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Longitudinal Effects of Residential Treatment for Eating Disorders: Symptom Trajectories and Predictors of Functional Outcomes

Sinead Day[1] | Deborah Mitchison[2] | W. Kathy Tannous[3] | Janet Conti[4] | Katherine Gill[5] | Long Le[6] | Haider Mannan[1] | Cathrine Mihalopoulos[6] | Lucie Ramjan[7] | Rebekah Rankin[1] | Phillipa Hay[8,9]

[1]Translational Health Research Institute, Western Sydney University, Penrith, New South Wales, Australia | [2]Graduate School of Health, University of Technology Sydney, Ultimo, New South Wales, Australia | [3]Translational Health Research Institute, School of Business, Western Sydney University, Penrith, New South Wales, Australia | [4]Translational Health Research Institute, School of Psychology, Western Sydney University, Penrith, New South Wales, Australia | [5]FND Australia Support Services, Davidson, New South Wales, Australia | [6]School of Public Health and Preventive Medicine, Monash University, Melbourne, Victoria, Australia | [7]Translational Health Research Institute, School of Nursing and Midwifery, Western Sydney University, Penrith, New South Wales, Australia | [8]Translational Health Research Institute, School of Medicine, Western Sydney University, Penrith, New South Wales, Australia | [9]Mental Health Services Camden and Campbelltown Hospitals, South West Sydney Local Health District, Sydney, Australia

Correspondence: Sinead Day (s.day2@westernsydney.edu.au)

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ABSTRACT

Objective: Residential treatment for eating disorders addresses the gap between inpatient and outpatient care, but evidence for longer-term and functional outcomes remains limited. The current study examined both clinical and functional outcomes from admission to a 6-month follow-up from Australia's first residential service for eating disorders.

Method: Measures of eating disorder symptoms, body mass index (BMI), anxiety, depression, general and eating disorder-specific health-related quality of life (HRQoL), and functional disability were completed at pretreatment, posttreatment, and 3- and 6-month follow-ups by 81 individuals with eating disorders ($M_{age} = 25.78$ years).

Results: Linear mixed effects modeling found that change in outcomes over time was best modeled by a cubic growth curve, such that participants showed a steep improvement from pretreatment to posttreatment followed by a worsening of symptoms by 3 months post-discharge, which tapered off by 6 months post-discharge. Pairwise comparisons indicated significant improvement between pretreatment and posttreatment for all outcomes, and between pretreatment and 6 months post-discharge for all outcomes except mental HRQoL. Treatment gains were maintained after discharge for shape and weight concerns, anxiety, general and eating disorder-specific HRQoL, and functional disability. Greater in-treatment improvement in eating disorder symptoms predicted steeper in-treatment improvement and posttreatment deterioration in eating disorder-specific HRQoL, mental HRQoL, and functional disability. Greater post-discharge mental health support predicted steeper improvement in functional disability.

Discussion: Results support the longitudinal effectiveness of residential treatment for clinical and functional outcomes. However, not all outcomes may maintain the degree of improvement seen at discharge, highlighting the importance of appropriate step-down care.

Trial Registration: Registration number: ACTRN12621001651875

Summary

- Residential treatment research for eating disorders has been limited by a lack of follow-up data and focus on functional outcomes in addition to clinical symptoms.
- The current study found improvement in eating disorder symptoms, anxiety, depression, BMI, and measures of functioning (functional disability, both generic and eating disorder-specific health-related quality of life) over time, including a 6-month follow-up.
- Clinical outcomes were mixed in whether worsening of symptoms was seen after discharge, but improvement in functional outcomes was maintained.
- Greater in-treatment improvement in eating disorder symptoms predicted a pattern of change over time in functional outcomes characterized by steeper in-treatment improvement and then slight deterioration after discharge.

1 | Introduction

Residential treatment addresses a common gap in the eating disorder (ED) spectrum of care between inpatient and outpatient services. Day programs and regular outpatient sessions with a psychologist or other mental health professional may be inadequate for individuals with medical instability, acute suicidality, or severe symptoms (Abbate-Daga et al. 2009; Anderson et al. 2017). While better equipped to manage these, inpatient services (though varied) typically focus on acute physical stabilization and are less likely to target the cognitive and affective symptoms and skills for autonomous living necessary for long-term psychological recovery (Hay et al. 2019). Inpatient settings can be experienced as restrictive (Rankin et al. 2023) and the highly structured environment hinders the generalizability of new skills upon discharge (Bryan et al. 2022; Smith et al. 2016). Inpatient care is often not preferred by individuals with EDs, and treatment completion is higher in outpatient settings (Hay et al. 2019). For those who require more intensive care than outpatient treatment, however, residential services offer 24-h care in a homelike environment, blending medical oversight with a focus on psychological and functional recovery (Brewerton and Costin 2011b).

Early research on residential treatment outcomes has been promising. A systematic review of 19 studies found improvement in ED symptoms, depression, anxiety, quality of life (QoL), and body mass index (BMI; where indicated for underweight/weight suppressed participants) (Peckmezian and Paxton 2020). An updated scoping review of 12 studies found similar improvement in clinical outcomes and QoL (Clague et al. 2024). However, studies have predominantly focused on ED behaviors and BMI, often overlooking aspects of ED psychopathology such as overvaluation of weight/shape, which is central to the transdiagnostic cognitive behavioral model (Fairburn et al. 2003, 2008). QoL has similarly been underexplored, included in only 5 out of 19 studies in the largest review of residential treatment (Peckmezian and Paxton 2020). Given the well-established link between EDs and poorer health-related quality of life (HRQoL) and functional impairment (Ágh et al. 2015; Winkler et al. 2014), there is growing recognition of the importance of QoL to ED recovery (Bardone-Cone et al. 2018). Improving HRQoL and functioning is also often a more personally valued goal for individuals with EDs (Mitchison et al. 2015, 2016), and ED symptom severity has been shown to negatively correlate with HRQoL over time (Mitchison et al. 2015).

Current residential treatment literature has limited follow-up data beyond discharge (Clague et al. 2024; Peckmezian and Paxton 2020), hindering understanding of whether and how treatment gains can be maintained. Only 8 out of 19 studies in Peckmezian and Paxton's (2020) review included follow-up data (1 month to 10 years post-discharge), with mixed findings about whether treatment gains were maintained. Predictors of better ED outcomes at follow-up included higher discharge BMI (4.6 years posttreatment for AN [Brewerton and Costin 2011a]), and less severe baseline depression, worry, and psychosocial functioning (1-year posttreatment [Fewell et al. 2017]). Across ED treatment settings, a meta-analysis of 126 studies indicated that poorer follow-up outcomes were predicted by more severe ED symptoms, weight/shape concerns, and depression, and lower BMI at baseline (Vall and Wade 2015). Recently, a study of the same residential service as the current study found that baseline, and greater early (first 4 weeks of treatment) improvement in ED symptoms—but not age, BMI, anxiety, or depression—predicted less severe ED symptoms at discharge (Day et al. 2025). In extension of previous research on predictors of clinical outcomes at follow-up from residential treatment, the current study will focus on predictors of functional outcomes post-discharge.

Thus, the current study aimed to assess the long-term effectiveness of residential treatment. It was hypothesized that residential care would lead to improvement in ED symptoms, comorbid psychological symptoms (anxiety, depression), functional impairment, and HRQoL both immediately posttreatment and at 3- and 6-month post-discharge. It was also hypothesized that greater improvement in ED symptoms during treatment and greater mental health support post-discharge would predict better functional outcomes.

2 | Materials and Methods

2.1 | Participants

The sample included 81 participants with an ED who received residential treatment. A power analysis using the R package *simr* (Green and MacLeod 2016) estimated that a minimum sample size of 50 was required to achieve 80% power in detecting a medium effect size. The sample represents 95% of unique admissions to the service over the data collection period (remaining 5% did not express interest in participation). Treatment took place between January 2022 and January 2024 at Wandi Nerida, the first Australian ED residential service. Admission criteria included a primary diagnosis of any ED (based on DSM-5 [American Psychiatric Association 2013] criteria) and medical stability. Treatment included individual and group psychological ED therapies (with individual therapy also focusing on mood

and anxiety as needed), meal support, nutritional rehabilitation, yoga, art therapy, equine therapy, and family therapy. This model of care is similar to residential programs from previous research (e.g., Monte Nido residential services; Brewerton and Costin 2011b). A comprehensive description of Wandi Nerida and its clinical effectiveness has been published elsewhere (Day et al. 2024, 2025). Treatment length was variable based on individualized treatment targets (see Day et al. 2024 for a description of the treatment phases). All participants engaged in discharge planning, including follow-up care with their treatment team prior to discharge.

2.2 | Materials

2.2.1 | Demographic Variables

At admission, participants completed a short demographic questionnaire including their age, gender, country of birth, socioeconomic status, and ED history. Participants' residential postcode was used to calculate a socioeconomic index for area (SEIFA) score that ranks areas in Australia based on relative socioeconomic advantage or disadvantage as a percentile (Australian Bureau of Statistics 2023).

2.2.2 | Clinical Outcomes

ED diagnosis was based on a semi-structured admission interview by psychologist and psychiatrist staff at the service. ED psychopathology over the past 28 days was self-reported using the Eating Disorder Examination Questionnaire (EDE-Q v.6) at each survey timepoint. It provides a global score of ED psychopathology and four subscales (restraint, eating concerns, weight concerns, shape concerns), each scored 0–6. The EDE-Q has shown good psychometric properties in Australian community samples (Mond et al. 2004a, 2004b) and can screen for EDs using a global cut-off score of 2.8 (Mond et al. 2008). It had good internal consistency in the current sample, McDonald's $\omega = 0.94–0.96$ (across four timepoints; all scores of >0.80 on McDonald's omega indicate strong reliability [Kalkbrenner 2023]). BMI (kg/m^2) was measured using calibrated scales and stadiometers and reported by clinical staff at each timepoint, and was only examined as a treatment outcome for participants identified by their treating team as requiring weight restoration based on their individual medical and weight history.

Anxiety symptoms were measured using the Generalized Anxiety Disorder Screener-7 (GAD-7; Spitzer et al. 2006). Scores range from 0 to 21, with higher scores representing greater anxiety. The GAD-7 has shown acceptable psychometric properties and a cut-off value of 8 for a probable anxiety disorder (Plummer et al. 2016). It had good internal consistency in the current sample, McDonald's $\omega = 0.92–0.95$. Depressive symptoms were measured using the Patient Health Questionnaire-9 (PHQ-9; Kroenke et al. 2001), with higher scores reflecting greater depression. Total scores range from 0 to 27, with a cut-off score of 10 predicting major depressive disorder (Manea et al. 2015). It has been validated in community and clinical samples (Costantini et al. 2021; Manea et al. 2015) and showed acceptable internal consistency in the current sample, McDonald's $\omega = 0.79–0.92$.

2.2.3 | Functional Outcomes

ED-specific HRQoL impairment was measured using the disease-specific Clinical Impairment Assessment (CIA; Bohn and Fairburn 2008), completed immediately after the EDE-Q. Scores range from 0 to 48, with higher scores reflecting greater HRQoL impairment as a result of ED symptoms. The CIA has been validated in community and clinical samples, with a clinical cut-off score of 16 (Raykos et al. 2019; Reas et al. 2010). It showed good internal consistency in the current sample, McDonald's $\omega = 0.93–0.97$.

The 12-item version of the World Health Organization Disability Assessment Schedule (WHODAS-12; Üstün et al. 2010) was used to measure health and disability. This measure asks the individual how much difficulty they have engaging in regular everyday activities. Scores range from 12 to 60, with higher scores reflecting higher disability. The WHODAS-12 has been shown to be a psychometrically sound in community and psychiatric samples (Axelsson et al. 2017; Üstün et al. 2010) and had acceptable internal consistency in the current sample, McDonald's $\omega = 0.86–0.92$.

The Medical Outcomes Survey Short Form (12-item) version 2 (SF-12v2) was used to assess generic HRQoL not solely attributed to the ED (as is assessed in the disease-specific CIA above). The SF-12 is a short version of the Medical Outcomes Survey (MOS) SF-36 and has two subscales, the Physical (PCS) and Mental Component Scores (MCS), representing physical and mental dimensions of HRQoL. Scores range from 0 to 100, with higher scores reflecting better HRQoL. Internal consistency could not be calculated for the current sample due to proprietary scoring procedures, but the SF-12v2 has been validated in adults with a variety of mental health conditions (Huo et al. 2018).

2.2.4 | Health Service Use Post-Discharge

At 3 months post-discharge, participants were asked about their engagement with ED follow-up care. They reported whether they were currently seeing a psychologist, psychiatrist, and/or dietitian for their ED, and the number of sessions per week with each over the last 3 months (since discharge).

2.3 | Design and Procedure

The current study was a repeated measures cohort study. It was prospectively registered on the Australian and New Zealand Clinical Trials Registry in November 2021, registration number ACTRN12621001651875. Outcomes were measured at admission, discharge, and at 3- and 6-month posttreatment. Data collection was scaffolded by the TrEAT Registry (ACSQHC-ARCR-279), which supports ED services to collect and collate outcomes data to support clinical practice and research (Australian Commission on Safety and Quality in Health Care, n.d.; The TrEAT Registry 2024). Participants were given an online study description and consent form on admission. Measures were administered using online surveys via Qualtrics, with participants identified using a unique numerical ID code. Pretreatment and discharge survey links

were provided by service staff, and surveys were completed using an electronic tablet. Post-discharge surveys were administered via email directly to the participant, with up to three reminders by email or phone call. Participants were also offered a small gift voucher for completing each follow-up survey. Ethics approval was granted by the Western Sydney University Human Research Ethics Committee (approval numbers H14742, H14478).

2.4 | Data Analysis

Analyses were performed using R Statistical Software (v4.3.1; R Core Team 2023). Descriptive statistics are provided for each outcome variable and timepoint. Data were available for 97.5% of the sample ($n = 79$) at pretreatment, 87.7% ($n = 71$) at discharge, 71.6% ($n = 58$) at 3 months post-discharge, and 61.7% ($n = 50$) at 6 months post-discharge. Little's test was not significant, suggesting that data were missing completely at random, $\chi^2(1235) = 988.40$, $p = 1.00$. Mann–Whitney U tests indicated that data missingness was not associated with demographic characteristics (age, socioeconomic status) or clinical or functional outcomes at admission (for missingness at subsequent timepoints), all $p > 0.05$.

Linear mixed effects models analyzed change in clinical and functional outcomes over time, nested within individual participants, using the R package *lme4* (Bates et al. 2015). Mixed effects models are robust to violations of the normality assumption (Schielzeth et al. 2020), handle missing data better than alternative methods, and can examine both linear and nonlinear trajectories of change (Mirman 2017). To assess the pattern of change in outcomes over time, quadratic and cubic fixed effects were added individually to the linear effect of time, and model fit was evaluated using the likelihood ratio test, with second- and third-order polynomials retained when a better fit was indicated (Mirman 2017). Orthogonal polynomials were used to reduce multicollinearity between time terms. All models included random intercepts for individual participants. R packages *lmerTest* (Kuznetsova et al. 2017) and *effectsize* (Ben-Shachar et al. 2020) were used to calculate parameter-specific p values, degrees of freedom (based on the Satterthwaite approximation), and Cohen's d effect sizes (Cohen 1988) for each fixed effect. R package *performance* (Lüdecke et al. 2021) was used to calculate marginal R^2 (variance explained by fixed effects) across the entire final model (Nakagawa and Schielzeth 2013). Pairwise comparisons assessed for change in standardized mean outcome between specific time points with Bonferroni-adjusted p values, using R package *emmeans* (Lenth 2017).

Additional mixed effects models examined moderators of change in functional outcomes (ED-specific HRQoL impairment, functional disability, and physical and mental HRQoL). Alongside the fixed effects of time, these models included age (in years), socioeconomic status (SEIFA percentile), treatment duration, and illness duration as potential covariates; and change in ED symptoms during treatment (below vs. above average change in global eating psychopathology on the EDE-Q from pretreatment to posttreatment) and level of ED follow-up care (< 1 session per week with a psychologist, psychiatrist, and/or dietitian vs. ≥ 1 session per week for the first 3 months' post-discharge) as expected predictors. Attrition was also initially examined as a predictor but was not retained due to limited variability and multicollinearity. Predictor models controlled for individual differences in severity of the functional outcome at baseline. Continuous predictor variables were mean centered and categorical predictors were dummy-coded. As with the previous models, higher order time terms were added individually to the linear effect of time, and in interaction with the other predictors, and model fit was evaluated using the likelihood ratio test. All predictors and interactions were included if they accounted for a significant amount of the overall variance in the outcome.

3 | Results

Participant age ranged from 16 to 50 years ($M = 25.78$, SE = 0.77) and all identified as female. The majority of participants (90.1%) were born in Australia. The most common ED presentation was anorexia nervosa restrictive subtype (40.0%), followed by atypical anorexia (36.3%), anorexia nervosa binge-purge subtype (15.0%), and bulimia nervosa and binge ED (8.8%). Most participants (93.8%) reported a comorbid mental health condition, including anxiety (64.2%), mood (61.7%), trauma-related (28.4%), personality disorders (12.3%), and autism (13.6%). Average scores on clinical and functional outcomes by timepoint are displayed by ED presentation in Table S1. The average ED age of onset was 15.24 years (SE = 0.58), and the mean illness duration was 10.13 years (SE = 0.68). Most (93.7%) of the sample reported at least one previous inpatient hospitalization for their ED. The average length of stay was 82 days in residential treatment (SE = 4.68) and 91.4% of participants completed at least 4 weeks of treatment.

Descriptive statistics are provided in Table 1. Outcome variables did not differ between ED diagnostic groups at baseline except for BMI, which, as expected, was lower among participants with anorexia nervosa, $\chi^2(4) = 60.47$, $p < 0.001$. BMI was only used as an outcome variable for participants with weight restoration as a treatment goal (95.1%). All participants who completed the 3-month follow-up survey reported engaging in further treatment with a psychologist, counselor, and/or dietitian between discharge and the 3-month follow-up. Of participants who completed the 6-month follow-up survey, the majority (85.7%) reported engaging in further treatment between 3 and 6 month post-discharge.

3.1 | Pattern of Change in Outcomes Over Time

Linear mixed effects models indicated that change in both clinical and functional outcomes was typically nonlinear (see Tables 2 and 3, with model comparison statistics provided in Table S2). A significant cubic effect of time was found for all clinical outcomes (ED symptoms, anxiety, depression, BMI) as well as ED-specific HRQoL impairment, functional disability, and physical and mental HRQoL. This indicated that, on average, participants experienced a steep improvement in symptoms from pretreatment to posttreatment followed by an increase in symptom severity after discharge, but this worsening of

TABLE 1 | Average clinical and functional outcomes by timepoint.

	Baseline		Discharge		3 Months post-discharge		6 Months post-discharge	
Variable	***M***	**SE**	***M***	**SE**	***M***	**SE**	***M***	**SE**
Clinical outcomes								
Global ED symptoms	4.68	0.13	2.97	0.17	3.72	0.19	3.82	0.23
Restraint	4.51	0.17	1.63	0.19	3.39	0.24	3.48	0.28
Eating concerns	4.02	0.14	2.14	0.18	2.89	0.19	3.05	0.22
Shape concerns	5.29	0.13	4.30	0.19	4.55	0.20	4.47	0.25
Weight concerns	4.91	0.16	3.79	0.22	4.07	0.21	4.18	0.25
Anxiety	15.62	0.60	11.52	0.80	13.34	0.90	13.48	0.90
Depression	20.00	0.69	13.49	0.85	15.95	1.05	16.32	0.82
BMI[a]	18.11	0.41	21.99	0.42	19.29	0.73	19.79	1.17
Functional outcomes								
ED-specific HRQoL impairment	41.25	0.95	28.28	1.69	31.98	1.69	32.82	1.79
Functional disability	30.27	0.98	24.49	1.18	25.77	1.18	25.18	1.16
Physical HRQoL	46.83	1.00	52.80	0.94	51.03	1.26	51.11	1.27
Mental HRQoL	26.97	1.07	31.73	1.35	29.63	1.45	28.94	1.49

Note: $N = 81$. Global ED symptoms, restraint, and eating, shape, and weight concerns were measured by the global and subscale scores of the EDE-Q. Anxiety was measured by the GAD-7, depression by the PHQ-9, ED-specific HRQoL impairment by the CIA, functional disability by the WHODAS-12, and physical and mental HRQoL by the SF-12.
Abbreviations: BMI, body mass index; ED, eating disorder; HRQoL, health-related quality of life; *M*, mean; SE, standard error.
[a]For participants with weight restoration as a treatment goal, $n = 77$.

outcomes tapered off from 3 to 6 months post-discharge. Effect sizes for time terms were large. Marginal R^2 values indicated that the fixed effects of time accounted for a larger amount of the variance in global ED symptoms, restraint, eating concerns, BMI, and ED-specific HRQoL impairment (16%–30%) than for other outcomes (typically 7%–13%).

3.2 | Change in Outcomes Between Timepoints

Consistent with hypotheses, pairwise comparisons showed significant improvement from pretreatment to posttreatment and pretreatment to 3 and 6 months post-discharge for clinical outcomes (see Table 4). This improvement at discharge was maintained at 3 and 6 months post-discharge for shape concerns, weight concerns, and anxiety. The remaining clinical outcomes showed slight worsening between discharge and the follow-ups. Effect sizes were medium to large.

In partial support of hypotheses, all functional outcomes also significantly improved from pretreatment to posttreatment (see Table 5). Level of improvement at discharge was maintained at follow-up for all functional outcomes. At the 6-month follow-up, all functional outcomes were improved over baseline except for mental HRQoL, which was only improved at the 3-month follow-up in comparison to admission. Effect sizes were medium to large. Average change in clinical and functional outcomes over time is further depicted in Figures S1 and S2.

3.3 | Additional Predictors of Functional Outcomes

Age, socioeconomic status, treatment duration, and illness duration were not significant (either alone or in interaction with time) for any of the functional outcomes, so they were removed from the final models. Significant main effects of in-treatment change in ED symptoms were found for ED-specific HRQoL impairment ($b = -11.72$, SE = 1.64, $t(34.78) = -7.16$, $p < 0.001$), mental HRQoL ($b = 7.41$, SE = 1.74, $t(32.58) = 4.25$, $p < 0.001$), and functional disability ($b = -3.82$, SE = 1.38, $t(34.04) = -2.77$, $p = 0.009$). These main effects indicated that impairment and disability were lower and mental HRQoL was higher (averaged across time) for participants who had above average improvement in ED symptoms during treatment.

Interaction effects for ED-specific HRQoL and mental HRQoL are represented in Figure 1a,b, and interaction effects for functional disability are represented in Figure 2a,b. Adjusting for the severity of the functional outcome at baseline, in-treatment ED symptom change interacted with time for ED-specific HRQoL impairment ($b = 113.04$, SE = 22.61, $t(101.42) = 5.00$, $p < 0.001$), generic mental HRQoL ($b = -60.02$, SE = 20.85, $t(93.31) = -2.88$, $p = 0.005$), and functional disability ($b = 35.56$, SE = 15.51, $t(97.95) = 2.29$, $p = 0.024$). Individuals with above average in-treatment ED symptom change exhibited a more pronounced quadratic trend for changes in ED-specific HRQoL impairment, generic mental HRQoL, and functional disability. These

TABLE 2 | Linear mixed effects modeling of fixed effects of time on clinical outcomes.

Outcome	Time	Estimate	SE	df	*t*	*p*	*d*	R^2_M
Global ED symptoms	Time	−4.56	1.07	183.50	−4.24	<0.001***	−3.22	0.19
	Time^2	8.27	1.04	177.53	7.97	<0.001***	5.15	
	Time^3	−6.32	1.03	177.48	−6.14	<0.001***	−3.61	
Restraint	Time	−3.08	1.46	192.06	−2.12	<0.001***	−2.10	0.30
	Time^2	13.62	1.42	184.66	9.58	<0.001***	6.61	
	Time^3	−12.52	1.42	184.91	−8.83	<0.001***	−5.48	
Eating concerns	Time	−4.98	1.20	185.09	−4.14	<0.001***	−3.45	0.22
	Time^2	9.33	1.16	177.32	8.01	<0.001***	5.64	
	Time^3	−6.68	1.16	177.40	−5.78	<0.001***	−3.73	
Shape concerns	Time	−5.34	1.10	182.86	−4.83	<0.001***	−3.38	0.08
	Time^2	4.21	1.07	177.24	3.95	<0.001***	2.64	
	Time^3	−3.13	1.06	177.16	−2.96	0.004**	−1.80	
Weight concerns	Time	−5.01	1.22	182.90	−4.12	<0.001***	−2.98	0.08
	Time^2	5.64	1.17	177.43	4.81	<0.001***	3.12	
	Time^3	−3.01	1.16	177.35	−2.58	0.011*	−1.56	
Anxiety	Time	−13.58	4.35	182.31	−3.13	0.002**	−2.21	0.07
	Time^2	19.26	4.20	176.91	4.59	<0.001***	2.86	
	Time^3	−12.76	4.22	177.69	−3.03	0.003**	−1.75	
Depression	Time	−18.05	5.31	181.62	−3.40	<0.001***	−2.74	0.13
	Time^2	32.54	5.14	174.60	6.33	<0.001***	4.30	
	Time^3	−20.79	5.16	175.74	−4.03	<0.001***	−2.54	
BMI[a]	Time	6.89	3.32	133.74	2.08	0.040*	2.32	0.16
	Time^2	−17.31	3.15	126.68	−5.49	<0.001***	−4.49	
	Time^3	15.27	3.35	128.86	4.56	<0.001***	2.33	

Note: Estimates are unstandardized. Second- and third-order polynomials are only included where they improved model fit based on the likelihood ratio test.
Abbreviations: BMI, body mass index; *d*, Cohen's *d* effect size for each fixed effect of time (0.2 = small, 0.5 = medium, 0.8 = large); df, degrees of freedom; ED, eating disorder; R^2_M, marginal R^2 (variance explained by fixed effects across entire model); SE, standard error.
[a]For participants with weight restoration as a treatment goal ($n = 77$).
*$p < 0.05$.
**$p < 0.01$.
***$p < 0.001$.

outcomes showed steeper improvement from pretreatment to posttreatment and steeper worsening from discharge to the 3-month follow-up. ED symptom change was not a significant predictor for physical HRQoL.

Adjusting for baseline functional disability, the level of mental health support post-discharge interacted with the linear effect of time for functional disability ($b = -35.20$, SE = 16.30, $t(97.79) = -2.16$, $p = 0.033$). Participants who accessed more frequent support for their ED in the first 3 months' post-discharge showed a more linear improvement in functional disability over time (see Figure 2). To assist in interpreting this finding, post hoc independent samples *t*-tests assessed for differences in functional disability at each timepoint between those who accessed high versus low levels of follow-up care. Functional disability was significantly higher at discharge ($t(32) = 2.34$, $p = 0.025$) and at 3 months post-discharge ($t(35) = 2.09$, $p = 0.044$) for those who accessed more frequent follow-up care, but did not differ between low versus high support groups at baseline or the 6-month follow-up. This suggests that individuals with greater disability at and after discharge might have self-selected greater follow-up support, which may have been protective against the steep worsening of disability post-discharge seen in those who accessed less frequent follow-up care. The level of follow-up support did not predict any of the other functional outcomes.

Post hoc independent samples *t*-tests did not find baseline differences in global ED symptom severity between those with high versus low levels of in-treatment ED symptom change, $t(67) = 1.43$, $p = 0.159$, or high versus low levels of follow-up

TABLE 3 | Linear mixed effects modeling of fixed effects of time on functional outcomes.

Outcome	Time	Estimate	SE	df	*t*	*p*	*d*	R^2_M
ED-specific HRQoL impairment	Time	−48.70	10.16	185.72	−4.79	<0.001***	−3.90	0.17
	Time^2	63.93	9.87	177.32	6.48	<0.001***	4.63	
	Time^3	−37.30	9.88	178.81	−3.78	<0.001***	−2.53	
Functional disability	Time	−28.80	6.43	180.73	−4.48	0.002**	−3.08	0.07
	Time^2	27.82	6.21	175.06	4.48	0.011*	2.80	
	Time^3	−13.33	6.23	175.89	−2.14	0.034*	−1.26	
Physical HRQoL	Time	21.60	7.66	178.18	2.82	0.005**	2.38	0.07
	Time^2	−28.27	7.39	167.42	−3.84	<0.001***	−2.95	
	Time^3	17.64	7.38	167.95	2.39	0.018*	1.72	
Mental HRQoL	Time	17.77	9.01	182.08	1.97	0.050*	1.74	0.05
	Time^2	−32.45	8.70	171.84	−3.73	<0.001***	−2.84	
	Time^3	17.77	8.67	172.33	2.05	0.042*	1.46	

Note: Estimates are unstandardized. Second- and third-order orthogonal polynomials are only included where they improved model fit based on the likelihood ratio test.
Abbreviations: *d*, Cohen's *d* effect size for each fixed effect of time (0.2 = small, 0.5 = medium, 0.8 = large); df, degrees of freedom; ED, eating disorder; HRQoL, health-related quality of life; R^2_M, marginal R^2 (variance explained by fixed effects across entire model); SE, standard error.
*$p < 0.05$.
**$p < 0.01$.
***$p < 0.001$.

care, $t(34) = 1.21$, $p = 0.233$. Independent samples *t*-tests also indicated that there were no differences in baseline severity of any of the functional outcomes by level of post-discharge mental health support or level of in-treatment ED symptom change, all $p > 0.05$. As the above models also controlled for baseline differences between individuals in severity of the functional outcome, the findings for in-treatment ED symptom change and level of follow-up support as predictors of functional outcomes are not due to baseline differences in severity of ED symptoms or functioning between these groups.

4 | Discussion

This study examined 6-month follow-up outcomes from an ED residential service. As predicted, both clinical symptoms (ED symptoms, anxiety, depression, BMI) and functional indicators significantly improved from baseline to discharge and baseline to 6 months post-discharge. Symptom improvement seen at discharge was maintained over the 6-month follow-up period for all functional outcomes and some clinical outcomes (shape and weight concerns, anxiety). Other clinical outcomes (global ED symptoms, eating concerns, restraint, depression, BMI) deteriorated after discharge, yet remained improved over baseline. The overall pattern of change in outcomes was nonlinear, with the steepest improvement observed during treatment and then slight worsening or plateauing of outcomes after discharge that was particularly evident in the first 3-month posttreatment.

This study is the first to document such a comprehensive set of clinical and functional outcomes for ED residential treatment and reveal trends in predictors of functional change, which are rare across ED treatment research in general. The findings indicate that ED residential treatment has the potential for medium-term improvement in functional impairment and HRQoL in addition to standard clinical outcomes such as ED symptoms and mood. However, the trend of outcomes over the follow-up period indicates that treatment gains may be easier to maintain in some symptom domains than others, highlighting the importance of step-down care and providing targets for clinicians to focus on during this transition.

The findings from this study are consistent with previous literature on the effectiveness of residential treatment and mixed findings for maintenance of treatment gains post-discharge (Clague et al. 2024; Peckmezian and Paxton 2020). Residual ED and comorbid psychological symptoms are common in individuals with remitted or recovered EDs (Tomba et al. 2019), and average symptoms remained in the clinical range for participants in the current study at follow-up. This is unsurprising given the nonlinear nature of ED recovery (de Vos et al. 2023; Kenny and Lewis 2023), with studies suggesting that more than half of individuals do not show complete abstinence from ED behaviors even after the most empirically supported treatments (Khalsa et al. 2017; Linardon and Wade 2018). Meeting criteria for ED remission or recovery is not anticipated following residential or other higher levels of care, due to the expectation that individuals will progress to a lower intensity and less restrictive treatment setting once they are able to. As such, the aim of intensive ED services is improvement, rather than full recovery.

Our study provides a greater focus on functioning and HRQoL than previous literature, with improvement in these outcomes maintained from discharge to follow-up. These results are encouraging considering the important role played by daily

TABLE 4 | Pairwise comparisons of a clinical outcome between timepoints.

Outcome variable	Fixed effects	Estimate	SE	df	*p*	*d*
Global ED symptoms	Pre—Discharge	1.77	0.15	186	<0.001***	1.99
	Pre—3-month FU	1.06	0.16	189	<0.001***	119
	Pre—6-month FU	0.99	0.17	190	<0.001***	1.11
	Discharge—3-month FU	−0.72	0.16	186	0.001**	−0.80
	Discharge—6-month FU	−0.78	0.17	187	0.001**	−0.87
Restraint	Pre—Discharge	2.91	0.21	190	<0.001***	2.36
	Pre—3-month FU	1.20	0.22	194	<0.001***	0.97
	Pre—6-month FU	1.08	0.23	195	<0.001***	0.88
	Discharge—3-month FU	−1.71	0.23	191	<0.001***	−1.39
	Discharge—6-month FU	−1.83	0.23	192	<0.001***	−1.48
Eating concerns	Pre—Discharge	1.95	0.17	187	<0.001***	1.94
	Pre—3-month FU	1.20	0.18	191	<0.001***	1.19
	Pre—6-month FU	1.07	0.19	193	<0.001***	1.07
	Discharge—3-month FU	−0.75	0.18	188	<0.001***	−0.75
	Discharge—6-month FU	−0.87	0.19	190	<0.001***	−0.87
Shape concerns	Pre—Discharge	1.04	0.15	186	<0.001***	1.14
	Pre—3-month FU	0.84	0.17	188	<0.001***	0.92
	Pre—6-month FU	0.95	0.18	189	<0.001***	1.04
	Discharge—3-month FU	−0.20	0.17	186	1.00	
	Discharge—6-month FU	−0.09	0.18	187	1.00	
Weight concerns	Pre—Discharge	1.17	0.17	185	<0.001***	1.17
	Pre—3-month FU	0.98	0.18	188	<0.001***	0.97
	Pre—6-month FU	0.90	0.19	189	<0.001***	0.89
	Discharge—3-month FU	−0.20	0.19	186	1.00	
	Discharge—6-month FU	−0.28	0.20	186	0.929	
Anxiety	Pre—Discharge	4.08	0.61	181	<0.001***	1.14
	Pre—3-month FU	2.86	0.66	183	<0.001***	0.80
	Pre—6-month FU	2.66	0.69	184	<0.001***	0.74
	Discharge—3-month FU	−1.23	0.67	181	0.419	
	Discharge—6-month FU	−1.42	0.70	181	0.253	
Depression	Pre—Discharge	6.58	0.75	182	<0.001***	1.50
	Pre—3-month FU	4.38	0.80	185	<0.001***	1.00
	Pre—6-month FU	3.72	3.72	186	<0.001***	0.85
	Discharge—3-month FU	−2.20	0.82	183	0.049*	−0.50
	Discharge—6-month FU	−2.86	0.85	183	0.006**	−0.65

(Continues)

TABLE 4 | (Continued)

Outcome variable	Fixed effects	Estimate	SE	df	*p*	*d*
BMI[a]	Pre—Discharge	−3.88	0.34	127	<0.001***	−1.88
	Pre—3-month FU	−1.90	0.57	134	0.007**	−0.92
	Pre—6-month FU	−1.83	0.52	134	0.004**	−0.89
	Discharge—3-month FU	1.98	0.57	134	<0.001***	0.96
	Discharge—6-month FU	2.05	0.52	134	<0.001***	0.99

Note: Estimates are unstandardized.
Abbreviations: BMI, body mass index; *d*, Cohen's *d* effect size (0.2 = small, 0.5 = medium, 0.8 = large); df, degrees of freedom; ED, eating disorder; FU, follow-up; SE, standard error.
[a]For participants with weight restoration as a treatment goal ($n = 77$).
*$p < 0.05$.
**$p < 0.01$.
***$p < 0.001$.

functioning in ED recovery (Bardone-Cone et al. 2018), particularly for those with longstanding EDs (which was the case in the majority of our sample, with a mean of 10 years illness duration) (Zhu et al. 2020). Given the live-in nature of residential treatment, the transition home after discharge is expected to introduce stressors such as returning to work/study, adjusting to family dynamics, and managing greater autonomy in eating behaviors. A recent qualitative study highlighted that challenges faced after discharge from residential treatment include difficulty accessing community-based care and feelings of isolation and homesickness for the residential treatment community (Rankin et al. 2025). This may explain why some of the clinical outcomes exhibited slight worsening over the follow-up period; in particular, dietary restraint (as participants no longer had 100% meal support) and eating concerns (due to having to make more independent decisions about food, eating, and avoiding ED behaviors). That is, due to the 24-h residential treatment environment, it is likely that some of the observed within-treatment improvements are an artifact of this containment (e.g., by mandating regular eating) and that rebound in clinical symptoms after discharge is to be expected after returning to the relatively unstructured home environment.

Although some ED symptoms worsened over the follow-up period, it is notable that functional outcomes did not show similar deterioration. This is a promising finding and may suggest that residential treatment improves individuals' coping strategies and functional abilities even when ED symptoms persist. However, HRQoL remained low at 3- and 6-month post-discharge, which highlights the importance of ongoing adequate care. This is consistent with literature emphasizing the need for stronger community transition pathways, including stepdown programs or planned check-ins post-discharge, to ensure the sustainability of treatment gains (Bryan et al. 2022; Rankin et al. 2023).

Degree of ED symptom change during treatment was supported as a predictor of change in functional outcomes over time. Specifically, individuals with above-average symptom change saw steeper in-treatment improvement in ED-specific HRQoL impairment, mental HRQoL, and functional disability, and steeper deterioration after discharge for ED-specific HRQoL impairment and functional disability. Across time, individuals with above-average in-treatment ED symptom change were also less severe on these functional outcomes.

These findings expand upon previous research on early ED symptom change as a predictor of better ED treatment outcomes (Day et al. 2025; Vall and Wade 2015), though our study used total in-treatment ED symptom change. Our results suggest that those who benefit the most from treatment may also be more susceptible to symptom resurgence after they transition to less intensive care, once again highlighting the importance of stepdown care and personalized follow-up to maintain treatment gains and support ongoing recovery. In addition, individuals who accessed more frequent healthcare for their ED in the 3 months post-discharge showed more consistent improvement in functional disability, supporting the role of stepdown care in protecting against decline in functioning after discharge.

4.1 | Strengths and Limitations

This study contributes to a limited evidence base for long-term outcomes of ED residential treatment post-discharge, for which ongoing research is necessary. As the current study only examined outcomes at 3 and 6 months post-discharge, even longer-term follow-ups are needed to determine whether the trends observed continue at a year or more after treatment and the impact of access to health services. We had limited information about the type of care accessed by individuals post-discharge; in particular, whether they accessed specialized ED day programs or intensive outpatient services, as opposed to infrequent outpatient sessions with a psychologist or dietitian. As such, although we examined the level of follow-up support as a predictor of functional outcomes, this was based on the frequency of support received and did not capture the intensity or type of support. Future studies should conduct more detailed analyses of whether the type and intensity of care post-discharge predicts follow-up outcomes, including whether the treatment accessed was by a specialist ED clinician. Although our sample captured 95% of admissions to the service during the data collection period, the representativeness of the findings may be limited by missing data at the follow-up time points.

As we were unable to conduct an exhaustive analysis of all potential predictors of functional outcomes over the

TABLE 5 | Pairwise comparisons of a functional outcome between timepoints.

Outcome variable	Fixed effects	Estimate	SE	df	*p*	*d*
ED-specific HRQoL impairment	Pre—Discharge	13.23	1.43	185	<0.001***	1.56
	Pre—3-month FU	10.09	1.53	189	<0.001***	1.19
	Pre—6-month FU	9.11	1.60	190	<0.001***	1.08
	Discharge—3-month FU	−3.14	1.58	187	0.286	
	Discharge—6-month FU	−4.12	1.64	187	0.078	
Functional disability	Pre—Discharge	5.85	0.90	181	<0.001***	1.11
	Pre—3-month FU	5.29	0.97	183	<0.001***	1.00
	Pre—6-month FU	4.96	1.01	184	<0.001***	0.94
	Discharge—3-month FU	−0.56	0.96	181	1.00	
	Discharge—6-month FU	−0.89	1.03	181	0.557	
Physical HRQoL	Pre—Discharge	−5.97	1.08	179	<0.001***	−0.96
	Pre—3-month FU	−4.41	1.17	184	0.001**	−0.71
	Pre—6-month FU	−4.10	1.21	185	0.005**	−0.66
	Discharge—3-month FU	1.56	1.18	180	1.00	
	Discharge—6-month FU	1.87	1.21	180	0.749	
Mental HRQoL	Pre—Discharge	−6.25	1.28	179	<0.001***	−0.85
	Pre—3-month FU	−4.49	1.37	184	0.008**	−0.61
	Pre—6-month FU	−3.53	1.42	185	0.083	
	Discharge—3-month FU	1.77	1.38	179	1.00	
	Discharge—6-month FU	2.72	1.43	180	0.348	

Note: Estimates are unstandardized.
Abbreviations: *d*, Cohen's *d* effect size (0.2 = small, 0.5 = medium, 0.8 = large); ED, eating disorder; FU, follow-up; HRQoL, health-related quality of life; SE, standard error.
**$p < 0.01$.
***$p < 0.001$.

post-discharge period, further research is required on what factors are associated with sustained improvement to QoL. These could include posttreatment factors such as whether living alone versus with supports, or the extent of work, study, or caregiving responsibilities. By focusing on expected predictors of functional outcomes over the follow-up period and to ensure adequate statistical power, we did not examine other common predictors of clinical outcomes such as psychological comorbidities or motivation for recovery, which should be included in future studies. Previous literature indicates that stressful life events, psychiatric comorbidity, AN restrictive subtype, and lower motivation to change are associated with a greater likelihood of ED relapse (Grilo et al. 2012; Sala et al. 2023). Although we did not find any differences in baseline outcomes (except for BMI) between diagnostic groups, we did not have a sufficient sample size within each group to examine whether they may have predicted change in outcomes over time. Finally, our study did not include a control group to compare the effectiveness of residential treatment with another ED treatment setting, though the residential service in this study was shown in a previous study to be more effective than a day program by end-of-treatment (Day et al. 2025). ED residential services are not uniform, and as such, follow-up outcomes may vary from other services that differ in their length of stay or treatment components.

4.2 | Implications and Future Directions

The results of this study are generally supportive of including residential services in the spectrum of evidence-based treatment settings for EDs. Given the difficulty maintaining full improvement from discharge to follow-up and continued poor HRQoL, the results suggest the importance of careful discharge planning that includes appropriate step-down care, such as an ED day program or intensive outpatient services. Individuals who show lower than expected ED symptom change during treatment may benefit from being referred to a higher intensity option for step-down care (e.g., day programs/partial hospitalization). Future studies of follow-up outcomes from residential treatment should seek to include larger sample sizes (to allow subgroup analyses), longer follow-up periods, and more detailed examination of posttreatment individual, treatment, and environmental factors that could affect outcomes.

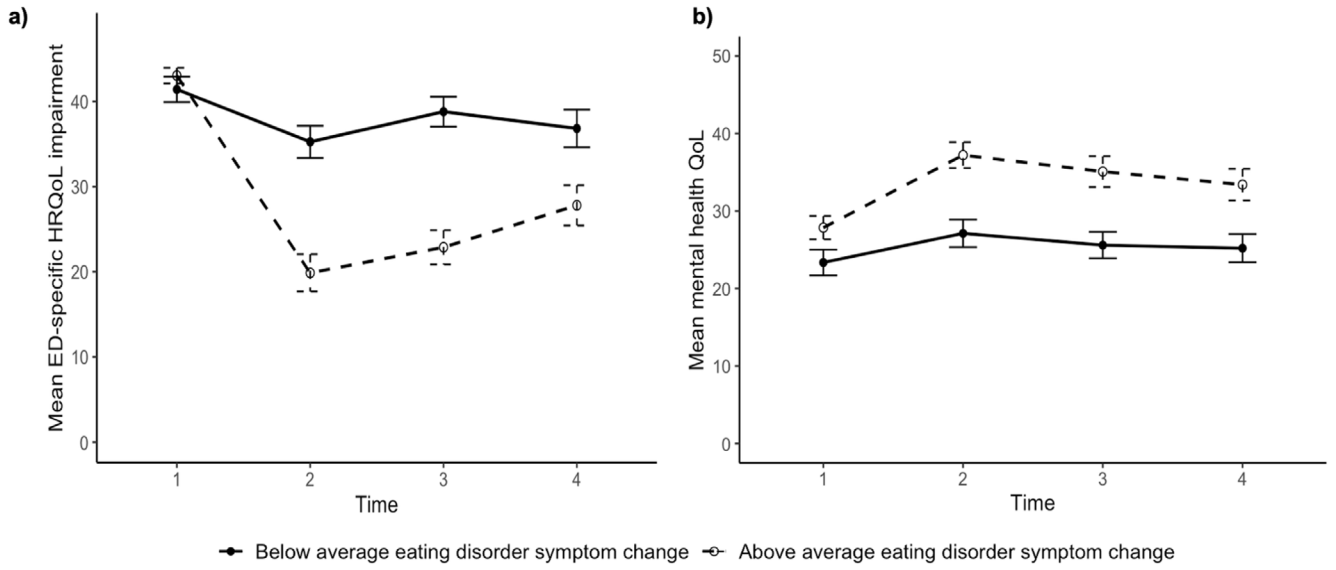

FIGURE 1 | Mean ED-specific HRQoL impairment and mental HRQoL over time by level of in-treatment ED symptom change. ED = eating disorder; HRQoL = health-related quality of life. Time 1 = pretreatment, 2 = discharge, 3 = 3 months' post-discharge, 4 = 6 months post-discharge. Error bars represent standard error.

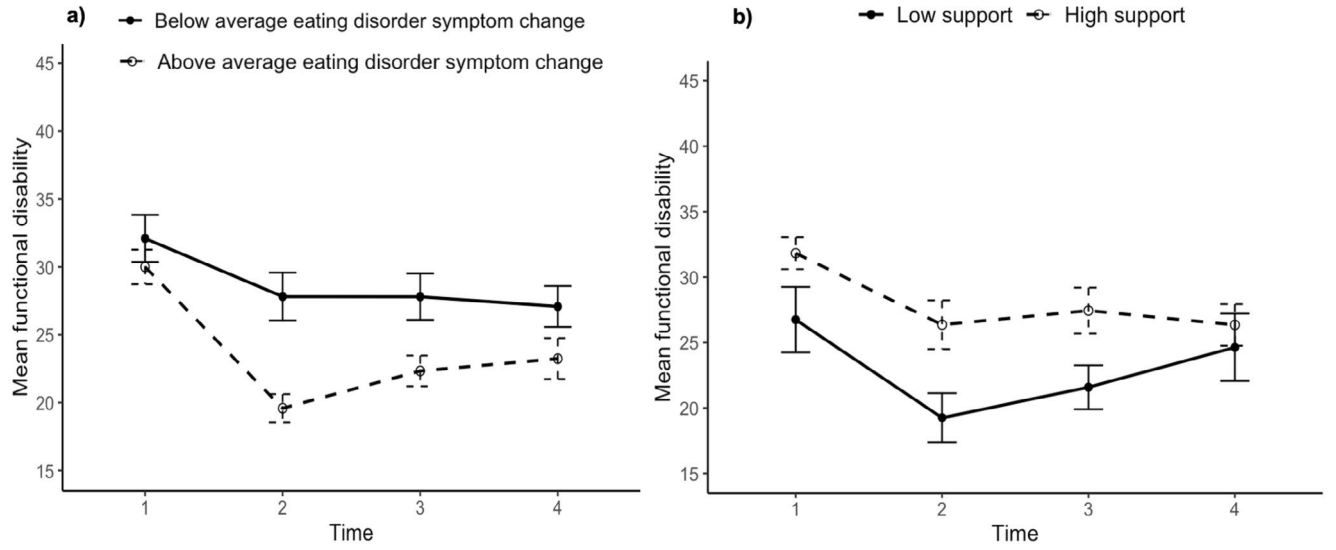

FIGURE 2 | Mean functional disability over time by level of in-treatment ED symptom change and follow-up support. ED = eating disorder. Time 1 = pretreatment, 2 = discharge, 3 = 3 months post-discharge, 4 = 6 months post-discharge. Low support = < 1 session per week with psychologist, psychiatrist, and/or dietitian for first 3 months' post-discharge. High support = 1 or more sessions per week. Error bars represent standard error.

4.3 | Conclusion

Individuals who received residential treatment experienced significant reduction in ED symptoms and improved functioning. Improvements from residential treatment are evident over short- to medium-term follow-ups, with good maintenance of treatment gains for weight and shape concerns, anxiety, functioning, and HRQoL. However, individuals are likely to experience worsening of other ED symptoms and mood after returning to the community, and those with below average in-treatment improvement in ED symptoms may be more susceptible to relapses in functioning post-discharge. Individuals being discharged from residential services would benefit from discharge planning that accounts for these risk factors associated with poorer follow-up outcomes. This may include continuing residential treatment until significant improvement has been made or ensuring additional step-down care for those who are unable to continue in order to support ongoing recovery.

Author Contributions

Sinead Day: conceptualization, data curation, formal analysis, investigation, methodology, project administration, resources, software, writing – original draft, writing – review and editing, visualization. **Deborah Mitchison:** conceptualization, funding acquisition, methodology, project administration, supervision, writing – review and editing. **W. Kathy Tannous:** conceptualization, funding acquisition, methodology, supervision, writing – review and editing. **Janet Conti:**

conceptualization, funding acquisition, writing – review and editing. **Katherine Gill:** conceptualization, funding acquisition, writing – review and editing. **Long Le:** conceptualization, writing – review and editing. **Haider Mannan:** conceptualization, funding acquisition, methodology, writing – review and editing. **Cathrine Mihalopoulos:** conceptualization, writing – review and editing. **Lucie Ramjan:** conceptualization, funding acquisition, writing – review and editing. **Rebekah Rankin:** conceptualization, investigation, project administration, writing – review and editing. **Phillipa Hay:** conceptualization, funding acquisition, methodology, project administration, supervision, writing – review and editing.

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Ethics Statement

Ethics approval for this study was granted by the human research ethics committee at Western Sydney University (H14478, H14742). The authors acknowledge that all participants provided informed consent for the use of their collated, deidentified data in this study.

Conflicts of Interest

Phillipa Hay has received sessional fees from the Therapeutic Guidelines publication and the Health Education and Training Institute (HETI, NSW), and royalties/honoraria from Hogrefe and Huber, McGraw Hill Education, Blackwell Scientific Publications, BioMed Central, and PLOS Medicine. She has prepared a report under contract for Takeda (formerly Shire) Pharmaceuticals regarding binge eating disorder (July 2017), and has been a consultant to Takeda Pharmaceuticals. She is currently a consultant to Tryptamine Therapeutics. She was a Member of the ICD-11 Working Group for Eating Disorders (2012–2019). The other authors declare no conflicts of interest.

Data Availability Statement

Data available on request due to privacy/ethical restrictions.

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Supporting Information

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