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Permalink

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Journal

European Eating Disorders Review, 28(2)

ISSN

1072-4133

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Publication Date

2020-03-01

DOI

10.1002/erv.2716

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Peer reviewed

RESEARCH ARTICLE

WILEY

Naturalistic outcomes for a day-hospital programme in a mixed diagnostic sample of adolescents with eating disorders

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Funding information

Hilda and Preston Davis Foundation

Abstract

Despite initial data suggesting positive treatment outcomes for adolescent eating disorder day-hospital programmes (DHPs), existing studies have included limited follow-up, small samples, and a focus on restricting-type eating disorders. To address these gaps, we explored naturalistic outcomes for an adolescent eating disorders DHP. Adolescent participants ($N = 265$) completed measurements at treatment admission, discharge ($n = 170$), and various lengths of follow-up ($n = 126$; $M_{\text{follow up}} = 278.87$ days). Results from multi-level models indicated significant increases in body weight for the anorexia nervosa group throughout treatment and maintenance of increased body weight from discharge to follow-up. In bulimic spectrum disorders, binge eating and purging significantly decreased from intake to discharge and did not change from discharge to follow-up. Across the entire sample, eating disorder symptoms decreased from intake to discharge and did not change from discharge to follow-up. Further, anxiety and depression decreased over the course of treatment and continued to decrease over the follow-up period. The current investigation represents the first study to explore longitudinal DHP outcomes within adolescent bulimic spectrum eating disorders. Our findings also highlight many challenges inherent in conducting naturalistic research; it is critical that the field continue to develop solutions to the barriers inherent in conducting longitudinal research on eating disorder treatment.

KEYWORDS

adolescent, day-hospital care, eating disorders, treatment

1 | INTRODUCTION

Eating disorders, including anorexia nervosa (AN) and bulimia nervosa (BN), are associated with elevated rates of premature death related to medical complications (Mitchell & Crow, 2006; Steinhausen,

2002); they are also linked with high levels of suicidality (Arcelus, Mitchell, Wales, & Nielsen, 2011) and reduced quality of life (Mond, Owen, Hay, Rodgers, & Beumont, 2005). Moreover, evidence indicates that even when receiving gold-standard treatments, many patients with eating disorders

experience poor outcomes, high relapse rates, and treatment drop out (Keel & Brown, 2010).

To date, there are several treatments that have demonstrated benefit for the treatment of adolescent eating disorders. In particular, a number of studies have supported the effectiveness and efficacy of family-based treatment (FBT; Lock & Le Grange, 2015) for the treatment of adolescent AN (Lock et al., 2010). Importantly, existing evidence-based adolescent treatments were all designed for and tested using an outpatient format (Dalle Grave, Calugi, Sartirana, & Fairburn, 2015; Le Grange, Crosby, Rathouz, & Leventhal, 2007; Lock et al., 2010). However, due to medical instability or lack of progress in outpatient therapy, many adolescents with eating disorders receive treatment at higher levels of care (e.g., Frisch, Herzog, & Franko, 2006; Goode, 2016; Wilson, Vitousek, & Loeb, 2000), such as inpatient, residential, intensive outpatient (IOP), and day-hospital programme (DHP), underscoring the need to expand treatment outcomes research to include these higher levels of care. Importantly, although higher levels of care are commonly used in clinical practice, their effectiveness for treating a range of eating disorders long-term remains tentative.

Given the status of FBT in the literature as the outpatient treatment of choice for adolescent AN (Couturier, Kimber, & Szatmari, 2013; Lock, 2015), recent literature has explored the feasibility of adopting FBT approaches for implementation in higher levels of care (Girz, Robinson, Foroughe, Jasper, & Boachie, 2013; Hayes, Welty, Slesinger, & Washburn, 2018; Henderson et al., 2014; Hoste, 2015; Murray et al., 2015; Ornstein, Lane-Loney, & Hollenbeak 2012; Rienecke, Richmond & Lebow, 2016; Rienecke & Richmond, 2018). The majority of existing studies have employed naturalistic and open trial formats, except for one randomized trial conducted in Germany wherein DHP was compared with inpatient care for weight restoration and maintenance (Herpertz-Dahlmann et al., 2014). Across studies, outcomes at discharge have generally been positive, with the majority of studies documenting increases in body weight, reduction in eating disorder behaviours, and reductions in anxiety and depression (Friedman et al., 2016).

There are two main limitations of the current work exploring FBT approaches for adolescent eating disorders delivered at higher levels of care. First, only five of the published open trials and one randomized trial exploring higher levels of care have collected data following discharge (Bryson, Scipioni, Essayli, Mahoney, & Ornstein, 2018; Goldstein et al., 2011; Herpertz-Dahlmann et al., 2014; Henderson et al., 2014; Rienecke & Richmond, 2018; Treat, McCabe, Gaskill, & Marcus, 2008). Given that stepdown and discharge from higher levels of care

are contingent on therapeutic progress, follow-up data are a critical first step to establishing whether programming provides patients with generalizable skills that can be used to maintain symptom reductions over time.

Second, existing studies have focused almost exclusively on restricting-type AN (AN-R), with few trials in higher levels of care including bulimic spectrum eating disorders. For instance, the only existing randomized controlled trial (RCT) on DHP focused exclusively on adolescents with AN-R (Herpertz-Dahlmann et al., 2014). Particularly in light of evidence from FBT RCTs and naturalistic studies in adult samples suggesting that individuals with AN, binge/purge subtype (AN-BP) are at risk for worse treatment outcomes (Le Grange et al., 2012; Vall & Wade, 2015), alongside a dearth of strong evidence-based treatments for adolescent BN, research exploring naturalistic outcomes for DHPs for diagnostic groups outside of AN-R is an important task for the field.

The present study sought to build upon prior research by exploring naturalistic treatment outcomes following discharge for an adolescent eating disorders DHP, using a mixed diagnostic sample. We hypothesized that participants would demonstrate significant decreases in eating pathology, anxiety, and depression from intake to discharge and that individuals with AN would gain significant body weight from intake to discharge. For those individuals diagnosed with bulimic spectrum disorders, we anticipated significant decreases in binge eating and purging behaviours from intake to discharge. Across outcome variables, we expected that following discharge, individuals would maintain gains from treatment, as evidenced by no change from discharge to follow-up time points.

2 | METHOD

2.1 | Participants and procedure

Participants for the present study were 265 adolescent patients diagnosed with clinically significant eating disorders who were admitted to the current DHP between October 2012 and September 2017, consented to participate in the centre's outcomes study and completed study surveys at treatment admission (see flow of study participants in Figure 1). Criteria for admission to DHP conformed to the criteria outlined by the American Psychiatric Association (Yager et al., 2014). Patients who were medically unstable at the time of DHP assessment were referred to a higher level of care and excluded from the study. No other exclusion criteria were implemented. For patients who had multiple admissions to the DHP ($n = 31$), data from their most recent admission were

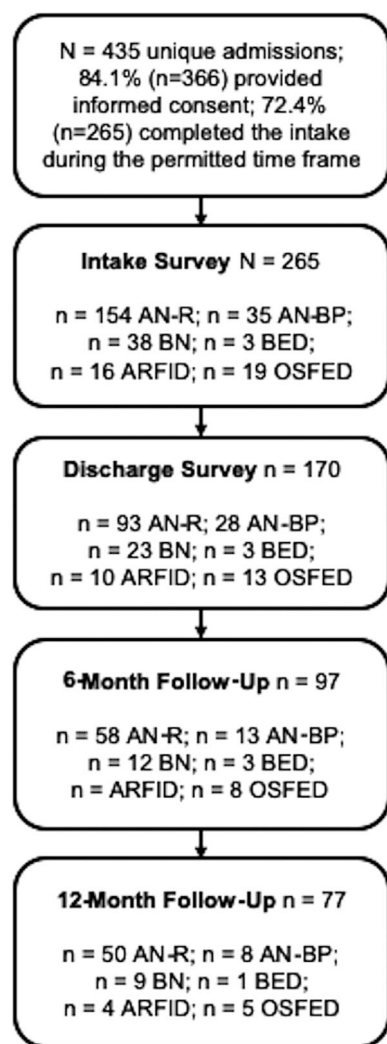


FIGURE 1 Participant flow chart

used; the mean length of time between multiple admissions was around 156 days (standard deviation [*SD*] = 254.26). Diagnoses were determined by staff psychiatrists using an unstandardized semi-structured interview at treatment admission. Participants met the 2010 draft criteria for the *Diagnostic and Statistical Manual of Mental Disorders—Fifth Edition* (DSM-5; American Psychiatric Association, 2013) AN, BN, binge eating disorder (BED), avoidant/restrictive food intake disorder, or other specified eating disorder. Based on these criteria, 154 patients (58.1%) were diagnosed with AN-R, 35 (13.2%) with AN-BP, 38 (14.4%) with BN, 3 (1.1%) with BED, 16 (6.0%) with avoidant/restrictive food intake disorder, and 19 (7.2%) with OSFED, which is consistent with past work in adolescent DHPs (e.g., Girz, Lafrance Robinson, Foroughe, Jasper, & Boachie, 2013; Henderson et al., 2014).

Participants who consented to the study completed online self-report surveys at admission, discharge, and

various lengths of follow-up (6 months, 1 year). Participants were sent surveys at all follow-up time points. Participants were initially compensated with a \$10 gift card for completing each of the follow-up surveys, which was later changed to \$50 to increase adherence. All study procedures were approved by the local Institutional Review Board.

2.2 | Programme description

The overarching goal of the current DHP programme is to educate, train, and prepare parents to effectively manage the recovery of their child upon the transition to home-based management and to motivate the young person to accept their parents' help to return to normal adolescent functioning. This is accomplished using a blend of FBT approaches (Eisler et al., 2016; Lock & Le Grange, 2015) and dialectical behavior therapy (Linehan, 2018), both of which were adapted for use in an intensive treatment setting. For further information on the theoretical blending of these approaches for use in a higher level of care setting, see Anderson et al. (2017). Generally, the programme serves individuals aged 12–18; however, in the event of individualized circumstances that indicate a patient would benefit from the specific components of the DHP, younger (e.g., 11 years old) or older (e.g., a 19-year-old with developmental disabilities) may be considered for admission. Treatment consists of 6–10 hr per day, 6 days a week, and includes individual therapy, family therapy, group therapy, multifamily group therapy, nutritional counselling, psychiatric care, and medical monitoring. Most often, individual nutritional counselling is provided to parents on an as-needed basis as a supplement to FBT, and adolescents receive nutritional psychoeducation in a group-based format. As patients make progress in the programme, they are stepped down to IOP (3 hr a day, 3–4 days a week), which includes the same programming content as included in DHP but facilitates a transition back into school and/or other activities. For more information regarding the theoretical orientation of the programme and active treatment components, please see the Data S1. In our sample, the average length of stay across DHP and IOP was 73.11 days (*SD* = 43.13).

2.3 | Measures

2.3.1 | Percent expected body weight

As recommended by Le Grange et al. (2012) for adolescent samples, we calculated expected body weight (EBW) using the body mass index (BMI) percentile method. This

method calculates EBW by using population norms (Kuczmarski et al., 2000) to estimate the 50th percentile weight for an individual's gender and height ($\%EBW = BMI/50\text{th percentile BMI for age and height} \times 100$; Le Grange et al., 2012). Participant BMI was calculated using objective height, weight, and age at treatment admission and discharge and self-reported weight, height, and age at follow-up, as objective data were not available after treatment discharge. Although this approach to weight reporting is not ideal, data from the participants' time in treatment support the validity of this approach, as self-reported height and weight and objective height and weight were strongly correlated at treatment admission, $r(237) = .98$, $p < .001$, and discharge, $r(159) = .91$, $p < .001$.

2.3.2 | Eating disorder examination questionnaire (Fairburn & Beglin, 1994)

The eating disorder examination questionnaire (EDE-Q) is a 31-item self-report questionnaire that assesses the severity of eating disorder psychopathology over the past 28 days. We used the EDE-Q global score, which averages across symptom subscales (e.g., eating concerns; shape concerns) to provide a general indication of cognitive eating pathology. In our sample, the subscale showed excellent internal consistency across time ($\alpha = .97$ for all time points).

2.3.3 | Beck depression inventory (Beck, Steer, & Brown, 1996)

The Beck depression inventory (BDI) is a 21-item assessment that evaluates depressive symptoms over the previous 2 weeks. The BDI demonstrated excellent internal consistency across time in the present sample ($\alpha = .95-.97$).

2.3.4 | State-trait anxiety inventory—trait subscale (Spielberger, Gorsuch, & Lushene, 1970)

The state-trait anxiety inventory—trait subscale (STAI-T) is a 20-item measure of trait anxiety symptoms. Internal consistency in the present sample was excellent across time ($\alpha = .92-.94$).

2.3.5 | Remission criteria

To explore patterns of remission in the sample, we chose a stringent definition of remission as employed in past

RCTs of FBT (Le Grange, Accurso, Lock, Agras, & Bryson, 2014; Lock et al., 2010). Specifically, full remission was defined as achieving 95% EBW, reporting an EDE-Q global score within 1 SD of adolescent community norms (Carter, Stewart, & Fairburn, 2001), and not engaging in binge eating or purging within the past 28 days.

2.4 | Statistical analysis

To increase the accuracy of model estimates, all participants who provided baseline data were included in all analyses, including those who dropped out of treatment against medical advice or did not complete assessments at follow-up. To evaluate changes on relevant outcome measurements from baseline to discharge and discharge to follow-up, we used multilevel models, conducted in R using the nlme package (Pinheiro, Bates, DebRoy, Sarkar, & R Core Team, 2018). To handle high levels of missing data, we used full information maximum likelihood estimation, which is considered a robust method for generation of model estimates with missing data (Allison, 2009) and generates estimates similar to multiple imputation methods (Ferro, 2014; Grund, Lüdtke, & Robitzsch, 2018; Peyre, Leplege, & Coste, 2011). Multilevel models included repeated measurements of dependent variables (EDE-Q, binge eating and purging frequency, %EBW, BDI-II, STAI-Trait) nested within participants. Multilevel models account for data that is nested in structure; models estimate both fixed, or average effects across a sample, and random effects, which model variability in effects. For the purposes of the current study, we report fixed effects, or the average effect of variables of interest across the full sample. Given differences in length of stay across participants and variability in the timing of assessments, we modelled time in days continuously, centring time around discharge (discharge = Day 0). Moreover, given differential processes affecting symptoms during and after treatment, we modelled time using a piecewise method, exploring changes from during treatment (e.g., intake–discharge, Piece 1) and following treatment (e.g., discharge–follow-up; Piece 2). Model fitting was approached in stages, and subsequent models were compared to ensure significant improvement in model fit using Akaike information criterion, Bayesian information criterion, and log-likelihood criteria. Final EDE-Q, BDI, and STAI models represent random intercept, random slope models. EBW, binge, and purge models represent random intercept, fixed slope models. All models included length of stay, age, and length of illness as covariates. To control for multiple comparisons, we used a Bonferroni correction and set the

alpha rate at .008 (.05/6 models = .008). Of note, the % EBW, binge eating, and purging analyses were conducted in subsets of the sample; we conducted %EBW analyses in the sample of individuals that had a diagnosis of AN-R or AN-BP at the time of admission ($n = 186$). We conducted binge eating analyses in individuals with AN-BP, BN, and BED ($n = 75$) and purging analyses in the AN-BP and BN groups ($n = 72$). Results from multilevel models are available in Table 3.

3 | RESULTS

3.1 | Patient demographics

Demographics at admission and descriptive statistics for main outcomes are presented in Table 1. As noted previously, the EDE-Q, BDI, and STAI models were conducted in the full sample ($N = 265$); the EBW Model was conducted in individuals with a diagnosis of AN ($n = 186$); the binge eating models were conducted in the BN, AN-BP, and BED subsample ($n = 75$), and the purge model was conducted in the BN and AN-BP subsample ($n = 72$). The average age of participants at intake was 15.67 ($SD = 1.71$; range = 11.56–21.19). The majority of

participants were Caucasian (67.5%; $n = 179$) with the remaining participants identifying as Asian (7.2%; $n = 19$), African American (0.4%; $n = 1$), Native American/Alaskan Native (0.4%; $n = 1$), or other race/ethnicity (23.4%; $n = 62$). A minority (16.6%; $n = 44$) of the sample identified as Hispanic. Overall, 58.1% of the sample ($n = 154$) were diagnosed with some psychiatric comorbidity, and 41.1% of the sample ($n = 109$) was prescribed psychiatric medication at admission (Table 1). The most common class of medication prescribed were antidepressant medications ($n = 95$; 35.8%). The most common referral sources were outpatient providers (32.7%, $n = 87$) and inpatient eating disorder specialty units (23.7%, $n = 63$).

Mean levels of eating disorder symptoms, as indicated by the EDE-Q (see Table 1), were consistent with past studies in DHP or residential samples that used the same measurement (range = 2.60–3.80; Bean, Louks, Kay, Cornella-Carlson, & Weltzin, 2010; Hoste, 2015; Rienecke et al., 2018). Past treatment outcomes studies in non-underweight, outpatient samples that used the EDE-Q also reported similar global means (range = 2.79–3.60; Dalle Grave, Calugi, Doll, & Fairburn, 2013; Dalle Grave, Calugi, Sartirana, & Fairburn, 2015).

Notably, many of the individuals diagnosed with AN in the current sample presented to treatment with a %

TABLE 1 Admission demographics

Variable	<i>M (SD)</i>	Variable	<i>n (%)</i>
Age (years)	15.67 (1.71)	Comorbid disorders at admission	
EBW (%EBW)	93.68 (18.30)	Mood disorder	114 (43.0%)
Length of illness (years)	2.17 (1.84)	Anxiety disorder	109 (41.1%)
Education (years)	9.75 (1.59)	ADHD/psychotic disorder	13 (4.9%)
Length of stay (days)	73.11 (43.13)	Substance use disorder	8 (3.0%)
EDE-Q global	3.22 (1.78)	Psychotic disorder	2 (0.8%)
BDI-II	26.04 (14.95)	Other comorbid disorder	6 (2.3%)
STAI-trait	55.17 (12.88)	Any comorbid disorder	154 (58.1%)
Binge eating (frequency; EDE-Q)	4.68 (6.54)	Psychotropic medication	
Purging (frequency; EDE-Q)	11.13 (12.50)	Antidepressant	95 (35.8%)
		Atypical antipsychotic	28 (10.6%)
		Mood stabilizer	8 (3.0%)
		Anxiolytic medication	15 (5.7%)
		ADHD medication	6 (2.3%)
		Sleep medication	7 (2.6%)
		Other medication	4 (1.5%)
		Gender (male)	20 (7.5%)
		EBW < 85%	94 (35.5%)

Abbreviations: ADHD, attention deficit hyperactivity disorder; BDI-II, Beck depression inventory II; EBW, expected body weight; EDE-Q, eating disorder examination questionnaire; STAI, state-trait anxiety inventory.

EBW above the cut-off recommended in prior iterations of the DSM for a diagnosis of AN (i.e., <85% EBW). The %EBW in our sample was likely influenced by the fact that around a quarter of our sample, participants were referred to our programme following completion of inpatient specialized eating disorder care.

3.2 | Patient retention and predictors of loss to follow-up

Sixty-four percent of participants completed discharge assessments ($n = 170$), and 47.5% ($n = 126$) of participants completed at least one follow-up assessment, although rates of completion varied across differing time points. The mean follow-up time point took place at 278.87 days following discharge ($SD = 100.68$ days). Participants who completed discharge surveys were not significantly different to those without discharge surveys in terms of intake EBW, self-reported anxiety, age, and length of illness ($ps < .05$). However, those that did not complete their discharge surveys had significantly lower intake EDE-Q global, $t(260) = 2.33$, $p = .02$, and BDI scores, $t(261) = 2.76$, $p = .005$, were more likely to have shorter lengths of stay, $t(249) = -8.70$, $p < .01$, and less likely to have “appropriate discharges” (i.e., discharged against medical advice, transferred to a higher level of care, left for personal reasons, or were discharged prematurely due to loss of insurance coverage), $\chi(1) = 41.75$, $p < .001$. Participants who completed follow-up assessments were not significantly different from those lost to follow-up in terms of intake or discharge %EBW, intake or discharge self-reported eating pathology, intake or discharge depression, intake or discharge anxiety, age, or length of illness ($ps < .05$). However, those who did not have “appropriate discharges” (i.e., discharged against medical advice, transferred to a higher level of care, left for personal reasons, or were discharged prematurely due to loss of insurance coverage; $n = 69$) were less likely to complete follow-up assessments than those who discharged appropriately, $\chi(1) = 12.41$, $p < .001$. People who did not complete follow-up assessments also tended to have had a significantly shorter length of stay, $F(1, 264) = 3.90$, $p = .049$.

3.3 | Primary outcomes

3.3.1 | Remission rates over time

Full and partial remission rates across differing time points are reported in Table 2; full and partial remission rates by diagnostic category are present in the Table S1. Of note, these results are expressed as a percentage of the

TABLE 2 Frequency of full remission and descriptive statistics for outcomes over time

Time point	Full remission		Full or partial remission		EDE-Q global		%EBW (AN subgroup)		BDI-II		STAI-T		Binge eating (AN-BP, BN, and BED)		Purging (AN-BP, and BN)	
	<i>n</i>	%	<i>n</i>	%	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>
Intake ($n = 265$)	—	—	—	—	3.22	1.78	87.48	10.27	26.04	14.95	55.17	12.88	4.68	6.54	11.13	12.50
Discharge ($n = 170$)	71	41.8	119	70.0	1.97	1.57	99.68	9.13	19.47	15.88	49.56	13.44	1.47	4.02	1.63	4.21
6-month FU ($n = 93$)	33	34.0	53	54.6	1.99	1.62	98.24	11.14	15.91	13.96	49.36	13.16	1.20	2.64	1.79	4.01
12-month FU ($n = 77$)	31	40.3	46	59.7	1.69	1.55	99.12	10.06	13.90	15.57	46.09	14.04	2.06	3.21	2.12	6.74

Abbreviations: AN, anorexia nervosa; AN-BP, anorexia nervosa, binge/purge subtype; BDI-II, Beck depression inventory II; BED, binge eating disorder; BN, bulimia nervosa; EBW, expected body weight; EDE-Q, eating disorder examination questionnaire; FU, follow-up; STAI-T, state-trait anxiety inventory—trait subscale.

TABLE 3 Estimates of fixed effects from multilevel models exploring changes in symptoms over time

Predictor	%EBW model		Binge model		Purging model		EDE-Q model		BDI model		STAI model	
	Est.	<i>p</i>	Est.	<i>p</i>	Est.	<i>p</i>	Est.	<i>p</i>	Est.	<i>p</i>	Est.	<i>p</i>
Intercept	98.10	<.001	1.78	.005	3.54	.004	2.12	<.001	19.23	<.001	50.35	<.001
Intake–discharge	0.14	<.001	−0.03	<.001	−0.08	<.001	−0.02	<.001	−0.10	<.001	−0.07	<.001
Discharge–follow up	−0.00	.977	−0.001	.862	−0.01	.407	−0.001	.078	−0.01	<.001	−0.01	.002
LOS	0.07	<.001	−0.01	.273	−0.04	.041	0.002	.420	0.03	.199	0.03	.070
Age	−1.28	.002	−0.30	.256	0.97	.126	−0.02	.778	−0.19	.684	−0.28	.522
Length of illness	0.15	.737	0.20	.314	−0.41	.394	−0.02	.726	0.36	.366	0.61	.127

Note. Each column represents the results from a separate multilevel model; we have included fixed effects from each model, along with the *p* value for each estimate. Intake–discharge indicates the effect of time from intake to discharge; discharge–follow-up indicates the effect of time from discharge to follow-up. Bolded effects are significant at *p* < .008.

Abbreviations: BDI, Beck depression inventory; EBW, expected body weight; EDE-Q, eating disorder examination questionnaire; LOS, length of stay; STAI, state–trait anxiety inventory.

reporting sample, rather than percentage of the full intake sample, as the remission status of those who did not complete assessments at discharge and follow-up time points could not be discerned. At discharge from treatment, 41.8% of the sample reported full remission of symptoms, defined as having an EDE-Q global score within a *SD* of community norms, having a body weight above 95% of expected body weight based on norms, and reporting no binge eating or purging behaviours in the past 28 days. At 6-month follow-up, 34% reported full remission from symptoms, and at 12-month follow-up, 40.3% were fully remitted.

When a more liberal partial remission status was examined (having an %EBW above 85 and reporting no behaviours over the past 28 days), 70% of the sample reported partial or full remission at discharge. At 6-month follow-up, 54.6% of the sample demonstrated either full or partial remission of symptoms; at 12-month follow-up, 59.7% were either partially or fully remitted.

3.3.2 | Expected body weight

Mean levels of EBW at discharge and follow-up time points are available in Table 2. Parameter estimates from multilevel models evaluating changes in EBW over time are available in Table 3. Results indicated significant increases in EBW in the AN subsample from intake to discharge and no changes in EBW from discharge to follow-up.

3.3.3 | Binge eating and purging behaviours

Mean levels of binge eating and purging behaviours across time points are available in Table 2. Results from

binge eating models (see Table 3) suggested significant decreases in binge eating from intake to discharge but did not decrease from discharge to follow-up. In a similar manner, results from purging models also suggested significant decreases in purging frequency from intake to discharge and did not change from discharge to follow-up.

3.3.4 | Eating disorder symptomatology

The EDE-Q global models (Table 3) indicated significant decreases in EDE-Q global scores from intake to discharge. Models indicated no significant changes in EDE-Q global scores from discharge to follow-up time points.

3.3.5 | Secondary outcomes by diagnosis over time

BDI and STAI models (Table 3) suggested significant decreases in depression and anxiety symptoms from intake to discharge, as well as significant decreases from discharge to follow-up.

4 | DISCUSSION

The purpose of the current investigation was to evaluate the naturalistic, longitudinal outcomes for adolescents who attended an eating disorders DHP, as the majority of existing studies conducted on family-based DHPs have either not included binge–purge-type eating disorders or follow-up data. The current study is one of the first in the literature to demonstrate improvements during and following a DHP in a mixed diagnostic group, and using a

large sample, provides additional naturalistic data supporting the use of DHPs.

An important point relevant to all results concerns the high level of attrition, which leaves our findings vulnerable to a number of biases. This limitation is not unique to our investigation but instead represents a larger issue for naturalistic research on eating disorders, particularly at higher levels of care. To date, the majority of treatment studies for adolescent eating disorders are either: (i) randomized controlled trials, most of which have been conducted in outpatient settings and have high retention rates secondary to grant funding, and (ii) naturalistic, open trials conducted in higher levels of care that focus on outcomes at discharge and have poor follow-up rates. To put our follow-up rates in context, observed rates in the current study were somewhat lower than another large, naturalistic study of adolescents discharged from a DHP that was recently published (Bryson et al., 2018), as well as other larger scale DHP samples collected in adult populations (e.g., Brown et al., 2018; Fittig, Jacobi, Backmund, Gerlinghoff, & Wittchen, 2008). Given that dropout in other large-scale treatment research has been linked to both poorer outcomes as well as better long-term outcomes (e.g., Gowers et al., 2010), it is challenging to determine the precise influence that our dropout rates may have had on our findings. Moving forward, creative solutions to increase follow-up rates across studies, explore common patterns and reasons for dropout in treatment studies, and improve the standard of treatment outcomes research for nonrandomized designs are necessary to produce results that provide a closer approximation of clinical reality.

With this caveat in mind, descriptive statistics regarding rates of remission in our sample indicate that 41% of the sample demonstrated full remission at discharge, and among individuals who completed follow-up surveys, between 34.0 and 40.3% of the sample demonstrated full remission at differing time points. When a more liberal definition of partial recovery was evaluated, between 55% and 70% of the sample reported a %EBW over 85% and no binge eating or purging over the previous 28 days. Given that this is the largest published sample of follow-up data from a DHP to date, few studies have reported remission rates, and those that have varied in their remission definitions, it is challenging to find an appropriate comparison for our results. The major RCT for outpatient FBT in AN reported full remission rates for end of treatment and follow-up as 42% and 49%, respectively (Lock et al., 2010). The major RCT for FBT for BN, also conducted in an outpatient setting, reported remission rates of 39% at discharge and 29% at 6-month follow-up (Le Grange et al., 2015).

Comparing our results to past open trials in higher levels of care, past reports have used various remission criteria. For instance, one past naturalistic DHP study in adolescents suggested that at follow-up, around 62.5% of the AN participants self-reported at least 95% of mean BMI for their age (Bryson et al., 2018), which is higher than the recovery observed in our sample. However, the sample recruited for follow-up in Bryson et al. (2018) was smaller than our sample ($n = 69$), and the authors did not include a cognitive criterion for remission. Overall, lack of consistent reporting and definitions for remission in existing literature remains a significant limitation of the field (Couturier & Lock, 2006).

Second, results indicated that cognitive eating disorder symptoms significantly decreased from intake to discharge and did not change from discharge to follow-up time points, indicating overall maintenance of symptom reductions. Although only one past open trial exploring the follow-up effects of DHP care included the EDE-Q as an outcome measurement (Rienecke & Richmond, 2018), our findings were consistent with trends across all previous investigations, suggesting that the majority of patients experience significant decreases in cognitive symptoms over the course of treatment (Bryson et al., 2018; Goldstein et al., 2011; Henderson et al., 2014; Rienecke & Richmond, 2018; Treat, McCabe, Gaskill, & Marcus, 2008). Supporting the clinical significance of our results, in our sample, mean levels of all EDE-Q subscales were within one *SD* of community norms at both discharge and follow-up (Carter, Stewart, & Fairburn, 2001). Overall, findings from EDE-Q models are consistent with past work suggesting beneficial outcomes associated with DHP.

Models exploring changes in body weight from intake to discharge and discharge to follow-up in the sample diagnosed with AN-R or AN-BP suggested increases in body weight from intake to discharge and maintenance of improvements from discharge to follow-up. Similar to EDE-Q analyses and prior open trials exploring the effects of family-based DHP (Bryson et al., 2018; Goldstein et al., 2011; Henderson et al., 2014; Rienecke & Richmond, 2018; Treat et al., 2008), findings from these models generally suggest that improvements in body weight concurrent with receiving DHP care are maintained over time. Of note, despite the fact that many participants presented to treatment with an EBW above the 85% cut-off recommended in prior iterations of the DSM (often secondary to prior treatment at higher levels of care), it remains important that participants continued to gain weight from intake to discharge, and all groups demonstrated a mean body weight above 85% of EBW at discharge and follow-up. Overall, although our data provide initial support regarding potential positive benefits

of DHP over time, there are a number of questions regarding higher levels of care more generally that must be explored in future research, such as the relative benefits of DHP in comparison with outpatient treatment, the effectiveness of differing approaches to the structure of higher levels of care (e.g., Herpertz-Dahlmann et al., 2014), as well as its cost effectiveness relative to other treatment options.

Past open trials of DHP in adolescent samples have not included a consideration of bulimic spectrum eating disorders; the one study that included adolescents with BN did not report changes in binge eating and purging behaviours over time (Henderson et al., 2014). In our sample, models exploring changes in binge eating and purging variables indicated significant decreases in both behaviours from intake to discharge and maintenance of improvements from discharge to follow-up. Given the high level of supervision present in the DHP, it is unsurprising that the sample demonstrated significant behavioural decreases from intake to discharge; however, the lack of changes from discharge to follow-up are promising, suggesting no significant rebound in symptoms following discharge from a higher level of care over time. However, it is important to note that despite the fact that our study aimed to evaluate outcome in bulimic spectrum eating disorders, the sample sizes for both BN and AN-BP remained small in comparison with restricting-type eating disorders. Although we believe that the diagnostic make-up of our sample is representative of adolescent eating disorders presented to higher levels of care (i.e., greater representation of AN-R), it is critical that future work evaluate BN-spectrum outcomes in larger samples.

Finally, models exploring secondary outcomes indicated significant decreases in depression and trait anxiety across the sample, both from intake to discharge and discharge to follow-up. These findings are consistent with data from RCTs for adolescent eating disorders and studies in adult and adolescent DHPs, which suggest that primarily eating disorder-focused treatment commonly results in decreases in depressive and anxious symptoms (Accurso, Ciao, Fitzsimmons-Craft, Lock, & Le Grange, 2014; Brown et al., 2018; Eisler, Dare, Hodes, Russell, Dodge, & Le Grange, 2000; Le Grange, Eisler, Dare, & Russell, 1992; Ornstein, Lane-Loney, & Hollenbeak, 2012). Given that clinically significant anxiety and mood disorders were commonly observed in our sample, it is notable that the sample self-reported significant changes in these symptoms, suggesting that participating in eating disorder treatments may result in changes in clinically significant emotional symptoms distinct from eating pathology. However, it is also possible that changes in anxious and depressive symptoms represent by-products

of changes in eating disorder symptoms and benefits associated with cessation of eating disorder behaviours. Although this possibility was not examined directly, it represents an important area for future research.

4.1 | Strengths and limitations

The current investigation has a number of strengths that enhance its contribution to the literature. First, the current study represents the largest sample of adolescents with eating disorders in the DHP outcomes literature, and the naturalistic design and lack of exclusion criteria enhance the representativeness of the sample and the generalizability of the findings to other, similar programmes. Moreover, given emphasis on restricting eating disorders in existing literature, the inclusion of both AN-BP and BN groups, as well as our use of full information maximum likelihood to handle missing data, represents other notable strengths.

Despite the strengths of the current study, there are also several notable limitations that are important for contextualizing our findings. First, an important limitation of our study, alongside many other studies of this kind, is the lack of systematic data collection on treatment that participants received following discharge from the DHP. Due to this limitation, alongside the lack of a comparison group, we cannot determine whether any observed improvements are associated with the care provided at our DHP or with other care received following discharge. Additionally, given small sample sizes for several of the diagnostic groups, we were not able to run main analyses exploring the effect of diagnosis. Further, we made the decision to use each participant's most recent treatment admission, which may have influenced the outcome of our results. It is critical that future work collect systematic data on participants' treatment throughout the duration of data collection, and whenever possible, consider the use of a comparator group. Third, although the current programme has a family-based focus, we did not collect data on parental variables, such as parental empowerment; given theoretical assertions that these processes are critical to success in FBT (Rhodes, Baillee, Brown, & Madden, 2008) and conceivably could be compromised within higher levels of care that provide an increased level of scaffolding, it will be critical for future work to measure these processes explicitly in outcomes research. Fourth, the sample was relatively homogeneous in demographic characteristics, with a small number of males and racial/ethnic backgrounds represented; thus, generalizability of these results to other demographic groups may be limited. Fifth, the use of self-report assessments, particularly for follow-up EBW measurements, represents a limitation. Although self-reported BMI

demonstrated a strong correlation with objective BMI at admit and discharge (r 's = .91–.98, $p < .01$), inaccurate self-reports may have biased EBW findings. Sixth, we were not able to analyse changes in psychiatric medication throughout treatment, which may have impacted outcomes. Relatedly, we did not collect data on prescribed medication at follow-up. Finally, the use of nonstandardized interviews for diagnosis and use of the BDI among younger patients (<13 years old) represent other significant assessment-based limitations. Although the use of semi-structured, nonstandardized interviews administered by psychiatrists likely represents a closer proximity of the clinical reality at many DHPs, future work should prioritize the use of formal structured interviews to enhance the reliability and validity of diagnoses. Moreover, future work exploring depressive symptoms in younger populations should employ developmentally appropriate symptom reports (e.g., the Children's Depression Inventory).

5 | CONCLUSIONS

Given the proliferation of higher levels of care for the treatment of eating disorders (Frisch, Herzog, & Franko, 2006; Goode, 2016; Wilson, Vitousek, & Loeb, 2000), prioritizing research exploring improvements associated with these treatments is an important endeavour. To date, the effectiveness of these programmes remains unclear, particularly in light of high attrition rates, a primary focus on restricting-type eating disorders, and lack of follow-up data. Overall, the results of the current study suggest that adolescents with various forms of eating pathology that present to a DHP demonstrate improvements in behavioural and cognitive symptoms over time and that these improvements continue or are maintained following discharge.

ACKNOWLEDGEMENTS

Authors of this work receive support from the Hilda and Preston Davis Foundation. The opinions and assertions expressed herein are those of the authors and are not to be construed as reflecting the views of the Davis Foundation. The authors wish to thank Noriko Coburn and Tiffany Nakamura for their roles in data collection.

CONFLICT OF INTEREST

All authors declare no conflict of interest.

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SUPPORTING INFORMATION

Additional supporting information may be found online in the Supporting Information section at the end of this article.

How to cite this article: Reilly EE, Rockwell RE, Ramirez AL, et al. Naturalistic outcomes for a day-hospital programme in a mixed diagnostic sample of adolescents with eating disorders. *Eur Eat Disorders Rev*. 2020;28:199–210. <https://doi.org/10.1002/erv.2716>