



## RESEARCH ARTICLE

# Anxiety, Obsessive-Compulsive, and Depressive Symptom Presentation and Change Throughout Routine Eating Disorder Treatment

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## ABSTRACT

**Objective:** The present study examined whether patients with binge/purge and restricting anorexia nervosa (AN-BP and AN-R), bulimia nervosa (BN), binge eating disorder (BED), avoidant/restrictive food intake disorder (ARFID), and other specified feeding and eating disorder (OSFED) differ in generalised anxiety disorder (GAD), obsessive-compulsive disorder (OCD), and depression *symptom* patterns and overall comorbid symptom severity at admission. We also assessed between-group differences in the patterns of change and overall comorbid symptom severity change from admission to discharge from routine eating disorder (ED) treatment at higher levels of care (HLOC).

**Method:** The initial sample included 3730 adults routinely assessed for GAD, depression, and OCD at admission and discharge from treatment.

**Results and Conclusions:** ED diagnostic groups exhibited somewhat different symptom patterns (e.g., AN-R and ARFID were more prone to GAD and OCD than depression symptoms; BED exhibited the opposite pattern) and overall symptom severity at admission (i.e., AN-BP and OSFED had the highest overall comorbid symptom severity; BED had the lowest). Although the overall symptom improvement was significantly greater in ARFID and BED than in AN-BP, AN-R, and OSFED, ED patients collectively and within each diagnostic group improved significantly in GAD, OCD, and depression symptoms following routine ED treatment at HLOC.

## Summary

- ED patients significantly improved during routine ED treatment at HLOC.
- The improvement was significant for all comorbid symptoms and all diagnostic groups.
- A small group of patients experienced symptom worsening from admission to discharge.

## 1 | Introduction

It is well-documented that those with a primary eating disorder (ED) diagnosis have an elevated risk for medical and psychiatric comorbidities (Cost, Krantz, and Mehler 2020; Hudson et al. 2007; Kaye et al. 2004). A host of mental health disorders can co-occur with anorexia nervosa restricting subtype (AN-R), anorexia nervosa binge-purge subtype (AN-BP), bulimia nervosa (BN), binge-eating disorder (BED), avoidant-restrictive intake disorder (ARFID), and other specified feeding and eating disorders (OSFED), though anxiety and depressive disorders are particularly prevalent (Hambleton et al. 2022; Hudson et al. 2007). Specifically, 30.5%–32.3% of treatment-seeking adult patients with EDs met the criteria for generalised anxiety disorder (GAD), between 28.5% and 32.8% met the criteria for major depressive disorder, 38.7%–42.6% met the criteria for any unipolar depression, and 4.3%–4.4% met the criteria for obsessive-compulsive disorder (OCD; Ulfvebrand et al. 2015). As a point of reference, the rates of anxiety, depression, and OCD in the United States (U.S.) general population are estimated at 3.1%, 8.4%, and 1.2%, respectively (Anxiety and Depression Association of America 2022; Bhatia 2020). These elevated rates of comorbidities have been replicated in population-based surveys and community samples of both adults (e.g., Hudson et al. 2007) and adolescents (e.g., Rojo-Moreno et al. 2015; Swanson et al. 2011). When subdivided into categories for each ED diagnosis, comorbidity estimates remain elevated (i.e., compared to population estimates), especially in females (see Ulfvebrand et al. 2015, though cf. Tyagi et al. 2015).<sup>1</sup>

The above empirical reports concern GAD, OCD, and major depressive disorder at a full-threshold diagnostic level. Many individuals with EDs may not meet the full criteria for a co-occurring disorder but may still experience symptoms of anxiety and mood disorders at elevated rates compared to the general population (Mischoulon et al. 2011). Anxiety/mood symptoms, above and beyond the distress and impairment caused by EDs, are associated with greater symptom severity and poorer prognosis (Sander, Moessner, and Bauer 2021), complicating case conceptualisation and impacting the success of treatment planning. Although many studies have compared the prevalence of full threshold comorbid diagnoses in EDs (e.g., Blinder, Cumella, and Sanathara 2006; Hambleton et al. 2022; Ulfvebrand et al. 2015), there is a dearth of comorbid ED research examining the prevalence and severity of GAD, OCD, and major depressive symptoms that do not necessarily meet the diagnostic threshold. To our knowledge, no studies have examined whether patients with AN-R, AN-BP, BN, BED, ARFID, and OSFED exhibit different patterns

of these symptoms upon admission to higher levels of care (HLOC).

Routine ED treatment at HLOC primarily focuses on the alleviation of ED symptoms such as restricting, binge eating, compensatory behaviours, and ED-related cognitions. A significant reduction in ED symptoms following such treatment has been found in both patients with EDs collectively and within specific ED diagnostic groups (e.g., Friedman et al. 2016; Rienecke et al. 2021). There are several reasons to believe that ED treatment, including routine treatment at HLOC, may not be limited to ED symptom improvement but may also lead to an improvement in comorbid symptoms. First, empirical work suggests a bidirectional relationship between ED symptoms and comorbid symptoms (Momen et al. 2022). Second, at least some symptom overlap exists between EDs and comorbid disorders (e.g., appetite loss, self-image issues). Accordingly, prior work has found that weight restoration as part of ED treatment for AN may positively impact comorbid symptoms, including those of depression, anxiety, and OCD (e.g., Pollice et al. 1997; Sala et al. 2011). Third, some skills taught during routine ED treatments (e.g., cognitive restructuring, exposures) likely have transdiagnostic relevance and contribute to improvements in both ED and comorbid symptoms. That is, although primarily targeting ED symptoms, routine ED treatments using evidence-based interventions more or less directly target comorbid symptoms. Some previous studies have indeed shown that OCD symptoms, worry, depressive symptoms, and overall psychological impairment lessen with routine ED treatment in HLOC (Abbate-Daga et al. 2015; Bégin et al. 2013; Fewell, Levinson, and Stark 2017; Fittig et al. 2008; Lewis et al. 2019; Rienecke et al. 2023). However, most of these studies have focused on depression and anxiety symptoms (for an exception, see Lewis et al. 2019; Rienecke et al. 2021) in AN and BN and had relatively small samples of or did not include diagnostic groups such as BED, ARFID, and OSFED.

The present study aims to expand previous findings by exploring whether GAD, OCD, and depression symptoms improve significantly and reliably from admission to discharge from routine ED treatment at HLOC across different ED diagnostic groups (AN-R, AN-BP, BN, BED, ARFID, OSFED). Moreover, we examine whether the six diagnostic groups differ in GAD, OCD, and depression symptom patterns and overall symptom severity at admission and whether these groups differ in patterns and overall change in symptom severity from admission to discharge. Such a detailed direct comparison of various ED diagnostic groups regarding comorbid symptoms is not common in the existing literature, and particularly rare are studies assessing comorbid symptom presentation and change in patients diagnosed with ARFID and OSFED, specifically in those seeking and receiving treatment at HLOC. Finally, previous studies, including those on related samples (e.g., Rienecke et al. 2021), have found that ED symptoms decrease significantly in all ED diagnostic groups from admission to discharge from ED treatment in HLOC. Thus, ED symptoms were not of primary interest in this study. Nonetheless, we briefly examine whether the change in comorbid symptoms corresponds with the change in ED symptoms, including weight gain in restrictive EDs (i.e., AN-R and ARFID) and a decrease in purging behaviours in BN.

## 2 | Methods

### 2.1 | Participants and Procedure

The initial sample included 3730 adults admitted to one of the locations of a multi-facility treatment centre providing inpatient (i.e., 24/7 care with intensive medical assistance), residential (i.e., 24/7 care with less regular medical assistance), partial hospitalisation (8–10 h per day, 7 days per week), and intensive outpatient care (i.e., 3–6 h per day, 3–5 days per week), between October 2020 and August 2023. ED diagnosis was determined based on a clinical interview carried out by psychiatrists, nurse practitioners/physician assistants, or licensed therapists, following the *DSM-5* criteria. In line with the *DSM-5*, patients were diagnosed with OSFED if they did not meet the full criteria for any of the feeding and eating disorders but did experience symptoms characteristic of a feeding and eating disorder that caused significant distress and/or impairment. Each participant provided informed consent before completing self-report measures within five business days of admission and 7 days of discharge. As is often the case with clinical samples, a substantial portion of data was missing, particularly but not only at discharge (i.e., some respondents had data on some but not all relevant measures at admission).<sup>2</sup>

### 2.2 | Treatment

Inpatient, residential, and partial hospitalisation programs involve individual (twice weekly) and family (weekly) psychotherapy sessions, as well as group therapy (3–4 h per day). Group sessions typically involve evidence-based interventions from dialectical behaviour therapy, acceptance and commitment therapy, and exposure and response prevention. Regular sessions with psychiatrists, weekly appointments with dietitians, and twice weekly physician visits (daily for inpatients) are also part of the treatment, as are supervised meals and snacks. Intensive outpatient treatment involves group psychoeducation (three 3-h sessions per week), individual or family therapy (an hour weekly), medical monitoring (weekly), and dietitian appointments (every 2 weeks). The admission level of care is determined based on medical and behavioural needs. Typically, patients step down to progressively lower levels of care until they can be discharged to outpatient treatment. A brief step-up may occur if a patient experiences medical or behavioural complications.

### 2.3 | Measures

The Generalised Anxiety Disorder Scale (GAD-7; Spitzer et al. 2006) is a 7-item self-report scale for assessing GAD symptoms. A 4-point Likert scale is provided as a response format (0 = *not at all* to 3 = *nearly every day*), with the total GAD-7 scores of 5, 10, and 15 being indicative of mild, moderate, and severe levels of anxiety. In the present study, the scale showed excellent internal consistency at admission ( $n = 2,714$ ,  $\alpha = 0.89$ ) and discharge ( $n = 2,018$ ,  $\alpha = 0.91$ ).<sup>3</sup>

The Obsessive–Compulsive Inventory-Revised (Foa et al. 2002) is an 18-item self-report measure of OCD symptoms. Participants

reported the amount of distress a situation described in a particular item provoked in them during the previous month. The response options ranged from 0 (not at all) to 5 (extremely), with OCI-R total scores of  $\leq 15$ , 16–27, and  $\geq 28$  indicating mild, moderate, and severe OCD symptoms (Abramovitch et al. 2020). The OCI-R demonstrated high internal consistency at admission ( $n = 3,710$ ,  $\alpha = 0.92$ ) and discharge ( $n = 2,647$ ,  $\alpha = 0.93$ ).

The Patient Health Questionnaire (PHQ-9; Kroenke, Spitzer, and Williams 2001) consists of nine items assessing the frequency of depression symptoms over the last 2 weeks. The response options range from 0 (*not at all*) to 3 (*nearly every day*). PHQ-9 total scores of 5, 10, 15, and 20 are indicative of mild, moderate, moderately severe, and severe levels of depression, respectively. The internal consistency of the PHQ-9 was excellent at admission ( $n = 3,709$ ,  $\alpha = 0.88$ ) and discharge ( $n = 2,654$ ,  $\alpha = 0.90$ ).

Eating Disorder Examination-Questionnaire (EDE-Q; Fairburn and Beglin 1994) consists of 28 items measuring the frequency and severity of ED attitudes and behaviours over the last 28 days. Global EDE-Q score, based on the 23 items with a 6-point Likert scale, was used as an indicator of overall eating psychopathology. Two items, related to the frequency of vomiting and exercising, were used as measures of purging behaviours. The internal consistency of the four subscales used for computing the EDE-Q global ranged from 0.77 (eating concern) to 0.93 (shape concern) at admission and from 0.78 (eating concern) to 0.95 at discharge (shape concern).

### 2.4 | Data Analytic Plan

Descriptive statistics for all variables at admission and discharge were computed first (for more information on data exploration, see Supporting Information S1: Supplement 1). Next, admission to discharge changes in GAD-7, OCI-R, and PHQ-9 scores were assessed using the paired-sample *t*-tests with Bonferroni correction to account for the multiple comparisons, making the significance level  $p < 0.01$ . Cohen's *d* was reported as a measure of effect size (Cohen 2013). Pearson correlation coefficients were computed to assess whether a change in GAD, OCD, and depression symptoms corresponds with the change in ED symptoms. A decrease in EDE-Q global scores was used to indicate ED symptom improvement in all EDs; weight gain and decreased frequency of purging behaviours were used as markers of ED symptom improvement in restrictive EDs (i.e., AN-R and ARFID) and BN, respectively.<sup>4</sup>

Reliable change (i.e., minimum change in admission to discharge points that can be considered reliable) was calculated, allowing us to determine whether changes in GAD, OCD, and depression symptoms experienced by individual patients were greater than those attributable to random error (for details on calculating reliable change, see Evans, Margison, and Barkham 1998). To be considered reliable, in our sample, each patient's admission to discharge change needed to exceed 5.11 points for GAD-7, 11.45 for OCI-R, and 6.33 for PHQ-9 (rounded up to 6, 12, and 7 for GAD-7, OCI-R, and PHQ-9, respectively, as individual patients' scores can change only in integers). Three

categorical reliable change variables were then created, one for each measure. Individual patients who reported an admission to discharge change equal or higher to the determined minimum change were considered to have gotten reliably better or worse, depending on whether the change was positive or negative. The percentage of those who got reliably better or worse on each symptom was reported in addition to *t*-test results so as not to conceal individual outcomes in group averages (Blampied 2022).

Residual change scores were then calculated for the GAD-7, OCI-R, and PHQ-9 by regressing discharge scores onto admission scores and then saving the residuals (Cronbach and Furby 1970). Using residual change scores, we captured change accounting for admission scores, thus removing the possibility of regression to the mean. The final step included an application of multivariate analysis of variance (i.e., profile analysis; Tabachnick and Fidell 2013), allowing us to examine whether different ED diagnostic groups show the same pattern on a set of measures (i.e., GAD-7, OCI-R, and PHQ-9). Specifically, profile analysis allowed us to test whether diagnostic groups' profiles on given measures are parallel (i.e., the parallelism hypothesis) and whether particular diagnostic groups, on average, score significantly higher on all measures than other diagnostic groups (i.e., the levels hypothesis). Two separate profile analyses were computed, one with the standardised GAD-7, OCI-R, and PHQ-9 admission scores and the other with the standardised residual GAD-7, OCI-R, and PHQ-9 change scores as measured variables. Standardised Z-scores based on the grand mean were computed to account for the different ranges of GAD-7, OCI-R, and PHQ-9 scores across all diagnostic groups. The diagnostic group (AN-R, AN-BP, BN, BED, ARFID, OSFED) was used as the grouping variable in both analyses. All analyses were performed in IBM SPSS Statistics (Version 28).

## 3 | Results

### 3.1 | Sample Characteristics and Descriptives

Descriptive information for the initial sample (i.e., all individuals with at least some data on the variables of interest) is provided in Table 1 (for descriptive information on the subsample with complete data on all variables of interest at both admission and discharge [ $N = 1848$ ], see Table S2).<sup>5</sup> In our sample, 78.9% of patients had at least one comorbid diagnosis, and 75.4% had a comorbid anxiety disorder, mood disorder, and/or an OC disorder (i.e., mostly OCD but also mixed obsessional thoughts and acts or, for several patients, OC personality disorder). Of note, the reported rates of comorbid mood, anxiety, and obsessive-compulsive disorders are conservative and not fully reliable; it is estimated that ~17% of ~800 patients whose secondary diagnosis cells were blank did have a comorbid diagnosis, despite these diagnoses not appearing in the dataset.<sup>6</sup>

### 3.2 | Admission to Discharge Change

On average, patients' scores at admission (Table 2) indicated moderately severe depression (Kroenke, Spitzer, and Williams 2001), and moderate levels of anxiety (Spitzer et al. 2006)

and OCD (Abramovitch et al. 2020). Patients' average GAD-7, OCI-R, and PHQ-9 scores significantly improved from admission to discharge, with small (OCD), moderate (GAD), and large (depression) effect sizes. Significant changes were observed on all three measures in both the full sample (Table 2) and within each diagnostic group (Table 3).

Admission-to-discharge decrease on GAD-7, OCI-R, and PHQ-9 significantly correlated ( $p < 0.001$ ) with the admission-to-discharge decrease on EDE-Q global ( $r = 0.457$ ,  $r = 0.380$ ,  $r = 0.568$  for GAD-7, OCI-R, and PHQ-9, respectively).<sup>7</sup> In a subset combining patients with ARFID and AN-R, admission-to-discharge improvement in comorbid symptoms significantly correlated with weight gain ( $r = 0.165$ ,  $p < 0.001$ ;  $r = 0.100$ ,  $p = 0.002$ ;  $r = 0.166$ ,  $p < 0.001$ , for GAD, OCD, and depression symptoms, respectively). In patients with BN, reduced frequency of exercising correlated positively with OCD ( $\rho = 181$ ,  $p = 0.012$ ), GAD ( $\rho = 201$ ,  $p = 0.022$ ), and depression ( $\rho = 0.212$ ,  $p = 0.003$ ) symptom improvement; reduced frequency of vomiting correlated with GAD ( $\rho = 0.217$ ,  $p = 0.013$ ) and depression ( $\rho = 204$ ,  $p = 0.004$ ) symptom improvement ( $r = 195$ ,  $p = 0.026$ ), but not with OCD symptom improvement ( $\rho = 089$ ,  $p = 0.219$ ). For EDE-Q-related descriptive statistics, see Table S3.

The percentage of those who got reliably better on non-targeted symptoms was 47.2%, 36.2%, and 20.7% for depression, GAD, and OCD symptoms, respectively (Table 2). However, a small portion of patients got reliably worse from admission to discharge (Tables 2 and 3). Of patients with complete data on all reliable change variables, 7.3% got worse on at least one (i.e., GAD, OCI-R, and/or PHQ-9). Significant differences in levels of care at discharge were found ( $\chi^2(3) = 14.133$ ,  $p < 0.01$ ) between this group and the group that did not get reliably worse on any of the symptoms. Among those discharged at IP, 12.5% got reliably worse on at least one symptom, compared to 11% of those discharged from RES, 7.4% of those discharged from PHP, and 5% of those discharged from IOP. Additionally, those who got reliably worse on at least one measure had significantly higher EDE-Q global scores at discharge but not at admission. There were no group differences in terms of the average length of stay in treatment. Age differences were significant, with those who got reliably worse on at least one measure being younger ( $M = 24.83$ ,  $SD = 8.1$ ) than those who did not get reliably worse on any measure ( $M = 26.8$ ,  $SD = 10.17$ ); however, the magnitude of the effect was small (Cohen's  $d = 0.21$ ).

### 3.3 | Symptom Patterns: Admission

The parallelism test, assessing diagnostic group  $\times$  (admission) symptoms effect, showed significant differences among the diagnostic groups in their symptom profiles at admission ( $F[10,5352] = 5.371$ ,  $p < 0.001$ ,  $\eta^2 = 0.010$ ). Statistically significant differences were also found for the levels, suggesting the overall symptom severity (i.e., scores averaged over all three measures) was different across diagnostic groups ( $F[5,2676] = 11.980$ ,  $p < 0.001$ ,  $\eta^2 = 0.022$ ). Specifically, the overall symptom severity in AN-BP and OSFED was significantly higher than in all other groups (i.e., AN-R, ARFID, BED), except for BN.



**TABLE 1** | Sample characteristics.

	<b>AN-R (N = 1074)</b>	<b>AN-BP (N = 597)</b>	<b>BN (N = 282)</b>	<b>BED (N = 259)</b>	<b>ARFID (N = 251)</b>	<b>OSFED (N = 1267)</b>	<b>Total (N = 3730)</b>
Age (SD)	25.7 (10.2)	26.8 (9.8)	27.4 (9.4)	36.3 (12.4)	25 (8.6)	26.7 (9.6)	27 (10.3)
Admission BMI	17.9 (2.8)	19 (3.8)	27.8 (8.6)	40.3 (9.9)	18.9 (3.6)	27.2 (8.5)	NA
Gender (N, %)							
Female	938 (87.3%)	518 (86.8%)	245 (86.9%)	212 (81.9%)	176 (70.1%)	1073 (84.7%)	3162 (84.8%)
Male	57 (5.3%)	25 (4.2%)	22 (7.8%)	40 (15.4%)	50 (19.9%)	68 (5.4%)	262 (7%)
FTM trans	9 (0.8%)	9 (1.5%)	3 (1.1%)	2 (0.8%)	5 (2%)	20 (1.6%)	48 (1.3%)
MTF trans	9 (0.8%)	3 (0.5%)	2 (0.7%)	1 (0.4%)	—	4 (0.3%)	19 (0.5%)
Non-binary/genderqueer	42 (3.9%)	34 (5.7%)	7 (2.5%)	3 (1.2%)	18 (7.2%)	71 (5.6%)	175 (4.7%)
Prefer not to disclose/other	19 (1.8%)	8 (1.3%)	3 (1.1%)	1 (0.4%)	2 (0.8%)	31 (2.4%)	64 (1.7%)
Race (N, %)							
White	943 (87.9%)	515 (86.4%)	224 (79.4%)	221 (85.3%)	210 (83.7%)	1021 (80.6%)	3134 (84.1%)
Hispanic/Latino	46 (4.3%)	22 (3.7%)	25 (8.9%)	18 (7%)	16 (6.4%)	70 (5.5%)	197 (5.3%)
Asian	24 (2.2%)	22 (3.7%)	11 (3.9%)	5 (1.9%)	8 (3.2%)	50 (3.9%)	120 (3.2%)
Black/African American	18 (1.7%)	12 (2%)	13 (4.6%)	10 (3.9%)	4 (1.6%)	60 (4.7%)	117 (3.1%)
American Indian or Alaska Native	3 (0.3%)	3 (0.5%)	1 (0.4%)	—	—	5 (0.4%)	12 (0.3%)
Native Hawaiian or other Pacific Islander	2 (0.2%)	—	1 (0.4%)	—	—	2 (0.2%)	5 (0.1%)
Other	37 (3.4%)	22 (3.7%)	7 (2.5%)	5 (1.9%)	13 (5.2%)	57 (4.5%)	140 (3.8%)
HLOC (admission)							
IP	340 (31.7%)	207 (34.7%)	15 (5.3%)	—	82 (32.7%)	117 (9.2%)	761 (20.4%)
RES	382 (35.6%)	227 (38%)	129 (45.7%)	29 (11.2%)	80 (31.9%)	385 (30.4%)	1232 (33%)
PHP	232 (21.6%)	113 (18.9%)	85 (30.1%)	59 (22.8%)	64 (25.5%)	403 (31.8%)	956 (25.6%)
IOP	120 (11.2%)	50 (8.4%)	53 (18.8%)	171 (66%)	25 (10%)	362 (28.6%)	781 (20.9%)
HLOC (discharge)							
IP	61 (5.7%)	43 (7.2%)	1 (0.4%)	—	13 (5.2%)	24 (1.9%)	142 (3.8%)
RES	251 (23.4%)	158 (26.5%)	46 (16.3%)	5 (1.9%)	69 (27.5%)	192 (15.2%)	721 (19.3%)
PHP	441 (41.1%)	241 (40.4%)	119 (42.2%)	30 (11.6%)	92 (36.7%)	434 (34.3%)	1357 (36.4%)
IOP	321 (29.9%)	155 (26%)	116 (41.1%)	224 (86.5%)	77 (30.7%)	617 (48.7%)	1510 (40.5%)
Comorbid disorders							
Mood	655 (61%)	410 (68.7%)	181 (64.2%)	130 (50.2%)	142 (56.6%)	850 (67.1%)	2368 (63.5%)
Anxiety	696 (64.8%)	395 (66.2%)	162 (57.4%)	114 (44%)	166 (66.1%)	793 (62.6%)	2326 (62.4%)
OC	178 (16.6%)	69 (11.6%)	17 (6%)	4 (1.5%)	33 (13.1%)	149 (11.8%)	450 (12.1%)
Weeks of treatment (SD)	9.3 (7.5)	9.3 (7.1)	9 (6.4)	8.9 (6.8)	8.9 (6.1)	9.1 (6.5)	9.1 (6.9)

Note: Three individuals had missing data on race, one chose not to disclose, and one reported mixed race. One female with BN had a BMI > 90; if that case is excluded for being an outlier, then  $M = 27.5$ ,  $SD = 7.5$  for the BN group.

BED had significantly lower symptom severity than all other groups except for ARFID, and AN-R had significantly lower symptom severity than AN-BP and OSFED but higher than

BED. Finally, BN had higher symptom severity than BED but did not differ significantly from any other groups (for more details, see Table S4).

**TABLE 2** | Symptom severity: Admission and discharge (total sample).

	Admission		Discharge		<i>t</i>	<i>df</i>	Cohen's <i>d</i>	Reliably better	Reliably worse	No reliable change
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>						
GAD-7	13.70	5.45	9.76	5.76	30.749	1874	0.710	678 (36.2%)	59 (3.1%)	1138 (60.7%)
OCI-R	21.24	14.94	16.53	13.84	24.087	2608	0.472	541 (20.7%)	102 (3.9%)	1966 (75.4%)
PHQ-9	16.60	6.56	10.18	6.68	50.615	2630	0.987	1242 (47.2%)	37 (1.4%)	1352 (51.4%)

Note: All the differences were significant at  $p < 0.001$ .

**TABLE 3** | Symptom severity: Admission and discharge (diagnostic groups).

	<u>Admission</u>		<u>Discharge</u>		<i>t</i>	Cohen's <i>d</i>	Reliably better	Reliably worse	No reliable change
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>					
GAD-7									
AN-R ( <i>n</i> = 594)	13.59	5.67	9.92	5.72	16.979	0.697	197 (33.2%)	19 (3.2%)	378 (63.6%)
AN-BP ( <i>n</i> = 320)	14.60	5.29	10.78	5.98	12.199	0.682	117 (36.6%)	10 (3.1%)	193 (60.3%)
BN ( <i>n</i> = 131)	13.60	5.18	9.41	5.55	8.501	0.743	47 (35.9%)	3 (2.3%)	81 (61.8%)
BED ( <i>n</i> = 92)	10.86	5.73	6.50	4.86	8.784	0.916	34 (37%)	3 (3.3%)	55 (59.8%)
ARFID ( <i>n</i> = 139)	12.93	5.60	8.06	5.39	9.959	0.845	57 (41%)	3 (2.2%)	79 (56.8%)
OSFED ( <i>n</i> = 599)	13.96	5.13	10.03	5.71	16.557	0.676	226 (37.7%)	21 (3.5%)	352 (58.8%)
OCI-R									
AN-R ( <i>n</i> = 805)	21.16	15.56	16.62	14.34	12.772	0.450	167 (20.7%)	33 (4.1%)	605 (75.2%)
AN-BP ( <i>n</i> = 455)	23.26	15.68	18.49	15.07	9.708	0.455	98 (21.5%)	22 (4.8%)	335 (73.6%)
BN ( <i>n</i> = 194)	20.94	14.00	15.55	12.12	6.653	0.478	40 (20.6%)	8 (4.1%)	146 (75.3%)
BED ( <i>n</i> = 138)	15.24	11.99	10.84	8.87	6.248	0.532	24 (17.4%)	1 (0.7%)	113 (81.9%)
ARFID ( <i>n</i> = 170)	18.77	14.32	12.29	10.88	8.609	0.660	45 (26.5%)	3 (1.8%)	122 (71.8%)
OSFED ( <i>n</i> = 847)	21.78	14.42	17.39	13.82	13.311	0.457	167 (19.7%)	35 (4.1%)	645 (76.2%)
PHQ-9									
AN-R ( <i>n</i> = 812)	15.63	7.03	9.80	6.63	26.511	0.930	353 (43.5%)	12 (1.5%)	447 (55.0%)
AN-BP ( <i>n</i> = 459)	17.86	6.42	11.13	7.21	21.178	0.989	229 (49.9%)	13 (2.8%)	217 (47.3%)
BN ( <i>n</i> = 197)	17.62	5.91	9.98	6.31	15.672	1.117	107 (54.3%)	2 (1%)	88 (44.7%)
BED ( <i>n</i> = 142)	15.32	6.12	7.86	6.04	14.728	1.236	73 (51.4%)	—	69 (48.6%)
ARFID ( <i>n</i> = 170)	13.71	6.27	7.46	5.68	13.725	1.053	77 (45.3%)	—	93 (54.7%)
OSFED ( <i>n</i> = 851)	17.41	6.10	11.00	6.55	28.198	0.967	403 (47.4%)	10 (1.2%)	438 (51.5%)

Note: All the differences were significant at  $p < 0.001$ .

A series of one-way repeated measures ANOVAs, accounting for multiple (i.e., 18) comparisons using Benjamini-Hochberg Correction (Benjamini and Hochberg 2000), was conducted to allow for the interpretation of the nonparallel profiles. Results showed that GAD and OCD symptoms were significantly more pronounced than depression symptoms in AN-R and ARFID, while the opposite was true for BED (Figure 1; for the figure with CI's, see Figure S1<sup>8</sup>). Finally, depression symptoms were more pronounced than GAD symptoms in BN (Table S5).

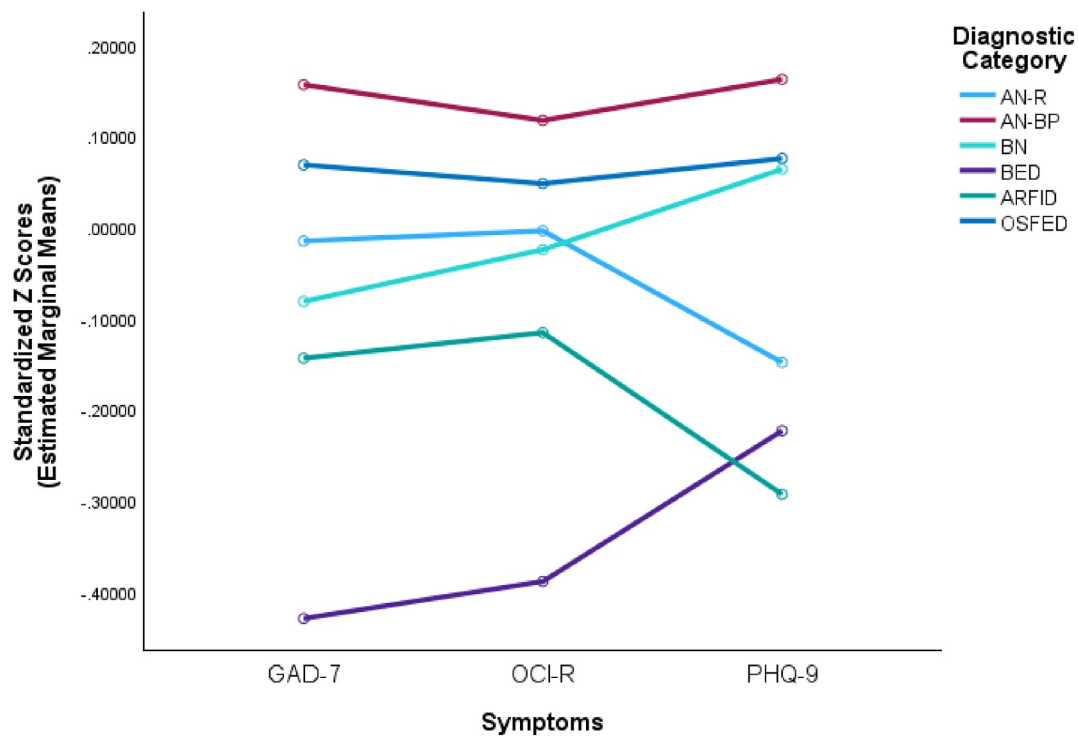
### 3.4 | Symptom Patterns: Change

The parallelism ( $F[10,3646] = 0.937$ ,  $p = 0.498$ ,  $\eta^2 = 0.003$ ) test was not significant. Significant differences were found for the levels test, suggesting the overall symptom change (i.e., change scores averaged over all three measures) was different across

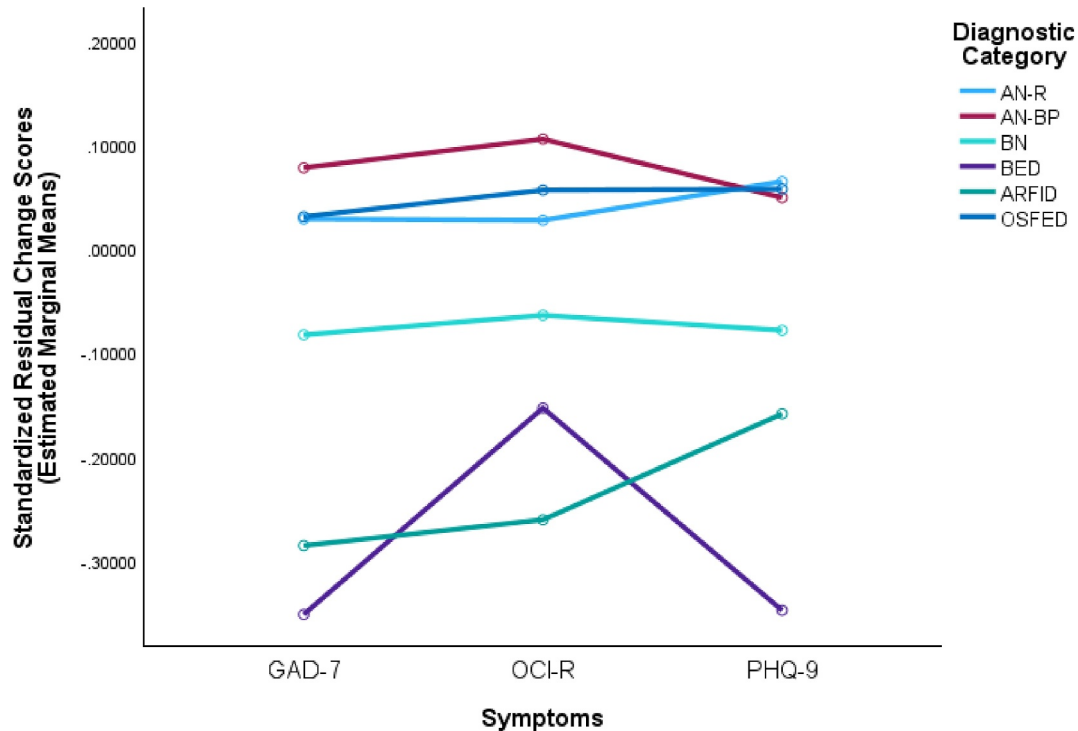
diagnostic groups ( $F[5,1823] = 5.627$ ,  $p < 0.001$ ,  $\eta^2 = 0.015$ ). To further explore these differences, contrasts were performed on marginal means, as recommended by Tabachnick and Fidell (2013). No differences were found among AN-BP, AN-R, and OSFED. However, these three groups were significantly different from ARFID and BED, with the change being significantly greater for the latter two (Figure 2; for the figure with CI's, see Figure S2). Finally, BN did not differ from any other group, and ARFID and BED did not differ from each other (Table S6).

## 4 | Discussion

Since symptoms of GAD, OCD, and depression are particularly prevalent in EDs, the present study assessed these symptoms at admission and their change from admission to discharge from



**FIGURE 1** | Admission scores.



**FIGURE 2** | Residual change scores. Those with the smallest residuals (i.e., actual discharge scores being smaller than predicted) improved most.

routine ED treatment at HLOC. According to our results, while patients, on average, presented at HLOC with moderately severe depression and moderate anxiety and OCD, these symptoms improved significantly from admission to discharge. We also assessed the reliability of admission-to-discharge changes in GAD, OCD, and depression symptoms, showing that the majority of patients either experience reliable improvement or do

not experience any reliable change (with reliable change operationalised stringently). Finally, we examined the differences between the six diagnostic groups (AN-R, AN-BP, BN, BED, ARFID, and OSFED) in terms of GAD, OCD, and depression symptom patterns and overall symptom severity at admission and the differences in patterns of change and overall change in symptom severity. Our results showed significant differences in

symptom patterns at admission, overall symptom severity at admission, and overall change in symptom severity from admission to discharge.

#### 4.1 | Admission to Discharge Change

Moderately severe levels of depression and moderate levels of anxiety and OCD found at admission align with previous research showing elevated levels of comorbidity in patients with EDs (Hambleton et al. 2022; Hudson et al. 2007; Ulfebrand et al. 2015). A significant admission-to-discharge reduction was observed in all comorbid symptoms, and comparable effect sizes and percentages of individuals experiencing reliable improvement were found across ED diagnostic groups.<sup>9</sup> As expected and in line with some previous work (e.g., Dolan et al. 2022; Olatunji et al. 2010; Pollice et al. 1997), the improvement in anxiety, OCD, and depression symptoms generally corresponded with the improvement in ED symptoms (the only exception being the absence of the relationship between reduced frequency of vomiting and OCD symptom improvement in BN). Overall, our findings are promising in that they suggest that the routine ED treatment at HLOC, although primarily targeting ED symptoms, leads to a significant and reliable improvement across a much broader range of symptoms in at least some patients. Nevertheless, although almost one-half of the sample experienced a reliable improvement in depression symptoms, and one-third experienced a reliable improvement in GAD symptoms, only around one-fifth experienced a reliable reduction in OCD symptoms. For a number of study patients, a change in depression, GAD, and OCD symptoms was not large enough to be considered reliable. Although such findings are notable, it is worth reiterating that the criteria for reliable change are rather stringent. A drop of 6, 12, and 7 points on GAD-7, OCI-R, and PHQ-9, respectively, suggests a substantial improvement, especially in the context of treatment that is, not primarily targeting the respective symptoms. That some individuals did not achieve such a considerable drop does not mean they did not improve at all; the majority, in fact, did.

Further, it is worth acknowledging that a small portion of patients experienced reliable admission-to-discharge worsening (i.e., an increase of at least 6, 12, and 7 points on GAD-7, OCI-R, and PHQ-9, respectively). While treatment-related studies usually focus on the extent of improvement, deterioration rates have only seldom been reported. A meta-analysis assessing outcomes of psychotherapy for depression in adults reported a median deterioration rate of 4% (Cuijpers et al. 2018). Another study showed that 1% of adults in randomised clinical trials comparing Cognitive Behavioural Therapy and pharmacotherapy experience reliable deterioration (Vittengl et al. 2016). Such results show that, albeit infrequently, patients do deteriorate throughout treatment, including on primarily targeted symptoms. Still, compared to controls, receiving psychotherapy is associated with a 61% lower chance of deterioration (Cuijpers et al. 2018), implying that some people likely deteriorate despite—and not because of—treatment. Previous studies on EDs also reported that a small group of patients experiences worsening from admission to discharge in both ED and comorbid symptoms (e.g., Muzi et al. 2020; Schlegel et al. 2014). To our

knowledge, no studies have compared deterioration rates in those with EDs who do and do not receive treatment, so we can only hypothesise, based on the results from Cuijpers et al. (2018), that patients receiving ED treatment at HLOC may deteriorate for different reasons, and that deterioration rates would be much higher had they not received treatment. In our study, symptom worsening was most common in those discharged from the highest level of care (i.e., IP). Lower deterioration rates in those discharged from RES, PHP, and IOP, respectively, suggest that those who did not exit treatment early in the step-down process (i.e., those who did not discharge while their ED symptoms were still severe enough to warrant the highest levels of care) were less likely to get reliably worse. Indeed, ED symptom severity at discharge was significantly higher in those who experienced reliable worsening in comorbid symptoms, compared to those who did not.

Of note, although the admission-to-discharge improvement was significant, the mean level of depression at discharge was in the moderate range (though closer to mild than moderately severe), the mean level of GAD symptoms was somewhere between mild and moderate, and the mean level of OCD symptoms remained in the moderate range (though close to mild). Together, our findings suggest (1) that the majority of ED patients who seek treatment at HLOC experience considerable levels of comorbid symptoms, (2) that ED treatment, although geared primarily towards EDs, may contribute to a broader symptom improvement, and (3) that at least some patients would benefit from additional targeted treatment for comorbid symptoms. For instance, Wade, Shafran, and Cooper (2024) identified different data-driven approaches on which clinicians may rely, depending on whether comorbid conditions seem to be a consequence of EDs (and remit with the remission of an ED), seemingly independent of EDs (impeding or not impeding ED treatment), or in a reciprocal relationship with EDs. The authors also proposed a 4-step data-driven protocol to manage co-occurring conditions that interfere with effective ED treatment. According to this protocol, assessment and treatment are parts of an iterative process: patients are assessed before the standard ED treatment begins and reassessed in the early stages of treatment. Such repeated assessments (e.g., using brief tools, such as GAD-7 and PHQ-9) allow clinicians to keep track of the treatment progress, identify comorbidities that may act as barriers to effective care, and use alternate, modular, or transdiagnostic approach (for more details about the protocol, please see Wade, Shafran, and Cooper 2024) to tackle these barriers. Wade et al. are not alone in emphasising that ED treatment could and should be data-driven. For instance, Levinson et al. (2023) used a combination of ecological momentary assessment and network analysis to develop data-driven personalised treatment for EDs; a recent open trial has found it to be highly feasible, acceptable, and promising in decreasing not only symptoms of EDs but also of co-occurring conditions such as anxiety and depression (Levinson et al. 2023). Further studies on how to treat patients with EDs and co-occurring conditions, especially in HLOC, are still warranted. However, while waiting for more research and more concrete guidelines, we encourage clinicians to rely on what we do have (e.g., recommendations by Wade, Shafran, and Cooper 2024) and assess (and reassess) comorbid symptoms, adjusting treatment to target these symptoms when indicated. Providing additional interventions to address comorbidities



might lead to even greater numbers of patients experiencing significant and reliable comorbid symptom improvement. Finally, such interventions might be most welcome for OCD symptoms, which seem to improve the least with standard care.

The smallest improvement in OCD symptoms may possibly be explained by the nature of the treatment our participants received. Specifically, the treatment incorporates elements of Dialectical Behaviour Therapy (Linehan 2015), Acceptance and Commitment Therapy (Hayes, Strosahl, and Wilson 2011), and Cognitive Behavioural Therapy (Beck 2020), which may all aid the improvement of anxiety and depression. While the treatment does incorporate some elements of Exposure with Response Prevention (ERP; Foa, Yadin, and Lichner 2012), most of the exposure work revolves around food or behaviours that interfere with ED treatment. Adding more specific, targeted, and frequent ERP interventions to existing ones may be needed for some patients to experience a more significant reduction in OCD symptoms.

## 4.2 | Symptom Patterns: Admission and Change

Our study showed that patients with AN-R and ARFID may be more prone to anxiety and OCD than depression (relative to other EDs), while the opposite may be true for BED and partially for BN. In terms of overall symptom severity at admission, AN-BP and OSFED were higher than all other groups except for BN; BED had lower symptom severity than all other groups except for ARFID, and AN-R was in between (i.e., lower than AN-BP and OSFED, but higher than BED); BN did not differ from any groups other than BED. Such results align with some previous studies (e.g., Bühren et al. 2014; Geist, Davis, and Heinmaa 1998; González-Pinto et al. 2004; Lewis et al. 2019), suggesting that patients diagnosed with EDs that involve binge eating/purging may, on average, experience more pronounced comorbid disorders symptoms than those who engage in restricting or bingeing only. Finally, previous studies have found not only similar levels of eating pathology but also similar rates of comorbidity of OSFED and other EDs (e.g., Mustelin, Lehtokari, and Keski-Rahkonen 2016; Withnell et al. 2022), highlighting that OSFED should not be perceived as less impairing than other EDs. Our results further emphasise this point. Of note, even where differences were significant, the magnitudes of effects were small—not unexpected, considering that our sample consisted solely of patients admitted to HLOC, in whom comorbidities are a rule rather than an exception. Of note, the ED diagnostic groups did not differ only in the overall levels of comorbid symptom severity at admission but also in ED severity (measured by EDE-Q) at admission (i.e., AN-R had the lowest reported ED severity, followed by BED, OSFED, BN, and AN-BP),<sup>10</sup> and at least some of the group differences in comorbid symptoms may be explained by group differences in ED symptoms.

The patterns of change were relatively equal across diagnostic groups. However, the groups differed in overall symptom change (although the effect sizes were small). A possible explanation for why patients diagnosed with ARFID and BED experienced a somewhat greater improvement than those diagnosed with AN-BP, OSFED, and AN-R is that individuals

with ARFID and BED tend to be less ambivalent about treatment and thus benefit more from it. While research on treatment outcomes for patients with ARFID is limited (Miskovic-Wheatley et al. 2023; Vanzhula et al. 2023), our findings align with some of the existing studies, showing that ARFID can be successfully treated in HLOC, along with other EDs (Ornstein et al. 2017). Similarly, the somewhat greater improvement observed in BED generally aligns with previous research showing that, compared with other EDs (mainly AN and BN), patients with BED often experience more favourable treatment outcomes (Miskovic-Wheatley et al. 2023). Interestingly, in our study, the BN group did not differ from any other groups.<sup>11</sup>

## 4.3 | Strengths and Limitations

Strengths of the present study include a large, clinical, diagnostically diverse sample of patients with EDs receiving treatment at HLOC, as well as the use of validated and widely used measures for symptom assessment. Moreover, while some of our findings confirm what is already known (i.e., (1) comorbidity is high in ED patients, (2) comorbid symptoms, particularly those of anxiety and depression, often improve with ED treatment), the strength of the present study is that it has directly and systematically compared six ED diagnostic groups regarding symptoms of anxiety, depression, and OCD at admission to HLOC and regarding the change in these symptoms from admission to discharge from HLOC. A particular strength involves including less-studied ED groups (i.e., OSFED and especially ARFID), showing how these groups present to routine treatment at HLOC (relative to other EDs) and how they respond to it. Including a not-so-small sample of adult patients receiving treatment for ARFID is of particular value as we still know very little about the presentation and treatment of ARFID in adults (e.g., Vanzhula et al. 2023). Relatedly, although the diagnostic groups had unequal sample sizes, no group was small (i.e., the smallest  $N = 90$ ), and the data inspection suggested no reason to believe the unequal sample sizes might have biased our results. Moreover, the diagnostic structure in our study is reasonably reflective of the true structure in ED treatment facilities. In addition, the strength of our study is that it attempted to look beyond group averages and acknowledge that some patients get worse in terms of depression, anxiety, and OCD symptoms from admission to discharge. Although not an uncommon clinical observation, such comorbid symptom worsening is rarely captured by studies assessing the ED treatment outcomes—of which most focus on changes in average scores.

Regarding limitations, while we did have some expectations results-wise, our study did not have well-established a priori hypotheses. Next, as the treatment centre did not consistently and accurately record the duration of disorders, we were unable to assess whether and to what extent the duration of EDs might have influenced the presentation at admission and the change. Additionally, while we briefly explored the characteristics of patients who get reliably worse on GAD, OCD, and depression symptoms, future research should continue to assess and report deterioration rates in patients with EDs and examine factors related to increased admission-to-discharge symptom severity; such studies may provide directions on how to treat this group more

effectively. Next, combining patients receiving treatment at different HLOCs may represent both a strength (i.e., the sample was diverse in that respect) and a weakness (i.e., the results may not replicate across specific HLOCs). Additionally, we did not look into atypical AN as a separate category nor did we examine the potential role of gender and age. For instance, younger ages may strengthen the association between ED symptomatology and anxiety/depression; older ages may be associated with greater ED symptom severity (Sander, Moessner, and Bauer 2021) but also with larger PHQ-9 changes from admission to discharge (Rienecke et al. 2023). Further, as our sample only included adults, the results may not generalise to children and adolescents. We also did not assess income, education, and socioeconomic status. Another important limitation concerns missing data. Of 3730 patients with at least some admission and some discharge data, only 49.5% had complete admission and discharge data. While missing data is not uncommon in patients assessed during routine treatment, and while we aimed to preserve as much data as possible, there is always a risk that the results might have been at least somewhat different had all patients provided complete data (e.g., those with missing data might have had worse outcomes compared to those with complete data). We note, however, that in our study, completers and non-completers did not seem substantially different from each other. Further, we only collected data at admission and discharge. While this is a standard practice in routine treatments,<sup>12</sup> future studies collecting and analysing long-term post-discharge follow-up data are needed to provide additional insights into the stability of the observed changes and long-term treatment effectiveness. Finally, many patients in our sample received medications to manage their conditions, including EDs, but also symptoms of anxiety, OCD, and depression. While we evaluated the change in comorbid symptoms during routine ED care with all that such care involves, assessing the differential usage and, possibly, the differential impact of medications on comorbid symptoms in different ED diagnostic groups was beyond this paper's scope, but it is an important avenue for future research. As one example, future work may examine the presence versus absence of a particular medication (e.g., an SSRI) and determine whether it interacts with diagnostic status (e.g., BN present vs. BN absent) to predict reductions in depression and anxiety symptoms.

## 5 | Conclusion

Previous studies show a high prevalence of GAD, OCD, and depression symptoms in patients seeking ED treatment. Our study aligns with these findings while also showing that patients experience a significant improvement in GAD, OCD, and depression symptoms from admission to discharge to the routine ED treatment at HLOC, although comorbid symptoms are not the clinical focus. However, our results also exhort treatment centres to judiciously avoid a 'one-size-fits-all' approach to treating patients with EDs and comorbidities. Instead, to optimise treatment at HLOC and thus maximise symptom improvement, a more personalised approach is needed. Such an approach would allow for the integration of evidence-based interventions that specifically target GAD, OCD, and depression symptoms and would likely lead to even higher numbers of patients experiencing significant and reliable comorbid symptom improvement. We are

aware a more personalised treatment would carry its own set of challenges. Still, such integration is highly desirable as the ultimate goal of every treatment should be to alleviate patients' distress and suffering more generally and not merely to improve the symptoms of a primary diagnosis. Finally, for those in whom comorbid symptoms may hinder ED treatment, such an integration may be not only desirable but also necessary.

## Author Contributions

**Mina Velimirović:** conceptualization, methodology, formal analysis, writing—original draft preparation, writing—review & editing. **Morgan Robison:** methodology, writing—original draft preparation. **Sophie Abber:** methodology, writing—original draft preparation. **Alan Duffy:** investigation, writing—review & editing. **Renee D. Rienecke:** investigation, writing—review & editing. **Jamie Manwaring:** investigation, writing—review & editing. **Dan V. Blalock:** investigation, writing—review & editing. **Megan Riddle:** investigation, writing—review & editing. **Philip S. Mehler:** investigation, writing—review & editing, supervision. **Thomas E. Joiner:** conceptualization, writing—original draft preparation, supervision.

## Ethics Statement

The study received approval from the Salus Institutional Review Board.

## Conflicts of Interest

Dr. Rienecke receives consulting fees from the Training Institute for Child and Adolescent Eating Disorders, LLC, and receives royalties from Routledge. The authors have no other conflicts to declare.

## Data Availability Statement

The data are unavailable (i.e., data involves medical health records, and participants did not consent to de-identified public data sharing); materials and code are accessible by contacting the corresponding author.

## Preregistration

The study was not preregistered.

## Reporting

This study involved an analysis of existing data rather than new data collection, so we did not report how the sample size was determined. Participants in our study completed a set of measures during their admission and discharge from treatment; we only report on the measures we used in this study. We do report all data exclusions and manipulations.

## Endnotes

<sup>1</sup> Some studies have shown that obsessive-compulsive disorder co-occurrence is below general population prevalence in those with AN-BP and BED (see Ulfvebrand et al. 2015, though cf. Tyagi et al. 2015).

<sup>2</sup> Attrition (and missing data in general) is not uncommon at higher levels of care in the real world of clinical practice. To determine whether the samples drawn only from those with complete data are representative of the overall sample, we compared those with complete versus incomplete data at admission, as well as those with complete versus incomplete data at discharge. Some differences between completers and non-completers were statistically significant at both admission and discharge (see Table S1). However, the effect sizes

were negligible (i.e.,  $d < 0.2$ ), indicating that the sample's representativeness is not compromised, at least not to a significant extent.

<sup>3</sup> The patients admitted between October 2020 and the summer of 2021 do not have GAD-7 data since this measure was incorporated into routine assessment only in the summer of 2021.

<sup>4</sup> Spearman's correlation coefficients were computed to assess the relationship between the change in GAD, OCD, and depression symptoms and reduced frequency of purging behaviours (i.e., exercising and vomiting), as the purging-related variables were not normally distributed.

<sup>5</sup> The sample sizes vary across the analyses as some statistical analyses did not require complete data on all measures (e.g.,  $t$ -tests), while other analyses did (e.g., multivariate analyses). For more details, see Supporting Information S1: Supplement 2.

<sup>6</sup> The diagnoses were likely missing due to a change in EMR provider and data not being correctly transmitted.

<sup>7</sup> Since the EDE-Q does not appropriately capture ARFID symptoms, we rerun the correlations, excluding patients with ARFID. The obtained correlations were somewhat higher ( $r = 0.490$ ,  $r = 0.397$ ,  $r = 0.583$  for GAD-7, OCI-R, and PHQ-9, respectively).

<sup>8</sup> Including CIs obscures an easy interpretation of the primary message of the figures, so we opted not to include them in the main text.

<sup>9</sup> Depression-related effect sizes were large in all diagnostic groups; GAD-related effect sizes were moderate in all groups, except BED and ARFID, in which they were large; OCD-related effect sizes were small in all groups, except BED and ARFID, where they were moderate.

<sup>10</sup> AN-R and BED did not significantly differ from each other but had lower ED severity than all other groups; OSFED had greater ED severity than AN-R and BED but lower than AN-BP; BN did not differ from OSFED and AN-BP. ARFID was not included in the group comparison.

<sup>11</sup> While some of the group differences in overall comorbid symptom change were significant, additional brief analyses showed that the only significant group differences in ED symptom change (captured by EDE-Q residual change scores) were those between BN and OSFED and BN and AN-R, with BN group experiencing a somewhat greater change in ED symptoms.

<sup>12</sup> Where applicable, patients treated at the ERC also complete step-down measures (e.g., between RES and PHP).

## References

- Abbate-Daga, G., E. Marzola, C. De-Bacco, et al. 2015. "Day Hospital Treatment for Anorexia Nervosa: A 12-Month Follow-Up Study." *European Eating Disorders Review* 23, no. 5: 390–398. <https://doi.org/10.1002/erv.2369>.
- Abramovitch, A., J. S. Abramowitz, B. C. Riemann, and D. McKay. 2020. "Severity Benchmarks and Contemporary Clinical Norms for the Obsessive-Compulsive Inventory-Revised (OCI-R)." *Journal of Obsessive-Compulsive and Related Disorders* 27: 100557. <https://doi.org/10.1016/j.jocrd.2020.100557>.
- Anxiety and Depression Association of America. 2022. "Anxiety Disorders – Facts & Statistics." <https://adaa.org/understanding-anxiety/facts-statistics>.
- Beck, J. S. 2020. *Cognitive Behavior Therapy: Basics and beyond*. New York, NY: Guilford Publications.
- Bégin, C., M. Gagnon-Girouard, A. Aimé, and C. Ratté. 2013. "Trajectories of Eating and Clinical Symptoms Over the Course of a Day Hospital Program for Eating Disorders." *Eating Disorders: Journal of Treatment and Prevention* 21, no. 3: 249–264. <https://doi.org/10.1080/10640266.2013.779188>.
- Benjamini, Y., and Y. Hochberg. 2000. "On the Adaptive Control of the False Discovery Rate in Multiple Testing With Independent Statistics."

*Journal of Educational and Behavioral Statistics* 25, no. 1: 60–83. <https://doi.org/10.3102/10769986025001060>.

Bhatia, R. 2020. *Depression – Facts & Statistics*. Anxiety and Depression Association of America. (November 2). <https://adaa.org/understanding-anxiety/depression/facts-statistics>.

Blampied, N. M. 2022. "Reliable Change and the Reliable Change Index: Still Useful After All These Years?" *Cognitive Behaviour Therapist* 15: e50. <https://doi.org/10.1017/S1754470X22000484>.

Blinder, B. J., E. J. Cumella, and V. A. Sanathara. 2006. "Psychiatric Comorbidities of Female Inpatients With Eating Disorders." *Psychosomatic Medicine* 68, no. 3: 454–462. <https://doi.org/10.1097/01.psy.00000221254.77675.fs>.

Bühren, K., R. Schwarte, F. Fluck, et al. 2014. "Comorbid Psychiatric Disorders in Female Adolescents With First-onset Anorexia Nervosa." *European Eating Disorders Review* 22, no. 1: 39–44. <https://doi.org/10.1002/erv.2254>.

Cohen, J. 2013. *Statistical Power Analysis for the Behavioral Sciences*. New York, NY: Academic Press. <https://doi.org/10.4324/9780203771587>.

Cost, J., M. J. Krantz, and P. S. Mehler. 2020. "Medical Complications of Anorexia Nervosa." *Cleveland Clinic Journal of Medicine* 87, no. 6: 361–366. <https://doi.org/10.3949/ccjm.87a.19084>.

Cronbach, L. J., and L. Furby. 1970. "How We Should Measure 'Change': Or Should We?" *Psychological Bulletin* 74, no. 1: 68–80. <https://doi.org/10.1037/H0029382>.

Cuijpers, P., M. Reijnders, E. Karyotaki, L. de Wit, and D. D. Ebert. 2018. "Negative Effects of Psychotherapies for Adult Depression: A Meta-Analysis of Deterioration Rates." *Journal of Affective Disorders* 239: 138–145. <https://doi.org/10.1016/j.jad.2018.05.050>.

Dolan, S. C., T. A. Brown, C. E. Wierenga, W. H. Kaye, and E. E. Reilly. 2022. "Changes in Anhedonia Over the Course of Eating Disorder Treatment." *International Journal of Eating Disorders* 55, no. 3: 399–405. <https://doi.org/10.1002/eat.23673>.

Evans, C., F. Margison, and M. Barkham. 1998. "The Contribution of Reliable and Clinically Significant Change Methods to Evidence-Based Mental Health." *BMJ Mental Health* 1, no. 3: 70–72. <https://doi.org/10.1136/ebmh.1.3.70>.

Fairburn, C. G., and S. J. Beglin. 1994. "Assessment of Eating Disorders: Interview or Self-report Questionnaire?" *International Journal of Eating Disorders* 16, no. 4: 363–370. [https://doi.org/10.1002/1098-108X\(199412\)16:4%3C363::AID-EAT2260160405%3E3.0.CO;2-%23](https://doi.org/10.1002/1098-108X(199412)16:4%3C363::AID-EAT2260160405%3E3.0.CO;2-%23).

Fewell, L. K., C. A. Levinson, and L. Stark. 2017. "Depression, Worry, and Psychosocial Functioning Predict Eating Disorder Treatment Outcomes in a Residential and Partial Hospitalization Setting." *Eating and Weight Disorders-Studies on Anorexia, Bulimia and Obesity* 22, no. 2: 291–301. <https://doi.org/10.1007/s40519-016-0357-6>.

Fittig, E., C. Jacobi, H. Backmund, M. Gerlinghoff, and H. U. Wittchen. 2008. "Effectiveness of Day Hospital Treatment for Anorexia Nervosa and Bulimia Nervosa." *European Eating Disorders Review* 16, no. 5: 341–351. <https://doi.org/10.1002/erv.883>.

Foa, E. B., J. D. Huppert, S. Leiberg, et al. 2002. "The Obsessive-Compulsive Inventory: Development and Validation of a Short Version." *Psychological Assessment* 14, no. 4: 485–496. <https://doi.org/10.1037/1040-3590.14.4.485>.

Foa, E. B., E. Yadin, and T. K. Lichner. 2012. In *Exposure and Response (Ritual) Prevention for Obsessive Compulsive Disorder: Therapist Guide*. USA: OUP.

Friedman, K., A. L. Ramirez, S. B. Murray, et al. 2016. "A Narrative Review of Outcome Studies for Residential and Partial Hospital-based Treatment of Eating Disorders." *European Eating Disorders Review* 24, no. 4: 263–276. <https://doi.org/10.1002/erv.2449>.



- Geist, R., R. Davis, and M. Heinmaa. 1998. "Binge/Purge Symptoms and Comorbidity in Adolescents With Eating Disorders." *Canadian Journal of Psychiatry* 43, no. 5: 507–512. <https://doi.org/10.1177/070674379804300510>.
- González-Pinto, A., F. Inmaculada, R. Cristina, et al. 2004. "Purging Behaviors and Comorbidity as Predictive Factors of Quality of Life in Anorexia Nervosa." *International Journal of Eating Disorders* 36, no. 4: 445–450. <https://doi.org/10.1002/eat.20058>.
- Hambleton, A., G. Pepin, A. Le, et al. 2022. "Psychiatric and Medical Comorbidities of Eating Disorders: Findings From a Rapid Review of the Literature." *Journal of Eating Disorders* 10, no. 1: 132. <https://doi.org/10.1186/s40337-022-00654-2>.
- Hayes, S. C., K. D. Strosahl, and K. G. Wilson. 2011. *Acceptance and Commitment Therapy: The Process and Practice of Mindful Change*. New York, NY: Guilford Press.
- Hudson, J. I., E. Hiripi, H. G. Pope, Jr., and R. C. Kessler. 2007. "The Prevalence and Correlates of Eating Disorders in the National Comorbidity Survey Replication." *Biological Psychiatry* 61, no. 3: 348–358. <https://doi.org/10.1016/j.biopsych.2006.03.040>.
- Kaye, W. H., C. M. Bulik, L. Thornton, N. Barbarich, K. Masters, and Price Foundation Collaborative Group. 2004. "Comorbidity of Anxiety Disorders With Anorexia and Bulimia Nervosa." *American Journal of Psychiatry* 161, no. 12: 2215–2221. <https://doi.org/10.1176/appi.ajp.161.12.2215>.
- Kroenke, K., R. L. Spitzer, and J. B. Williams. 2001. "The PHQ-9: Validity of a Brief Depression Severity Measure." *Journal of General Internal Medicine* 16, no. 9: 606–613. <https://doi.org/10.1046/j.1525-1497.2001.016009606.x>.
- Levinson, C. A., B. M. Williams, C. Christian, et al. 2023. "Personalizing Eating Disorder Treatment Using Idiographic Models: An Open Series Trial." *Journal of Consulting and Clinical Psychology* 91, no. 1: 14–28. <https://doi.org/10.1037/ccp0000785>.
- Lewis, Y. D., T. Gilon Mann, A. Enoch-Levy, et al. 2019. "Obsessive-compulsive Symptomatology in Female Adolescent Inpatients With Restrictive Compared With Binge-Purge Eating Disorders." *European Eating Disorders Review* 27, no. 3: 224–235. <https://doi.org/10.1002/erv.2638>.
- Linehan, M. M. 2015. *DBT® Skills Training Manual*. New York, NY: Guilford Press.
- Mischoulon, D., K. T. Eddy, A. Keshaviah, et al. 2011. "Depression and Eating Disorders: Treatment and Course." *Journal of Affective Disorders* 130, no. 3: 470–477. <https://doi.org/10.1016/j.jad.2010.10.043>.
- Miskovic-Wheatley, J., E. Bryant, S. H. Ong, et al. 2023. "Eating Disorder Outcomes: Findings From a Rapid Review of Over a Decade of Research." *Journal of Eating Disorders* 11, no. 1: 85. <https://doi.org/10.1186/s40337-023-00801-3>.
- Momen, N. C., O. Plana-Ripoll, Z. Yilmaz, et al. 2022. "Comorbidity Between Eating Disorders and Psychiatric Disorders." *International Journal of Eating Disorders* 55, no. 4: 505–517. <https://doi.org/10.1002/eat.23687>.
- Mustelin, L., V. L. Lehtokari, and A. Keski-Rahkonen. 2016. "Other Specified and Unspecified Feeding or Eating Disorders Among Women in the Community." *International Journal of Eating Disorders* 49, no. 11: 1010–1017. <https://doi.org/10.1002/eat.22586>.
- Muzi, L., L. Tieghi, M. A. Rugo, and V. Lingiardi. 2020. "Evaluating Empirically Valid and Clinically Meaningful Change in Intensive Residential Treatment for Severe Eating Disorders at Discharge and at a 6-Month Follow-Up." *Eating and Weight Disorders-Studies on Anorexia, Bulimia and Obesity* 25, no. 6: 1609–1620. <https://doi.org/10.1007/s40519-019-00798-2>.
- Olatunji, B. O., C. D. Tart, S. Shewmaker, D. Wall, and J. A. Smits. 2010. "Mediation of Symptom Changes During Inpatient Treatment for Eating Disorders: The Role of Obsessive-Compulsive Features." *Journal of Psychiatric Research* 44, no. 14: 910–916. <https://doi.org/10.1016/j.jpsychires.2010.02.011>.
- Ornstein, R. M., J. H. Essayli, T. A. Nicely, E. Masciulli, and S. Lane-Loney. 2017. "Treatment of Avoidant/Restrictive Food Intake Disorder in a Cohort of Young Patients in a Partial Hospitalization Program for Eating Disorders." *International Journal of Eating Disorders* 50, no. 9: 1067–1074. <https://doi.org/10.1002/eat.22737>.
- Pollice, C., W. H. Kaye, C. G. Greeno, and T. E. Weltzin. 1997. "Relationship of Depression, Anxiety, and Obsessionality to State of Illness in Anorexia Nervosa." *International Journal of Eating Disorders* 21, no. 4: 376. [https://doi.org/10.1002/\(SICI\)1098-108X\(1997\)21:4%3C367::AID-EAT10%3E3.0.CO;2-W](https://doi.org/10.1002/(SICI)1098-108X(1997)21:4%3C367::AID-EAT10%3E3.0.CO;2-W).
- Rienecke, R. D., D. V. Blalock, A. Duffy, et al. 2021. "Posttraumatic Stress Disorder Symptoms and Trauma-Informed Care in Higher Levels of Care for Eating Disorders." *International Journal of Eating Disorders* 54, no. 4: 627–632. <https://doi.org/10.1002/eat.23455>.
- Rienecke, R. D., P. S. Mehler, A. Duffy, D. Le Grange, and D. V. Blalock. 2023. "A Brief Examination of Treatment Outcomes in Higher Levels of Care for Individuals With Eating Disorders Across Age Groups." *European Eating Disorders Review* 32, no. 3: 431–439. <https://doi.org/10.1002/erv.3054>.
- Rojo-Moreno, L., P. Arribas, J. Plumed, et al. 2015. "Prevalence and Comorbidity of Eating Disorders Among a Community Sample of Adolescents: 2-Year Follow-Up." *Psychiatry Research* 227, no. 1: 52–57. <https://doi.org/10.1016/j.psychres.2015.02.015>.
- Sala, L., C. Mirabel-Sarron, P. Gorwood, A. Pham-Scottez, A. Blanchet, and F. Rouillon. 2011. "The Level of Associated Depression and Anxiety Traits Improves During Weight Regain in Eating Disorder Patients." *Eating and Weight Disorders* 16, no. 4: e280–e284. <https://doi.org/10.1007/BF03327473>.
- Sander, J., M. Moessner, and S. Bauer. 2021. "Depression, Anxiety and Eating Disorder-Related Impairment: Moderators in Female Adolescents and Young Adults." *International Journal of Environmental Research and Public Health* 18, no. 5: 2779. <https://doi.org/10.3390/ijerph18052779>.
- Schlegl, S., N. Quadflieg, B. Löwe, U. Cuntz, and U. Voderholzer. 2014. "Specialized Inpatient Treatment of Adult Anorexia Nervosa: Effectiveness and Clinical Significance of Changes." *BMC Psychiatry* 14: 1–12. <https://doi.org/10.1186/s12888-014-0258-z>.
- Spitzer, R. L., K. Kroenke, J. B. Williams, and B. Löwe. 2006. "A Brief Measure for Assessing Generalized Anxiety Disorder: The GAD-7." *Archives of Internal Medicine* 166, no. 10: 1092–1097. <https://doi.org/10.1001/archinte.166.10.1092>.
- Swanson, S. A., S. J. Crow, D. Le Grange, J. Swendsen, and K. R. Merikangas. 2011. "Prevalence and Correlates of Eating Disorders in Adolescents: Results From the National Comorbidity Survey Replication Adolescent Supplement." *Archives of General Psychiatry* 68, no. 7: 714–723. <https://doi.org/10.1001/archgenpsychiatry.2011.22>.
- Tabachnick, B. G., and L. S. Fidell. 2013. *Using Multivariate Statistics*. 6th ed. London, UK: Pearson.
- Tyagi, H., R. Patel, F. Rughooputh, H. Abrahams, A. J. Watson, and L. Drummond. 2015. "Comparative Prevalence of Eating Disorders in Obsessive-Compulsive Disorder and Other Anxiety Disorders." *Psychiatry Journal* 2015: 1–6. <https://doi.org/10.1155/2015/186927>.
- Ulfvebrand, S., A. Birgegård, C. Norring, L. Högdahl, and Y. von Hausswoll-Juhlin. 2015. "Psychiatric Comorbidity in Women and Men With Eating Disorders Results From a Large Clinical Database." *Psychiatry Research* 230, no. 2: 294–299. <https://doi.org/10.1016/j.psychres.2015.09.008>.
- Vanzhula, I. A., E. Wang, M. K. Martinelli, C. Schreyer, and A. S. Guarda. 2023. "Inpatient Hospital Course and Self-Reported Symptomatology in Underweight Adults With ARFID Compared to Age-And Sex-Matched Controls With Anorexia Nervosa." *Journal of Eating Disorders* 11, no. 1: 206. <https://doi.org/10.1186/s40337-023-00912-x>.



Vittengl, J. R., R. B. Jarrett, E. Weitz, et al. 2016. "Divergent Outcomes in Cognitive-Behavioral Therapy and Pharmacotherapy for Adult Depression." *American Journal of Psychiatry* 173, no. 5: 481–490. <https://doi.org/10.1176/appi.ajp.2015.15040492>.

Wade, T. D., R. Shafran, and Z. Cooper. 2024. "Developing a Protocol to Address Co-occurring Mental Health Conditions in the Treatment of Eating Disorders." *International Journal of Eating Disorders* 57, no. 6: 1–9. <https://doi.org/10.1002/eat.24008>.

Withnell, S. J., A. Kinnear, P. Masson, and L. P. Bodell. 2022. "How Different Are Threshold and Other Specified Feeding and Eating Disorders? Comparing Severity and Treatment Outcome." *Frontiers in Psychology* 13: 784512. <https://doi.org/10.3389/fpsyg.2022.784512>.

### Supporting Information

Additional supporting information can be found online in the Supporting Information section.