Family-based treatment for adolescent anorexia nervosa: outcomes of a stepped-care model

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Objective: Stepped-care models of treatment are under-explored in eating disorders. To enhance treatment outcomes, and informed by literature about adaptations to FBT, we developed an FBT-based stepped-care model for adolescents with AN that was consistent with family preference (i.e., tailored) and responsive to adolescent needs (i.e., intensity). The aim of this study was to evaluate the effectiveness of this model in terms of remission at end-of-treatment. Method: Adolescents (N=82), aged 12-18 years (M=15.1, SD=1.8) and meeting DSM-5 criteria for AN, were assessed at baseline, Weeks 24 and 48. FBT was tailored to family preference and clinical need, with 16-18 sessions by Week 24. This was followed by three FBT booster sessions or an extension of FBT plus booster sessions (Week 48). The primary outcome was defined as weight >95% of %mBMI plus within one SD of the EDE global score community norms. Results: Remission rates were 45.1% and 52.4% at Weeks 24 and 48, respectively. Commensurable improvements were evident across secondary outcomes (e.g., EDE subscale scores). As a reference point, remission rates compared positively with results from a recent RCT from the same center and at the same time points (Week 24: 45.1% vs 32.1%, Week 48: 52.4% vs 30.2%). Controlling for propensity score, no statistically significant differences were observed. Discussion: This stepped-care model, designed to be responsive to the individual needs of adolescents and their families, achieved encouraging rates of remission. This study provides an important signal that supports future clinical trials of stepped-care models for adolescents with AN.

Key Words: Adolescent-centered care, Family-centered care, Adolescence, Eating disorders, Anorexia nervosa, Family-based treatment
Family-based treatment for adolescent anorexia nervosa: outcomes of a stepped-care model

Anorexia Nervosa (AN) is a pernicious eating disorder characterized by a profound fear of fatness that is associated with significant psychiatric comorbidity, medical morbidity, psychosocial impairment and heightened mortality (van Hoeken & Hoek, 2020). The usual onset of AN is during adolescence; if treatment efforts at this developmental stage fail, individuals with AN are at significant risk of developing a severe and enduring illness (Wonderlich, Bulik, Schmidt, Steiger & Hoek, 2020). A considerable body of literature underscores family-based treatment (FBT) as the most efficacious intervention for this patient population (Lock & Le Grange, 2019). However, enthusiasm for FBT should be tempered, as typically at the end of a course of standard FBT (i.e., 16-18 sessions over 6-9 months) (Le Grange et al., 2019) fewer than 40% of adolescents are remitted as defined by weight $\geq$95% of median Body Mass Index (%mBMI) plus within one standard deviation ($SD$) of the community norm of the Eating Disorder Examination (EDE) global score. Adolescents who fail to respond to FBT are expected to benefit from more intensive treatment, but current options such as inpatient care, residential care or partial hospitalization, are highly resource intensive. Evaluating the utility of such treatments has been hampered by methodological concerns in the limited number of studies that have compared different levels of care (Anderson et al., 2017). There is also interest in adaptations of FBT that aim to improve its efficacy, as well as the development and testing of other treatments such as enhanced cognitive-behavior therapy (CBT-E) (Dalle Grave & Calugi, 2020).

Despite the modest rates of remission achieved with a course of standard FBT, the treatment landscape has benefitted from several adaptations that have helped elucidate the workings of this intervention. For instance, we have gained a better understanding of potential optimal dose (i.e., how much FBT) (Lock, Agras, Bryson & Kraemer, 2005), mechanisms (i.e., how FBT operates) (Byrne, Accurso, Arnow, Lock & Le Grange, 2015), moderators (i.e., for whom FBT works) (Le
Grange et al., 2012), and the role of different formats of FBT (e.g., conjoint family treatment or parent-focused treatment (PFT) (Le Grange et al., 2016). Early weight gain (>2kg by session 5) has been shown to predict weight recovery at the end-of-treatment (EOT) (e.g., Doyle, Le Grange, Loeb, Doyle, & Crosby, 2010; Hughes, Sawyer, Accurso, Singh & Le Grange, 2019; Madden et al., 2015). There is some evidence that adapting FBT to be more responsive for those families where the adolescent struggles to reach this early weight goal results in better outcomes; specifically, this adaptive approach appears to allow families who are struggling at one month to ‘catch-up’ with those families who were able to achieve this early marker of success (Lock et al., 2015). Taken together, these advances point to how a FBT stepped-care model might enhance treatment outcomes.

While a common feature of clinical practice, less consideration has been given to developing a formal model of care that enables tailoring to both the adolescent and family’s context. Indeed, stepped-care models of care are vastly under-explored in the eating disorders literature (Buchman, Attia, Dawson & Steinglass, 2019; Dalle Grave, Ricca & Todesco, 2001; Wilson, Vitousek & Loeb, 2000), with remarkably few large-scale studies examining such an approach [e.g., adults with bulimia nervosa, Mitchell et al. (2011) and adolescents with AN, Herpertz-Dahlmann, Bonin & Dahmen (2021)]. To consolidate what we have learned from this body of recent research in FBT, and enhance treatment outcomes, we developed an FBT-focused (conjoint, adaptive and PFT) stepped-care model that is consistent with family preference (i.e., tailored) and adolescent clinical needs (i.e., intensity) for the treatment of AN. Our main goal was to evaluate the effectiveness of this model in terms of remission at EOT. To provide a reference point for the outcomes demonstrated within this stepped-care model, we compared remission rates with those of a recent randomized clinical trial (RCT) that was conducted by the same group prior to introducing this stepped-care model. Given that a stepped-care model is likely to be more responsive to the individual needs of adolescents and
their families as opposed to a ‘one size fits all’ approach within an RCT, we hypothesized that rates of remission in our stepped-care model would be superior to those achieved in our recent RCT.

**Method**

**Treatment Setting**

Treatment was provided at the Royal Children’s Hospital Eating Disorders Program, a specialist program that provides integrated medical and mental health care across inpatient and outpatient settings within a tertiary public hospital in Melbourne, Australia that has delivered FBT for over a decade (Hughes et al., 2014). Between 2010 and 2015, an RCT of FBT and PFT was conducted as previously reported [c.f., Le Grange et al. (2016)]. Following the RCT, a stepped-care model was implemented as part of standard care for future adolescents presenting with AN. Outpatient treatment was provided by a multi-disciplinary team from adolescent medicine and mental health. Therapy was provided by clinicians experienced in the treatment of adolescent AN, trained in FBT (conjoint, adaptive and PFT) and adolescent focused therapy (AFT), who received weekly supervision. Medical care was provided by pediatricians and clinical nurse consultants experienced in eating disorders. Ethics approval was granted by the Royal Children’s Hospital Human Research Ethics Committee.

**Sample Selection for Stepped Care**

All adolescents who presented to the program from July 2016 to January 2019 were assessed for suitability. Following referral to the eating disorder service, a phone triage was completed with a parent by a clinical nurse consultant. If appropriate for the service [aged ≥18 years with DSM-5 AN (APA, 2013)], the adolescent and their parents attended a one-day assessment to confirm diagnosis and treatment planning. Assessment included completion of standardized measures (see below) and a clinical evaluation by a multi-disciplinary team. For hospitalized adolescents (brief inpatient stay for medical stabilization typically lasting ~two weeks), baseline %mBMI was defined as weight at the
day of hospital discharge rather than weight at the start of hospitalization. The remainder of the assessment protocol was conducted just prior to discharge. During the period of analysis presented here, 91 adolescents with DSM-5 AN were assessed. Of these, two chose not to accept recommended treatment, three did not have a family member who could participate in FBT or PFT, and a further four did not provide consent to use their data for research. The final sample for analysis comprised 82 adolescents (90% of adolescents who presented during the study time).

**Stepped-Care Model**

Figure 1 outlines the stepped-care model. Parents of adolescents could choose between two forms of FBT; conjoint (standard FBT) or separated (PFT). Allowing parents to choose which form of FBT they received aimed to enhance engagement, i.e., considered to be respectful to parents and anticipated to enhance their sense of autonomy and empowerment at a challenging time (Dixon, Holoshitz & Nossel, 2016). The exception was based on the assessment of parental expressed emotion (EE) (see assessment below); high EE parents were advised to receive PFT rather than conjoint FBT given prior findings indicating that high EE was more likely to improve in PFT as opposed to FBT (c.f., Allan, Le Grange, Sawyer, McLean & Hughes, 2018). In the first four weeks of treatment, all families received six treatment sessions plus one 3-hour parent education and skills group (Ganci, Pradel & Hughes, 2018).

Early responders in conjoint FBT, defined as adolescents who gained $\geq$2kg between weeks 1 and 5, continued in conjoint FBT. Prior work confirms that obtaining this goal is a predictor of weight restoration at EOT (Doyle et al., 2010, Hughes et al., 2019; Le Grange et al., 2014, Lock et al., 2005; Madden et al., 2015). Therefore, early non-responders, i.e., those who did not reach this marker, stepped-up at week 5 to receive adaptive FBT (Lock et al., 2015). In keeping with this adaptation, these families were provided four targeted sessions at this point to revitalize their efforts.
at weight restoring their adolescent. Study treatments are detailed below (note, there is no adaptive approach for PFT).

All adolescents and their families were offered 16-18 sessions of treatment regardless of format (i.e., conjoint FBT, PFT or adaptive FBT) over a course of 24 weeks. At 24 weeks, remitted adolescents, defined \textit{a priori} as \( \geq 95\% \) mBMI and EDE Global Score within 1SD of population means, were offered three booster sessions (weeks 28, 36 and 48). This departure from standard practice was intended to maintain remission by providing a more gradual end to therapy, be responsive to families’ choice and their need for support, and further enhance parents’ confidence and skills in addressing setbacks. Along this line and based on the notion that preference in type of treatment can lead to improved outcomes (Swift, Callahan, Copper & Parkin, 2018), families of adolescents not remitted at Week 24 were recommended to choose either an extension of FBT for three months plus three booster sessions, switch to FBT plus individual supportive therapy with the adolescent, or switch to AFT (Fitzpatrick, Moye, Hoste, Lock & Le Grange, 2010). Taken together, this stepped-care model included proactive steps (i.e., baseline variables that inform treatment selection) and reactive steps (i.e., within treatment variables that inform ongoing treatment decisions).

The family-based interventions employed are summarized below.

\textit{Conjoint Family-Based Treatment (FBT)} was manualized more than two decades ago. It expects all family members to participate, and treatment progresses through three phases. The first focuses almost exclusively on supporting the parents in their efforts to assist the adolescent to gain weight. The second session is an \textit{in vivo} family meal. The second phase guides the parents to hand decisions regarding food intake back to the adolescent, while the third phase reviews adolescent development now that it is unencumbered by the eating disorder. FBT was offered as 16 sessions over six months (Lock & Le Grange, 2015).
Adaptive Family-Based Treatment is an adaptation to conjoint (standard) FBT. When the latter did not result in weight gain of at least 2kg by the fifth week of treatment, four targeted sessions of Intensive Parental Coaching were added to the standard FBT protocol which aimed to enhance parental self-efficacy related to re-feeding and meal support skills. Three of these four sessions (a family review, parent-only session, repeated family meal) were added at the start of the fifth week of treatment, The fourth session was a further parent-only session in phase 2. Two of these four sessions replaced standard FBT sessions while two were additional sessions. Therefore, Adaptive FBT consisted of 18 sessions offered over six months (Lock et al., 2015).

Parent-Focused Treatment (PFT) is a form of FBT where parents are supported with the same treatment goals as conjoint FBT. However, the format differs in that the adolescent and siblings do not participate in treatment sessions. In PFT the adolescent was joined by a nurse consultant for 15 minutes prior to their parents’ session with the therapist. The nurse weighed the adolescent, assessed medical stability, and provided brief supportive counseling. Following this, the nurse passed relevant clinical information (e.g., weight) on to the treating therapist who met with the parents (50 minutes). Direct contact between the therapist and adolescent was limited to the introductory session and the concluding session. Unlike conjoint FBT, there was no family meal session in PFT (Hughes, Sawyer, Loeb & Le Grange, 2015).

Assessments
Adolescents and parents completed interviews and questionnaires at baseline, week 24 (EOT), and week 48 (end of boosters, or end of extension plus boosters). Assessments were delivered by independent assessors, trained in the semi-structured measures, and not involved in the delivery of treatment. The EDE (Fairburn & Beglin, 1994) is a semi-structured investigator-based interview that determines the severity of eating disorder psychopathology, mostly over the preceding 28 days.
Baseline weight was measured using calibrated digital scales (gown and after voiding) and height was measured using calibrated wall-mounted stadiometers. Co-occurring psychiatric diagnoses were confirmed by the team child psychiatrist. In addition to the EDE, weight, height, and demographic variables, at baseline, questions based on the Five Minute Speech Sample (FMSS; Magaña et al., 1986) were used to measure parental EE. Adolescent depression (Child Depression Inventory; CDI (Kovacs, 1992), and self-esteem (Rosenberg Self-Esteem Scale; RSES (Rosenberg, 1965) were assessed at all three timepoints.

**Statistical Analysis**

All analyses were conducted using SPSS v.25 (IBM Corp. Released 2017). A two-tailed alpha of .05 was used to evaluate tests of significance. Two groups (stepped-care model and the prior RCT) that followed similar assessment protocols at the same time points, were compared at baseline on sociodemographic and clinical characteristics as well as secondary outcome measures using independent samples $t$-tests or Mann-Whitney U tests for continuous measures and chi-square or Fisher’s Exact tests for categorical measures.

A logistic regression analysis was performed using baseline demographic and clinical characteristics, as well as baseline secondary outcome measures, to predict participation in the stepped-care model versus the RCT. The predicted probability of participation in the stepped-care model based upon baseline characteristics, referred to as a *propensity score*, was derived for each participant. This propensity score was used as a covariate in subsequent analyses.

The primary outcome was *remission*, defined *a priori* as $\geq 95\%$ mBMI and EDE Global Score $\leq 1.59$. Those adolescents with missing body weight were considered not remitted. In the event of valid weight but missing EDE data, the imputed value for the EDE Global score based upon multiple imputation (Schafer & Graham, 2002) was used to determine remission status. Multiple imputation with 20 replications based upon Markov chain Monte Carlo models was used to impute
EDE Global scores for calculating remission rates. This procedure was used to maintain consistency with the RCT reporting of remission rates (Le Grange et al., 2016). The two studies were compared on remission rates separately at weeks 24 and 48 using logistic regression controlling for propensity score. Both studies were compared on secondary outcome measures (EDE Global Score, RSES, CDI, and weight) using independent samples t-tests and repeated measures mixed-effects models. Models were based upon available data and included a random intercept, and fixed effects for study, visit, study-by-visit interaction, and propensity score. A first-order autoregressive covariance structure was used to account for repeated observations.

Exploratory analyses were conducted investigating predictors and moderators of remission separately at weeks 24 and 48. Analyses were based upon logistic regression, with models using study, predictor, and study-by-predictor interaction (i.e., test of moderation) and to predict remission status controlling for propensity score. All categorical predictor/moderator variables were coded as -0.5 vs. 0.5, and all continuous predictors were centered around the grand mean prior to analyses.

**Results**

**Stepped-Care Model (N = 82)**

Adolescents met DSM-5 (American Psychiatric Association & American Psychiatric Association, 2013) criteria for AN, and had a mean (SD) age of 15.1 (1.8) years. The majority were female (75/82; 91.5%), had a mean %mBMI of 84.9 (SD 6.9), and mean (SD) duration of illness of 10.6 (7.4) months. One quarter (25.6%) required hospital admission for medical stabilization prior to embarking on outpatient treatment, while almost half (45.1%) presented with a comorbid psychiatric diagnosis. The stepped-care model and RCT adolescents were largely similar in terms of demographic and clinical characteristics. The only significant difference between the two groups was age, with stepped-care adolescents being slightly younger (see Table 1).

[Insert Table 1 about here]
Treatment and Assessment Completion

Seventy-five adolescents in the stepped-care model (91.5%) completed treatment (attended ≥50% of prescribed dose at week 24). Rates of assessment completion (valid weight and EDE) were 93.9% at Week 24 and 80.5% at Week 48. For the RCT, 90 adolescents (84.9%) completed treatment (same definition as above). Rates of assessment completion (valid weight and EDE) were 88.7% at EOT (corresponding to Week 24), and 69.8% at 6-month follow-up (corresponding to Week 48). Assessment completion rates did not differ significantly between treatment groups.

Primary and Secondary Outcomes

In terms of the primary outcome of the stepped-care model, remission was 45.1% at Week 24 and 52.4% at Week 48. By comparison, remission in the RCT was 32.1% at Week 24 (Fisher’s Exact $p = .071$; Logistic regression $p=.126$) and 30.2% at Week 48 (Fisher’s Exact $p = .003$; Logistic regression $p = .222$)$^1$. However, when controlling for propensity score, no statistically significant differences were observed at either Week 24 or Week 48 (see Figure 2). In terms of secondary outcomes, there was improvement in the clinical parameters (EDE Global, RSES, CDI, and %mBMI) of adolescents in stepped care from baseline to Weeks 24 and 48. Comparable rates were achieved in the RCT ($p$’s .096-.940) (see Table 2).

Early Response to Treatment

Early response to FBT (≥2kg by week 5) was achieved by 75.6% (62/82) of adolescents in the stepped-care model compared to 55.7% (59/106) in the RCT (Fisher’s exact $p = .006$).

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$^1$ Fisher’s Exact shows a direct comparison between the stepped-care model and the RCT, while the logistic regression controls for propensity score. In calculating remission, and to maintain consistency with the approach for the RCT, we used imputed EDE Global Scores. For other analyses, since we were using baseline as an observation rather than a covariate, all other analyses were based on available data without imputation.
Non-specific predictors and moderators of primary outcome

In the stepped-care model, baseline younger age, higher EDE Global Score, Shape and Weight Concerns, and higher weight predicted remission at week 24 (see Table 3). No significant moderator variables were found for week 24. Younger age and higher weight at baseline also predicted remission at week 48. In addition, baseline history of a comorbid psychiatric disorder (most prevalent GAD and MDD) was found to be a significant moderator of remission at week 48; 64.9% of those without a comorbid psychiatric history were remitted compared to 31.0% of those with such a history. In the RCT, 20.4% of those without a comorbid psychiatry history were remitted at week 48 compared to 35.1% with a history of such a diagnosis. All analyses controlled for propensity score, which captures overall baseline differences between the stepped-care model and the RCT.

[Insert Table 3 about here]

Hospitalization during treatment

Ten (12.2%) adolescents were hospitalized during treatment in the stepped-care model, while 19 (17.9%) adolescents in the RCT were hospitalized during treatment (Fischer’s exact $p=.314$). Most hospitalizations were for medical reasons, and adolescents were able to resume outpatient treatment upon discharge.

Discussion

This study set out to describe and evaluate the effectiveness of a FBT stepped-care model in the treatment of adolescents with AN. To contextualize this examination, remission and secondary outcomes at Weeks 24 and 48 were compared to those of an RCT of FBT conducted at the same treatment program prior to introduction of this stepped-care model.

An impressive rate of remission was achieved within this stepped-care model. While 45% of adolescents were remitted at Week 24, adolescents continued to improve over time, such that 52%
were remitted at Week 48. To provide a reference point for this primary outcome, remission rates for the RCT at the same respective time points were 32% (EOT for the RCT) and 30% (6-month follow-up for the RCT). It is important not to overstate these comparisons as while the difference in rates of remission between the stepped-care model and the RCT was statistically significant at Week 48 when using Fisher’s Exact, it was no longer significant when controlling for propensity scores. While our conclusion that there is no statistical difference in remission between the stepped-care model and the RCT is an appropriately conservative approach, our findings do point to a potential positive clinical significance. Also, wider comparisons of this stepped-care model with the only three RCTs that used the same definition of remission (i.e., Le Grange et al., 2016; Lock et al., 2010; Madden et al., 2015) showed that our stepped-care model achieved remission rates exceeding those of these prior RCTs (between 10 and 30 percentage points higher). Such a comparison though is best evaluated in a future randomized controlled study.

An impressive finding within this stepped-care model was the proportion of early responders, defined as achieving weight gain of at least 2kg by week 5 of FBT. Three quarters of adolescents in stepped care compared to just over half of adolescents in the RCT reached this treatment target. As early success in weight gain is a solid predictor of weight restoration at EOT (e.g., Doyle et al., 2010; Le Grange, Accurso, Lock, Agras & Bryson, 2014; Madden et al., 2015; Hughes et al., 2019), it is encouraging that the majority of those in this stepped-care model showed an early response to treatment. In all other aspects, significant clinical improvements were noted in the stepped-care model, all of which were comparable to those in the RCT.

In the exploratory moderator analysis, baseline younger age, higher weight and lower eating disorder psychopathology were all identified as non-specific predictors of remission at week 24 and/or week 48. Given that duration of illness in the present study was relatively brief (<1 year, on average), our predictor findings lend further support to prior studies (Lock et al., 2010) that
underscore the value of early identification and intervention in adolescent AN in order to promote more favorable rates of remission. As perhaps expected, only one potential moderator was identified; baseline comorbid psychiatric diagnosis (most prevalent GAD and MDD) was found to be a significant moderator at week 48. Those adolescents who presented without a co-occurring psychiatric disorder were more likely to have remitted than those who presented with such a co-occurring diagnosis. As an aside, it is noteworthy that within the RCT there was no difference in remission between adolescents with versus those without a comorbid psychiatric diagnosis. This seemingly paradoxical finding should be approached with caution as moderator analyses are exploratory and potentially confounded when compared across two studies (Kraemer, 2016). Yet, it might be prudent to specifically attend to psychiatric comorbidity in future stepped-care models.

Taken together, the favorable remission rates achieved in this stepped-care model invite some speculation. It may be that early in the stepped-care model, and in comparison to the RCT, the extent that clinicians highlighted the week 5 marker to parents at week one, and the addition of a three-hour parent group intervention that offers peer support, might have contributed to early success in weight gain. However, as these findings are not within an RCT, we cannot exclude that these improvements in remission rates when compared to the RCT findings do not reflect other factors, such as improved coordination of care within the service. Given the consistent supervision across both the RCT and this study, it seems unlikely that improvement in the quality or standard of FBT contributed to these differences, but we cannot exclude this. Once families reached the week 5 marker, treatment in the stepped-care model was responsive to individual adolescent and family treatment needs, e.g., adaptive FBT. This approach to providing treatment is inherently more flexible than in most RCTs. Towards the tail end of treatment in the stepped-care model (week 24), even if remitted, targeted care through week 48 was formally defined and made available to all adolescents and their families. That is, a set number of three booster sessions were offered or an
extension of FBT plus three booster sessions. By contrast, adolescents in the RCT (30%), received care from other services during the follow-up period, which was provided on an ad hoc basis when required. Parsing out which, if any, of these variables contributed to this favorable response in the stepped-care model remains beyond the design of this study but warrants further research, especially as early studies of duration did not suggest any difference in outcomes for FBT that extended for longer than 6 months (Lock et al., 2005).

While not a study limitation per se, it is important to note that this stepped-care model was perhaps more resource and labor-intensive (e.g., the addition of a parent group, provision of adaptive FBT) than standard FBT provided in similar settings. Anecdotally, and as one example, clinicians in this stepped-care model, some of whom had provided clinical care in the preceding RCT, commented on the complexity of this approach that required tracking through the various arms of treatment, although, this process was aided by the research coordinator and clinical nurse consultants. By comparison, the two treatment arms of the RCT seemed relatively straight-forward. On the other hand, treatment provided in this stepped-care model was intended to be more tailored and responsive to individual adolescent and family contexts, although in the end provided ‘more treatment’ for some than might be typical compared to the prior RCTs for FBT. Consequently, the generalizability of our findings may be commensurately constrained. Disappointingly, lack of resources precluded our ability to follow the adolescents and their parents who participated in this study beyond the completion of treatment, which hampers our capacity to assess the durability of the gains that were established during the active study period. Some strengths are worth noting. The two studies were sequential, that is, the stepped-care model directly followed the completion and integrated the findings of the RCT. In addition, several clinical staff worked on both studies. Moreover, the clinicians were all well-versed in FBT, and outcome was measured with the gold-
standard EDE conducted by independent assessors. Similar rates of participation and retention were achieved within both the stepped-care model and the RCT.

What we have learned from treatment-related FBT studies prior to the start of this endeavor, provided us with a tailored, albeit labor intensive, stepped-care model. Our results provide evidence for proof of principle for a stepped-care approach and, while preliminary, highlight some potential benefits of this model of care. Certainly, remission rates in adolescent AN above 50% (when using the high bar for remission defined in this study) should be celebrated in what is otherwise a challenging treatment landscape. This was a modest effectiveness study and our enthusiasm for these findings should commensurately be tempered. However, it offers a suitable starting point for a future trial of stepped care that can provide more definitive directions in the treatment of this adolescent population.
References


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Table 1: Baseline Demographic and Clinical Characteristics: Stepped-Care Model vs RCT

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<th>SC (N=82)</th>
<th>RCT (N=106)</th>
<th>Sign p-value^{1,2}</th>
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<tr>
<td>Sex, male/female (%)</td>
<td>7/82 (8.5%)</td>
<td>13/93 (12.3%)</td>
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<td>ED Diagnosis, AN-R/AN-b/p (%AN-R)</td>
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<td>Comorbid Medical Diagnosis^{1}, Y/N (%)</td>
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<td>Age, Mean (SD)</td>
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<td>15.54 (1.48)</td>
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<td>%mBMI, Mean (SD)</td>
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<td>81.90 (6.06)</td>
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<td>23.68 (6.67)</td>
<td>25.59 (7.37)</td>
<td>.088^{2}</td>
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</table>

Key: SC = Stepped Care; RCT = Randomized clinical trial; AN-R = anorexia nervosa restricting subtype; AN-b/p = anorexia nervosa binge/purge subtype; %mBMI = percent median Body Mass Index; EDE Global = Eating Disorder Examination Global Score; CDI = Child Depression Inventory; RSES = Rosenberg Self-esteem Score; ^1Chi-square test; ^2Independent sample t-test; ^3For instance, Diabetes, Asthma, Anaphylaxis, PCKD, Alopecia, NF1, Thalassemia
Table 2: Secondary Outcomes: Stepped-Care Model vs RCT, *Mean (SD)* at Baseline, Week 24 and Week 48

<table>
<thead>
<tr>
<th></th>
<th>SC (N=82)</th>
<th>RCT (N=106)</th>
<th>Sign p-value¹</th>
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<tr>
<td><strong>EDE Global Baseline</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Week 24</td>
<td>2.50 (1.77)</td>
<td>2.15 (1.68)</td>
<td>.845</td>
</tr>
<tr>
<td>Week 48</td>
<td>1.36 (1.44)</td>
<td>.95 (1.33)</td>
<td>.763</td>
</tr>
<tr>
<td></td>
<td>.77 (1.07)</td>
<td>.80 (1.28)</td>
<td>.613</td>
</tr>
<tr>
<td><strong>RSES Baseline</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Week 24</td>
<td>23.68 (6.67)</td>
<td>25.59 (7.37)</td>
<td>.822</td>
</tr>
<tr>
<td>Week 48</td>
<td>26.95 (7.61)</td>
<td>28.46 (8.01)</td>
<td>.940</td>
</tr>
<tr>
<td></td>
<td>28.77 (6.69)</td>
<td>29.79 (7.71)</td>
<td>.788</td>
</tr>
<tr>
<td><strong>CDI Baseline</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Week 24</td>
<td>19.27 (10.83)</td>
<td>17.03 (10.82)</td>
<td>.604</td>
</tr>
<tr>
<td>Week 48</td>
<td>13.26 (11.01)</td>
<td>10.67 (11.62)</td>
<td>.475</td>
</tr>
<tr>
<td></td>
<td>9.92 (8.78)</td>
<td>8.06 (9.49)</td>
<td>.626</td>
</tr>
<tr>
<td><strong>%mBMI Baseline</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Week 24</td>
<td>84.93 (6.87)</td>
<td>81.90 (6.06)</td>
<td>.865</td>
</tr>
<tr>
<td>Week 48</td>
<td>98.71 (12.32)</td>
<td>92.19 (9.68)</td>
<td>.096</td>
</tr>
<tr>
<td></td>
<td>97.59 (8.01)</td>
<td>93.78 (11.12)</td>
<td>.461</td>
</tr>
</tbody>
</table>

**Key:** SC = Stepped Care; RCT = Randomized controlled trial; EDE Global = Eating Disorder Examination Global Score; RSES = Rosenberg Self-esteem Total Score; CDI = Child Depression Inventory Total; %mBMI = median Body Mass Index; ¹Covariate-adjusted contrast from mixed-effects model
Table 3: Stepped-Care Model: Summary of Moderator Analysis

<table>
<thead>
<tr>
<th>Predictor</th>
<th>Week 24 Remission</th>
<th>Week 48 Remission</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sex</td>
<td>.260</td>
<td>.820</td>
</tr>
<tr>
<td>Age</td>
<td>.026 (OR = .717)</td>
<td>.018 (OR = .636)</td>
</tr>
<tr>
<td>Duration of illness</td>
<td>.622</td>
<td>.626</td>
</tr>
<tr>
<td>Comorbid Psychiatric Dx</td>
<td>.478</td>
<td>.124</td>
</tr>
<tr>
<td>EDE Global</td>
<td>.039 (OR = .759)</td>
<td>.885</td>
</tr>
<tr>
<td>EDE Restraint</td>
<td>.050 (OR = .813)</td>
<td>.578</td>
</tr>
<tr>
<td>EDE Shape Concerns</td>
<td>.024 (OR = .761)</td>
<td>.971</td>
</tr>
<tr>
<td>EDE Weight Concerns</td>
<td>.035 (OR = .749)</td>
<td>.700</td>
</tr>
<tr>
<td>EDE Eating Concerns</td>
<td>.243</td>
<td>.103</td>
</tr>
<tr>
<td>Percent mBMI</td>
<td>.001 (OR = 1.148)</td>
<td>.091</td>
</tr>
<tr>
<td>RSE-T</td>
<td>.088</td>
<td>.638</td>
</tr>
<tr>
<td>CDI-T</td>
<td>.340</td>
<td>.667</td>
</tr>
</tbody>
</table>

Key: All cells represent p values; EDE Global = Eating Disorder Examination Global Score; Percent mBMI = Percent median Body Mass Index; CDI-T = Child Depression Inventory Total; RSE-T = Rosenberg Self-esteem Total Score.
Legend Figure 1: FBT Stepped-Care Model for Adolescent Anorexia Nervosa
Key: Stepped Care vs RCT: Week 24=EOT for RCT; Week 48=6-month follow-up for RCT; RCT=16 sessions over 6 months; ……….indicates no further treatment; 'Received prior FBT; AFT=adolescent focused therapy.
Legend Figure 2: Remission in Stepped-Care Model vs the RCT at Week 24 and Week 48
Key: SC = Stepped-Care Model; RCT = Randomized Clinical Trial; Bar chart represents raw data prior to propensity analyses.
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