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**ORIGINAL ARTICLE**

# Sex differences in the effects of residential treatment on the quality of life of eating disorder patients

**Theodore Weltzin · Pamela Bean · Eric Klosterman · Han-Joo Lee · Robyn Welk-Richards**

**Abstract**

*Aims* This study compared the effects of residential treatment on improving health-related quality of life (HRQOL) between males and females diagnosed with eating disorders (EDs) from admission to discharge and at follow-up. This study also analyzed the association between changes in HRQOL and changes in the severity of ED pathology, depression, and trait anxiety.

*Methods* 145 consecutive patients (34 males and 111 females) admitted to a residential ED unit completed a panel of surveys at admission and discharge. The survey panel included the Eating Disorders Quality of Life Survey (EDQLS), the Eating Disorder Examination Questionnaire, the Quick Inventory of Depressive Symptomatology and the State-Trait Anxiety Inventory. An online follow-up survey was also conducted for the EDQLS. Mixed-factorial ANOVA was used to examine sex differences and changes in HRQOL between admission, discharge and post-treatment follow-up. Multiple regression analysis was used to investigate the relationship between sex, change in HRQOL, and changes in all other variables studied.

*Results* By the end of residential treatment, both males and females had made similar statistically significant improvements in HRQOL from admission to discharge, which persisted after treatment. Greater decreases in ED pathology and trait anxiety significantly predicted greater increases in HRQOL during residential treatment while sex and changes in depression did not.

*Conclusion* The data show that residential treatment is an effective approach to improving HRQOL in both males and females with EDs. Greater improvements in trait anxiety and ED pathology contributed to greater improvement in HRQOL in these patients.

**Keywords** Quality of life · Residential eating disorder treatment

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## Introduction

Outcomes research in eating disorder (ED) treatment has traditionally focused on evaluating changes in symptom severity such as body dissatisfaction and drive for thinness as well as ED behaviors such as binge eating and purging [1–4] but has failed to address broader areas of concern such as health-related quality of life (HRQOL). HRQOL assesses how a person perceives a health or mental-health disorder's impact on a variety of domains relate to their daily life. These domains can include general health, physical functioning, emotional functioning, cognitive functioning, and social well-being [5].

Generic quality of life (QOL) measures such as the World Health Organization Quality of Life-BREF

(WHOQOL-BREF) [6] and generic HRQOL measures such as the Short Form-36 (SF-36) [7] have been previously used to measure QOL in ED patients and they have been found to discriminate between the QOL of normal and ED populations, predominantly females [8].They have also demonstrated improvements in perceived HRQOL 2 years after outpatient treatment of women diagnosed with EDs [9] but despite these improvements ED patients were more dysfunctional in all domains of the SF-36 compared with women in the general population. Using the same survey, another study [10] reported that ED patients had significantly poorer QOL than a normal reference group and no differences were found between the main diagnostic ED groups (anorexia nervosa, bulimia nervosa and eating disorder not otherwise specified).

In addition to these studies, several other reports have documented that these generic measures have some drawbacks [11, 12]. For instance, they seem insensitive to the impact of different ED diagnoses on QOL [12]; they are usually not developmentally appropriate for all ages in terms of content and language [9, 12]; there are no reports documenting results in males diagnosed with eating disorders; and they seem insensitive to some ego-syntonic features of ED patients, especially those diagnosed with anorexia nervosa [12, 13]. An example of ego-syntonicity in someone with an ED refers to a patient reporting good QOL because he/she feels in control and proud of achieving a desired weight loss while they are in fact unable to comprehend the negative effects of their restrictive behaviors. Although ego-syntonicity has not yet been thoroughly studied in relation to QOL, it has been attributed to reports of elevated QOL in anorexia nervosa patients [13].

New ED-specific HRQOL measures have been developed in the last few years to address some or all of these concerns with limited success [14–16]. More recently, the Eating Disorders Quality of Life Scale (EDQLS) was developed specifically to minimize response bias attributable to ego-syntonicity and to be sensitive to changes in HRQOL with treatment in both adolescents and adults even though the test's generalizability to males has yet to be explored in depth [17].

Despite the growing body of opinion suggesting the importance of HRQOL research in the ED field, studies regarding the use of ED-specific HRQOL measures are still rare and largely overlooked [5]. Research involving sex differences in ED-specific HRQOL is even more limited. The ability to compare males and females with EDs has been historically difficult due to women being the majority of people diagnosed with EDs as well as being more likely to be treated for an ED than males [18]. One study [18] found that sex was not a moderator in the relationship between ED-specific HRQOL and several psychosocial

risk variables, including body dissatisfaction, internalization of sociocultural ideals, and restrained eating. Only the relationship between QOL and objectified body consciousness was moderated by sex [18]. Another study [19] evaluated how body image affects QOL with no significant sex differences; instead, body image QOL was found to be negatively associated with drive for thinness, bulimia and body dissatisfaction.

The lack of ED-specific HRQOL research has been compounded by the fact that these past studies have only involved community samples or patients in outpatient and inpatient settings. To date, there have been no reports of the use of HRQOL surveys in residential treatment for EDs. There is some evidence of the effectiveness of day treatment programs to improve the weight, symptoms and behaviors in patients diagnosed with EDs [20], but it is not clear if cognitive changes are as robust in partial hospital settings as compared to residential settings [21]. Residential treatment represents a higher level of care than both partial and outpatient settings while providing the ability to deliver an adequate dose of treatment which is specifically targeted to meet each patient's needs. It also allows for the delivery of therapies that target not only the ED but also the frequently observed co-morbid pathologies in these patients. However, some providers still believe that there is not sufficient evidence that ED treatment is more beneficial in residential versus partial hospital or outpatient settings [22].

In an attempt to add to the growing knowledge in ED outcomes research regarding both HRQOL and the effects of residential care on males and females diagnosed with eating disorders, this study evaluated the relationship between sex and changes in HRQOL from admission to discharge and at follow-up. This study also examined whether changes in depression, trait anxiety, and ED pathology from admission to discharge were significant predictors of change in HRQOL during residential treatment of patients diagnosed with EDs.

## Materials and methods

### Participants

The sample consisted of 145 consecutive patients (34 males and 111 females) admitted to a residential treatment facility in the United States known as the Eating Disorder Center (EDC) in Oconomowoc, Wisconsin between August 2011 and March 2013. Admission diagnoses were made by board-certified psychiatrists based on DSM-IV-TR criteria.

Sample demographic and clinical characteristics are compared in Table 1. The analyses show that females did not differ significantly in comparison to males with regard

**Table 1** Male and female participant demographic and clinical characteristics

| Characteristic | Males (N = 34) | | Females (N = 111) | | Test statistics and significance level[a] |
|---|---|---|---|---|---|
| | $N^b$ | Mean (SD) range | $N^b$ | Mean (SD) range | |
| Education (years) | 27 | 13.1 (2.0) 10–18 | 79 | 12.9 (2.6) 8–20 | $U = 1042.0, p = 0.857$ |
| Age (years) | 34 | 23.1 (9.5) 16–58 | 111 | 23.0 (8.9) 13–53 | $U = 1851.5, p = 0.868$ |
| Age of ED symptoms onset (years) | 32 | 13.8 (3.7) 6–24 | 97 | 13.3 (4.3) 4–40 | $U = 1369.5, p = 0.316$ |
| Duration of illness (years) | 32 | 9.4 (10.3) 1–48 | 97 | 9.5 (9.4) 0–42 | $U = 1547.0, p = 0.978$ |
| Time in treatment (days) | 34 | 63.7 (32.4) 22–175 | 111 | 58.7 (25.1) 13–134 | $U = 1751.5, p = 0.527$ |
| Admission BMI (weight in kg/height m$^2$) | 34 | 21.4 (7.2) 15.7–53.6 | 111 | 19.6 (4.7) 14.4–49.5 | $U = 1501.0, p = 0.072$ |
| Admission EDE-Q Global Score | 33 | 3.0 (1.4) 0–5.4 | 111 | 4.0 (1.4) 0–6.0 | $t(142) = -3.71, p < 0.001$ |
| | $N$ | Percent (frequency) | $N$ | Percent (frequency) | |
| Race (% caucasian) | 34 | 97 (n = 33) | 111 | 96 (n = 106) | $\chi^2(3) = 2.02, p = 0.569$ |
| Marital (% single) | 34 | 94 (n = 32) | 111 | 90 (n = 100) | $\chi^2(3) = 0.83, p = 0.843$ |
| Time in treatment (current) | 34 | | 111 | | $\chi^2(1) = 0.34, p = 0.562$ |
| <=60 days | | 53 (n = 18) | | 59 (n = 65) | |
| >60 days | | 47 (n = 16) | | 41 (n = 46) | |
| Primary diagnosis | 34 | | 111 | | $\chi^2(2) = 0.81, p = 0.666$ |
| AN (both types) | | 47 (n = 16) | | 56 (n = 62) | |
| BN | | 24 (n = 8) | | 20 (n = 22) | |
| EDNOS | | 29 (n = 10) | | 24 (n = 27) | |
| Psychiatric comorbidity (% >1 DSM-IV diagnosis) | 34 | 97 (n = 33) | 111 | 90 (n = 100) | $\chi^2(1) = 1.67, p = 0.197$ |
| BMI category[c] | 18 | | 65 | | $\chi^2(2) = 2.70, p = 0.259$ |
| Underweight | | 22 (n = 4) | | 43 (n = 28) | |
| Normal | | 56 (n = 10) | | 43 (n = 28) | |
| Overweight | | 22 (n = 4) | | 14 (n = 9) | |
| Admission EDE-Q Global Score (% > = 2.3) | 33 | 64 (n = 21) | 111 | 87 (n = 97) | $\chi^2(1) = 9.70, p = 0.002$ |

*ED* eating disorder, *EDE-Q* eating disorder examination questionnaire, *AN* anorexia nervosa, *BN* bulimia nervosa, *EDNOS* eating disorder not otherwise specified, *DSM-IV* diagnostic and statistical manual of mental disorders 4th Edition, *BMI* body mass index

[a] Several statistical tests were performed to examine differences in demographic and clinical characteristics between males and females (see "Statistical analysis" for details)

[b] Not all patients were included in each test; sample sizes were based on the availability of demographic information in the patients' medical records as well as patient participation in clinical assessments

[c] Since there are differences in criterion for determining underweight/overweight for BMI in subjects under the age of 20, for any related analysis we selected cases whose age was 20 and older [37]

to age in years (Males: $M = 23.1$, SD = 9.5; Females: $M = 23.0$, SD = 8.9), years of education (Males: $M = 13.1$, SD = 2.0; Females: $M = 12.9$, SD = 2.6), the age (in years) of onset of ED symptoms (Males: $M = 13.8$, SD = 3.7; Females: $M = 13.3$, SD = 4.3) and the duration of their illness (Males: $M = 9.4$ years, SD = 10.3; Females: $M = 9.5$ years, SD = 9.4). Both sexes also did not significantly differ in terms of their ethnicity (97 % of males were Caucasian vs. 96 % of females) or marital status (94 % of males were single vs. 90 % of females); the most common primary diagnosis was anorexia nervosa (47 % of males and 56 % of females) and almost all of them (97 % of males and 90 % of females) exhibited psychiatric comorbidity at the start of treatment.

Males stayed slightly longer in treatment than females, but this difference was not significant. The majority of residents received less than 60 days of residential care. Males and females also did not significantly differ in BMI at admission (Males: $M = 21.4$, SD = 7.2; Females: $M = 19.6$, SD = 4.7) although most males were classified predominantly in the normal weight range (56 %) while females were either underweight (43 %) or in the normal weight range (43 %). The main statistically significant difference was found in the admission EDE-Q global score with males showing $M = 3.0$, SD = 1.4; 64 % above the cutoff of 2.3 and females showing $M = 4.0$, SD = 1.4; 87 % above the cutoff of 2.3. A cutoff score of 2.3 on the global scale of the EDE-Q has been reported to yield

optimal validity coefficients (sensitivity = 0.83, specificity = 0.96, positive predictive value = 0.56) [23].

## Study design

Study variables were measured at admission and discharge from residential treatment. Patients were asked to complete a panel of surveys within the first 48 h of admission and again within 72 h of discharge. The completion of these tests occurred in a quiet room, away from staff and other residents. After discharge, patients were contacted to complete an online survey.

Patients provided written informed consent for their data to be used in this study. The Rogers Center for Research and Training approved the study design and the consent forms used.

## Follow-up response rate calculation

All 145 residents who participated in this study were contacted after discharge to respond to the EDQLS survey online using a password protected link sent to them via e-mail to an address provided by them before the end of treatment. The mean response time between discharge and follow-up was 7 months (SD = 3.8 months, range 3–17 months). This wide range of contact dates was due to teething of the project related to the availability of staff resources to conduct the online follow-up.

The response rate was calculated based on the method described by Beerten et al. [24], which classifies survey participants as either eligible or not eligible to respond to surveys. Using this approach, the results showed that 119 of the total 145 residents included in this analysis were eligible to participate in the follow-up survey and 26 were not eligible due to invalid or missing e-mail addresses. Of those who were eligible, 50 responded to the survey (responders), 15 refused to complete the survey, and 54 did not respond to the follow-up emails despite several contact attempts (non-responders). Response rate, which is defined as the total number of completed surveys (50) divided by the total number of eligible participants (119), was 42 %.

## Instruments used

### Eating disorders quality of life scale (EDQLS)

The EDQLS is a 40-item condition-specific clinical assessment tool, written at a 14-year old reading level and is designed to measure HRQOL in adolescents and adults with EDs. A 5-point Likert scale ranging from 1 (strongly disagree) to 5 (strongly agree) is used for rating purposes. The scales are divided into 12 domains, which consist of cognitive functioning, education/vocation, family and

close relationships, relationships with others, future/outlook, appearance, leisure, psychological health, emotional health, values and beliefs, physical health and eating issues. The total score is derived by adding the item ratings for all domains, with higher scores indicating better HRQOL [17].

The validation studies for the EDQLS included 171 individuals aged 14–60 years from 12 programs providing any kind of inpatient, outpatient and/or day treatment. A cross-sectional baseline analysis showed that the total raw mean score for the EDQLS was 110 out of 200 (SD = 27.6). The internal consistency was reported as $\alpha = 0.96$ [17]. A change of 10 % or one-half of a standard deviation in the total scores has been used as indication of clinically meaningful change in outpatient settings [25].

Cronbach's alpha was performed on the sample used in the present study to measure internal consistency of the EDQLS total scale for males and females at admission, discharge and follow-up. Internal consistency of the EDQLS was high for both males ($\alpha = 0.95$ at both admission and discharge) and females ($\alpha = 0.94$ at admission and $\alpha = 0.96$ at discharge). Internal consistency was also high for the EDQLS in the males who completed the follow-up survey ($\alpha = 0.94$) as well as females who completed the follow-up survey ($\alpha = 0.97$).

### Quick inventory of depressive symptomatology (QIDS)

The QIDS is a 16 item, self-report instrument that is designed to screen for symptoms of depression in the last 7 days. It measures the nine criterion symptom domains that define a major depressive episode as defined by DSM-IV (and DSM-5) criteria. The total test score can range from 0 to 27; the higher the score, the higher is the severity of depression. Internal consistency was reported as $\alpha = 0.86$ [26]. Scores from 0 to 5 indicate no depression, 6–10 mild, 11–15 moderate, 16–20 severe and 21–27 very severe depression [27].

### State-trait anxiety inventory (STAI)

The STAI is a self-report instrument that differentiates between temporary conditions of "state anxiety" and more chronic qualities of "trait anxiety." It has two separate 20-item scales that are analyzed to determine anxiety in specific situations. Higher STAI scores indicate higher severity of anxiety symptoms [28]. Low scores (20–39) indicate calmness and serenity, intermediate scores (40–59) indicate moderate levels of tension and nervousness and high scores (60–80) reflect intense apprehension and fearfulness. Internal consistency was reported as $\alpha = 0.93$ for the State scale and $\alpha = 0.90$ for the Trait scale.

*Eating disorder examination questionnaire (EDE-Q)*

The EDE-Q consists of 36 questions about behaviors and cognitions relating to eating, body shape, and weight in the prior 28 days; scores from four subscales are averaged to provide a global score. The higher the EDE-Q scores, the higher is the severity of ED pathology [29]. Internal consistency for the EDE-Q global score has been reported as $\alpha = 0.90$ [30].

Residential treatment at the eating disorder center

Residential treatment at the EDC starts by setting goals and objectives for each patient based on an individualized treatment plan. During the course of treatment, a resident may participate in any or all of the following treatment components: group therapy, individual therapy, family therapy, experiential (art and relaxation) therapies, education-school collaboration, weekend family programming, ropes and challenges course, nutritional counseling, daily living responsibilities, community reintegration activities, and medical care [31, 32]. For patients with anorexia nervosa, treatment is focused on facilitating weight gain and avoiding the use of compensatory behaviors. The nutritional component of residential treatment consists of monitoring weight to ensure adequate weight-restoration and maintenance; when the goal of treatment is to disrupt the binge-eating behavior, then the treatment consists of monitoring a decrease in weight. Residents are educated in appropriate meal plan development and compliance with an individualized meal plan provided by a dietician/nutritionist.

Residents diagnosed with co-morbid conditions such as high anxiety or OCD are assigned to the cognitive behavioral therapy (CBT) track where they meet several times per week with a behavioral specialist to create and work through a fear hierarchy. All residents learn formal thought-challenging techniques of CBT and some dialectic behavioral therapy (DBT) skills including mindfulness and distress tolerance. Co-morbid conditions such as depression and anxiety are managed not only in individual and group therapy but also through medication and meetings with a psychiatrist twice a week. Medical conditions such as low testosterone, amenorrhea, osteopenia/osteoporosis, and delayed growth are managed either by a medical doctor on site or by referral to an endocrinologist/specialist at a local hospital. All these treatment components result in the delivery of a multidisciplinary residential approach which is unique for each resident and is aimed at treating not only the ED but also their comorbid psychopathologies.

Statistical analysis

To compare demographic and clinical characteristics, several statistical tests were used depending on the type and normality of the data. The independent-samples $t$ test was performed on admission EDE-Q global scores, which were normally distributed. The Wilcoxon–Mann–Whitney test was used for all other continuous variables that violated the assumption of normality. The Chi square test for association was performed to examine sex differences in nominal variables.

A mixed-factorial analysis of variance (ANOVA) was used to explore the effect of sex and timepoint on ED-QLS total scores from admission to discharge. Main effects were examined using post hoc comparisons with a Bonferroni correction to reduce the likelihood of a Type I error. A mixed-factorial ANOVA was also used to compare sex differences in EDQLS total score between admission, discharge and follow-up for patients who completed the follow-up survey at all three timepoints. Post hoc comparisons with a Bonferroni correction were used to examine the main effects of timepoint and sex on EDQLS total score from admission to discharge, from discharge to follow-up and from admission to follow-up.

Before the analysis of variance, the data were checked for assumptions of homogeneity of variances and covariances, sphericity, normal distributions and outliers. Levene's test indicated that the assumption of homogeneity of variances was violated in the admission scores for the follow-up sample ($F = 4.41$, $p = 0.041$); therefore, a square root transformation was used on the EDQLS variables to correct for unequal variances between the timepoints. After transformation, the sample passed Levene's test at all of the timepoints studied in addition to satisfying the assumptions mentioned previously.

Multiple regression was used to identify how sex and residual change scores for the EDE-Q global scale, QIDS, and STAI-Trait together contribute to the relationship with residual change scores in the EDQLS from admission to discharge.

The significance level was set at an $\alpha$ of 0.05 for all statistical tests.

## Results

Changes in quality of life from admission to discharge

For the entire sample, the estimated mean EDQLS score increased from 103.8 (SE = 2.6) at admission to 145.3 (SE = 2.7) at discharge. When separated by sex, the mean EDQLS total score in males increased from 109.0 (SD = 26.1) at admission to 155.3 at discharge (SD = 23.5) and the mean EDQLS total score in females increased from 98.8 (SD = 26.2) at admission to 135.4 (SD = 29.1) at discharge (Fig. 1).
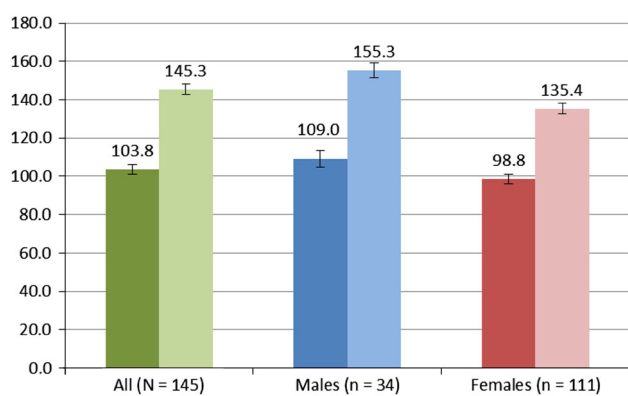
Fig. 1 Changes in health-related quality of life (EDQLS total score) from admission to discharge

**Table 2** Results of mixed-factorial ANOVA for EDQLS admission and discharge scores ($N = 145$)

| Effects | $F$ | $\eta_p^2$ | $p$ |
|---|---|---|---|
| Timepoint | $F(1, 143) = 256.93$ | 0.64 | <0.001 |
| Sex | $F(1, 143) = 10.58$ | 0.07 | 0.001 |
| Timepoint × sex | $F(1, 143) = 3.51$ | 0.02 | 0.063 |

Results of the mixed-factorial ANOVA are found in Table 2. There was no statistically significant interaction between sex and timepoint on EDQLS scores, $F(1, 143) = 3.51$, $p = 0.063$, $\eta_p^2 = 0.02$, suggesting that both males and females made similar improvements at the timepoints measured. Results also showed a significant main effect of timepoint on EDQLS scores, $F(1, 143) = 256.93$, $p < 0.001$, $\eta_p^2 = 0.64$ as reflected by post hoc comparisons showing a significant increase in estimated mean EDQLS total score from admission to discharge ($p < 0.001$) in both sexes. The main effect of sex showed that males had significantly higher EDQLS total scores than females regardless of timepoint, $F(1, 143) = 10.58$, $p = 0.001$, $\eta_p^2 = 0.07$.

Changes in quality of life between admission, discharge and follow-up

Analysis of the changes in EDQLS total score from admission to discharge and follow-up showed that males who responded to the follow-up survey (responders; $n = 11$) had mean EDQLS total scores of 115.4 (SD = 33.2), 155.8 (SD = 25.2) and 147.8 (SD = 24.0) at admission, discharge and follow-up, respectively (Fig. 2a). Males who did not participate in the follow-up survey (non-responders; $n = 23$) had mean EDQLS total scores of 106.0 (SD = 22.2) at admission and 155.0 (SD = 23.3) at discharge.
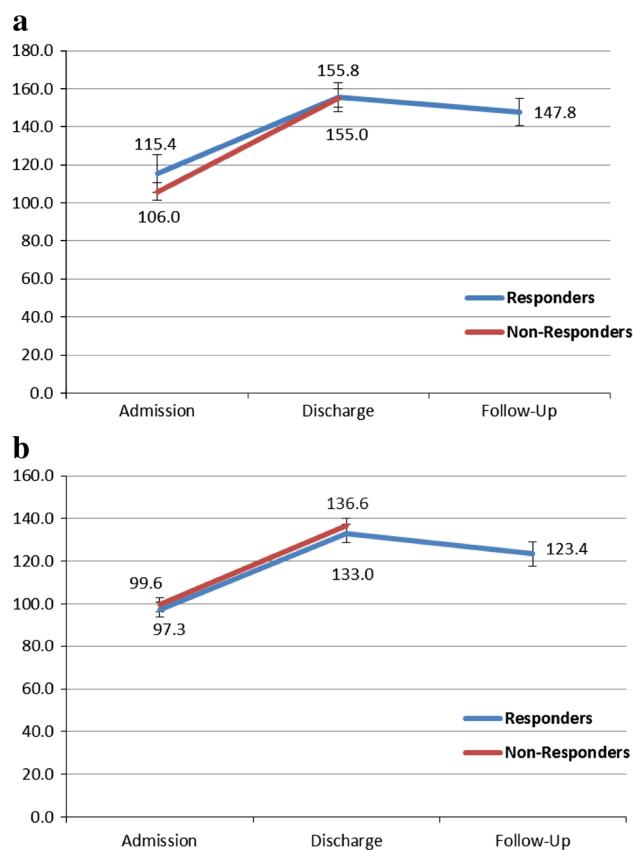


Fig. 2 **a** EDQLS total score changes in males over time. **b** EDQLS total score changes in females over time

Females who responded to the follow-up survey (responders; $n = 39$) had mean EDQLS total scores of 97.3 (SD = 21.4), 133.0 (SD = 27.8) and 123.4 (SD = 35.9) at admission, discharge and follow-up, respectively (Fig. 2b). Females who did not participate in the follow-up survey (non-responders; $n = 72$) had mean EDQLS total scores of 99.6 (SD = 28.6) at admission and 136.6 (SD = 29.9) at discharge.

Results of the mixed-factorial ANOVA using the transformed data for the three timepoints are found in Table 3. There was no significant interaction between timepoint and sex, $F(2, 85) = 0.23$, $p = 0.767$, $\eta_p^2 = 0.01$, reflecting similar changes in scores over time for males and females. Again, there was a significant main effect of timepoint on EDQLS total score, $F(2, 85) = 32.83$, $p < 0.001$, $\eta_p^2 = 0.41$, as reflected by the post hoc analysis showing a statistically significant improvement in HRQOL from admission to discharge ($p < 0.001$) and from admission to follow-up ($p < 0.001$) but not from discharge to follow-up ($p = 0.213$). The main effect of sex showed that males had significantly higher EDQLS total scores than females regardless of timepoint, $F(1, 48) = 7.07$, $p = 0.011$, $\eta_p^2 = 0.13$.

**Table 3** Results of mixed-factorial ANOVA for EDQLS admission, discharge, and follow-up scores ($n = 50$)

| Effects | $F$ | $\eta_p^2$ | $p$ |
| --- | --- | --- | --- |
| Timepoint | $F(2, 85) = 32.83$ | 0.41 | <0.001 |
| Sex | $F(1, 48) = 7.07$ | 0.13 | 0.011 |
| Timepoint × sex | $F(2, 85) = 0.23$ | 0.01 | 0.767 |

**Table 4** Results of multiple regression analysis for variables predicting residual change in EDQLS total score ($n = 78$)

| Variable | $\beta$ | SE | $B$ | $T$ | $p$ |
| --- | --- | --- | --- | --- | --- |
| STAI-Trait RC | −0.37 | 0.10 | −0.35 | −3.65 | <0.001 |
| QIDS RC | −0.13 | 0.10 | −0.12 | −1.29 | 0.201 |
| EDE-Q Global RC | −0.40 | 0.09 | −0.37 | −4.16 | <0.001 |
| Sex | 0.04 | 0.20 | 0.10 | 0.50 | 0.618 |

*RC* standardized residual change

## Symptom changes as predictors of change in quality of life

The sample used in the multiple regression was limited to those who completed all the surveys used (EDQLS, QIDS, STAI and EDE-Q) at both admission and discharge ($n = 78$). This sample consisted of 11 males and 67 females. The sample size used in the multiple regression analysis is smaller than the total number of participants due to a hospital-wide decision to introduce the QIDS as a new depression measure after the beginning of the study.

To account for baseline differences, residual change scores (rather than admission-to-discharge differences) were used for all the measures. Residual change in the STAI-State and STAI-Trait was highly correlated ($r = 0.83$, $p < 0.001$) so the STAI-State was taken out of the analysis since state anxiety only measures transient anxiety at the time that the measure was completed while trait anxiety is more indicative of a person's typical level of anxiety [28].

The multiple regression analysis (Table 4) shows that sex and greater negative residual change scores in the QIDS, STAI-Trait and the EDE-Q global scale significantly predicted greater positive residual change in EDQLS total score from admission to discharge, $F(4, 73) = 27.64$, $p < 0.001$, adj. $R^2 = 0.58$. This predictor model indicates that approximately 58 % of the variance of residual change in EDQLS total score could be significantly accounted for by the four variables studied: sex, depression, trait anxiety and ED pathology. The residual change score in the EDE-Q global scale significantly added to the prediction ($\beta = -0.40$, $p < 0.001$) as did residual change score in the STAI-Trait scale ($\beta = -0.37$, $p < 0.001$). However, the residual change score in the QIDS did not significantly add to the prediction ($\beta = -0.13$, $p = 0.201$) and neither did sex ($\beta = 0.04$, $p = 0.618$).

## Discussion

Outcomes research specific to measuring the impact that EDs have on the HRQOL of ED patients is limited, as is research targeting the benefits of residential care for individuals diagnosed with an ED. Such information is even scarcer with regard to sex differences. The data provided in this report show that males and females seeking residential treatment are remarkably similar in their demographics profiles. The main significant differences in clinical characteristics between the male and female samples were the mean admission EDE-Q global score which was higher in females and the larger percentage of females presenting to treatment with EDE-Q global scores above the cutoff. This may at least partially explain why males in residential treatment consistently reported significantly higher HRQOL. In addition, since the EDE-Q has been primarily validated in female samples, the EDE-Q may not be as accurate when assessing the motives and behaviors indicative of EDs in males [33].

The improvement in HRQOL was significant from admission to discharge for the entire sample. When analyzed separately, both sexes made comparable improvements in HRQOL during treatment, as indicated by the lack of a significant interaction between sex and timepoint. The lack of sex differences is similar to prior research on ED-specific HRQOL based on body image QOL [19]. A significant improvement in HRQOL while in treatment was also found in the follow-up sample for both sexes, as well as a non-significant decrease in HRQOL from discharge to follow-up. This shows that improvements are maintained after discharge for both males and females. The significant improvements in HRQOL made from admission to follow-up are similar to those found using the SF-36 after ED outpatient treatment [9]. Although we were only able to reach 42 % of participants for the follow-up survey, similarities in EDQLS total scores at admission and discharge between responders and non-responders indicate that the smaller follow-up sample can still be considered a good representation of all study participants [34].

This report also examined the association between change in HRQOL and improvements in clinical symptoms, and whether sex influences that association. It is interesting that greater decreases in ED pathology and trait anxiety helped to significantly predict greater improvements in HRQOL, but changes in depression did not. Sex was not a significant predictor either, providing additional support to the conclusion that sex is not a factor in how

much improvement in HRQOL a patient makes during residential treatment. Previous research had found improvements in ED pathology and anxiety accompanied by improvements in HRQOL in ED patients, although the relationships in the amount of change between these variables had not yet been explored in a residential setting [35].

One of the advantages of generic QOL instruments versus ED-specific instruments is the availability of normative scores for the former [8–10]. Currently, there are no results reported for the EDQLS in a non-ED (control) population. One way of evaluating the data when controls are unavailable is to determine how much the scores have improved at discharge compared to the start of treatment. Since the mean admission EDQLS score for all males was 109.0 and the standard deviation was 26.1, the data show that males improved their EDQLS scores by almost 2 standard deviations from admission to discharge (155.3) and the scores remained at a similar level during follow-up (147.8). Similarly, females improved their EDQLS scores by 1.5 standard deviations during residential treatment and these improvements also remained consistently above 1 SD at follow-up. Despite a long mean duration of illness in the sample, these results showed that a residential treatment facility can provide clinically significant change after a mean stay of 60 days (SD = 26.9 days) based on the current sample. This evidence is supported by past research that found a lack of a relationship between duration of illness and QOL in ED patients [36].

Adair et al. [17] completed a multi-site validation study of the EDQLS, which was based on a sample of ED patients in inpatient, outpatient, day treatment, and/or consultation programs. This is in contrast to our use of the EDQLS in a purely residential setting at a single treatment center. Also, the Adair study consisted of mainly females, with only six males involved compared to the 34 males in this study. A third difference is that patients completed the EDQLS at admission, discharge, follow-up while Adair et al. only collected baseline data with the EDQLS. With these differences in mind, the mean EDQLS total scores found in our female samples at admission were comparable to the baseline EDQLS total score of 100 found in the validation study. Internal consistency for both sexes at all timepoints were also similar to the Cronbach's α of 0.96 found in the validation study. A notable difference in results between the two studies is that our male sample consistently scored higher than females on the EDQLS at all-timepoints, while Adair et al. observed that males scored lower than females. They did not test this difference for statistical significance, however, due to their small male sample.

Some of the limitations of this study include a substantial difference in sample size between males and females which is due to both women being the majority of

people diagnosed with EDs as well as being more likely to be treated for an ED than males [18]. The continuation of outcome studies at our facilities will allow us to increase the sample of males for future studies as well as gathering a population that is more ethnically diverse. Additionally, only 42 % of eligible participants responded to the EDQLS follow-up survey. Although similar admission and discharge EDQLS scores between responders and non-responders indicate that the follow-up sample is still a good representation of the entire sample, we have recently developed new contact procedures which include a mixture of phone calls and emails with positive increases in the overall follow-up rate. Another limitation regarding follow-up was that the time range between discharge and follow-up response was rather wide (3–17 months) but this was due to unexpected teething in the availability of personnel, which has now been solved. Lastly, norms are not available for the EDQLS, which limits the study's ability to compare the scores in the residential treatment sample to a healthy HRQOL using this measure. Future studies should establish an EDQLS total score that indicates healthy functioning in a treatment or community sample to more easily evaluate the efficacy of residential treatment on ED-specific HRQOL.

## Conclusion

Overall, these results suggest that males and females alike respond positively to a residential treatment model that targets the EDs and its accompanying co-morbid psychopathologies. The results of the multiple regression showed that greater improvements in HRQOL go hand-in-hand with greater improvements in trait anxiety and ED pathology. The data presented in this report set the stage for much needed outcomes research in the areas of HRQOL and residential treatment for EDs. Residential treatment offers a holistic approach to healing and provides a foundation upon which individuals can begin to recreate their identity and redefine their life through healing in all areas of pathology and discontent.

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