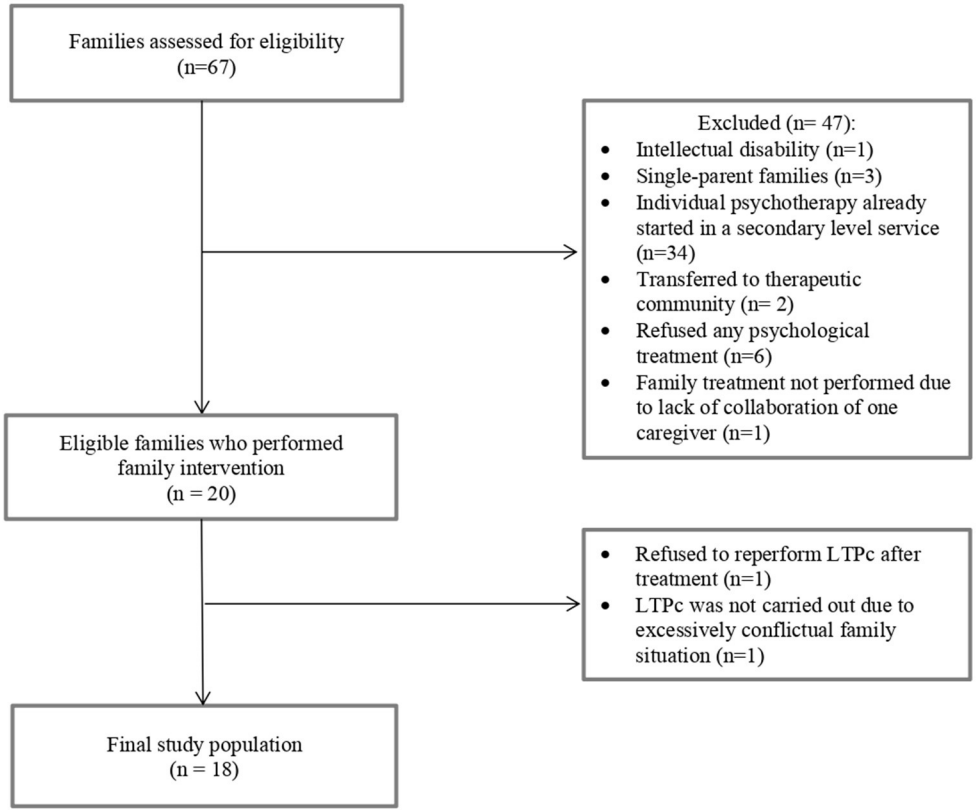

FIGURE 1 | Flow chart of the study population.

epilepsy), or other psychiatric comorbidities with an organic substrate (e.g., celiac disease, Wilson's disease). Single-parent families and individuals partially unable to understand Italian were also considered ineligible. Finally, to avoid interrupting or modifying ongoing therapies, we also excluded patients who were already receiving psychotherapy at a secondary-level service. The study was approved by the Ethics Committee of the Policlinico San Matteo in Pavia, Italy (P-20170016006). All the enrolled patients and their parents provided written informed consent to participate in the study. **Figure 1** illustrates the flow chart of the participant selection process.

Procedures

The patients were interviewed by a trained child neuropsychiatrist, who collected clinical and socio-demographic data. To confirm the RED diagnosis and verify the presence of any comorbidities, the semi-structured DSM-based K-SADS interview (43) was administered to the patients and their parents. Furthermore, the absence of intellectual disabilities was verified through administration of the age-appropriate Wechsler intelligence scale: WISC-IV (44) or WAIS-IV (45). To evaluate family functioning, the LTPc procedure (13) was used twice, before (T_0) and after the treatment (T_1). Every LTPc session, performed in a dedicated room, was videotaped and subsequently coded independently by two raters, who had first received specific training.

Treatment

The treatment lasted 6 ($\pm$2) months and involved a multidisciplinary team (**Figure 2**), as the main international guidelines suggest that the care of patients affected by REDs should be entrusted to a team of medical, social, and rehabilitation healthcare professionals (24, 46).

Our multidisciplinary team comprised an expert neuropsychiatrist, a neuropsychiatry resident, psychotherapists, a psychiatric rehabilitation specialist, an educator, and a nurse.

The integrated treatment model (see **Supplementary Material**) consisted of at least 24 sessions of psychodynamic psychotherapy for the adolescent patient, scheduled once a week and conducted in an individual or group setting (40, 47, 48), at least 12 parental role intervention sessions (49, 50), and at least 12 treatment sessions focusing on triadic or family interaction. The parental role sessions took place every other week, alternating with the triadic or family interventions. The first session with the parents always involved the use of video feedback, which allows parents to work directly on their own limits and resources, favors the development of the ability to reflect on the relationship (mentalization), and significantly improves the therapeutic alliance (51–53).

Finally, nutritional counseling was provided, as well as neuropsychiatric monitoring of the progress of the treatment, to allow introduction or adjustment of pharmacological therapy as needed, as in the case of comorbid depressive or anxious

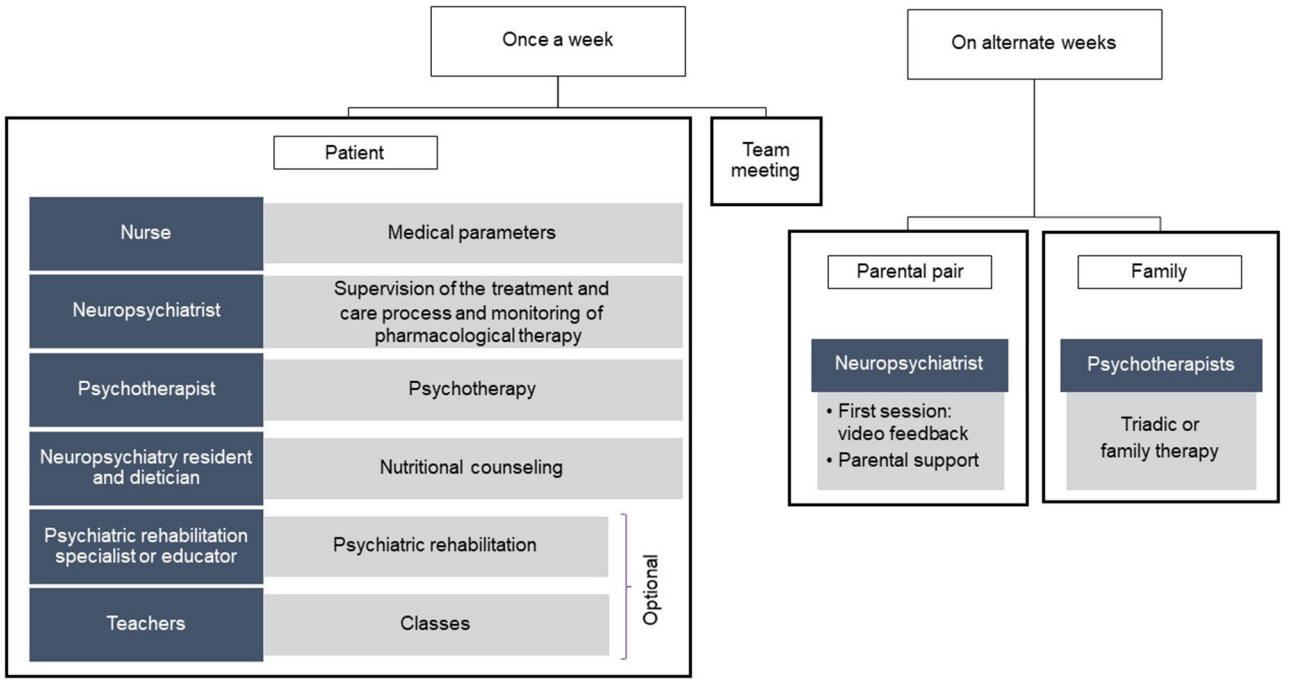

FIGURE 2 | Overview of the multi-disciplinary intervention.

symptoms. Further details on the intervention are reported in **Supplementary Material**.

The LTPc: Procedure and Coding

The LTPc is a standardized and well-validated observation-based method used in clinical and research settings to assess dysfunctional patterns in triadic or family interactions (13). The procedure requires parents and daughter to pretend that they are planning a weekend where the adolescent daughter stays home alone. The pretend play is divided into four phases. In phase 1, the mother interacts with the patient while the father assumes the role of observer. In phase 2, the father plans the activity with the patient while the mother observes. In phase 3, all the family members interact with each other. Finally, in phase 4, the parents talk together, while the adolescent assumes the role of observer. The entire process is videotaped and lasts ∼15 min.

The LTPc coding system used in this study has been explained in previous publications (14, 52, 54, 55). Essentially, it considers four aspects of interaction (i.e., participation, organization, focal attention, affective contact), which are rated, in each phase, on a three-point Likert scale (0 = dysfunctional; 1 = partially functional; 2 = functional). On this basis, descriptions of each family member's interactive contribution and of the overall family functioning are obtained. The total family score, which identifies one of four types of family alliance, is the sum of the scores recorded by each family member in each phase (13).

Statistical Analyses

The statistical analyses were conducted using IBM SPSS Version 21 for Windows. Descriptive statistics were calculated for each variable. To test for stability, we adopted the mean-level change method (56) and rank-order consistency method (57). To assess mean differences in LTPc scores, separate paired sample *t*-tests were computed for each LTPc phase (1, mother-daughter; 2, father-daughter; 3, triadic interaction; 4, parental pair).

RESULTS

Table 1 reports the descriptive statistics for this sample. Eighteen 11- to 17-year-old girls (M = 14.64 years, SD = 1.47) who were being cared for in day-hospital settings participated in the study with their parents. Eleven girls came from the Child Neurology and Psychiatry Unit of the IRCCS Mondino Foundation in Pavia (61.11%) and seven from the Child and Adolescent Neuropsychiatry Unit of the Bambino Gesù Children's Hospital in Rome (38.89%). Two of the 18 pairs of parents were divorced (11.10%). The average duration of symptoms prior to clinical referral was 13.32 months (SD = 11.33). The severity of the patients' clinical conditions was assessed using the MROAS and coded as: 0 = good outcome, 1 = intermediate outcome, and 2 = poor outcome. These outcomes were distributed as follows: 25.4% good, 44.1% intermediate, and 30.5% poor. At baseline (T_0), the average percentage of weight loss reported by the patients was 22.02% (SD = 11.15), and their average BMI was 13.1 kg/m^2 (SD = 18.74) (range: 11.91–32.11 kg/m^2). The median pre-treatment percentile BMI was 1.2. Within the sample, 28 of 67 patients were using medications before T_0 (i.e., 6.9% were taking antipsychotics, 58.6% antidepressants, 6.9% benzodiazepines,

TABLE 1 | Descriptive statistics: patients' baseline diagnoses and therapies both before and during the multidisciplinary treatment program.

Diagnosis	*N*	%
Eating disorders		
Anorexia nervosa	13	72.22
Another restrictive eating disorder	5	27.78
Schizophrenia		
No	17	94.44
Yes[a]	1	5.56
Depressive disorders[b]		
No	8	44.44
Yes	10	55.56
Anxiety disorders[c]		
No	17	94.44
Yes	1	5.56
Personality disorders		
No	16	88.89
Yes	2	11.11
Therapies in place before T_0	***N***	**%**
Patient		
No	2	11.11
Yes	16	88.89
Parents		
No	4	22.22
Yes	14	77.78
Triadic or family therapy		
No	4	22.22
Yes	14	77.78
Interventions completed at T_1 (all sessions completed)	***N***	**%**
Patient		
No	0	0.00
Yes	18	100.00
Parents		
No	2	11.11
Yes	16	88.89
Triadic or family therapy		
No	4	22.22
Yes	14	77.78
Dietary program		
No	2	11.11
Yes	16	88.89

[a] *This diagnosis was made after enrollment in the study.*
[b] *Major Depressive Disorder, or Other Specified Depressive Disorder, or Unspecified Depressive Disorder.*
[c] *Separation Anxiety Disorder, or Other Specified Anxiety Disorder, or Unspecified Anxiety Disorder.*

and 27.6% a combination of antipsychotics and antidepressants). The total family score in phase 2 (father–daughter) showed a statistically significant positive change from T_0 to T_1 (see **Table 2**). No significant differences emerged for the other LTPc phases.

DISCUSSION

The aim of the present study was to assess post-treatment changes in family functioning among families of adolescents with severe REDs who underwent a multidisciplinary 6-month treatment program. We observed a significant change in the family functioning score for the LTPc phase 2, in which the father interacts with his daughter while the mother acts as a silent observer. This suggests that the fathers, when playing an active role, could improve dyadic family functioning. This finding is consistent with the idea, emerging from previous pioneering studies, that encouraging paternal involvement can improve patient outcomes (20, 21). In the families of girls affected by REDs, fathers tend to be disengaged from the caregiving role. Although this may be merely a defensive reaction to their daughter's illness, it can lead to a less affective bond and influence the quality of family interactions and the patient's outcome (15, 58). It can be speculated that the treatment model here proposed had more effect on the fathers than on the other members of the triad. In line with the current literature (59, 60), the results of our study therefore support the clinical indication of promoting affective engagement and participation of all family members, including fathers, in the care of adolescent patients, especially those with REDs (18, 19). A growing body of literature indeed suggests that therapeutic approaches to severe REDs in adolescence should include the promotion of paternal—and not only maternal—participation (20, 21, 61), in order to enhance the parents' alliance and improve the quality of triadic interactions. Paternal involvement and warmth have been shown to be fundamental for patient outcomes, and fathers who tend to draw back and remain emotionally and concretely detached need to be encouraged and supported (18, 20, 21, 62).

We did not find a similar change in maternal interactive behavior after the treatment. As others have pointed out (63–65), mothers are usually more involved in their daughters' afflictions. It is likely that a more prolonged family treatment would be needed in order to change dysfunctional interactive patterns in mothers. However, it can also be speculated that when fathers prove able to play a more active role, this may be due in part to mothers managing to give them more space (15).

We also found no post-treatment change in the functioning of the parental pair. This is in line with the fact that our treatment model, based on a psycho-pedagogical approach, was designed to strengthen the parental role rather than address relational dynamics (such as conflict and conflict management) between the parents themselves (66). Consequently, we were not surprised that the functioning of the parental pair remained unchanged after the treatment.

Finally, the treatment was not found to change triadic functioning. We can assume that a 6-month treatment is not long enough to modify interactions at the triadic level.

The lack of impact of the treatment on triadic functioning could also be explained by the fact that dyadic relations were highly impaired in our sample of adolescents; these were indeed patients whose psychopathological conditions were severe enough to warrant intervention by tertiary-level services.

TABLE 2 | Descriptive statistics for the LTPc phases and mean comparisons.

	T_0		T_1		Mean comparisons		
LTPc scores	**Mean**	**SD**	**Mean**	**SD**	***t***	***p***	η_p^2
Phase 1 (mother-patient)	5.94	1.43	6.17	1.58	−0.58	0.57	0.019
Phase 2 (father-patient)	5.61	1.88	6.56	0.92	−2.36	0.03*	0.247
Phase 3 (mother-father-patient)	4.00	2.95	3.83	2.85	0.17	0.87	0.002
Phase 4 (mother-father)	5.22	2.05	4.78	2.65	0.77	0.45	0.034

The family members involved in each LTPc phase are reported in brackets.
*Significance: *p < 0.05.*

This study has some limitations. First, the relatively small sample size (due to the need to include only triads with complete data and to the exclusion of patients already receiving psychotherapy) limits the generalizability of the findings. Future research in larger samples is needed. Second, we focused on REDs because the families of patients affected by these conditions frequently show dysfunctional family relations (15, 67). Future studies should investigate whether our results extend to other eating disorders. Finally, in line with the descriptive aim of this study, no control groups were included. Future research is warranted to address the relative effect of this multidisciplinary treatment program compared with care as usual and with other family- or patient-centered interventions.

CONCLUSIONS

Since the psychopathological organization underlying REDs can vary, the therapeutic approach should be tailored to the specific features of the single patient. In particular, in the most severe cases, particular attention should be paid to parental (dyadic) and triadic or family interactions, but psychotherapy for patients only (individual or group) may also be very useful. We strongly suggest that a flexible therapeutic approach allowing integrated interventions (psychodynamic psychotherapy for patients, support for the parental role, and triadic or family intervention) might better meet the needs of the most impaired patients referred to tertiary care services. The LTPc may help clinicians to improve their understanding of dysfunctional family interactions and even uncover potential protective factors that might be further exploited to enhance the efficacy of the family intervention in RED patients (15). In addition, performing the LTPc after the treatment may assist the clinical decision-making process. For example, its findings may support the decision to continue with the current treatment or allow the treatment to be tailored to the needs of the family, perhaps suggesting a less-intensive program of treatment in order to obtain a better balance of family psychological and economic resources.

DATA AVAILABILITY STATEMENT

The raw data supporting the conclusions of this article will be made available upon reasonable requests to the corresponding author.

ETHICS STATEMENT

The present study was reviewed and approved by Ethics Committee of the Policlinico San Matteo in Pavia, Italy (P-20170016006). Written informed consent to participate in this study was provided by the participants' legal guardian/next of kin.

AUTHOR CONTRIBUTIONS

MM designed the study. MO, CR, MCr, MCC, and VZ collected data. LP conducted statistical analyses. MCh and RB provided scientific supervision. All authors contributed to the drafting of the manuscript and agreed on the final version to be submitted for publication.

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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.2021.653047/full#supplementary-material

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MINI REVIEW
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The Interpersonal-Psychological Theory of Suicide to Explain Suicidal Risk in Eating Disorders: A Mini-Review

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Suicide is a major cause of death in Eating Disorders (EDs) and particularly in anorexia nervosa (AN). The aim of the present mini-review was to summarize the literature focusing on the interpersonal-psychological theory of suicide (IPTS) by Thomas E. Joiner, as applied to explain suicidal risk in EDs. PubMed database was used to search articles focused on IPTS in EDs; 10 studies were eventually included. The majority of the included studies reported data from the same sample, even though the hypotheses and analyses for each study were unique. The investigated suicidal outcomes were suicidal ideation (SI) (40%), non-suicidal self-injury (10%), suicide attempt (40%) and suicide (10%). In ED patients Perceived Burdensomeness (PB) may play an important role, especially regarding SI risk. ED patients may feel like a burden to their close ones, and actually some of the ED symptoms may be an expression of anger and hate against the self. Overall, currently available research has supported some IPTS derived predictions (i.e., ED symptoms may increase PB and thereby SI), but not others (i.e., the elevated suicide rate in AN may be due to higher acquired capability for suicide). Further research on IPTS tenets as well as on other theoretical perspectives and constructs (e.g., interoceptive awareness), hopefully with a longitudinal design and adequate follow-up duration, might allow a more thorough understanding of the complex topic of suicidal behavior in ED patients.

Keywords: suicide, eating disorders, thwarted belongingness, perceived burdensomeness, acquired capability for suicide

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INTRODUCTION

Every year 800,000 people die by suicide worldwide (1). Even though the phenomenon may be underestimated, suicide has been suggested to be a major cause of death in Eating Disorders (EDs) (2), and it is likely the first or second cause of death in patients with anorexia nervosa (AN) (2–5). Recently, also suicide attempts (SA) were found to be a major issue in EDs, especially in binge-purging subtypes, i.e., in bulimia nervosa (BN) (21%) and binge-purging AN (AN-bp) (25.6%) compared to restrictive AN (AN-r) (9–10%) (6).

Some shortcomings of the existing literature about the topic should be underscored (4, 5): the majority of the available research is cross-sectional or retrospective, which leaves the timing

of the mortality risk unclear; virtually all research has been conducted using the Diagnostic and Statistical Manual of Mental Disorders-IV (DSM-IV) definitions, hence the impact of changes to ED diagnoses in DSM-5 on prevalence rates of suicidal behavior has still to be better understood. Last, the high rate of comorbid psychopathology and of diagnostic crossover in EDs may also have affected the reported relationships between EDs and suicidal behavior.

Despite these shortcomings, a higher frequency of suicide is usually found in AN (4), while a higher one of SA is found in BN (6). One hypothesis to explain this discrepancy may be based on the fact that, compared to BN, AN patients may be more compromised from a medical standpoint (3), hence it is possible that, in their case, a SA eventually leads to suicide, while it would not in "healthier" BN patients, notwithstanding the underlying intention to die. In any case, it is likely that the meaning of suicidal behavior is different in AN and BN. Indeed, it is more likely that for AN patients the desired outcome of a SA is death, as they usually show higher intent and lethality, similar to suicidal individuals. On the other hand, for BN patients SA may represent an expression of multi-impulsivity (7) or an attempt to achieve affect regulation. From this standpoint, the focus of a suicide-prevention approach should be on meaning in life for AN, and rather on affect regulation skills and impulsivity for BN (3, 4).

Some at-risk features for SA and suicide have been identified in ED patients, such as purging type, chronicity of disease, low Body Mass Index (BMI) for AN, comorbidity with major depression, obsessive symptoms, drug abuse (2–5). The role of major depression has been supported quite consistently across studies (2–6, 8), as the one of comorbid alcohol/drug abuse (2–6, 8, 9) and binge/purging subtype (2, 3, 6, 8). Affective problems and/or dysregulation (4–6, 8–10) and impulsivity (2, 6, 8–10) may be relevant, as well. Other factors include comorbid anxiety, comorbid cluster B personality disorders, obsessive traits, need for control, perfectionism, self-criticizing cognitive style, poor self-esteem, interoceptive deficits, trauma-related issues (2–6, 8–10).

Briefly, although it is acknowledged that EDs are associated with suicidal ideation (SI), SA, and suicide death, little is known about the dynamic interplay between these conditions. In other words, it is possible that EDs either directly or indirectly contribute to suicidality, as well as the reverse. It is also possible that EDs and suicidality share common biological and psychological dysfunctions that eventually lead a given individual to be more likely to experience both (5). Furthermore, a clear approach to suicidality in EDs through the lens of a specific theory of suicide is still lacking, even though suggestions have been proposed about the relationship between ED symptoms, death and self-inflicted death. The self-destructiveness and the constant attacks against the body which are implicit and typical in ED behaviors have to do with death, either with a drive toward it or with an all-powerful denial of it, in the struggle to exist within the narrowest parameter (11). Bruch underscored that as AN patients feel guilty for surrendering to the gross and vulgar demands of the body, they may choose and want to live as the self, but to die as the body (12). It has been argued that AN patients are not attracted by death, but rather they are seeking control over their life in the struggle to gain a sense of identity. Anyway, since they fail in really achieving such control, the ED symptoms represent a latent suicidal act as the result of feeling depressed, while maintaining an illusion of "false" control (12–17).

The Interpersonal-Psychological Theory of Suicide (IPTS), introduced by Thomas E. Joiner in 2005 (18), is aimed at explaining the differences in individual suicidal behaviors. The three constructs underlying the IPTS, which interact with each other, are the following (19): Thwarted Belongingness (TB) and Perceived Burdensomeness (PB) would predict SI, while the Acquired Capability (AC) for suicide would be linked to suicidal behavior. For a lethal SA, according to this theory, all three domains should be present; the fact that they are generally co-occurring only in a subgroup of individuals is the reason why the lifetime suicide rate is lower than that of ideation, which is present in 15% of the population (20, 21).

The TB construct describes a sort of "barrier" preventing some individuals to feel satisfied with their relationships, for the absence of support networks or because they do not feel a real connection with others, despite having frequent contacts. Two specific variables are present in TB: loneliness (e.g., to feel disconnected from others), and the absence of reciprocal care (e.g., neither to support nor to receive support from others). The PB construct describes a feeling of being so incompetent and unable to offer a meaningful contribution to the relationship and that one's existence represents a burden to anyone, to the point that her/his death has more value for others than her/his life. Two variables have been described also for PB: liability (e.g., the feeling that one's own death is worth more than the life to others) and self-hate (e.g., hate against the self). The AC construct is linked to the fact that some individuals, through a history of repeated painful experiences, are able to get used to the fear and pain involved in self-harm, becoming more fearless (if the fear actually diminishes), more courageous (if the fear persists but is tolerable) or both (18). AC includes two variables as well: fearlessness about death (FAD) and elevated physical pain tolerance.

TB and PB are assessed with the Interpersonal Needs Questionnaire (INQ) (22) while AC is assessed with the Acquired Capability for Suicide Scale (ACSS) (23).

The aim of the present mini-review was to summarize the literature findings where the IPTS was tested to explain suicidal risk in any ED.

METHODS

Search Strategy

A literature search was performed to identify studies focusing on the IPTS in EDs. PubMed database was used to search articles using the following search terms: [(Joiner) OR (interpersonal theory of suicide) OR (thwarted belongingness) OR (perceived burdensomeness) OR (acquired capability) OR (capability for suicide) OR (fearlessness about death) AND (eating disorders)].

Following the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) (24) flowchart, studies selection was made on February 28th 2021, screening titles first, then abstracts and eventually the full texts of the articles.

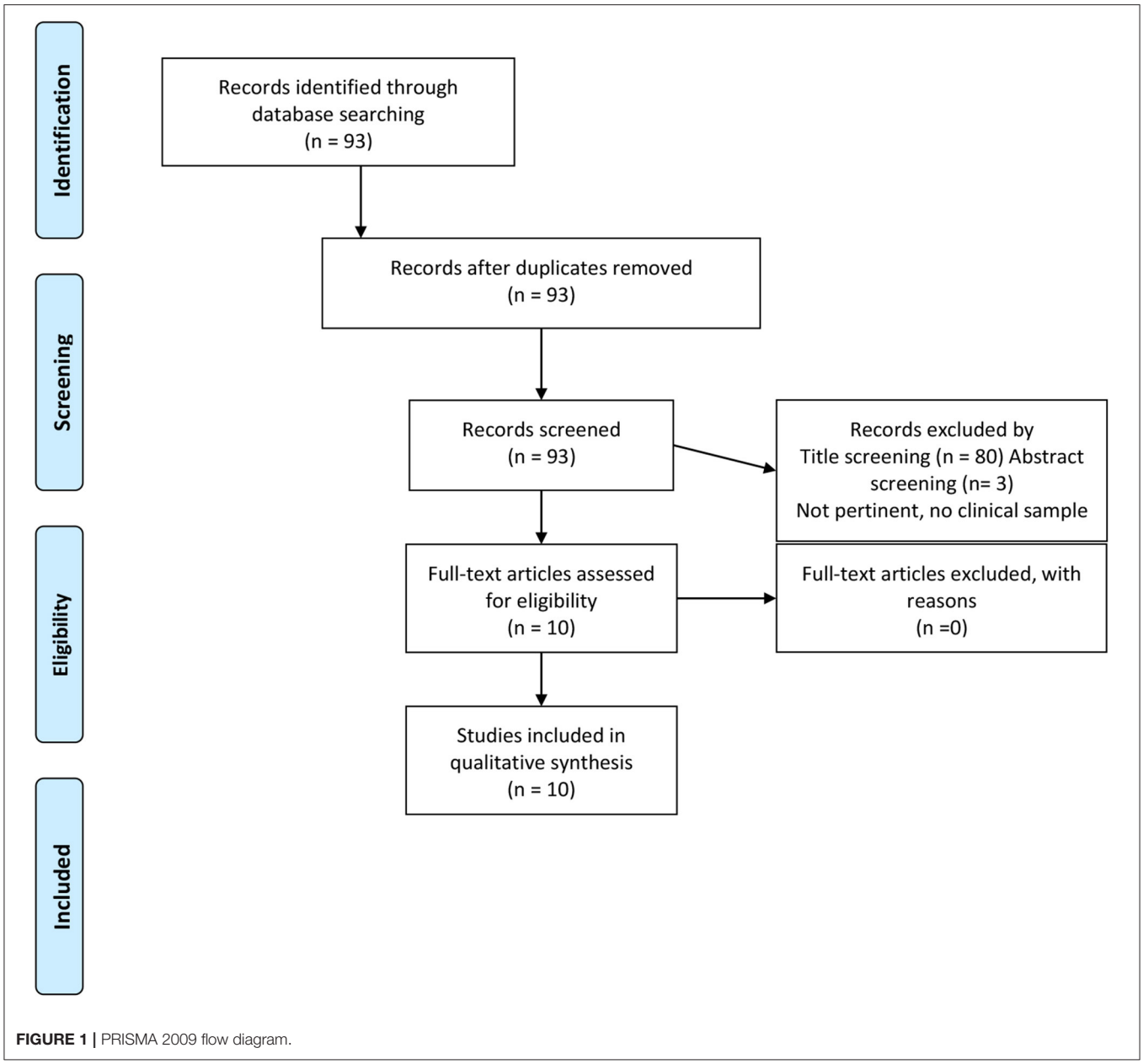

FIGURE 1 | PRISMA 2009 flow diagram.

Two independent reviewers (CG and RC) assessed the articles identified by the search string; a third reviewer (PZ) resolved any discrepancy that emerged between the reviewers. See **Figure 1** for details.

Studies were included if (1) they examined any type of ED; (2) they focused on IPTS; (3) they focused on any form of suicide-related outcome: SI, non-suicidal self-injury (NSSI), SA, and suicide; (4) they were written in English.

Studies were excluded if: participants were not ED patients.

The reference lists of the identified studies and reviews were checked as well for further relevant articles.

The following data were extracted and tabulated: first author name and year of publication, country, study design, main aim, suicidal outcomes, sample features (such as gender, age, BMI, diagnosis), methods (scales), and main findings.

Study quality was assessed, as appropriate, with the Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) (25) and with the Quality Assessment Tool for Case Series Studies (26).

RESULTS

Figure 1 shows the study selection procedure: titles, abstracts and full texts were excluded in case they were not pertinent to the review topic or did not assess a clinical sample. **Table 1** includes

TABLE 1 | Main features of the studies included in the mini-review (listed in alphabetical order).

Study	Country	Design	Aim	Suicidal outcome	Sample features	Methods	Main findings
Bodell et al. (29)	USA	Naturalistic longitudinal study	To examine between- and within-person associations between burdensomeness, belongingness and SI	SI	97 females (*N* = 78 residential treatment; *N* = 17 partial hospitalization) DSM-5 diagnoses: *N* = 33 AN *N* = 27 BN *N* = 29 OSFED *N* = 1 BED *N* = 7 USFED Mean age 26.7 ± 7.6	Baseline assessment: EDE-Q; BDI-II Weekly assessment across 12 weeks of treatment: DSI-SS; INQ	Patients with higher levels of perceived burdensomeness reported higher mean symptoms of SI. Neither between- nor within-person effects of belongingness were associated with SI. Levels of burdensomeness, but not thwarted belongingness, significantly predicted SI at the subsequent week. SI itself predicted burdensomeness.
Dodd et al. (31)	USA	Cross-sectional	To assess the association between interoceptive deficits, NSSI and SA. To investigate the role of ACS facets (FAD and pain tolerance) as links in the association between NSSI and SA, and between interoceptive deficits and SA	NSSI, SA	*N* = 96 ED patients DSM-5 diagnoses: *N* = 34 AN *N* = 27 BN *N* = 35 OSFED Mean age 26.8 ± 7.9 *N* = 70 previous NSSI *N* = 26 at least one lifetime SA	EDI-3 Interoceptive Deficits subscale FASM ACSS FAD subscale Subjective pain tolerance (one Likert-type item)	Significant association between interoceptive deficits and NSSI; between interoceptive deficits and SA; between interoceptive deficits and FAD. Significant association between NSSI and both FAD and pain tolerance. Significant association between previous SA and pain tolerance, but not FAD. Indirect relation between interoceptive deficits and SA; largely mediated by NSSI, FAD and pain tolerance. Limited support for IPTS-derived hypotheses.
Forrest et al. (33)	USA	Cross-sectional	To determine whether current and lifetime ED symptoms were positively related to SI through thwarted belongingness and perceived burdensomeness in ED patients	SI	*N* = 100 ED patients from residential (*N* = 80) or partial hospitalization ED treatment DSM-5 diagnoses: *N* = 34 AN *N* = 27 BN *N* = 30 OSFED *N* = 1 BED *N* = 8 USFED Mean age 26.92 ± 7.86	EDE-Q EDI-3 Body Dissatisfaction Scale EPPES BDI-II DSI-SS INQ	First model (current symptoms): current body dissatisfaction and fasting were related (indirectly) to increased SI through higher burdensomeness (controlling for depression). Second model (lifetime symptoms): lifetime fasting was related (indirectly) to increased SI through higher burdensomeness (controlling for depression). Current and lifetime ED symptoms, as body dissatisfaction and fasting, may increase burdensomeness. Body dissatisfaction and fasting were positively related to thwarted belongingness, which anyway was neither a significant positive predictor of SI nor a robust mediator between ED symptoms and SI.

(Continued)

TABLE 1 | Continued

Study	Country	Design	Aim	Suicidal outcome	Sample features	Methods	Main findings
Holm-Denoma et al. (27)	USA and Germany	Case reports (9 cases)	To investigate reasons for the occurrence of death by suicide in AN, in the light of Joiner's theory of suicide	Death by suicide	Sample 1: *N* = 4 cases of death by suicide in AN patients from the USA; mean age: 24.8 Sample 2: *N* = 5 cases of death by suicide in AN patients from Germany	Examination of 9 case reports of patients died by suicide in a sample of patients followed for AN. Sample 1: SCID SADS ED-LIFE Sample 2: SIAB Focus on likelihood of methods to result in death and likelihood of being rescued.	Explanation of high rates of suicide in AN: use of highly lethal methods (8 of the 9 cases) in the context of low rescue potential (7 of the 9 cases). Use of highly lethal methods is in line with Joiner's theory of SB, especially fearlessness about death. Convergent support for Joiner's hypothesis about the link between AN and a relatively high rate of suicide.
Pisetsky et al. (36)	US	Cross-sectional	To test the Interpersonal Theory of Suicide (IPTS) in ED	SI, SA	*N* = 114 ED AN 8.8% BN 21.1% BED 23.7% ED NOS 46.5% 93.9% female Age: 33.7 ± 12.11 88.6% in outpatient treatment, 11.4% in day treatment or residential	INQ PPES ACSS-FAD EDE-Q	65 participants (57.0%) had lifetime SI. 24 (21.1%) had lifetime SA. Thwarted belongingness and perceived burdensomeness were associated with lifetime SI. Painful and provocative events were associated with lifetime SA.
Selby et al. (28)	Multi-site study across North America and Europe	Cross-sectional	To explore whether repetitive exposure to painful and destructive behaviors such as vomiting, laxative use, and NSSI was a mechanism that linked AN-binge-purging (ANBP) subtype, as opposed to AN-restricting subtype (ANR), to extreme suicidal behavior	SA	Study 1: *N* = 787 AN Age: 29.7 ± 11.2 Study 2: *N* = 249 AN Age: 26.30 ± 8.50	EATATE SIAB DIGS	Study 1: Structural equation modeling results supported provocative behaviors as a mechanism linking ANBP to suicidal behavior. A second, unexpected mechanism emerged linking ANR to suicidal behavior via restricting. Study 2: Replicated findings of Study 1, including the second mechanism linking ANR to SA. Two potential routes to suicidal behavior in AN seem to have been identified: one route through repetitive experience with provocative behaviors for ANBP, and a second for exposure to pain through the starvation of restricting in ANR.

(Continued)

TABLE 1 | Continued

Study	Country	Design	Aim	Suicidal outcome	Sample features	Methods	Main findings
Smith et al. (32)	US	Cross-sectional, Case-control	To test the Interpersonal Theory of Suicide (IPTS) in ED	SI, SA	*N* = 100 ED *N* = 85 Psychiatric patients *N* = 93 College students	INQ ACSS-FAD DSI-SS	Within the ED sample, no interaction was found, but perceived burdensomeness was associated with SI, and perceived burdensomeness and fearlessness about death were associated with past SA. The ED and psychiatric patients had greater thwarted belongingness, perceived burdensomeness, and SI than college students.
Trujillo et al. (34)	US	Longitudinal, Cohort	To examine the bidirectional, longitudinal relationship between ED symptoms and thwarted belongingness and perceived burdensomeness	–	*N* = 92 ED treatment-seeking 95.6 female Age: 32.82 ± 11.99	EDDS-5 EDI INQ	T1 ED symptoms did not predict T2 TB or PB. T1 TB did not predict T2 ED symptoms. T1 PB did predict T2 ED symptoms. Among participants with AN/sub/AN, T1 TB and PB predicted T2 ED symptoms.
Velkoff and Smith (35)	USA	Longitudinal study (8 weeks)	To examine between-person variability inn within-person change in ACS in ED patients over the course of 8 weeks of treatment	ACS	*N* = 100 ED patients from residential facility DSM-5 diagnoses: *N* = 34 AN *N* = 27 BN *N* = 30 OSFED *N* = 1 BED *N* = 8 USFED Mean age 26.92 ± 7.86 *N* = 27 at least one previous SA *N* = 45 SI at baseline *N* = 77 previous NSSI	Weekly assessments with the ACSS FAD subscale and subjective pain tolerance (as assessed by one Likert-type item) (number of assessments = 8.17 ± 5.5)	Patients had midlevel ACS at baseline. Growth mixture modeling found no significant linear change in any of the two facets of ACS (FAD and pain tolerance) over the course of treatment. ACS may be more stable than originally theorized.
Witte et al. (30)	USA	Cross-sectional	To test the hypothesis that the extreme restrictive eating (characteristic of AN) facilitates acquiring the capability for suicide	SA	*N* = 100 ED female patients 26.92 ± 7.86 (range: 18–58) Primarily non-Hispanic (96%) and White (94%)	ACSS-FAD EDE-Q Physical pain tolerance	Findings did not support Joiner's hypothesis that restrictive eating is key in acquiring the capability for suicide.

Diagnoses acronyms: AN, Anorexia Nervosa; AN-BP, Anorexia Nervosa binge/purging type; AN-R, Anorexia Nervosa restricting type; BED, Binge Eating Disorder; BN, Bulimia Nervosa; ED NOS, Eating Disorder Not Otherwise Specified; OSFED, other specified feeding or eating disorder; USFED, unspecified feeding or eating disorder. Suicidal behavior acronyms: ACS, Acquired capability for suicide; NSSI, Non-suicidal self-injury; SA, suicide attempt; SB, suicidal behavior; SI, suicidal ideation. Questionnaires acronyms: ACSS, Acquired Capability for Suicide Scale; ACSS-FAD, Acquired Capability for Suicide Scale – Fearlessness About Death; BDI, Beck Depression Inventory; DIGS, Diagnostic Interview for Genetics Studies; DSI-SS, Depressive Symptom Index–Suicidality Subscale; EATATE, Eatate-life Phenotype; EDDS-5, Eating Disorder Diagnostic Scale for DSM-5; EDE-Q, Eating Disorder Examination Questionnaire; EDI, Eating Disorder Inventory; ED-LIFE, Eating Disorders Longitudinal Interval Follow-up Evaluation; EPPES, Eating Behaviors Painful and Provocative Events Scale.

the data extracted from the 10 studies we eventually included in the mini-review (27–33).

Most of the included studies reported data from the same sample from a larger study, even though the hypotheses and analyses for each study were unique (29–33, 35).

Eight out of the 10 studies were performed exclusively in the US; 2 (20%) involved samples recruited both in the US and in another country [Germany, for (27); Europe for (28)].

Study design was cross-sectional in 6 (60%) out of 10 studies (28, 30–33, 36); it was longitudinal in 3 (30%) studies only (29, 34, 35). The remaining study was a case series (27).

All the studies included ED patients only (27–31, 33–36), except for the one by Smith et al. (32) which included a control group of psychiatric patients and a control group of college students.

Sample size ranged from a minimum of 9 patients in the case series about suicide death by Holm-Denoma et al. (27) to a maximum of 787 AN patients in the study by Selby et al. (28).

Regarding suicidal outcomes, the studies investigated the following: SI (40%) (29, 32, 33, 36); NSSI (10%) (31); SA (40%) (28, 31, 32, 36); death by suicide (10%) (27). In the remaining studies, the outcome was specifically related to IPTS dimensions, for instance the study by Trujillo et al. (34) focused on TB and PB and the ones by Velkoff and Smith and Witte et al. (30, 35) on AC.

Most studies included at least one measure for EDs, usually one of the Eating Disorders Inventory (EDI) versions or the Eating Disorders Examination Questionnaire (EDE-Q); this datum was not specified in some studies (32, 35). Regarding measures for the IPTS, the INQ was used in the following studies: (29, 33, 34) while the ACSS was used in these ones: (30, 31, 35). Some studies used both the INQ and the ACSS (32, 36). Holm-Denoma et al. (27) studied 9 cases of suicide in AN patients and Selby et al. (28) analyzed two samples of AN patients in the light of the IPTS, even though they used no specific measure.

The results from the studies involving the same sample were the following (29–33, 35): patients with higher levels of PB, but not TB, also reported more SI-related symptoms; furthermore, a bi-directional relation between SI and PB was found, as PB predicted SI at the subsequent week, while SI predicted PB (29); the IPTS hypothesis that restrictive eating might be key in AC was not supported (30); significant associations were found between pain tolerance and both NSSI and previous SA, and between FAD and NSSI, but not SA (31); PB was associated with SI, while both PB and FAD were associated with previous SA (32); both current (body dissatisfaction and fasting) and lifetime (fasting) ED symptoms were indirectly related to SI through higher PB, after controlling for depression (33); in an 8-week longitudinal study, no significant linear change in any of the two facets of AC (FAD and pain tolerance) was reported, leading the Authors to conclude that AC could be a more stable construct than originally supposed (35).

Holm-Denoma et al. with their case series including 9 deaths by suicide in AN patients supported Joiner's hypothesis about a link between AN and a relatively high suicide rate, as they found a use of highly lethal methods in the face of a low rescue potential, in line with the IPTS assumptions, especially those about FAD (27). Pisetsky et al. found an association of both TB and PB with lifetime SI, and a further association of painful and provocative events with lifetime SA (36). Selby et al. found two possible pathways to suicidal behavior, especially SA, in AN (28): one through repetitive experience with provocative behaviors (vomiting, laxative use, NSSI) in the binge/purging subtype of AN, and one through the painful experience of starvation in the restricting subtype. Trujillo et al. studied the associations between ED symptoms and TB and PB (34). ED symptoms at baseline did not predict either TB or PB at follow-up. Baseline TB did not predict ED symptoms at follow-up, while baseline PB did.

Tables 2, **3** describe the study quality assessment performed with the Strengthening the STROBE, except for the Holm and Denoma study (24) which was evaluated with the Quality Assessment Tool for Case Series Studies.

DISCUSSION

The aim of this mini-review was to summarize literature focusing on the IPTS by Thomas E. Joiner, to better understand the phenomenon of suicidal risk in EDs in the light of this theoretical model. From the perspective of the IPTS, it has been suggested that suicidal behaviors are frequent in EDs (in particular in AN), because ED behaviors, like dietary restriction, constitute painful and provocative experiences that could increase capability for suicide (4–6). In other words, EDs might indirectly increase risk for suicidal behavior in patients, via the AC for suicide.

The available evidence summarized in this mini-review failed to support a role for TB in the suicidal behavior of ED patients. Indeed, only the study by Pisetsky et al. (36) described an association between TB and SI. Thus, satisfaction with relationships does not seem to play a key role in suicidal behavior for ED patients. It is not clear whether this is due to the fact that patients are indeed satisfied with relationships, or to the fact that they do not consider relations a relevant issue. On the other hand, some evidence supported an association between PB and suicidal behaviors, either SI (29, 32, 33, 36) or SA (32). Therefore, in ED patients it seems that PB may play an important role, especially regarding SI risk. ED patients may feel incompetent and like a burden to their close ones, and actually some of the ED symptoms may be an expression of anger and hate directed against the self.

Symptoms like extreme fasting and starvation, vomiting and other purging behaviors, may be linked to self-hate and self-aggression and represent a sort of equivalent of self-injury; furthermore, they represent recurrent painful experiences, and according to the IPTS tenets they may eventually increase suicidal risk through AC for suicide (28). Indeed, even though elevated physical pain tolerance is consistent with the ED clinical picture (both in restricting and binge/purging ED subtypes), research findings are not consistent regarding elevated pain tolerance among those with AN and BN compared to those without EDs (28, 31). With more detail, FAD was associated with NSSI but not SA (31); nonetheless Holm-Denoma et al. considered their findings consistent with the IPTS assumptions about FAD, as the

TABLE 2 | Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) scores of the included studies.

N	Study	Title and abstract		Introduction		Methods																		Results													Discussion				Other information
		1		2	3	4	5	6		7	8	9	10	11	12						13			14			15	16			17	18	19	20	21	22
		a	b					a	b						a	b	c	d	e	a	b	c	a	b	c		a	b	c					
1	Bodell et al. (29)	1	1	1	1	1	1	1	NA	1	1	0	1	1	0	1	1	0	0	1	0	0	0	1	1	1	NA	NA	NA	1	1	1	1	1	1
2	Dodd et al. (34)	1	1	1	1	1	0	0	NA	1	1	1	1	1	1	0	1	NA	1	0	0	0	1	1	NA	1	0	NA	NA	1	1	1	1	1	0
3	Forrest et al. (33)	1	1	1	1	1	1	1	NA	1	1	0	1	1	1	1	1	NA	0	1	0	0	1	1	NA	1	NA	NA	NA	1	1	1	1	0	0
4	Pisetsky et al. (2016)	0	1	1	1	1	0	1	NA	1	1	0	0	1	1	1	0	NA	0	1	0	0	1	0	NA	1	NA	NA	NA	1	1	1	1	0	0
5	Selby et al. (28) Study 1	0	1	1	1	1	0	1	NA	1	1	1	0	1	1	1	1	NA	1	0	0	0	1	0	NA	0	NA	NA	NA	1	1	1	0	0	1
	Selby et al. (28) Study 2					0	0	1	NA	1	1	1	0	1	1	1	1	NA	1	0	0	0	0	0	NA	0	NA	NA	NA	1	1	1	1	1	
6	Smith et al. (32)	1	1	1	1	1	1	1	1	1	1	0	0	0	1	1	1	0	0	1	0	0	1	0	NA	1	NA	NA	NA	1	1	1	1	1	0
7	Trujillo et al. (34)	0	1	1	1	1	1	1	NA	1	1	0	0	1	1	1	1	0	0	1	0	0	1	0	1	1	NA	NA	NA	1	1	1	1	1	0
8	Velkoff and Smith (35)	1	1	1	1	1	0	0	NA	1	0	0	0	0	1	1	1	0	1	0	0	0	0	0	0	1	NA	NA	NA	1	1	1	1	1	1
9	Witte et al. (30)	0/NA	NA	1	1	1	0	0	NA	1	1	0	0	1	1	0	1	NA	1	1	0	0	1	0	NA	1	NA	NA	NA	1	1	1	1	1	0

NA, not applicable.

TABLE 3 | Quality of reporting of the included case series study according to the Quality Assessment Tool for Case Series Studies.

Study	1	2	3	4	5	6	7	8	9	Quality rating (Good, Fair, or Poor)
	Was the study question or objective clearly stated?	Was the study population clearly and fully described, including a case definition?	Were the cases consecutive?	Were the subjects comparable?	Was the intervention clearly described?	Were the outcome measures clearly defined, valid, reliable, and implemented consistently across all study participants?	Was the length of follow-up adequate?	Were the statistical methods well-described?	Were the results well-described?	
Holm-Denoma et al. (27)	Yes	Yes	Yes	Yes	NA	Yes	Yes	NA	Yes	Good

NA, not applicable.

9 suicide deaths they described in AN patients were characterized by the choice of highly lethal methods and by poor chances of rescue (27). This is in contrast with the "fragility hypothesis" according to which AN individuals would have a higher risk of suicide death because of their starvation-induced frailty (37). According to this theory, a non-lethal SA would become lethal for an AN subject. However, high lethal methods were found in AN as well (27).

Pain tolerance was associated with NSSI and previous SA (31) and, in line with this finding, painful provocative behaviors (such as purging ones and NSSI) and the painful experience of starvation were both considered possible pathways to suicidal behavior (28) and their association with lifetime SA was supported (36). On the contrary, Witte et al. did not support the role of the painful experience of restrictive eating in building AC (30).

Briefly, ED behaviors like vomiting, laxative use, and over-exercise may be associated with FAD (elements of AC for suicide) while other ED factors, like restriction and AN diagnosis, may not. Hence, study results are not conclusive regarding the construct of FAD, which does not seem higher than in psychiatric comparison groups (28).

Furthermore, regarding the AC dimension as composed by the two facets of FAD and pain tolerance, it was also suggested that it might be a much more stable construct than originally theorized, as no change was found over an 8-weeks period by Velkoff and Smith (35). Nonetheless, the dearth of longitudinal studies about this topic, and the brief period of observation of the available ones, do not allow to draw definitive conclusions.

To the best of our knowledge, this is the first mini-review focused on IPTS in EDs. Some limitations should be underscored, such as the limited number of included studies, the fact that many of them were performed in overlapping samples, which could represent a bias; the fact that all the available studies were performed in US, except for two which also involved samples from European Countries. Last, of course, considering the focus of this work, other theoretical approaches to suicidality in EDs have not been addressed.

Regarding studies' quality, the most critical issues emerging from the STROBE assessment were the following: the description of setting, location and relevant dates (item 5); the explanation of efforts to address possible sources of bias (item 9); details about how study size was arrived at, reason for non-participation at each study stage and number of participants with missing data (items 10, 13b, 13c, 14b). Last, most studies failed to acknowledge source of funding (item 22).

Summarizing, available research findings included in this mini-review only partially supported some of the IPTS tenets. Nonetheless, it has to be underscored that the IPTS was primarily developed to explain suicide deaths, which are not easy to address in scientific studies. Indeed, only the case series by Holm-Denoma et al. dealt with suicide deaths (27), while all the other studies included in this mini-review were about either SI or SA, or about specific IPTS constructs, which may represent a rather different situation. Furthermore, the available literature is mainly based on cross-sectional studies, which do not allow to understand the possible evolution of TB, PB and AC over time. Even though Velkoff and Smith found no change in AC (35), it might be argued that the assessment period could have been too short to highlight any change (just 8 weeks).

Further studies focusing on IPTS tenets as well as on other theoretical perspectives and constructs [e.g., interoceptive awareness, as in the Dodd et al. study (31)], hopefully addressing the critical issues emerged from the studies' quality assessment performed in the current mini-review, with a longitudinal design and adequate follow-up duration might offer a more thorough perspective on the complex topic of suicidal behavior in ED patients.

AUTHOR CONTRIBUTIONS

CG and PZ conceived the study. CG and RC performed the literature screening and review. Any discrepancy about reviewers was resolved with the consultation with PZ. The manuscript was drafted by CG and RC and revised for relevant intellectual content by PZ and FM. All the authors read and approved the final version of the manuscript.

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BRIEF RESEARCH REPORT
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Lifetime Weight Characteristics of Adult Inpatients With Severe Anorexia Nervosa: Maximal Lifetime BMI Predicts Treatment Outcome

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Background: The body mass index is a key predictor of treatment outcome in patients with anorexia nervosa. In adolescents, higher premorbid BMI is a strong predictor of a favorable treatment outcome. It is unclear whether this relationship holds true for adults with anorexia nervosa. Here, we examine adult patients with AN and investigate the lowest and highest lifetime BMI and weight suppression as predisposing factors for treatment outcome.

Methods: We included 107 patients aged 17–56 with anorexia nervosa and tracked their BMI from admission to inpatient treatment, through discharge, to follow-up at 1–6 years. Illness history, including lowest and highest lifetime BMI were assessed prior to admission. We used multiple linear regression models with minimal or maximal lifetime BMI or weight suppression at admission as independent variables to predict BMI at admission, discharge and follow-up, while controlling for patients' age, sex, and duration of illness.

Results: Low minimal BMI had a negative influence on the weight at admission, which in turn resulted in a lower BMI at discharge. Higher maximal BMI had a substantial positive influence on BMI at discharge and follow-up. Weight suppression was highly correlated with maximal BMI and showed similar effects to maximal BMI.

Conclusion: Our findings strongly support a relationship between low minimal lifetime BMI and lower BMI at admission, and between higher maximal lifetime BMI or weight suppression and a positive treatment outcome, even years after discharge. Overall, maximal BMI emerged as the most important factor in predicting the weight course in adults with AN.

Keywords: anorexia nervosa, weight characteristics, hospitalization, weight suppression, treatment outcome

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INTRODUCTION

Treatment for anorexia nervosa (AN) aims to restore and maintain a healthy body weight and to reduce the core psychopathology of the illness (1, 2), but long-term prognoses are oftentimes poor (3). The body mass index (BMI) is not only a key diagnostic measure of AN, but also a central measure of treatment outcome.

Premorbid BMI is assumed to be an important biological risk factor for the etiology of AN in adolescents, with lower premorbid BMI predicting the onset of AN (4). Previous studies in children and adolescents have suggested that higher premorbid weight acts as a protective factor for the onset of AN. For example, a large longitudinal study that tracked the BMI of children from birth to 12.5 years of age reported that the average growth trajectory of children with a subsequent onset of AN was lower than the trajectory of children who later did not develop an eating disorder (5). Premorbid BMI has been shown to be an important predictor of BMI at admission [e.g., (6, 7)]. In adolescents, higher premorbid BMI has been shown to be predictive of a favorable treatment outcome at discharge, at 1-year follow-up (6), and at 6–12-year follow-up (8). It is currently unclear if this relationship holds true for adult patients (9). In particular, it is unclear what role the longer duration of illness or the later onset of AN play with respect to the association of pretreatment weight characteristics and treatment outcome. The longer illness history of adult patients results in a more variable weight trajectory compared to adolescents. Premorbid BMI may not capture the complexity of trajectory and illness history. To account for this, the lowest and highest lifetime BMI can be used as key characteristics of past illness course.

While premorbid BMI is a measure of absolute weight status, weight suppression (the difference between highest adult weight and current *or* lowest weight) (10) represents a measure of relative weight status. Greater current weight suppression has been found to predict future onset of AN (11) and has been associated with faster and greater weight normalization during inpatient treatment of AN [e.g., (12, 13)]. However, there are mixed findings regarding long-term treatment outcomes, with reports of higher weight suppression at the time of lowest BMI being associated with higher BMI at 6- to 18-year follow-up (14), and higher weight suppression at discharge predicting better weight maintenance at 1-year follow-up (15), but also reports showing no effect of weight suppression at discharge on weight maintenance at 1-year follow-up (16).

Here, we examine BMI trajectories in adult patients with AN and investigate the lowest and highest lifetime BMI, and the weight suppression at the time of lowest BMI as predisposing factors for treatment outcome. Specifically, we examine the influence of minimal lifetime BMI, maximal lifetime BMI, and maximal weight suppression on the BMI at admission to inpatient treatment, at discharge, and at 1–6-year follow-up. Patients' age, sex, and duration of illness are considered as additional predictors.

METHODS

Participants and Procedure

From January 2014 to December 2020, a total of 239 inpatients received psychiatric treatment at our eating-disorder unit, 181 of whom met the DSM-IV-TR criteria for AN during at least one of their stays. One hundred seven (59.1%) of the patients with AN had complete data and had given written informed consent to the analysis of their routinely collected data. Thus, the final sample included in this study consisted of 98 female and nine male patients. Illness history was assessed before admission to inpatient treatment, including minimal and maximal lifetime body mass index (BMI, kg/m^2) and age at illness onset. Self-reported weights were verified using medical records. Weight-gain during treatment was measured at admission and at discharge as part of the regular treatment protocol. For patients with multiple stays during the study period, the cumulative duration of treatment, the BMI at first admission, and the BMI at last discharge were used. The reported age for all patients is the age at first admission and illness duration represents the time between illness onset and age at first admission. A subsample of 63 patients (female = 61, male = 2) participated in a follow-up. For the follow-up measurement, patients who had been discharged for at least 1 year were contacted by e-mail and telephone and asked to complete an online survey. As part of the survey, patients were asked to report their current weight and whether they had sought further treatment after discharge.

Inpatient Treatment

All study participants were treated at our specialized eating-disorder unit. The inpatient treatment consists of a multimodal therapy programme with a target BMI $\geq$18.5 kg/m^2, comprising individual and group psychotherapy, somatic controls and treatment, and structured nutrition increase, with the main goal of normalizing and stabilizing eating behavior and weight. Other therapeutic elements include body-perception therapy, art therapy, nutritional counseling, physiotherapy, and for patients who are advanced in the programme, vocational or educational training and cooking groups. Prior to admission, the indication for hospitalization and illness history is assessed in an detailed medical history interview. Minimal motivation and cooperation for voluntary therapy should be given as the admission to the unit is elective. All patients receive three main meals and three snacks per day with a fixed energy content ranging from 1,600 to 3,000 kcal/day depending on the treatment phase. Patients are required to participate in all elements of the treatment and to gain an average of 700 g/week until they reach the target BMI. Patients who are unable to adhere to the programme for several weeks have to discontinue therapy. However, as the overarching goal is to rehabilitate the patients as much as possible in their everyday lives, patients may complete treatment in several segments, taking breaks and resuming inpatient treatment at a later time. Between discharge and follow-up, the vast majority of patients (89%) received outpatient treatment in form of individual psychotherapy.

Data Analysis

For the calculation of maximal and minimal lifetime BMI (maximal and minimal BMI hereafter), patients' height at admission and the recalled minimal and maximal lifetime weight after reaching current height were used. Maximal weight suppression was calculated as the difference between maximal BMI and BMI at admission.

For demographic and clinical data, mean, standard deviation (SD), and range are reported. Percentages are rounded to integers. To compare demographic and weight characteristics between female and male patients, Fisher's exact tests were

used for the categorical characteristics and Wilcoxon rank sum tests were used to compare continuous characteristics. Bivariate Pearson correlations were calculated to examine the associations among BMI measures (results can be found in the **Supplementary Material**). To assess the predictive relevance of minimal BMI, maximal BMI, and maximal weight suppression for BMI at admission, at discharge, and at follow-up we fitted linear regression models, estimated using ordinary least squares. First we estimated a base model with the following prognostic parameters as independent variables: age at admission, duration of illness, sex, and BMI at admission (for the prediction of BMI at discharge) and BMI at discharge (for the prediction of BMI at follow-up). Next, minimal or maximal BMI or maximal weight suppression were added as predictors to the basic model to determine the additional variance they explained. To ensure robust estimations of regression coefficients, minimal and maximal BMI or maximal weight suppression were not entered in the same model due to collinearity. Analyses were conducted using R version 4.0.3 (17). All p-values are two-sided and were considered statistically significant at the 5% level.

RESULTS

Sample Characteristics

Demographic and weight characteristics are summarized in **Table 1**. The female and male patients reported similar minimal and maximal BMI, maximal weight suppression, and a similar proportion of anorexia subtypes, with roughly 1/3 binge-purge and 2/3 restrictive. Female patients showed a slightly higher prevalence of depression compared to male patients (**Table 1**). During the study period, 38 patients (36%) were hospitalized more than once (up to five times).

BMI at Admission

Relationship Between Minimal/Maximal BMI, Weight Suppression and BMI at Admission

We performed a multiple regression analysis in which the dependent variable was BMI at admission while the independent variables were age, sex, and duration of illness (base model). The model explained a weak proportion of variance (adj. $R^2 = 0.06$). Adding minimal BMI to the base model significantly improved the prediction [$F_{(1, 102)} = 60.95$, $p < 0.0001$], explaining a substantial proportion of variance (adj. $R^2 = 0.41$). Within this model the effect of minimal BMI was significantly positive (**Table 2**). Adding maximal BMI to the base model did not improve the prediction [$F_{(1, 102)} = 0.34$, $p = 0.562$]. Adding weight suppression to the base model significantly improved the prediction [$F_{(1, 102)} = 20.87$, $p < 0.0001$], explaining a moderate proportion of variance (adj. $R^2 = 0.21$). Within this model the effect of weight suppression was significantly negative (**Table 2**).

BMI at Discharge

Treatment Outcome

At discharge, 33% of patients had reached normal weight with a BMI $\geq$18.5 kg/m^2 (good treatment outcome), while 67% percent were still underweight (intermediate treatment outcome), including 23% which were severely underweight (BMI $<$ 16.0 kg/m^2, poor treatment outcome). The proportion of underweight patients was similar between female and male patients (all $p > 0.80$). Interestingly, the subgroup with severe underweight at discharge showed a history of severe underweight in minimal BMI (**Figure 1A**), whereas a less clear picture emerged for maximal BMI (**Figure 1B**).

Relationship Between Minimal/Maximal BMI, Weight Suppression and BMI at Discharge

We performed a multiple regression analysis in which the dependent variable was BMI at discharge while the independent variables were age, sex, duration of illness, and BMI at admission (base model). The model explained a moderate proportion of variance (adj. $R^2 = 0.21$). Within this model the effect of BMI at admission was significantly positive (**Table 2**). Adding minimal BMI to the model did not improve the prediction [$F_{(1, 101)} = 1.451$, $p = 0.231$]. Adding maximal BMI to the base model significantly improved the prediction [$F_{(1, 101)} = 5.412$, $p = 0.022$], explaining a substantial proportion of variance (adj. $R^2 = 0.24$). Within this model the effect of BMI at admission (beta = 0.52, 95% CI [0.33, 0.71], $t_{(101)} = 5.39$, $p < 0.001$) and the effect of maximal BMI were significantly positive (**Table 2**). Adding weight suppression at admission to the base model did improve the prediction [$F_{(1, 101)} = 5.41$, $p = 0.022$]. The model explained a significant and substantial proportion of variance (adj. $R^2 = 0.24$). Within this model, effect of weight suppression at admission was significantly positive (**Table 2**).

BMI at Follow-Up

Follow-Up Outcome

Within the subsample of 63 patients who participated in the follow-up, the women reported a lower average BMI at follow-up (mean = 17.85 (2.12), [12.05, 22.86]) compared to the men (mean = 21.48 (2.57), [19.67, 23.30], $p = 0.043$). Follow-up took place after an average of 2.89 years (SD = 1.45, range = [1.00, 5.90]). At follow-up, 42% of patients reported a BMI $\geq$18.5 kg/m^2. Of the subsample, 19% had maintained a BMI $\geq$18.5 kg/m^2, 23% had reached a BMI $\geq$18.5 kg/m^2 after discharge, while another 23% had lost weight and returned to underweight (BMI $<$18.5 kg/m^2), and 34% were underweight at discharge as well as follow-up. Separating the patients into normal weight (BMI $\geq$18.5 kg/m^2), underweight (BMI $<$18.5 kg/m^2), and severe underweight BMI ($<$16.0 kg/m^2) by their BMI at follow-up, there was no evidence for differences between these subgroups of BMI at admission or discharge (**Figure 2**).

Relationship Between Minimal/Maximal BMI, Weight Suppression and BMI at Follow-Up

Finally, we performed a multiple regression analysis in which the dependent variable was BMI at follow-up while the independent variables were age, sex, duration of illness, BMI at admission, and BMI at discharge (base model). The model explained a non-significant and weak proportion of variance (adj. $R^2 = -0.007$). Adding minimal BMI to the model did not improve the prediction [$F_{(1, 57)} = 3.00$, $p = 0.089$]. Adding maximal BMI to the base model significantly improved the prediction [$F_{(1, 57)} = 5.09$, $p = 0.028$], however the model explained only

TABLE 1 | Demographic and weight characteristics.

	Sex		
	Male ***n*** **= 9**	**Female** ***n*** **= 98**	
Variable	**Mean (SD) [Range]/*n* (%)**	**Mean (SD) [Range]/*n* (%)**	***p*-value[a]**
Age (years)	24.14 (5.58) [17.19, 34.52]	24.86 (8.44) [17.00, 55.77]	0.9
Age at illness onset (years)	18.44 (3.88) [14.00, 24.00]	17.17 (5.84) [10.00, 46.00]	0.2
Illness duration (years)	5.70 (5.33) [1.15, 17.52]	7.71 (7.32) [0.50, 41.77]	0.5
BMI at admission	15.96 (1.33) [13.40, 18.20]	14.55 (1.65) [10.60, 18.30]	**0.023**
BMI at discharge	17.80 (1.61) [15.80, 20.10]	17.32 (1.84) [11.90, 20.40]	0.6
Min. BMI	14.19 (1.50) [11.00, 16.00]	13.52 (1.67) [10.00, 17.50]	0.15
Max. BMI	21.61 (3.49) [17.00, 28.00]	20.76 (3.43) [15.60, 39.00]	0.4
Weight suppression	5.66 (3.03) [1.70, 11.90]	6.21 (3.67) [0.20, 22.40]	0.6
AN type			>0.9
binge-purge	3 (33%)	34 (35%)	
restrictive	6 (67%)	64 (65%)	
Comorbid depression	2 (22%)	58 (59%)	**0.041**

[a]*Wilcoxon rank sum test; Fisher's exact test. In bold, p-values < 0.05.*

TABLE 2 | Summary of regression models for BMI at admission, discharge and follow-up.

Variable	**Base model**			**Min. BMI**			**Max. BMI**			**Weight suppression**		
	Beta	**95% CI[a]**	***p*-value**	**Beta**	**95% CI[a]**	***p*-value**	**Beta**	**95% CI[a]**	***p*-value**	**Beta**	**95% CI[a]**	***p*-value**
Admission												
Age (years)	0.06	0.00, 0.11	0.051	0.01	−0.04, 0.05	0.70	0.05	−0.01, 0.11	0.11	0.09	0.04, 0.14	**0.001**
Illness duration (years)	−0.05	−0.11, 0.02	0.14	0.01	−0.04, 0.07	0.60	−0.04	−0.11, 0.02	0.20	−0.06	−0.12, 0.00	**0.046**
Sex	−1.40	−2.5, −0.23	**0.019**	−1.00	−1.9, −0.13	**0.025**	−1.30	−2.5, −0.20	**0.021**	−1.20	−2.3, −0.22	**0.018**
Min. BMI				0.62	0.46, 0.78	**<0.001**						
Max. BMI							0.03	−0.07, 0.13	0.60			
Weight suppression										−0.19	−0.27, −0.11	**<0.001**
R^2 (adj. R^2)		0.09 (0.06)	**0.021**		0.43 (0.41)	**<0.001**		0.09 (0.06)	**0.04**		0.24 (0.22)	**<0.001**
Discharge												
Age (years)	−0.01	−0.07, 0.05	0.80	−0.02	−0.07, 0.04	0.60	−0.03	−0.09, 0.03	0.30	−0.03	−0.09, 0.03	0.30
Illness duration (years)	−0.02	−0.08, 0.05	0.50	−0.01	−0.08, 0.06	0.80	−0.01	−0.07, 0.06	0.80	−0.01	−0.07, 0.06	0.80
Sex	0.31	−0.84, 1.5	0.60	0.27	−0.88, 1.4	0.60	0.39	−0.74, 1.5	0.50	0.39	−0.74, 1.5	0.50
BMI at admission	0.53	0.34, 0.73	**<0.001**	0.44	0.20, 0.69	**<0.001**	0.52	0.33, 0.71	**<0.001**	0.64	0.43, 0.85	**<0.001**
Min. BMI				0.15	−0.10, 0.40	0.20						
Max. BMI							0.11	0.02, 0.21	**0.022**			
Weight suppression										0.11	0.02, 0.21	**0.022**
R^2 (adj. R^2)		0.24 (0.21)	**<0.001**		0.25 (0.21)	**<0.001**		0.28 (0.24)	**<0.001**		0.28 (0.24)	**<0.001**
Follow-up												
Age (years)	0.03	−0.09, 0.16	0.60	−0.01	−0.14, 0.13	>0.90	−0.07	−0.22, 0.08	0.40	−0.07	−0.22, 0.08	0.40
Illness duration (years)	−0.05	−0.19, 0.08	0.40	−0.01	−0.15, 0.14	>0.90	0.02	−0.13, 0.16	0.80	0.02	−0.13, 0.16	0.80
Sex	−1.90	−4.6, 0.82	0.20	−2.30	−5.0, 0.42	0.10	−2.00	−4.6, 0.64	0.14	−2.00	−4.6, 0.64	0.14
BMI at admission	0.15	−0.22, 0.53	0.40	−0.06	−0.51, 0.38	0.80	0.13	−0.23, 0.49	0.50	0.38	−0.04, 0.79	0.074
BMI at discharge	−0.03	−0.43, 0.37	0.90	−0.06	−0.45, 0.33	0.80	−0.09	−0.48, 0.30	0.60	−0.09	−0.48, 0.30	0.60
Min. BMI				0.42	−0.07, 0.90	0.089						
Max. BMI							0.25	0.03, 0.46	**0.028**			
Weight suppression										0.25	0.03, 0.46	**0.028**
R^2 (adj. R^2)		0.07 (0.01)	0.48		0.12 (0.03)	0.28		0.15 (0.06)	0.15		0.15 (0.06)	0.15

[a]*CI, Confidence Interval. In bold, p-values < 0.05.*

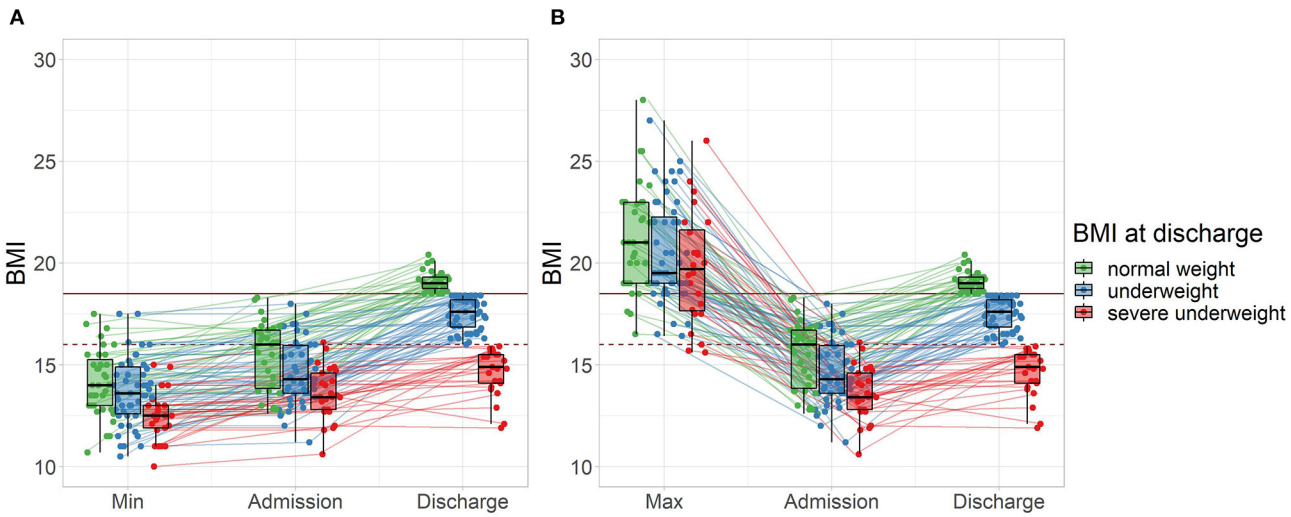

FIGURE 1 | Treatment outcome and lifetime weight characteristics of all patients ($n = 107$) grouped by BMI at discharge. **(A)** Minimal lifetime BMI. **(B)** Maximal lifetime BMI (two patients with a maximal BMI >30 are not displayed). The horizontal mark of the boxplots signifies the median, edges of the box represent 25 and 75th percentiles, and the whiskers extend to 1.5 interquartile ranges. Normal weight: BMI ≥18.5 kg/m^2, represented by the solid horizontal line, severe underweight: BMI <16.0 kg/m^2, represented by the dashed horizontal line.

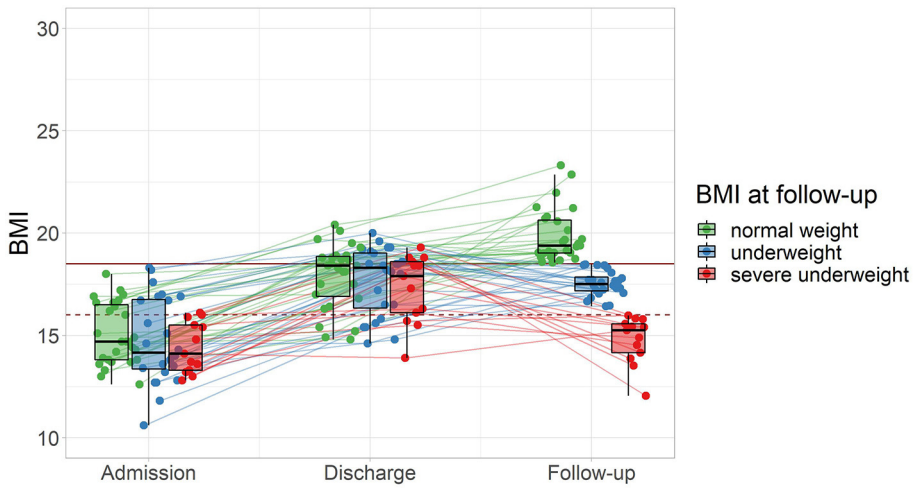

FIGURE 2 | Follow-up outcome and weight trajectories of patients from admission to follow-up ($n = 63$) grouped by BMI at follow-up. The horizontal mark of the boxplots signifies the median, edges of the box represent 25 and 75th percentiles, and the whiskers extend to 1.5 interquartile ranges. Normal weight: BMI ≥18.5 kg/m^2, represented by the solid horizontal line, severe underweight: BMI <16.0 kg/m^2, represented by the dashed horizontal line.

a non-significant proportion of variance (adj. $R^2 = 0.06$). Within this model the effect of maximal BMI was significantly positive (**Table 2**). Adding weight suppression at admission to the base model did improve the prediction [$F_{(1, 57)} = 5.09$, $p = 0.028$]. The model explained a not significant and moderate proportion of variance (adj. $R^2 = 0.06$). Within this model, effect of weight suppression at admission was significantly positive (**Table 2**). Similar multiple regression results were seen for all follow-up models when including time between discharge and follow-up (time to follow-up) as covariate. Time to follow-up did not significantly alter the model predictions (all $F < 1.44$, $p > 0.24$) and had no significant effect on BMI at follow-up (all $t < 1.20$, $p > 0.24$).

DISCUSSION

The BMI is a critical marker of illness severity in AN and is widely considered a key predictor of treatment outcome in adolescent, however detailed analysis of the predictive value of BMI history in adult patients has been lacking. In the present study, we examined the lowest and highest lifetime BMI, and the weight suppression at admission as predisposing factors for the outcome of inpatient

treatment in adult patients with AN. Specifically, we analyzed the relationship of minimal BMI, maximal BMI, and maximal weight suppression with the BMI at admission, discharge, and follow-up, while controlling for other parameters of illness history.

Our results showed a strong association of minimal lifetime BMI and BMI at admission, even when considering patients' age, sex, and duration of illness. An increment of 1.0 kg/m^2 in minimal BMI was associated with a mean increase of 0.62 kg/m^2 in BMI at admission. Higher weight suppression contributed moderately to the prediction of lower BMI at admission when controlling for age, sex, and duration of illness, whereas maximal BMI had no predictive power for the BMI at admission. This indicates, similar to the premorbid BMI in adolescents (6, 18), that minimal lifetime BMI is a strong predictor for the weight status at admission in adults. For the BMI at discharge, BMI at admission and the parameters of illness history together explained 21% of the variance, with BMI at admission being the strongest outcome predictor. Minimal BMI added little information to this. However, maximal BMI and weight suppression improved this prediction independently of BMI at admission, with a 1.0 kg/m^2 increase in maximal BMI or weight suppression being associated with a 0.11 kg/m^2 increase in BMI at discharge. The counterintuitive association of higher weight suppression as beneficial predictor is consistent with previous reports of a positive association of weight suppression and weight gain during inpatient (12, 13, 19) and outpatient treatment (20). Given the high correlation between weight suppression and maximal BMI, it stands to reason that the beneficial effect of weight suppression is driven by maximal BMI.

Finally, the BMI at follow-up was not predictable by BMI at admission or BMI at discharge. Minimal BMI was significantly correlated with BMI at follow-up, but added no additional information when controlling for the other variables. However, higher maximal BMI or weight suppression of 1.0 kg/m^2 was associated with a 0.25 kg/m^2 increase in BMI at follow-up. The lack of predictive power of the BMI at discharge is in contrast to reports of a 6-month follow-up (21), however this difference might be explained by the longer time to follow-up in our study. Consistent with our results, the above-mentioned study reports low predictive power for the minimal BMI (21). Maximal BMI itself has not been considered as predictor of follow-up BMI in previous research, but appears to be the driving force behind weight suppression at admission given their high correlation. The positive predictive power of weight suppression is in line with reports on adolescents with AN (14), where greater weight suppression at lowest BMI predicted higher BMI at 6-, 10-, and 18-year follow-up.

Taken together, a low minimal lifetime BMI seems to have a negative influence on the weight at admission, which in turn results in a lower BMI at discharge. Higher maximal BMI had a positive influence on BMI at discharge, and at follow-up maximal BMI had become more important than BMI at admission or discharge, contributing significantly to a higher weight. Overall, maximal BMI emerged as the most important factor in predicting the course of AN. While the underlying mechanism for this is unclear, lower maximal BMI may reflect metabolic aspects of the illness, such as a genetic predisposition to lower body fat, which is known to contribute to the etiology of AN (22, 23). From a clinical point of view, our therapeutic experience suggests that a maximal lifetime BMI within a normal range can positively influence the course of weight gain treatment. It is conceivable that for patients who have had body experiences with weight in the normal range, therapeutic weight gain up to a know weight is more imaginable and thus easier to achieve.

In recent years, the concept of the weight suppression, as the difference between maximal BMI and current or lowest BMI, has gained attention. Our results support the notion that greater weight suppression at admission is associated with higher BMI at discharge and better weight maintenance at follow-up. Considering the constituents of weight suppression that may drive its predictive power (10), it is apparent that maximal lifetime BMI is the key factor in the present study. Therefore, given the law of parsimony (Occam's razor), it seems most important to determine the maximal BMI in order to predict treatment outcome and BMI at follow-up in patients with AN.

The longer duration of illness in our adult sample did not emerge as meaningful predictors of treatment outcome or outcome at follow-up. While duration of illness is a known influence on long-term trajectories of AN [e.g., (3, 24)], this is in line with follow-up reports assessing treatment outcome at 6-month (21) and 1-year follow-up (6). Of concern, although in line with the literature (25–27), is that more that the half of the patients had remained underweight or returned to underweight at follow-up. These troubling findings underline the need of new therapeutic strategies to better treat severely ill patients and prevent relapse, and intensify research in this field (28).

One of the limitations of the present study is that a direct comparison between minimal BMI, maximal BMI and premorbid BMI is only partially possible. However, in adult samples, it is often not possible to determine the premorbid BMI since information on height at illness onset are not available. Instead, the minimal and maximal lifetime BMI are readily available data that are well-remembered by patients. Minimal and maximal lifetime BMI were assessed using self-reported values from the medical history interview. While all information was carefully checked against the medical records, biased reporting cannot fully be ruled out. However, as weight is inherently a key information to anorexia nervosa, patients are very accurate in reporting their weights (29, 30). The present study focussed on BMI as measure of treatment and follow-up outcome. While BMI is a core outcome measure in AN, the authors note that psychiatric and psychological aspects also play an important role and should be considered in future studies.

To conclude, our results suggest that a lower minimal lifetime BMI presents a negative prognostic factor in the short-term, promoting a lower BMI at admission. In contrast, a higher maximal lifetime BMI proved to be a positive prognostic factor in the medium and long-term, promoting better treatment outcomes even years after discharge. In addition, the very high correlation between maximal BMI and weight suppression at admission emphasizes the role of maximal BMI in weight trajectories. These findings highlight the importance of considering both the lower and especially the upper end

of the lifetime weight range when treating adult patients with severe AN.

DATA AVAILABILITY STATEMENT

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

ETHICS STATEMENT

The studies involving human participants were reviewed and approved by Kantonale Ethikkommission Zürich. The patients/participants provided their written informed consent to participate in this study.

AUTHOR CONTRIBUTIONS

L-KK: conceptualization, data curation, formal analysis, visualization, writing–original draft, and review & editing. HM: formal analysis and writing–review & editing. GM: conceptualization, writing–review & editing, and funding acquisition. All authors contributed to the article and approved the submitted version.

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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.2021.682952/full#supplementary-material

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Predictors of Stepping Up to Higher Level of Care Among Eating Disorder Patients in a Partial Hospitalization Program

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Partial hospitalization programming (PHP) is a treatment option available for individuals with eating disorders (ED) who have made insufficient progress in outpatient settings or are behaviorally or medically unstable. Research demonstrates that this level of care yields efficacy for the majority of patients. However, not all patients achieve recovery in PHP and later admit to a higher level of care (HLOC) including residential treatment or inpatient hospitalization. Although PHP is an increasingly common treatment choice for ED, research concerning outcome predictors in outpatient, stepped levels of care remains limited. Thus, the current study sought to identify the predictors of patients first admitted to PHP that later enter residential or inpatient treatment. Participants were 788 patients (after exclusions) enrolled in adolescent or adult partial hospitalization programs in a specialized ED clinic. When compared to patients who maintained treatment in PHP, a significantly greater proportion of patients who discharged to a HLOC had previously received ED residential treatment. Moreover, patients who discharged to a HLOC were diagnosed with a comorbid anxiety disorder and reported greater anxious and depressive symptomatology. A logistic regression model predicting discharge from PHP to a HLOC was significant, and lower body mass index (BMI) was a significant predictor of necessitating a HLOC. Supplemental programming in partial hospitalization settings might benefit individuals with previous ED residential treatment experience, higher levels of anxiety and depression, and lower BMIs. Specialized intervention for these cases is both practically and economically advantageous, as it might reduce the risk of rehospitalization and at-risk patients needing to step up to a HLOC.

Keywords: partial hospitalization, higher level of care, eating disorder, predictor, residential, inpatient

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INTRODUCTION

Eating disorders (EDs) are difficult to treat with high non-response, dropout, and relapse rates (Fassino et al., 2009; Keel and Brown, 2010; Abbate-Daga et al., 2013). As such, there is a need to better understand the factors that impact both treatment response and long-term outcomes. Identifying predictors of these factors is necessary to improve therapy protocols, inform treatment planning, and identify patients at risk for unfavorable prognoses (Keel and Brown, 2010; Vall and Wade, 2015). An important consideration when examining treatment predictors is the level of care the patient is receiving.

Treatment at partial hospitalization programs (PHP) is most often intended for individuals who have made insufficient progress in outpatient ED treatment or have ED-related behavioral or medical instability that requires regular monitoring. Research has demonstrated that the PHP level of care is effective for many patients (Brown et al., 2018; Reilly et al., 2020). PHPs represent attractive treatment choices to patients, clinicians, and insurance providers, as they demonstrate improved cost-effectiveness and comparable outcomes to inpatient and residential treatment (Anderson et al., 2017). However, not all patients achieve recovery in PHP treatment settings. Thus, some of these individuals later seek admission to a higher level of care (HLOC), including inpatient hospitalization and residential treatment (Abbate-Daga et al., 2015). Although PHP settings are an increasingly common treatment choice for individuals with EDs, research concerning outcome predictors in these settings remains limited. In a recent meta-analysis of outcome predictors, 67% of included studies were from randomized controlled trials and reflected specific treatment settings: 51.5% inpatient, 32.5% outpatient, 1.6% PHP and 0.8% residential settings (Vall and Wade, 2015). As randomized control trial findings might not reflect outcomes in more naturalistic settings, such as outpatient or stepped-level of care settings (e.g., PHP), additional research is warranted to replicate results and identify other variables that might impact ED treatment outcomes in these environments (Vall and Wade, 2015; Walker et al., 2020).

Previous research, not necessarily pertaining to PHP settings as mentioned above, has identified numerous baseline variables that predict outcomes and mediators that help explain favorable treatment response, including: higher body mass index (BMI), fewer binge/purge episodes, increased motivation to recover, lower shape/weight concern, fewer comorbidities, and better interpersonal functioning (Vall and Wade, 2015; Linardon et al., 2016). Several studies have also evaluated whether age is a predictor of outcome, with inconsistent results. For example, some studies have found younger age predicts more favorable outcome in outpatient settings (e.g., Agras et al., 2014), while others have demonstrated the opposite pattern of older age predicting better outcome (Grilo et al., 2012), or found no association between age and treatment outcome (e.g., Lammers et al., 2015). Temperament represents a relatively new area of focus associated with ED treatment outcome (Kaye et al., 2015); five-year follow-up from outpatient treatment suggests that temperamental traits such as low novelty seeking, high harm avoidance, and high reward dependence predict clinical improvement in ED symptoms (Segura-García et al., 2013). Similarly, emotion dysregulation has recently been identified as a critical mechanism in the development and maintenance of EDs (Lavender, 2015) with greater emotion regulation skills predicting favorable ED outpatient treatment outcomes (MacDonald et al., 2017).

Although identifying factors that predict favorable treatment outcomes is essential, it is equally—if not more important—to identify variables that predict poor prognosis. A systematic and meta-analytic review by Vall and Wade (2015), looking mostly at data from inpatient and outpatient settings, demonstrated that higher eating pathology at baseline predicted worse outcomes. Another systematic review evidenced a consistent link between anxiety and depression and worse ED treatment outcomes (Berkman et al., 2007). Smith et al. (2018) identified baseline general anxiety, as well as social anxiety, as significant predictors of poor end of treatment ED psychopathology in residential settings. Accurso et al. (2016) found that higher depression scores predicted more ED psychopathology at short-term follow-up from outpatient treatment, and two studies examining outpatient outcomes at 12-month follow-up found that higher depression scores and the presence of major depression were associated with more episodes of binge eating and purging (Fahy and Russell, 1993; Bulik et al., 1998). Further, research has consistently revealed that longer duration of illness and lower body mass index (BMI) at baseline are poor prognostic factors (Howard et al., 1999; Reas et al., 2000; Pinter et al., 2004).

Although research has identified general predictors for unfavorable treatment outcomes, a critical yet understudied subset of patients with poor outcomes are those that enter PHP for an ED but later require a HLOC due to needing more support and intensive treatment. As treatment in PHP levels are an increasingly common and attractive choice for ED patients, it is crucial to understand which types of patients will have favorable outcomes in these settings. Moreover, it is important to identify patients early on in treatment who often need or could benefit from a HLOC. Further, elucidating PHP patient characteristics that necessitate a HLOC is advantageous in identifying and implementing supplemental programming in PHP settings that might benefit individuals experiencing severe eating pathology and potentially prevent having to step up to a HLOC (Fewell et al., 2017).

As noted, there is a lack of literature examining outcome predictors at the PHP level, and there is limited research that evaluates the clinical indicators that predict unfavorable outcomes. As such, the purpose of the current study was to better characterize PHP patients who require a HLOC and identify predictors of those who discharged to a HLOC (i.e., residential or inpatient) after an initial PHP admission. Specifically, we aimed to characterize patients who require a HLOC by examining their demographic and baseline clinical characteristics and differences on these variables between patients who discharged to a HLOC and patients appropriate for PHP. Although the current study was exploratory in nature, it also aimed to assess previously identified predictors of treatment outcome (i.e., anxiety, depression, eating pathology, duration of illness, age, BMI) as predictors of patients requiring a HLOC.

METHODS

Participants and Procedure

Nine-hundred sixty-three patients who admitted to PHP participated in the present study. Eight were excluded for missing reason for discharge data. Eighty of the 955 remaining participants readmitted to PHP at a later date, and only data from their initial admissions were used in the present study. This decision was intended to identify the maximum number of participants who discharged to a HLOC while also differentiating

patients who discharged to a HLOC from patients who were appropriate for continued PHP (i.e., by reducing the chances that patients who enrolled in PHP and discharged to a HLOC before returning to PHP would be included in the "appropriate for continued PHP group" and compared to those who discharged to a HLOC). However, because treatment history data were not collected until July 2016, the 501 participants who participated in the study prior to this date may have attended the current study's PHP in the past. Six participants who re-admitted to PHP at a later date were excluded from the present study due to having no available data from their initial admission. Participants whose only involvement with the current study's program prior to PHP admission was the 5-day Intensive Family Treatment program ($n = 3$) were included in the present study.

Of the 949 total participants, 728 were classified as appropriate for PHP, as evidenced by reasons for discharge indicating a completed treatment course or need for further PHP. Specifically, 631 discharged appropriately, 46 discharged due to insurance reasons, 43 discharged for personal reasons or to return to their college, work, or non-local residence, and 8 discharged to a different PHP. Participants who discharged from PHP against medical advice ($n = 132$) or as a result of failing a therapeutic contract ($n = 29$) were excluded from analyses due to the nuanced and heterogeneous nature of these discharges that cannot be adequately captured by a binary variable. For example, some participants who discharged against medical advice or failed a therapeutic contract may have been appropriate for further PHP, while others may have discharged upon a higher level of care being recommended or presented as a contingency of failing a therapeutic contract. Following admission to PHP, sixty patients discharged to a higher level of care, with 43 discharging to a residential treatment center, 13 discharging to inpatient hospitalization for imminent suicidality or suicide attempts, and four discharging to inpatient hospitalization for acute weight loss and/or medical instability.

Admission criteria for PHP were in line with the American Psychiatric Association's medical, psychiatric, and behavioral criteria guidelines for the treatment of EDs (Yager et al., 2014). Informed consent was obtained from all participants, and an Institutional Review Board approved all study procedures. All patients who admitted to these programs and who voluntarily consented to research involvement were included in the current study.

Brief Program Overview

The ED PHP where the study took place includes a multidisciplinary team (including a licensed therapist or psychologist, psychiatrist or nurse practitioner, dietitian, and nursing staff) that provides regular individual, family, and group therapy, medication management, meal support, and dietary consultation. Upon admission to PHP, patients attend treatment for 10 hours per day, 6 days per week. As symptoms improve, patients step down to intensive outpatient programming before discharging to regular outpatient care. Adult programming utilized a dialectical behavior therapy (DBT) model [see Brown et al. (2018) for more details] whereas adolescent programming used a family-based therapy (FBT)-DBT approach [see Reilly et al. (2020) for more details].

Patient characteristics and demographic data were collected only from patients who entered at the PHP-level of care, and included: patients' age, sex, gender identity, race, ethnicity, ED diagnosis, duration of illness, and BMI, as well as diagnoses of mood, anxiety, and alcohol and substance use disorders. The question assessing gender identity was added to the study at a later date and may not fully represent the gender identities of the full sample; prior to the addition of this variable, the extent to which participants reported their gender as sex is unknown. As the data used in this study have been collected over many years, the methods used to determine ED and comorbid diagnoses have varied. Some patients' diagnoses were determined by staff psychiatrists and nurse practitioners at admission, while others were diagnosed using structured clinical interviews such as the *Structured Clinical Interview for DSM-5* (First et al., 2015; SCID) or the *Mini International Neuropsychiatric Interview* (Sheehan et al., 1998; MINI).

Participants mostly identified their sex as female (91.6% female).The most commonly identified gender identities were female (87.2%) and male (8.8%), though a small number of patients identified as gender-non-conforming (3.3%) and different identity (0.7%). Patients were a mean age of 20.87 (SD = 8.35), and just over half (52.6%) were adults. In terms of race and ethnicity, 73.3% identified as Caucasian, 6.5% as Asian, 1.5% as Black, 0.9% identified as either Native Hawaiian/Pacific Islander or Native American/Alaskan Native, 17.8% identified as other, and 18.4% identified as Hispanic. The ED diagnostic breakdown of the sample is as follows: 49.5% Anorexia Nervosa Restricting type (AN-R), 12.7% Anorexia Nervosa Binge-eating/Purge type (AN-BP), 21.8% Bulimia Nervosa (BN), 2.2% Binge Eating Disorder (BED), 5.8% Avoidant and Restrictive Food Intake Disorder (ARFID), 8.9% Other Specified Feeding and Eating Disorder (OSFED), and 0.1% Unspecified Feeding and Eating Disorder (USFED).

Average duration of ED was 6.03 years (SD = 7.51) and mean admit BMI was 20.19 kg/m^2 (SD = 4.76). In terms of current comorbidities, 54.3% of the sample had a mood disorder, 53.8% had an anxiety disorder, 5.7% had alcohol use disorder, and 9.0% had substance use disorder.

Measures

Previous HLOC ED treatment was assessed using a single item question which asked, "Have you previously been in treatment for an eating disorder?" Response options included inpatient, residential, PHP, and outpatient. BMI (kg/m^2) was calculated using height and weight measured in the clinic upon admission.

Eating Disorder Examination Questionnaire

The eating disorder examination questionnaire (EDE-Q; Fairburn and Beglin, 1994) is a 31-item self-report questionnaire that assesses the severity of ED psychopathology over the past 28 days. This study used the EDE-Q global score, which averages across symptom subscales (e.g., restraint, weight concern, eating concern, shape concern) to provide a general indication of cognitive eating pathology. In our sample, the EDE-Q global

subscale showed excellent internal consistency across time ($\alpha = 0.97$).

The State and Trait Anxiety Inventory

The State–Trait Anxiety Inventory—Trait subscale (STAI-T; Spielberger et al., 1970) is a 20-item self-report measure that assesses trait anxiety. The STAI-T subscale demonstrated good internal consistency in the current study ($\alpha = 0.95$).

Difficulties in Emotion Regulation Scale

The Difficulties in Emotion Regulation Scale (DERS; Gratz and Roemer, 2004) is a 36-item scale used to measure emotion regulation difficulties. The current study used the DERS total score, with higher scores indicating greater difficulty with emotion regulation. Previous research has indicated this measure has sound psychometric properties in samples of both adults and adolescents (Gratz and Roemer, 2004; Neumann et al., 2010). Internal consistency in the present study was good (DERS total $\alpha = 0.96$).

The Sensitivity to Punishment/Sensitivity to Reward Questionnaire

The Sensitivity to Punishment/Sensitivity to Reward Questionnaire (SPSRQ; Torrubia et al., 2001; Franken and Muris, 2006) is a self-reported instrument that includes 48 yes/no questions. This measure is divided into two subscales: Sensitivity to Reward (SR; $\alpha = 0.81$) and Sensitivity to Punishment (SP; $\alpha = 0.89$).

The Beck Depression Inventory

The Beck Depression Inventory (BDI-II) is a 21-item, self-report rating inventory that measures characteristic attitudes and symptoms of depression (Beck et al., 1996). Symptoms during the past 2 weeks using a variable rating scale (i.e., 19 items use a 4-point scale, two items use a 7-point scale). Internal consistency in the present study was good (BDI total $\alpha = 0.93$).

Data Analysis

Means, standard deviations, and frequencies were calculated to describe both patients who admitted to a HLOC following PHP admission and patients who continued to be treated in PHP. *T*-tests and chi-square tests were used to detect group differences on clinical and demographic variables and examine patterns of missing data. Bonferroni corrections were applied to control for multiple comparisons.

Firth logistic regression with penalized maximum likelihood estimation was used to examine predictors of admitting to a HLOC following PHP admission. This analysis was selected to mitigate imbalance and separation issues inherent in predicting rare events that comprise a small proportion of the total sample. Because this was the first study to examine predictors of needing a HLOC among PHP patients, we selected predictors both based on established correlates and predictors of poor treatment prognosis and on group differences in the present study between those who stepped up to HLOC and those who were appropriate for PHP. Of the five variables that differed between the two treatment groups, three were included in logistic regression models, while two were excluded due to being highly correlated ($\rho > 0.80$) with other variables in the model. Lastly, a binary program term (adolescent vs. adult program) was included as a predictor in the models.

As such, individuals who did and did not necessitate admission to a HLOC following PHP admission were regressed upon ED diagnosis, duration of illness, BMI, eating pathology (i.e., EDE-Q global score), trait anxiety (i.e., STAI trait subscale), depression (i.e., BDI total score), and eating disorder program (i.e., adolescent or adult program). To ensure an adequate number of participants per cell, the ED diagnosis variable was condensed into three categories (i.e., AN, BN, OSFED); for the purposes of this analysis, the OSFED category contained patients with DSM-V diagnoses of ARFID, BED, OSFED, and USFED. In the first model, the higher level of care group consisted of all patients who admitted to a HLOC following PHP admission; patients who admitted to the hospital due to suicidality and/or suicide attempts were excluded from the second model.

RESULTS

Patients with missing reasons for discharge data ($n = 8$) were significantly younger [$t_{(796)} = 5.98$, $p < 0.001$] and had a shorter duration of illness [$t_{(777)} = -6.55$, $p < 0.001$] when compared to patients whose reasons for discharge were documented. There were no group differences on missing/non-missing reasons for discharge data on any of the following continuous and categorical variables: eating disorder psychopathology, age of onset, admit or discharge BMI, trait anxiety, depressive symptoms, emotion dysregulation, sensitivity to punishment, race, ethnicity, or diagnoses of comorbid depressive, anxiety, alcohol use, and substance user disorders (*p*s > 0.05). Individuals with missing data on anxiety [$\chi^2_{(1,N=793)} = 6.33$, $p = 0.02$] and depressive disorders [$\chi^2_{(1,N=793)} = 5.66$, $p = 0.02$] were more likely to discharge to a higher level of care, while missing data on all other baseline variables were not related to reason for discharge (*p*s > 0.05).

When compared to patients who were appropriate for continued PHP, a significantly greater proportion of patients who discharged to a HLOC had previously received ED treatment at residential treatment centers ($\phi_c = 0.21$) and were diagnosed with comorbid anxiety disorders ($\phi_c = 01$). Moreover, patients who discharged to a HLOC had a lower BMI ($d = 0.58$) and reported greater anxious ($d = 0.71$) and depressive ($d = 0.67$) symptomatology than those who were appropriate for continued PHP. See **Table 1** for details.

When all patients were included in the first logistic regression, the overall model was significant in predicting the dependent variable [i.e., admission to a HLOC following PHP admission; Likelihood Ratio $\chi^2_{(8)} = 22.94$, $p = 0.003$]. Only BMI significantly predicted discharging to a HLOC. Specifically, for every one unit decrease in BMI, participants were 15% more likely to admit to a HLOC (**Table 2**). Upon excluding patients who were hospitalized for suicidality and/or suicide attempts following PHP admission, the overall model remained statistically significant [Likelihood Ratio $\chi^2_{(8)} = 21.57$, $p = 0.005$]. BMI remained the only significant predictor ($\chi^2 = 10.91$, OR $= 0.78$, $p = 0.001$), such that every one unit decrease in BMI

TABLE 1 | Patient and clinical characteristics at PHP admission.

	Stepped up to HLOC	Appropriate for PHP	*t* or χ^2 value	*p*-value
Age, mean years (±SD)	19.15 (6.33)	21.01 (8.48)	2.11	0.04
PHP program attended			0.49	0.47
Adolescent (<18 years)	31 (52.67%)	345 (47.07%)		
Adult (18+ years)	29 (48.33%)	388 (52.93%)		
Sex, *n* (%)			-	-
Female	74 (100%)	677 (92.11%)		
Male	0 (0%)	58 (7.89%)		
Race, *n* (%)			0.1	0.75
Caucasian	45 (75%)	531 (73.14%)		
Asian	4 (6.67%)	47 (6.47%)		
African American	1 (1.67%)	11 (1.52%)		
Native American/Alaskan Native	0 (0%)	3 (0.41%)		
Native Hawaiian/Pacific Islander	0 (0%)	4 (0.55%)		
Other racial background	10 (16.67%)	130 (17.91%)		
Ethnicity, *n* (%)			0.01	0.91
Hispanic/Latino	11 (18.97%)	132 (18.33%)		
Non-Hispanic/Latino	47 (81.03%)	588 (81.67%)		
Eating disorder diagnosis, *n* (%)			4.28	0.09
AN-R	32 (55.17%)	359 (49.04%)		
AN-BP	12 (20.69%)	88 (12.02%)		
BN	11 (18.97%)	161 (21.99%)		
BED	0 (0%)	17 (2.32%)		
ARFID	1 (1.72%)	45 (6.15%)		
OSFED	2 (3.45%)	61 (8.33%)		
USFED	0 (0%)	1 (0.14%)		
Duration of illness mean years (±SD)	5.56 (6.38)	6.07 (7.59)	0.49	0.57
Mean admit BMI (±SD)	18.67 (3.40)	20.31 (4.83)	−3.47	0.001*
Comorbidities, *n* (%)				
Mood disorder	31 (55.36%)	390 (54.17%)	0.03	0.86
Anxiety disorder	40 (71.43%)	377 (52.43%)	7.54	0.006*
Alcohol use disorder	2 (3.57%)	42 (5.84%)	-	-
Substance use disorder	8 (14.29%)	62 (8.62%)	2.03	0.15
Treatment history, *n* (%)				
Residential	11 (57.89%)	48 (24.37%)	9.81	0.002*
Inpatient	9 (47.37%)	89 (45.18%)	0.03	0.85
PHP	9 (35.18%)	40 (20.31%)	1.31	0.25
IOP	9 (47.37%)	53 (26.77%)	3.55	0.06
Outpatient	18 (94.74%)	133 (67.51%)	6.12	0.01
Psychopathology and temperament, *n* (%)				
EDEQ global	4.03 (1.55)	3.50 (1.69)	2.56	0.01
State anxiety	63.67 (11.37)	58.49 (12.92)	3.35	0.001*
BDI-II score	32.30 (11.97)	26.99 (13.86)	3.03	0.004*
DERS score	116.48 (26.00)	111.06 (29.64)	1.42	0.16
Punishment sensitivity mean	15.05 (5.87)	16.56 (6.84)	0.7	0.5

Percentages were calculated based on available data. Group differences on gender identity, sex, and alcohol use disorder were not assessed due to one or more categories per variable containing <5 cases. Group differences on eating disorder diagnosis were assessed by grouping the variable into three categories (AN, BN, and all other eating disorders); group differences on race were assessed by grouping the variable into patients identifying as Caucasian and patients identifying as Black, Indigenous, and People of Color (BIPOC). p-values ≤ 0.006 were considered statistically significant.

AN-R, Anorexia Nervosa Restricting Type; AN-BP, Anorexia Nervosa Binge Purge Type; BN, Bulimia Nervosa; BED, Binge Eating Disorder; ARFID, Avoidant and Restrictive Food Intake Disorder; OSFED, Other Specified Feeding and Eating Disorder; USFED, Unspecified Feeding and Eating Disorder; PHP, Partial Hospitalization Program; IOP, Intensive Outpatient Program.

*$p \leq 0.006$.

TABLE 2 | Predictors of discharging to a higher level of care following PHP admission.

Variable	*B* (SE)	χ^2	Exp(*B*)	*p*-value
Intercept	−1.26(1.49)	0.66	0.28	0.42
ED diagnosis				
AN[a]	-	-	-	-
BN	0.39 (0.49)	0.59	1.47	0.44
OSFED	−0.75 (0.69)	1.31	0.47	0.25
Duration of illness (years)	0.02 (0.02)	0.80	1.02	0.37
BMI	−0.16 (0.07)	6.67	0.85	0.01*
EDEQ Global	0.15 (0.14)	1.14	1.16	0.29
Treatment Program (adult or adolescent)	0.13 (0.35)	0.67	1.14	0.73
Trait anxiety	0.01 (0.02)	0.33	1.01	0.57
BDI	0.01 (02)	0.36	1.01	0.55

[a]*Indicates comparison group for non-binary categorical variables.*

ED, Eating Disorder; AN, Anorexia Nervosa; BN, Bulimia Nervosa; OSFED, Other Specified Feeding and Eating Disorders; BMI, Body Mass Index; EDEQ, Eating Disorder Examination Questionnaire; BDI, Beck Depression Inventory.

*$p < 0.05$.

resulted in a 22% greater likelihood of admitting to a HLOC. This model's restricted log likelihood value (−113.27) was closer to zero than in the original model (−143.17), suggesting model fit is improved when patients who were hospitalized for suicidality and/or suicide attempts were excluded from the analysis.

DISCUSSION

The current study sought to identify predictors of patients first admitted into a PHP level of care who later required a step up to residential or inpatient treatment settings. Findings demonstrate that patients with lower BMIs were more likely to admit to a HLOC from PHP. Data indicate that this finding remains statistically significant when psychiatric hospitalizations for suicidality and/or suicide attempts were excluded. Results highlight the importance of considering BMI when developing treatment plans for newly admitted patients to PHP settings.

Previous research demonstrates that lower BMI at pretreatment is a poor prognostic factor (Fahy and Russell, 1993; Howard et al., 1999; Agras et al., 2000; Pinter et al., 2004; Berkman et al., 2007). One study identified lower BMI at the time of inpatient admission predicts PHP failure and inpatient readmission for patients with anorexia nervosa (Howard et al., 1999). Another study conducted in an inpatient setting highlighted that patients with anorexia nervosa with BMIs below 15 kg/m^2 were significantly more likely to develop a lower BMI at follow-up (Pinter et al., 2004). Two studies examining bulimia nervosa in outpatient settings identified that lower BMI pretreatment was associated with worse outcome in terms of binge/purge frequency and eating disorder psychopathology at end of treatment and short-term follow-up (Fahy and Russell, 1993; Agras et al., 2000). The current study adds to the previous literature in revealing that transdiagnostic patients with EDs with lower BMIs at admission, specifically in PHP settings, were more at risk for stepping up to HLOC. As such, patients across ED diagnoses with lower BMIs might demonstrate greater need for more comprehensive, targeted interventions, specifically in regards to nutrition, when admitting to PHP settings.

Exploration of group differences revealed that when compared to patients appropriate for continued PHP, patients who discharged to a HLOC were significantly more likely to have previously received ED residential treatment. This highlights the importance of acknowledging and exploring previous treatment history at admission. Certainly, communication between treatment facilities is necessary to supplement success (Anderson et al., 2017). Further, knowledge of previous treatment can inform the implementation of expectations outlined at admission to a PHP. Setting clear behavioral contingences based on previous treatment that reinforce functional rather than dysfunctional behaviors might engender early change (Wisniewski and Ben-Porath, 2015; Ziser et al., 2018). Establishing an explicit treatment contract collaboratively with patients to align with their personal goals might enhance patients' motivation, compliance, and autonomy (Wisniewski and Ben-Porath, 2015). As such, initiating collaborative contingency contracts at the outset of PHP treatment for patients with a history of residential treatment might augment outcomes.

Additionally, group differences demonstrated that patients who discharged to a HLOC were more likely to be diagnosed with comorbid anxiety disorders and endorsed greater anxious and depressive symptomatology.

Previous research consistently demonstrates that higher levels of anxiety and depression are related to poorer prognosis (Berkman et al., 2007; Vall and Wade, 2015). Indeed, neurobiological research indicates that anxiety inhibits motivation to eat, which maintains the cycle of restriction and weight loss (Frank et al., 2019). As such, combining nutritional rehabilitation with specific biological interventions might supplement treatment outcome (Frank et al., 2019).

Strengths and Limitations

The current study's strengths include a large sample of adolescent and adult patients presenting for treatment with diverse presentations of ED. Although we consider conducting research in a naturalistic PHP setting a strength, treatment outcomes research within routine clinical practice presents unique limitations. First, therapists within the current study's PHP utilized an evidenced-based framework but practiced independently, and treatment fidelity assessments were not administered. Another limitation to the study is the lack of standard diagnostic assessment across the entire sample. Further, the sample included patients from one PHP, limiting generalizability to other PHP facilities. Also related to the generalizability of these findings is that it is unknown how many patients declined research participation, and if or how patients who did not consent to be involved in research differ from those in this study, and whether the findings would hold if they were included. Lastly, the number of patients in this sample that discharged from PHP to a HLOC was small and comprised just under 8% of the total sample. As such, observed power to detect a small effect (odds ratio = 1.2 or 20% increase in likelihood) in a logistic regression model was just 12%. However, this estimate may not accurately reflect the power achieved using firth logistic regression, the analysis selected for this study due to its appropriateness for predicting rare events among unbalanced groups (King and Langche, 2001). Even so, the present study was likely underpowered to detect predictors of discharge to a HLOC as well as nuanced interaction effects that may exist among predictors.

CONCLUSION

To our knowledge, this was the first study to explore clinical predictors of patients who require a HLOC after initial admission to a PHP. Findings indicated targeted early interventions in ED PHP settings might benefit patients with lower BMIs. Additionally, current findings suggested that patients exhibiting higher levels of anxiety and depression and/or reporting previous ED residential treatment experience might also benefit from supplemental intervention strategies. Specialized treatment for these cases is both practically and economically advantageous as it might reduce the risk of re-hospitalization and at-risk patients needing to step up to a HLOC.

DATA AVAILABILITY STATEMENT

The data the support the findings of this study can be made available from the corresponding author upon request.

ETHICS STATEMENT

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

AUTHOR CONTRIBUTIONS

All authors listed have made a substantial, direct and intellectual contribution to the work, and approved it for publication.

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Rehospitalization and "Revolving Door" in Anorexia Nervosa: Are There Any Predictors of Time to Readmission?

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Objective: Anorexia nervosa (AN) is a severe psychiatric illness with multifactorial etiology and unsatisfactory treatment outcomes. Hospitalization is required for a substantial number of patients, and readmission (RA) commonly occurs. Some individuals need multiple hospitalizations sometimes over a short amount of time, thus, delineating the "revolving door" (RD) phenomenon. However, very little is known about readmissions and their frequency in AN. Therefore, we aimed to longitudinally investigate readmissions in AN in order to: (a) characterize patients with AN who need readmission (i.e., RA-AN), sometimes rapidly (RD-AN); (b) ascertain differences between RA-AN and non-RA-AN groups during baseline hospitalization; (c) investigate as to whether clinical or psychometric parameters worsened on RA; and (d) analyze predictors of time-to-readmission in AN.

Methods: A total of 170 inpatients with AN were enrolled at their baseline hospitalization; all their subsequent rehospitalizations were recorded with a longitudinal design by which each patient has been observed for 3 years. Patients were classified as RD-AN if requiring a readmission <12 months since last discharge. Clinical characteristics were measured upon admission and discharge for each hospitalization, and at all time points, patients completed questionnaires assessing eating and general psychopathology, and body shape concerns.

Results: Sixty-seven patients (39.4%) needed at least one readmission and 62 (92.5% of RA-AN) reported RD. Compared with non-RA-AN, those with RA-AN were younger, reported a shorter duration of illness, and were more frequently diagnosed with AN-BP. Also, greater severity of anxious and depressive symptoms and body shape concerns emerged in the RA-AN group. The outcome of baseline hospitalization did not differ between groups, and only depressive symptoms worsened at readmission. Shorter duration of AN and low weight gain during baseline hospitalization predicted early readmission but did not survive statistical control. In contrast, high scores on drive for thinness upon baseline hospital entry robustly predicted a shorter time to readmission even after statistical control.

Discussion: Individuals with AN who require readmission do so over a short period notwithstanding a positive treatment outcome during their baseline hospitalization. Shorter time-to-readmission can be predicted mostly in case of marked drive for thinness and poor weight gain at baseline hospital admission.

Keywords: eating disorders, drive for thinness, treatment, readmission, body image, depression, anxiety, body dissatisfaction

INTRODUCTION

Anorexia nervosa (AN) is a severe mental disorder with multifactorial etiology, highly peculiar patterns of eating behaviors, and psychiatric and organic comorbidities. Mortality is high, also as a consequence of organic conditions sometimes coupled with suicidal ideation (1), mostly for those patients severe to the point of requiring hospitalization (2). Currently, treatments are poorly satisfactory (3), with long-term recovery outcomes of ∼60% (4). Despite a wide agreement on the need for treating patients as much as possible in the outpatient setting, not only because of cost effectiveness but also to minimize treatment-related social isolation, in an increasing number of cases, hospitalization is required, even for the youngest patients (5).

Per international guidelines (6), hospitalization in AN should be considered to provide medical stabilization and initiate refeeding, when the physical health of the patients is compromised to the point that their clinical management becomes unbearable in the outpatient setting. Moreover, an absolute weight or body mass index (BMI) threshold should not be used to require hospitalization since the rate of weight loss could be much more relevant than BMI itself (6). In addition, the exacerbation of AN could put patients at risk of suicidal crisis that hospitalization could mitigate instead. Still, hospitalization becomes an option for all patients who experience high difficulties with treatment adherence (i.e., following eating plans while at home) because of partial motivation or environmental obstacles leading to psychic and physical consequences. Therefore, given the severity of admitted patients, hospitalization in AN offers unique challenges for both patients and clinicians, mostly in the context of a very acute and not infrequently unplanned admission (i.e., through the emergency room). If the latter is the case, patients do not undergo the preliminary steps in treatment that could promote their motivation; therefore, they find themselves accepting a high-intensity therapeutic condition without being engaged in treatment and aware of needing it (7).

Although it is an everyday clinical experience that readmissions (RAs) in AN are fairly common, currently, this kind of outcome has received scant attention. In fact, in spite of providing patients with specific discharge plans (6), a substantial number of patients require multiple hospitalizations, sometimes over a short period of time. There are few longitudinal studies in AN on inpatients, and RA is rarely considered as an outcome itself, with most works focusing instead on the stabilization/improvement of outcome measures at follow-up (8–11). Earlier data suggested RAs as becoming increasingly frequent over time (12), but no other data are currently available for adults with AN. In contrast, literature on adolescents with AN paid closer attention to rehospitalizations, with studies supporting previous RAs, young age, low socioeconomic status, co-occurring illnesses, and poor rate of weight gain during hospitalization as predictors of rehospitalization (13–15). However, rehospitalizations in adolescents with AN seem to be quite uncommon (16), and the available data may not apply to adults.

The "revolving door" (RD) phenomenon defines those patients who undergo multiple hospitalizations in a relatively short time. In the field of psychiatry, since its first description for alcoholism (17), the analysis of RD has been mostly applied to affective and non-affective psychoses. For example, research showed that RD patients with bipolar disorders had more frequently mixed episodes or medical comorbidities (18) than non-RD individuals. Similarly, patients with schizophrenia reported more often RD in the case of greater severity of psychotic symptoms, lifetime substance use, and premature discharge (19) compared with non-RD individuals. Despite its utilization, the RD definition remains polyform, potentially echoing the specificities of the samples taken into account. Consequently, the definition of RD ranges from two (5, 20, 21) or three or more hospitalizations in the last year (18) to three or more psychiatric admissions in 2 years (22) to three hospitalizations during lifetime (23).

Given the aforementioned gaps in the literature, with this study, we aimed to expand current knowledge on the characteristics of patients who require RA in AN (RA-AN) and the frequency and predictors of rehospitalization. Consistently with earlier research, we defined RD patients with AN (RD-AN) as those who required RA within 12 months since last discharge. With more detail, adopting a longitudinal design, we aimed to (a) identify and characterize patients with AN who needed to be readmitted (i.e., RA-AN) and those who required such an early hospital RA to meet criteria for RD (RD-AN), (b) ascertain eventual differences between patients with RA-AN and those without reutilization of the hospital stay (i.e., RA-AN vs. non-RA-AN) during their baseline hospitalization, (c) investigate as to whether clinical or psychometric parameters worsened on RA, and (d) analyze time to RA in RA-AN and ascertain the predictors of rehospitalization, focusing on clinical variables of patients at baseline admission (i.e., diagnostic subtype, eating, general psychopathology, and clinical variables) and their outcome at baseline hospitalization (i.e., weight improvement).

We expected to determine a substantial number of patients being RA-AN and meeting the RD-AN criteria since it is a common clinical experience that a relevant proportion of those who need RA do so over the short run. We also *a priori* hypothesized that patients with RA-AN would respond more poorly to baseline hospitalization than the non-RA-AN counterpart and that RA-AN would show poorer BMI on RA compared with baseline hospitalization. Concerning the predictors of time to RA, we hypothesized greater clinical severity (i.e., low BMI, severe eating psychopathology, and anxiety and depressive symptoms) and poorer response to baseline hospitalization (i.e., poor BMI increase during hospitalization) as the potential predictors of RA in AN.

MATERIALS AND METHODS

Participants

A total of 186 patients with AN, voluntarily admitted to the hospitalization program at the Eating Disorders Center of the "Città della Salute e della Scienza" hospital at the University of Turin, Italy, were consecutively enrolled from March 2013 to December 2017. The recruitment for this study was terminated to perform at least 3 years of longitudinal observation (i.e., until December 2020) for all participants. Consequently, we could identify and report also eventual RAs during 36 months after discharge. We labeled patients with AN who needed to be readmitted after their baseline hospitalization discharge as RA-AN and those who required RA within 12 months since last discharge as RD-AN.

The inclusion criteria were as follows: (a) diagnosis of AN as assessed by an experienced psychiatrist with the Structured Clinical Interview for Diagnostic and Statistical Manual of Mental Disorders, fifth edition (DSM-5) (24), (b) age $>$ 16 years old, and (c) no psychotic or bipolar disorders. Of all candidates, 12 returned incomplete assessments, and 4 refused study participation. Finally, 170 inpatients with AN were included in this study for which written informed consent was provided by all patients (or parents in the case of age of patient $<$18 years old). This study was approved by the Ethical Committee of the "Città della Salute e della Scienza" hospital at the University of Turin, Italy, with protocol number 0036472.

Treatment

All participants were inpatients treated at the specialist eating disorder (ED) unit of the Eating Disorders Center of the "Città della Salute e della Scienza" hospital, University of Turin, Italy. The majority of patients (over 80%) were admitted through the emergency room in a very acute phase of AN. The international guidelines underlie treatment delivery so the clinical team is multidisciplinary (psychiatrists, clinical psychologists, psychiatric nurses, internal medicine physicians, and registered dietitians) and extensively experienced. In addition, treatment is delivered following the requirements and specificities needed when dealing with patients with AN who need inpatient treatment (25, 26). Since several patients are hospitalized because of an emergency condition and without a pre-hospitalization treatment plan fostering motivation, the intervention is focused on the following aims: to re-establish patients' clinical life-threatening conditions, work with the patients (twice per week) to foster their motivation for the subsequent therapeutic steps, deliver structured daily sessions on symptom management focusing on diet and body image concerns, work psychologically (twice per week) to understand the possible causes of those factors that led to an emergency admission, and provide families with psychoeducation. Individualized treatment plans are provided (27), and behavioral contracting about meals and eating symptoms is performed. Parenteral/enteral nutrition is proposed according to individual needs; given the severity of the patients, the nasogastric tube can also be required to avoid refeeding syndrome.

Materials

Sociodemographic and clinical characteristics of the patients were collected upon hospital admission (T0) and discharge (e.g., end of treatment, EOT) with a clinical interview during each hospitalization event (i.e., H1: baseline admission; H2: readmission). Body mass index (BMI) was obtained by clinicians after measurement of height and weight of the patients at both time points for each hospitalization.

All participants completed the following assessments at both T0 and EOT:

- Eating Disorder Inventory-2 (EDI-2), Italian validation (28): the questionnaire evaluates the eating-related pathology. The present study considered the first three symptomatic subscales of the tool, namely, drive for thinness (DT), bulimia (B), and body dissatisfaction (BD), as they assess the attitudes toward eating, weight, and body (29). Higher scores in each subscale suggest a greater severity of the measured symptom. The Italian version of the questionnaire has a good internal consistency [Cronbach alpha value $>$0.90 (30)].
- State-Trait Anxiety Inventory [STAI (31)]: two sets of 20 questions measure the state anxiety (i.e., the current level of anxiety) and the trait anxiety (i.e., anxiety as a stable trait). Participants range on a scale from 1 (never) to 4 (always). The internal consistency is good with alpha Cronbach values between 0.86 and 0.95 (32).
- Beck Depression Inventory [BDI; (33)]: the 13-item questionnaire assesses depressive symptoms severity as follows: a global score between 0 and 4 corresponds to low/minimal symptoms, scores from 5 to 15 indicate mild/moderate depression, while rates from 16 to 39 reveal severe depressive symptomatology. The internal consistency is good, with an alpha Cronbach value of 0.86 (34).
- Body Shape Questionnaire [BSQ (35)]: this tool evaluates body image and body dissatisfaction. It consists of 34 items asking for feelings of the patients on body shape during the last weeks. Higher scores indicate higher levels of body dissatisfaction. The internal consistency is good, with Cronbach's alpha values between 0.82 and 0.89 (36).

In case of re-hospitalization, patients completed, in addition to STAI and BDI, the following:

- Eating Disorder Examination Questionnaire (EDE-Q), Italian version (30): the questionnaire measures the occurrence of typical behaviors of eating disorders during the last 28 days. It provides four subscales (dietary restraint, eating concerns, weight concerns, and shape concerns) and a global score. Higher scores correspond to higher eating-related psychopathology. The internal consistency of the Italian version is good with a Cronbach alpha value of 0.90 (30).

Statistical Analysis

To compute the analysis, the SPSS 27.0 statistical software package (IBM SPSS Statistics for Windows, Version 27.0., IBM Corp, Armonk, NY, USA) was used.

A paired-sample *t*-test was used to calculate differences between patients' baseline characteristics between baseline (T0 at H1) and second (T0 at H2) hospitalization. Independent sample *t*-test and Fisher's exact test were used to compare groups reporting RA (RA-AN) or not (non-RA-AN) for continuous and categorical variables, respectively. Repeated measure ANOVA was run to verify the eventual differences in clinical outcome between RA-AN and non-RA-AN during the first hospitalization. The difference in BMI between T0 at H1 and EOT at H1 was calculated as ΔBMI.

Percentiles were used to categorize the variables of interest as measured at the beginning of the baseline hospitalization (i.e., T0 at H1). For example, patients were categorized as follows: high DT in case of score >15 (50th percentile of the whole sample). To assess clinical outcome during H1, the 50th percentile of ΔBMI was calculated. Log-rank-tests were run to compare time-to-readmission survival curves between those with high vs. low scores on those measures that significantly differed between RA-AN and non-RA-AN groups (i.e., age, duration of illness, BMI, DT, B, BD on the EDI-2, BDI, STAI-S, BSQ, and ΔBMI). Subsequently, Cox regressions (proportional hazard regressions) were used in order to clarify whether a certain baseline variable (i.e., high vs. low DT) could be significantly associated with time-to-readmission also after statistical control for confounders, namely, those variables that differed between RA-AN and non-RA-AN groups.

RESULTS

Sociodemographic and Clinical Characteristics of the Sample

Patients were all Caucasian and voluntarily admitted. None of them left the program against medical advice. Of the 170 patients, 124 (72.9%) were diagnosed with the restricting type of AN (AN-R), while 46 (27.1%) were diagnosed with the binge-purging (AN-BP) subtype. The mean age of the sample was 24.8 ± 9.6 years, the mean duration of illness was 6.5 ± 8.2 years, and the mean BMI was 14.2 ± 1.7 (i.e., overall extreme AN according to the DSM-5 severity specifiers). The mean duration of H1 was 35.5 ± 16.7 days, and that of H2, for those requiring it, was 29.1 ± 14.6 days.

Readmission and Revolving Door in Anorexia Nervosa

A total of 67 (RA-AN; 39.4%) patients required to be rehospitalized after H1, and 62 of them (92.5% of RA-AN) met the criteria for being classified as RD patients (i.e., at least an RA within 12 months since last discharge; RD-AN). In the RA-AN group ($n = 67$), 34 patients needed only one RA after H1 discharge (20% of the whole sample), while 33 (19.4% of the whole sample) required more than two admissions after H1 discharge (range, 3–15 hospitalizations). All RAs were at our specialist ED inpatient unit. The survival analysis is shown in **Figure 1**.

Differences in Clinical Variables and Outcome Between RA and Non-RA Patients With Anorexia Nervosa at Their Baseline Hospitalization

No differences emerged between RA-AN and non-RA-AN concerning gender (Fisher's exact test, $p = 1$), whereas patients with AN-BP were classified as RA-AN more frequently than those with AN-R (RA-AN: AN-BP, 37.3%; AN-R, 62.7%; and non-RA-AN: AN-BP, 20.4%; AN-R, 79.6%; Fisher's exact test, $p = 0.021$). As shown in **Table 1**, non-RA-AN and RA-AN did not differ on the number of previous hospitalizations. In addition, non-RA-AN and RA-AN differed concerning age, duration of illness, drive for thinness (DT), bulimia, and body dissatisfaction (BD) subscales on the EDI-2; depressive symptoms; state anxiety; and body image concerns as measured by BDI, STAI-S, and BSQ, respectively. No differences emerged concerning psychiatric comorbidity as well or major depression (RD-AN, 36.5%; non-RD-AN, 35%; Fisher's exact test, $p = 0.868$) or anxiety disorders (RD-AN, 9.5%; non-RD-AN, 11%; Fisher's exact test, $p = 1$).

Concerning the outcome, both groups significantly improved on all considered outcomes between T0 and T1 at H1 (i.e., BMI, EDE-Q total score, BDI, STAI-S, BSQ; see **Supplementary Material**) with no significant interactions between the considered variables and RA-AN/non-RA-AN groups. After H1 discharge, no differences emerged concerning post-discharge treatment plans (RA-AN, outpatient service, 49.2%; day hospital/residential, 50.8%; and non-RA-AN, outpatient service, 47.5%; day hospital/residential, 52.5%; Fisher's exact test, $p = 0.871$). After discharge from baseline hospitalization, all patients received outpatient treatment.

Differences Between Baseline Hospitalization and Readmission for RA-AN

When analyzing the changes in the scores of the patients over time comparing subsequential RAs (i.e., H1 and H2), the BMI improved, while the BDI significantly worsened in the same timeframe (see **Table 2**). Both STAI-S and EDE-Q total score did not show any changes when H1 and H2 scores were compared.

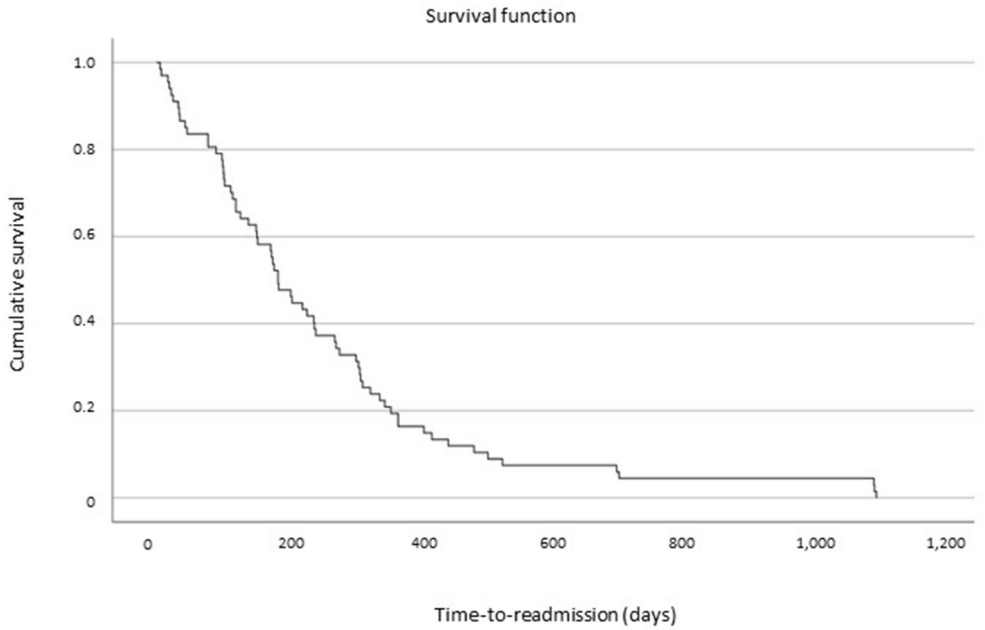

FIGURE 1 | Survival analysis after baseline discharge of time-to-readmission for patients with anorexia nervosa.

TABLE 1 | Differences in clinical variables during baseline hospitalization between readmitted (RA-AN) and non-readmitted (non-RA-AN) patients with anorexia nervosa (AN).

	Patients with AN $n = 170$			
	Non-RA-AN $N = 103$	RA-AN $N = 67$	Test statistics	
	Mean (SD)	Mean (SD)	*t*	*p*
Age, years	26.1 (10.6)	22.9 (7.6)	2.1	**0.035**
Duration of illness, years	7.5 (9.3)	4.9 (5.8)	2	**0.042**
Number of previous hospitalizations	1 (2)	1.3 (2.6)	0.71	0.478
Body mass index	14.1 (1.7)	14.4 (1.8)	1.03	0.305
Duration of first hospitalization, days	35.7 (18.8)	35.2 (12.8)	0.2	0.841
EDI-2				
Drive for thinness	10.9 (7.8)	14.7 (7.2)	2.97	**0.003**
Bulimia	2.4 (4)	4.4 (5.4)	2.67	**0.008**
Body dissatisfaction	13.3 (6.7)	16 (7)	2.35	**0.020**
BDI	14.4 (7.7)	18.5 (7.8)	3.13	**0.002**
STAI-T	55.3 (13.2)	59.3 (14.5)	1.75	0.082
STAI-S	52.4 (14.3)	57.3 (14.3)	2.03	**0.044**
BSQ	114.2 (45.9)	132.5 (42.2)	2.54	**0.012**

EDI-2, Eating Disorders Inventory-2; BDI, Beck Depression Inventory; STAI-T, State-Trait Anxiety Inventory-Trait; STAI-S, State-Trait Anxiety Inventory-State; BSQ, Body Shape Questionnaire. Bold values mean $p < 0.05$.

Survival Analysis of Time to Readmission in Anorexia Nervosa

The 13.4% of patients classified as RA-AN required RA within the first 30 days since discharge, while the mean time to RA was 251.8 ± 239.6 days. Patients with AN-R did not differ from those with AN-BP in terms of time to RA (AN-R mean days, 274.6; AN-BP mean days, 213.7; log-rank test, $p = 0.23$) as well as patients with an enduring duration of illness [set at 7 years per earlier literature (37), ≥7 years of AN mean days, 246.7; <7 years of AN mean days, 257.4; log-rank test, $p = 0.604$].

After splitting the sample according to the 50th percentile of the variables that differed between groups (i.e., high vs. low age, duration of illness, BMI, and DT, bulimia, and BD on the EDI-2, BDI, STAI-S, and BSQ), a different time to RA emerged

TABLE 2 | Differences across baseline and second hospitalization for patients with AN reporting (RA-AN) or not (non-RA-AN) readmissions after baseline discharge.

	RA-AN $N = 67$			
	T0 at H1	T0 at H2	Test statistics	
	Mean (SD)	Mean (SD)	*t*	*p*
BMI	14.5 (1.7)	15.5 (3.2)	2.92	**0.005**
BDI	18.8 (7.7)	21.3 (7.9)	2.59	**0.013**
STAI-S	58.1 (14.5)	61.6 (13.8)	1.78	0.081
EDE-Q total score	4 (1.5)	4 (1.6)	0.014	0.989

T0, hospital admission; H1, baseline hospitalization; H2, readmission; BMI, body mass index; BDI, Beck Depression Inventory; STAI-S, State-Trait Anxiety Inventory-State; EDE-Q, Eating Disorder Examination Questionnaire. Bold values mean $p < 0.05$.

for patients with short vs. long duration of illness (short duration mean days, 190.3; long duration mean days, 308.9; log-rank test, $p = 0.042$) and low vs. high DT at first hospitalization (low DT mean days, 334.5; high DT mean days, 203.1; log-rank test, $p = 0.025$). In contrast, no significantly different survival times emerged comparing patients with high vs. low age (younger age mean days, 222.2; older age mean days, 286.3; log-rank test, $p = 0.399$), bulimia (low bulimia mean days, 306.7; high bulimia mean days, 216.4; log-rank test, $p = 0.222$), and BD (low BD mean days, 265.4; high BD mean days, 240.4; log-rank test, $p = 0.613$) subscales on the EDI-2, BMI (low BMI mean days, 308; high BMI mean days, 212.8; log-rank test, $p = 0.124$), BDI (low BDI mean days, 235.3; high BDI mean days, 260.1; log-rank test, $p = 0.877$), STAI-S (low-STAI-S mean days, 259.3; high-STAI-S mean days, 244.2; log-rank test, $p = 0.442$), and BSQ (low BSQ mean days, 314.8; high BSQ mean days, 223.4; log-rank test, $p = 0.124$) measured upon baseline hospital admission of the patients.

With respect to the outcome of baseline hospitalization, we considered in the analysis the weight gain of the patients during hospitalization (ΔBMI), splitting the sample according to the 50th percentile (i.e., ΔBMI = 0.7). Patients with low vs. high weight gain during hospitalization significantly differed in time to RA (low-ΔBMI mean days, 208.7; high-ΔBMI mean days, 351.4; log-rank test, $p = 0.017$).

Predictors of Time to Readmission in Anorexia Nervosa

As shown in **Table 3**, when examining the predictors of shorter time to RA, patients with shorter duration of illness reported an increased likelihood of early RA compared with those with a longer duration of illness. However, this finding did not survive statistical control for confounders. Instead, as shown in **Figure 2**, patients with high DT were significantly associated with a greater risk of being readmitted earlier than those with low DT (see also **Table 3**). This result held significance even after statistical control for age, duration of illness, EDI-2 subscales bulimia and BD, STAI-S, BSQ, and BDI and ΔBMI, namely, those variables that significantly differed between the RA-AN and non-RA-AN groups at baseline hospitalization. Similarly, patients with low ΔBMI were significantly associated with a greater risk of being readmitted earlier than those with high ΔBMI (see **Table 3**). As for DT, this result held significance after statistical control for confounders (i.e., age, duration of illness, EDI-2 subscales bulimia and BD, STAI-S, BSQ, and BDI). However, when baseline DT was also added to the model, its significance was lost. High vs. low age, BMI, bulimia and BD (EDI-2), BDI, STAI-S, and BSQ did not result as significant predictors of time to RA in AN.

DISCUSSION

With this study, we aimed to investigate the patterns of rehospitalization in inpatients with severe AN measuring readmissions, frequent readmissions, and predictors of time-to-readmission. Four main findings emerged: first, a substantial number of patients (40%) required readmission (RA-AN), and the vast majority of the latter group (62 of 67 patients) met the criteria for RD (i.e., rehospitalization in the first 12 months after discharge). Second, the RA-AN and non-RA-AN groups responded equally well to their baseline hospitalization; third, when needing RA, the BMI of the patients improved, while depressive symptoms worsened. Finally, a shorter duration of illness predicted early RA but did not hold significance after statistical control for confounders. In contrast, high baseline levels of DT significantly predicted early RA independently of all baseline differences between groups as well as BMI improvement during the previous hospitalization. In addition, the improvement of BMI during baseline hospitalization was found to be a robust predictor of time to RA, but when DT was added to the model, it did not hold significance.

Overall, these are novel findings in the field of AN, since no longitudinal data were currently available on time trends before rehospitalization and predictors of time to RA in adult patients with AN. In line with the *a priori* hypothesis, our results suggest an RA rate (67 of 170 patients, 39.4%) in line with an earlier research (38), but this finding also helps expand knowledge on the time required to be readmitted since the vast majority (92.5%) of patients with AN who needed RA did so within 12 months since their last discharge. On the one hand, this finding highlights the need for a fluid transition between inpatient and outpatient services, as already advocated (6), also in other fields of psychiatry (39). The transition between inpatient and outpatient services has long been considered a possible contributing cause of frequent RAs with estimates of a lack of

TABLE 3 | Predictors of time-to-readmission in anorexia nervosa.

	Uncorrected model			Model 1			Model 2		
	Wald's test	***p***	**Hazard ratio (95% CI)**	**Wald's test**	***p***	**Hazard ratio (95% CI)**	**Wald's test**	***p***	**Hazard ratio (95% CI)**
H1 baseline variables									
Young age vs. old age	0.7	0.4	1.2 (0.7–2)						
Long vs. short duration of illness	4	**0.045**	0.6 (0.4–0.9)	1.9	0.167	0.55 (0.2–1.3)			
High DT vs. low DT	4.8	**0.028**	1.9 (1.1–3.4)	4.2	**0.043**	4.2 (1.1–16.4)	4.1*	**0.045***	4.4* (1.1–18.5)
High B vs. low B	1.5	0.226	1.4 (0.8–2.5)						
High DT vs. low DT	0.25	0.615	1.1 (0.7–1.9)						
Low BMI vs. high BMI	2.3	0.13	0.67 (0.4–1.1)						
High BDI vs. low BDI	0.24	0.87	1 (0.6–1.9)						
High STAI-S vs. low STAI-S	0.58	0.44	1.2 (0.7–2)						
High BSQ vs. low BSQ	2.3	0.13	1.6 (0.9–2.8)						
H1 outcome variable									
Low ΔBMI vs. high ΔBMI	5.6	**0.018**	1.9(1.1–3.3)	5.3	**0.021**	2.3 (1.1–4.4)	3.8#	0.5#	2#(0.9–4)

H1, baseline hospitalization; DT, Drive for thinness; BMI, Body Mass Index; BDI, Beck depression Inventory; STAI-S, State-Trait Anxiety Inventory-State; BSQ, Body Shape Questionnaire.
Model 1: Corrected model for age, duration of illness, EDI-2 subscales bulimia and body dissatisfaction, STAI-S, BSQ, and BDI.
Model 2: Corrected model for age, duration of illness, EDI-2 subscales bulimia and body dissatisfaction, STAI-S, BSQ, and BDI, and DT or ΔBMI.
**Model 2 corrected also for ΔBMI.*
#*Model 2 corrected also for DT. Bold values mean $p < 0.05$.*

a link to outpatient care after an acute hospitalization ranging from 22 to 90% (40). In this vein, interventions that bridge the transition home, thus, increasing community support, have been recently authoritatively advocated for AN (41). On the other hand, it should also be noted that individualized discharge plans could have helped avoid even more rapid patterns of RAs; in fact, different from earlier studies on general psychiatry (42), the first month since hospital discharge was not a critical period for RA. Notably, the RA-AN and non-RA-AN groups did not show differences in post-discharge plans, and partial hospitalization was delivered to a substantial number of cases to minimize the inpatient–outpatient dichotomy, in keeping with guidelines (6) and literature suggesting day hospital interventions as a significant tool of continuing care after hospitalization (43). Finally, our findings are also in line with an earlier research on predictors of relapse (44) reporting that 41% of participants relapse during the 1-year follow-up period and that the highest risk of relapse occurs between 4 and 9 months post-treatment.

Of note, when analyzing the differences between RA-AN and non-RA-AN at the entry of their baseline hospitalization, several differences emerged. First, patients in the RA-AN group were younger and had a lower duration of illness. This is of interest, since this finding may indicate the need for specific therapeutic plans for the youngest patients, who instead tend to show duration of untreated illness even longer than the adults (45). In addition, this datum is in line with earlier studies on poor reliability of duration of illness as a proxy for clinical severity of AN (46–48). Patients with RA-AN were more frequently diagnosed with BP-AN (and, relatedly, reported a higher bulimia score on the EDI-2), in line with data showing patients with BP-AN as poor responders (49) and being more susceptible to relapse after treatment (44). Although the groups did not differ in psychiatric comorbidity, thus, supporting an intertwined relationship between AN and anxiety and depression (50), such symptomatologies were more pronounced in the RA-AN group than in the non-RA-AN group. Patients with RA-AN reported a trend of greater severity also concerning body image; notwithstanding, the BMI did not differ between groups, in line with literature questioning the utility of BMI itself as a severity specifier (51).

When evaluating the outcome of baseline hospitalization, both groups showed a significant improvement on all measures considered, different from what we hypothesized. Therefore, putting this datum in perspective, no differences in response to baseline hospitalization emerged between those who, months later, would have required RA or not. In addition, the mean length of baseline hospitalization was comparable between groups and in line with earlier data (52). However, it is noteworthy that no early discharge emerged for RA-AN, since both groups remained hospitalized for a similar time; again, no consensus exists on the role of early discharge and frequent RAs, with the available literature on other mental disorders both supporting (19) and opposing (22) difference in length of stay between RD and non-RD patients. As already outlined earlier, no differences emerged in discharge plans, different from data about bipolar disorders (18).

Different than expected, it is of note that, comparing BMI at the entry of baseline hospitalization vs. RA, the RA-AN group reported improved BMI, thus, suggesting a different main cause requiring hospitalization. Echoing this finding, also eating psychopathology and anxiety symptoms were overall stable, while depressive symptoms significantly worsened. This is of interest since it has been suggested that the causes for RA could include significant weight loss (15), while our data suggest that this is not the main factor since depressive

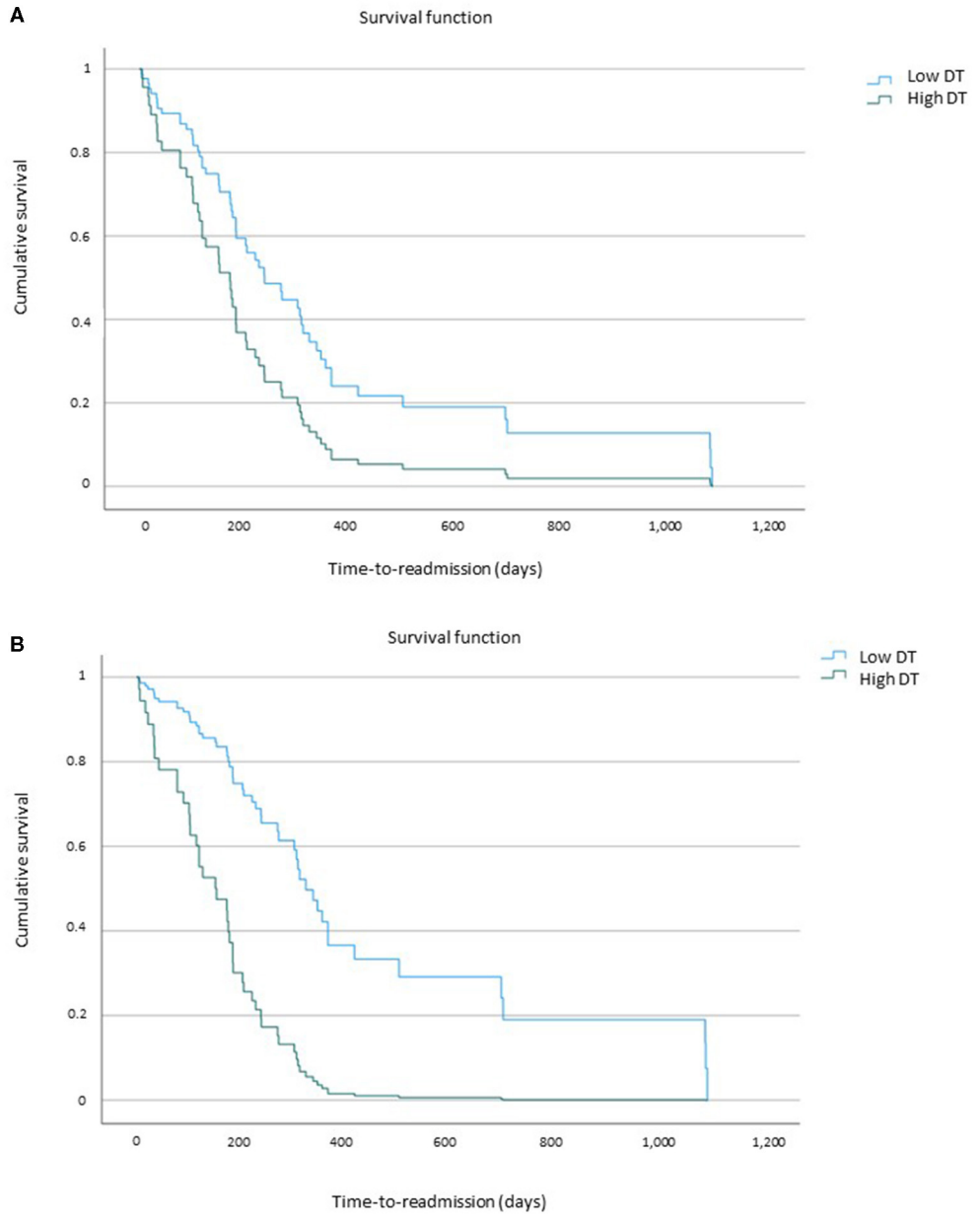

FIGURE 2 | High drive for thinness (DT) as a predictor of shorter time-to-readmission. **(A)** Uncorrected model of high drive for thinness (DT) as a predictor of time-to-readmission. **(B)** Corrected model (statistical control for age, duration of illness, EDI–2 bulimia and body dissatisfaction, STAI-S, BDI, and BSQ) of high drive for thinness as a predictor of time-to-readmission.

symptoms seem to take the lion's share in this regard. Earlier research suggested that comorbidity is substantially independent of BMI (53) and that depressive aspects can become even more prominent after the improvement of ED (54). Finally, it has been reported that depressive symptoms are correlated with the course of body image disturbances; in fact, during treatment and the related BMI improvement, the correlation of symptoms of depression and body image perceptions increased (55). Therefore, this could be a relevant factor influencing the course of AN, and further research is needed to investigate depressive symptoms as maintaining factors in AN.

Echoing the young age of patients in the RA-AN group, a shorter duration of illness (<3 years) predicted early RA, in keeping with literature questioning duration of AN as a reliable severity specifier (46–48). However, this predictor did not hold significance after statistical control, so other factors (i.e., depressive symptoms) could have influenced this finding. Interestingly, high levels of DT robustly predicted a shorter time before RA for patients with severe AN. In contrast with the *a*

priori hypothesis on other potential predictors, this datum is in line with what we hypothesized when designing this study. This finding on DT as a predictor of time to RA expands knowledge on the longitudinal outcome of AN since time to RA had not been investigated so far. With more details, the available studies on longitudinal outcomes in AN focused on good vs. poor clinical outcomes (9), potentially underreporting data on RA itself, which could be generically labeled as poor outcome. We focused on DT because it is a core component of AN psychopathology (29). It has been recently proposed as a reliable severity specifier for AN (56), and earlier research found DT to be associated with poor outcome (9). Interestingly, DT predicted early RA even against statistical control (actually, gaining relevance after statistical control) of all clinical (age, duration of illness, body image concerns, and improvement in BMI) and comorbidity-related (depressive and anxious symptoms) aspects, notwithstanding their relevance in AN (55–57). In keeping with data on positive outcomes at follow-up in the case of high BMI at discharge (10), our findings showed that improvement in BMI during baseline admission predicted time to RA, also after statistical control. This is of importance since our sample was composed of individuals with extreme AN (BMI $<$ 15) facing an acute phase of the disorder. Such a difficult condition is particularly challenging in the light of data on unfavorable outcomes for those who require emergency hospitalizations (58) and for whom no pharmacological agents showed effectiveness (59). In fact, these patients experience a very acute phase of AN without receiving the recommended motivational preparation and engagement performed when hospitalizations are planned instead of required because of a life-threatening emergency. In addition, certain BMIs require a cautious approach (27), and weight gain is particularly complex to achieve. However, the significance of improvement in BMI did not hold significance when DT was added to the model as a confounder (while the opposite, i.e., DT controlled for improvement in BMI, survived statistical control). Therefore, our data support earlier studies suggesting that "it should not be expected that weight gain alone will ultimately confer commensurate psychological symptom remission" [(3), p. 542]. According to our findings, the hypothesis can be raised that the increase in BMI, if coupled with high DT, does not exert a protective effect on RAs. Therefore, clinicians should pay closer attention to the improvement of both aspects, mostly for patients with heightened DT. Earlier data from our group showed that DT during hospitalization can even worsen, despite the improvement of all other clinical parameters (60).

In conclusion, our study provided evidence on a frequently overseen aspect of AN, namely, the time trends before rehospitalization and related predictors. Significantly, patients with AN showed a pattern of frequent utilization of the inpatient facility, although the RA-AN and non-RA-AN groups responded equally well to baseline hospitalization. In addition, BMI and eating psychopathology improved, and depressive symptoms worsened when RA became necessary. The subtype of AN, psychiatric comorbidity, duration of illness, and depressive and anxious symptoms did not predict early RA, while DT was found to be the strongest predictor of time to RA for patients with severe AN, independent of several other well-known components of the clinical constellation of symptoms in AN, including anxiety, depression, and body image concerns. Moreover, improvement in BMI during hospitalization was found to be the other key predictor of the amount of time required before RA, although to a smaller extent than high scores of DT. As such, future research is needed to confirm these findings and overall promote the investigation of factors potentially involved in the clinical trajectory of patients in such an acute condition of AN. In fact, in the era of precision medicine, individualized treatment approaches should be proposed to patients who suffer from such a pernicious condition like (extreme) AN.

In spite of several strengths including the sizable sample, longitudinal design, real-world context, and specialized treatment delivered, this study has some limitations: the severity of included patients with AN and the data collection at an academic specialized ED unit could hamper data generalizability. Moreover, the sample size was not large enough to perform a comparison between RA-AN and RD-AN, and all patients reported prior hospitalizations, although not differing between groups. Notwithstanding, these data could have interesting treatment implications. In line with recent data on the cognitive–affective biases about one's own body in AN (61), baseline DT upon admission, and BMI improvement while hospitalized should be both taken into account when designing individualized treatments and post-discharge plans for patients with AN, even for those who are acutely ill.

DATA AVAILABILITY STATEMENT

Data available on request due to privacy/ethical restrictions.

ETHICS STATEMENT

This study was approved by the Ethical Committee of Città della Salute e della Scienza hospital at the University of Turin, Italy with protocol number 0036472. Written informed consent to participate in this study was provided by all participants and by the participants' legal guardian/next of kin, when needed.

AUTHOR CONTRIBUTIONS

EM and GA-D conceived and designed the study. ND, PL, and FS conducted the assessments. EM and PL drafted the manuscript and ran the analyses. FS and GA-D supervised the analyses. ND and GA-D critically revised the manuscript. All authors approved the final article.

SUPPLEMENTARY MATERIAL

The Supplementary Material for this article can be found online at: https://www.frontiersin.org/articles/10.3389/fpsyt.2021.694223/full#supplementary-material

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