The Effects of Cognitive-Behavioural Therapy for Eating Disorders on Quality of Life: A Meta-Analysis

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Abstract

Objective: Meta-analyses have documented the efficacy of cognitive-behavioural therapy (CBT) for reducing symptoms of eating disorders. However, it is not known whether CBT for eating disorders can also improve quality of life (QoL). This meta-analysis therefore examined the effects of CBT for eating disorders on subjective QoL and health-related quality of life (QoL). **Method:** Studies that assessed QoL before and after CBT for eating disorders were searched in the PsycInfo and Medline database. Thirty-four articles met inclusion criteria. Pooled within and between-groups Hedge's *g* were calculated at post-treatment and follow-up for treatment changes on both subjective and HRQoL using a random effects model. **Results:** CBT led to significant and modest improvements in subjective QoL and HRQoL from pre to post-treatment and follow-up. CBT led to greater subjective QoL improvements than inactive (i.e., wait-list) and active (i.e., a combination of bona fide therapies, psychoeducation) comparisons. CBT also led to greater HRQoL improvements than inactive, but not active, comparisons. Pre-post QoL improvements were larger in studies that delivered CBT individually and by a therapist or according to the cognitive maintenance model of eating disorders (CBT-BN or CBT-E); though this was not replicated at follow-up **Conclusions:** Findings provide preliminary evidence that CBT for eating disorders is associated with modest improvements in QOL, and that CBT may be associated with greater improvements in QOL relative to comparison conditions.

Keywords: Eating disorders; Quality of Life; Cognitive-behavioural therapy

The Effects of Cognitive-Behavioural Therapy for Eating Disorders on Quality of Life: A Meta-Analysis

Eating disorders are highly prevalent, chronic and disabling conditions that negatively impacts an individual's quality of life (QoL) [1]. Individuals with eating disorders consistently report a poorer QoL than healthy controls [2], and studies have reported greater QoL impairments in individuals with eating disorders relative to other mental health conditions (e.g., mood disorders)[3] and to several common medical disorders (e.g., angina and cystic fibrosis)[4].

QoL is a multidimensional construct encompassing physical, psychological and social dimensions of health[5]. There are several approaches to measuring QoL. One approach is to assess QoL through objective indicators (e.g., income level, housing status), generally by reference to the standing of an individual to the population [6]. Other approaches of assessing QoL are through self-report questionnaires. Many QoL measures assess an individual's sense of wellbeing, satisfaction with life, and overall happiness [7]. This assessment of QoL is typically referred to as subjective QoL[7]. Subjective QoL can be a global measure of wellbeing or satisfaction, or it can be broken down into distinct domains (e.g., social wellbeing). Subjective QoL measures typically used within eating disorder populations include the Social Adjustment Scale, the Questionnaire on Life Satisfaction, and the Quality of life Enjoyment and Satisfaction Questionnaire. Unlike subjective QoL, health-related quality of life (HRQoL), which is also assessed via self-report, assesses one's life specifically in relation to physical, psychological, and social health. HRQoL is composed of both "generic" and "disease-specific" measures. Generic measures (e.g., Short-Form 36) can be applied to anyone and are generally used to make comparisons across conditions and populations [7]. Generic measures can also be used as a global measure or it can also be broken down into specific domains (e.g., physical and mental HRQoL). Conversely, disease-specific

measures are designed to assess HRQoL in a specific populations, with the intention of assessing impairment peculiar to specific psychopathology[7]. Both generic and disease-specific measures are recommended for use in eating disorder research; generic measures allow for QoL comparisons across several populations (e.g., healthy controls, psychiatric populations) while eating disorder-specific measures are designed to rule out the confluence of comorbid psychopathology on QoL and are also more sensitive to change[8].

Cognitive-behavioural therapy (CBT) is effective for reducing symptoms of eating disorders. While several distinct cognitive-behavioural treatment protocols and formats (e.g., day-patient, inpatient, self-help) for eating disorders exist, a specific form of therapist-led manualised CBT (CBT-BN) is the leading evidence-based treatment for bulimia nervosa (BN) and binge eating [9]. CBT-BN is based on a cognitive maintenance model of BN and it has recently been revised so it is suitable for the treatment of all eating disorders (CBT-E)[10]. Given the superior effects of CBT-BN at reducing eating disorder symptoms relative to alternate psychological and pharmacological treatments, international treatment guidelines recommend CBT-BN as the first-line of treatment for certain eating disorders[11].

While eating disorder symptom reduction is critical for determining CBTs success, individuals with eating disorders typically seek treatment because of the debilitating effect their condition has on their QoL[12]. Thus, there has been a recent focus on assessing treatment outcomes in terms of *both* symptom reduction and improvements in QoL[8]. Several studies have assessed the impact of CBT for eating disorders on subjective and HRQoL, and a generally consistent finding is that QoL improves immediately following CBT[13, 14]. However, QoL changes following CBT— and eating disorder treatment in general — has received minimal research attention, and key questions remain unanswered. For instance, it is not known (1) what the *magnitude* of QoL improvements immediately following CBT are; (2) whether improvements in QoL following CBT are sustained over the long-term; (3) whether

CBT is more effective at improving QoL in the short and long-term than both active and inactive comparisons.

The current meta-analysis aims to address this gap by examining (a) if, and to what extent, CBT for eating disorders improves QoL in the short and long-term and (b) whether CBT is superior to alternative psychological treatments at improving QoL in the short and long-term. We also aim to test whether the effects of CBT on QoL are moderated by certain study characteristics, including (1) diagnosis, (2) study design, (3) treatment modality (individual, group, self-help), (4) treatment format (CBT-BN or CBT-E vs. other), (5) study quality, and (6) analysis reported (completer, intention to treat).

Method

This review was conducted according to the Preferred Reporting Items for Systematic Reviews and Meta-analysis (PRISMA) guidelines[15].

Search Strategy

The primary search strategy involved searching the PsycInfo and Medline database in December 2016. The following two sets of terms were searched simultaneously using the AND Boolean operator; (a) “eating disorder” OR bulimi* OR anorexi* OR binge* OR EDNOS; (b) CBT* or “cognitive-behav*” OR “cognitive behav*. The secondary search strategy involved searching the reference list of included papers and relevant reviews.

Inclusion and Exclusion Criteria

Included studies were those that (a) administered CBT that was specifically designed to treat eating disorders, (b) in an adult eating disorder sample, (c) that included at least one measure of QoL at pre-treatment and post-treatment or follow-up, (d) and was published in English and in a peer-review journal. Excluded studies were that that (a) administered a multidisciplinary treatment that included components of CBT in combination with other psychological or pharmacological treatments; (b) administered CBT weight loss

interventions; (c) administered purely behavioural treatments or third-wave cognitive-behavioural treatments (e.g., Acceptance and Commitment Therapy, Dialectical Behaviour Therapy), since these treatments distinguish themselves from CBT by focusing on different aspects and perusing a different treatment goal. Although RCTs are the best method for testing a treatments efficacy, due to the limited published studies that have assessed QoL change, we included both prospective controlled and uncontrolled designs. This allowed us to calculate both uncontrolled (i.e., pre-post change) and controlled effect sizes (i.e., comparison between conditions). Because we are aware of the limitations of uncontrolled effect sizes [16], we ensured that our controlled effect sizes were based on the available RCTs.

Study Selection

The search strategy outputs from the databases were combined. Duplicates were removed. Titles and abstracts were screened to determine whether the study was related to the research question. To maximise identification of relevant articles, the full-text of any study that administered CBT for eating disorders was read entirely to determine eligibility. This was because QoL is typically a secondary outcome reported and is often not mentioned in the title or abstract when it is reported in text. Articles that met inclusion criteria were screened to determine eligibility for meta-analysis. Authors of articles that did not provide sufficient data to calculate an effect size were contacted. Both authors discussed studies for which inclusion was uncertain. A total of 34 articles met full inclusion criteria. Thirty-three articles were included in the meta-analysis (one paper[17] did not provide sufficient data to calculate an effect size). A flowchart of the search strategy is presented in Figure 1.

Quality Assessment

The quality of included studies was assessed using the Quality Assessment Tool for Quantitative Studies developed by the Effective Public Health Practice Project (EPHPP) [18]. This assessment tool was deemed suitable for systematic reviews on intervention

effectiveness, and can be used for RCTs and pre-post designs[18]. Content and construct validity has been established[19]. A rating of "strong", "moderate" or "weak" methodological quality was assigned to each of the following six different domains: (1) selection bias; (2) study design; (3) confounders; (4) blinding; (5) data collection methods; (6) withdrawals and drop-outs. Then, a global quality rating was made based on the ratings from the six domains. Studies that received no "weak" domain ratings were rated as "strong" quality, while those with one "weak" rating were rated as "moderate" quality, and those with two or more "weak" ratings were rated as "weak" quality. Any discrepancies were discussed among authors until a consensus was reached. Given the limited number of included studies, and consistent with previous meta-analyses, studies were not excluded based on their quality rating.

Data Extraction

The following information was extracted from the included studies: Diagnostic type; sample size; study design; CBT modality (individual therapist-led, group, self-help) and type (based on the cognitive maintenance model, CBT-BN/CBT-E, or not); comparison treatment (active or inactive); length of follow-up; QoL measure; analysis reported (completer or ITT); any data that would permit calculation of an effect size.

Effect Size Calculation and Data Synthesis

Primary analyses were conducted for post-treatment and follow-up subjective QoL and HRQoL changes. For studies that reported multiple follow-up points, effect sizes were calculated for the last reported follow-up. ITT data were prioritised over completer data,

For within-subject designs (pre-post change or pre to follow-up change), the standardised mean gain was calculated by dividing the difference between the post-treatment (or follow-up) and pre-treatment QoL mean by the pooled standard deviation[21]. Effect sizes were then converted to Hedge's *g* to correct for biases due to small sample sizes[22]. The standard error is needed to correct for these biases. To obtain the standard error in repeated

measures designs, the correlation between pre-treatment and post-treatment (or follow-up) QoL score is needed. However, *r* was not reported in included studies. Thus, we used the test retest reliability of the relevant scale published in separate studies[21]. Then, to calculate a pooled effect size, each studies overall effect size was weighted by its inverse variance. A positive *g* indicates QoL improvements from pre to post treatment/follow-up. A negative *g* indicates decrements in QoL from pre to post-treatment/follow-up. Small (0.2), medium (0.5) and large (0.8) effects are specified.

For between-subject designs (CBT versus comparisons), the standardised mean difference, *d*, was initially calculated by dividing the difference between the post-treatment (or follow-up) CBT group mean and the post-treatment (or follow-up) comparison group mean by the pooled standard deviation[21]. *D* was also converted to Hedge's *g* to account for sample size and pooled effect sizes were calculated by weighing each effect size by its inverse variance. Relative to comparison conditions, positive *g* indicates that CBT was associated with a greater QoL while a negative *g* indicates that CBT was associated with a lower QoL. One included study administered interpersonal psychotherapy (IPT) and behaviour therapy (BT) as comparison treatments[23]. For this study, we computed an effect size comparing CBT to IPT, as across included studies IPT was administered more often as a comparison treatment.

At times, multiple effect sizes were calculated from the same study. This occurred when studies reported data for several subjective QoL or several HRQoL measures, or when studies compared multiple CBT conditions (e.g., self-help, therapist-led) to a control condition. Including multiple effect sizes from the same study biases the overall effect size estimate[24]. To maintain statistical independence, we computed separate effect sizes for each subjective or HRQoL measure or for CBT control comparison, and then aggregated these estimates to produce an overall effect size for that study. Although we intended on analysing

the effects of CBT on specific subjective and HRQoL domains (e.g., physical and mental domains), this was not feasible because too few studies used measures that assess these separate domains. For the few studies that assessed multiple domains, an aggregated effect size combining these domains on either subjective or HRQoL was computed.

Heterogeneity and Moderator Analyses

To calculate the pooled effect sizes, the Comprehensive Meta-Analysis program was used. For primary analyses, a random effects model was used over a fixed effects model. In the fixed effects model, it is assumed that all studies in the meta-analysis are homogenous and are essentially replications of each other. In the random effects model, however, it is assumed that all included studies can be seen as a sample drawn from the population. Compared to the fixed effects model, the random effects model produces wider 95% confidence intervals, which means that it typically produces more conservative test statistics[24]. Heterogeneity was assessed using the Q and I^2 statistic. The Q statistic assesses the presence of heterogeneity, while the I^2 statistic assesses the degree of heterogeneity, ranging from zero (complete homogeneity) to 100 (complete heterogeneity)[25].

Since heterogeneity was expected, we examined whether the effect sizes were moderated by study characteristics. For each subgroup, a pooled effect size is calculated, and a test is conducted to examine whether subgroup effect sizes differ significantly from each other. A mixed effects model was used, which pools studies *within* subgroups using a random effects model, but tests for significant differences *between* subgroups using a fixed effects model[24]. Mixed effects models are generally a conservative approach for testing moderation effects, and are widely used in meta-analytic research. However, it is important to note that the use of mixed effect models has been criticised for failing to detect true effects when the number studies contributing to an analysis is low[26]. Rather, some have suggested that estimations based on Bayesian procedures are more appropriate, as Bayesian calculations

have been shown to be more stable and powerful in meta-analyses with a small number of studies. However, Bayesian procedures require knowledge of a prior distribution (the range of possible values) for τ, which is often not known[26, 27]. Statistically significant differences between subgroups are denoted by the Qbetween statistic. The following categorical moderators were examined for both the within and between-group analyses:

Diagnosis. A transdiagnostic, BN, anorexia nervosa (AN), or binge eating disorder (BED) sample.

CBT modality. Individual therapist-led CBT, group CBT, or CBT self-help.

CBT type. CBT that was based on the cognitive maintenance model of eating disorders (i.e., CBT-BN[28] or CBT enhanced[29]), or an alternative CBT approach.

Quality rating. Strong, moderate, or weak quality rating.

Analysis reported. ITT or completer data reported.

Study design. Controlled study or a pre-post design (only for within groups analyses).

Comparison type. Delivery of an inactive (e.g., wait-list) condition or active comparison treatment (only for between groups analyses).

Publication Bias

The Fail-Safe N was calculated to address potential publication bias[30]. The Fail-Safe N estimates how many missing studies would need to be included in the meta-analysis for the effect size to become statistically non-significant. An effect is considered robust to publication bias if N is greater than 5K + 10, where K is the number of studies included in the analysis[30].

Results

Study Characteristics

Thirty-four papers met full inclusion criteria. Effect sizes could not be calculated for one paper[17], so 33 papers were included in the meta-analysis. Table 1 and 2 presents the characteristics of the included RCTs and non-RCTs, respectively. The majority of studies received a "moderate" quality rating (*k*= 17) followed by "strong" (*k*= 11) and then "weak" quality ratings (*k*= 6). See Table 1 and 2 for domain and global quality ratings for each study. Of the 33 studies, 23 were RCTs, one was an uncontrolled study, and 9 were single treatment pre-post designs. Of the 24 studies that included a comparison condition, nine used a wait-list control while 12 administered an active comparison. The most common active comparison treatment was IPT (*k*=4); other active comparisons included Emotion and Social Mind Training, Behavioural Weight Loss, Specialist Supportive Clinical Management, Psychoeducation, Supportive Expressive Therapy, Multidisciplinary Specialist Treatment, Treatment as Usual and Short-term Focal Psychotherapy (all *k's*=1).The most frequent mode of delivery was individual therapist-led (*k*=14) followed by guided self-help (*k*=11) and then group CBT (*k*=9)[1]. Majority of studies used a transdiagnostic sample (*k*=14), followed by BN (*k*=8) BED (*k*=9) and AN (*k*=2).

The most commonly used subjective QoL measure was the Social Adjustment Scale (*k*= 10) followed by the Questionnaire on Life Satisfaction (QLS; k= 3), Satisfaction with Life Scale (k=2), Work and social Adjustment Scale (k=2), Quality of Life Enjoyment and Satisfaction Questionnaire – Short Form (QLESQ; *k*=2), EuroQol visual analogue scale (*k*=1), and the Quality of Life Index – Spanish Version (*k*=1). Only two generic HRQoL measures were reported across studies, with three studies reporting the Short-Form 36 and one study reporting the World Health Organisation QoL scale. Several studies assessed eating disorder-specific HRQoL measures, with the Clinical Impairment Assessment (k= 6) being the most frequently reported measure, followed by the Impact of Weight on Quality of Life

[1] One study administered both an individual therapist-led and a guided self-help CBT.

Scale (*k*=4) and the Quality of Life in Eating Disorders Scale (*k*=1). No study assessed objective indicators of QoL.

Within-Group Effect Size

Pre-post effect size. For the within-group pre-post analysis on *subjective QoL* (N_{comp} = 20, *N*= 1,044 participants), the random effects model produced a statistically significant, medium effect size of *g* = 0.50 (95% CI = 0.38, 0.62), v= .001, *p*<.001 (see Figure 2). The Fail-Safe *N* was 2725 indicating no publication bias. . There was significant heterogeneity, *Q* = 59.23, *p*<.001, I^2 = 67.92. The SAS (N_{comp} = 13) was the most commonly used measure of subjective QoL, and when we analysed the pre-post effect of SAS scores, the pooled effect size was *g*= 0.57 (95% CI= 0.43, 0.71), *v*= .005. The QLESQ (N_{comp}=2, *g*= 0.43, 95% CI [0.32, 0.54], *v*=.003) and the QLS (N_{comp}= 2, *g*= 0.33, 95% CI [0.11, 0.55], *v*=.013) was also used in more than one study, and significant small to medium effect sizes were observed.

For *HRQoL* (N_{comp} = 16, *N* = 717 participants), the random effects model produced a statistically significant, medium effect size of *g* = 0.55 (95% CI = 0.42, 0.69), v=.007, *p*<.001 (See Figure 2). There were no indications of publication bias (Fail-Safe N = 3986). There was significant heterogeneity present, *Q* = 370.78, *p*<.001, I^2= 95.95. For eating disorder-specific measures (N_{comp}=11), a statistically significant medium effect size was observed (*g* = 0.58 [95% CI = .39, .77], *v*=.009). When the CIA (N_{comp}= 5) was used as a measure of eating disorder-specific HRQoL, a significant large effect size was observed (*g*= 0.80, 95% CI [0.49, 1.15], *v*=.028). When the IWQoL was used (N_{comp}= 5), a significant small effect size was observed (*g*= 0.34, 95% CI [0.23, 0.44], *v*=.003). For generic HRQoL measures (N_{comp}=4), a significant medium effect was observed (*g*= .50 [95% CI = .33, .76], *v*=.008). When the SF-36 was used as a measure of generic HRQoL (N_{comp}=3), a significant medium effect size was observed (*g*= 0.47, 95% CI [0.26, 0.67], *v*=.011).

We then conducted moderator analyses on both the subjective QoL and HRQoL pooled effect size to try and explain the statistical heterogeneity. Table 3 presents the pooled effect size for each subgroup across both subjective and HRQoL measures. Significant differences between subgroups are denoted by the $Q_{between}$ statistic. Several moderation effects were observed.

First, the effect size for *subjective QoL* was significantly larger for studies that administered individual therapist-led CBT as opposed to studies that administered group CBT or self-help CBT. Second, the effect size for both *subjective* and *HRQoL* was significantly larger for studies that reported completer data as opposed to ITT data. Third, the effect size for *HRQoL* was significantly larger for studies that used a transdiagnostic sample as opposed to studies that used a BN or AN sample. Finally, the effect size for *HRQoL* was significantly larger for studies that administered CBT based on the cognitive maintenance model (CBT-BN or CBT-E) as opposed to studies that administered an alternative CBT type (See Table 3).

Pre-treatment to follow-up effect size. The random effects model for *subjective QoL* (N_{comp} = 11, N = 400 participants) produced a statistically significant large effect size of g = 0.81 (95% CI = 0.63, 0.99), v= .009, Z = 8.73, p<.001. There were no indications of publication bias (Fail-Safe N = 1065) and there was significant heterogeneity present, Q = 52.15, p<.001, I^2= 80.82. When the SAS was used as a measure of outcome (N_{comp}= 7), a significant medium effect size was also observed (g= 0.67, 95% CI [0.54, 0.82], v=.005). A significant large effect (g= 1.32, 95% CI [0.16, 2.46], v=.337) was also observed when the QLS was used as an outcome (N_{comp}=2).

For *HRQoL* (N_{comp} =11, N= 474 participants), the random effects model produced a statistically significant medium effect size of g = 0.52 (95% CI = 0.27, 0.77), v=.016, Z = 4.08, p<.001. There were no indications of publication bias (Fail-Safe N =1121) and there was significant heterogeneity, Q = 276.29, p<.001, I^2= 96.74. For eating disorder-specific

measures (N_{comp}=6), a statistically significant medium effect size was observed (g= 0.61, [95% CI = .28, .94], v=.028). When the IWQoL was used as an outcome (N_{comp}= 5), and a significant medium effect was also observed (g= 0.48, 95% CI [0.23, 0.73], v=.016). For generic HRQoL (N_{comp}=4), a significant small effect was observed (g= 0.37 [95% CI = 0.16, 0.59], v=.012). When the SF-36 was used as an outcome (N_{comp}=3), a significant small effect size was observed (g= 0.25, 95% CI [0.06, 0.44], v=.009).

Subgroup analyses were also performed for analyses examining subjective QoL and HRQoL changes from pre-treatment to follow-up (Table 3). The effect size for *HRQoL* at follow-up was significantly larger for studies that reported completer data compared to studies that reported ITT data. The effect size for *HRQoL* at follow-up was also significantly smaller for studies that received a medium quality rating as opposed to studies that received a strong or weak quality rating. No other significant moderator effects were observed.

Between-Group Effect Size

Post-treatment effect size. When comparing CBT to any comparison (active or inactive) condition, the between groups random effects model for *subjective QoL* produced a statistically significant small effect of g = 0.39 (95% CI = 0.20, 0.57), v= .009, p<.001 (N_{comp} = 13, N=1,108 participants, Figure 3). There were no indications of publication bias (Fail-Safe N = 112) and there was significant heterogeneity, Q= 27.03, p= .007, I^2= 56.09. When the SAS was used as an outcome (N_{comp} = 8), a significant small effect size was also observed (g= 0.28, 95% CI [0.12, 0.43], v=.006).

For *HRQoL* (N_{comp} = 7, N= 406 participants), the random effects model produced a significant, small effect size of g= 0.31 (95% CI = 0.07, 0.5), v=.013, p=.013 (Figure 5). Significant heterogeneity was present, Q= 14.96, p=.021, I^2=59.91. The Fail-Safe N was 25, which is less than the criterion of 5k+10, suggesting that this effect is not particularly robust and is susceptible to publication bias. For eating disorder-specific HRQoL (N_{comp}=5), a

significant medium effect size was observed (g= 0.26 [95% CI = 0.001, 0.51], v=.017). The CIA (g= 0.34, 95% CI [0.09, 0.71], v=.025), but not the IWQoL (g= 0.21, 95% CI [-0.16, 0.57], v=.035), produced a statistically significant effect size.

Subgroup analyses were then conducted for the between groups post-treatment effect size for subjective QoL and HRQoL. Table 4 presents the pooled post-treatment effect size for each subgroup of studies. Only one moderation effect was found; the effect size for *HRQoL* at post-treatment was significantly larger when studies reported completer data as opposed to ITT data. Comparison type, diagnosis, treatment type, or study quality did not moderate the observed effect size.

Follow-up effect size. When comparing CBT to any comparison condition, the between groups random effects model for *subjective QoL* produced a significant, small effect size of g= 0.33 (95% CI = 0.07, 0.57), v= .016, Z= 2.55, p=.011 (N_{comp} = 8, N= 605 participants). There was significant heterogeneity present, Q= 15.01, p= .036, I^2=53.34. This effect was not particularly robust, as indicated by a Fail-Safe N of 24. When the SAS (N_{comp}= 5) was used as an outcome, a non-significant effect size was observed (g=0.11, 95% CI [-0.08, 0.29], v=.010).

For *HRQoL* (N_{comp}= 6, N= 337 participants), we observed a statistically significant small effect size of g= 0.28 (95% CI= 0.11, 0.44), v= .007, Z= 3.27, p=.001. There was no significant heterogeneity (Q= 4.34, p= .501, I^2=0.00). This effect size was not robust to publication bias (Fail-Safe N= 12). A non-significant small effect size was observed for *eating disorder-specific* HRQoL measures (g= 0.23 [95% CI= -0.06, 0.52], v=.022). A non-significant effect size was also observed when the IWQoL (g= 0.38, 95% CI [-0.21, 0.94], v=.089) and CIA (g= 0.12, 95% CI [-0.22, 0.45], v=.030) was used. There were not enough studies to assess *generic* HRQoL measures. Given that there were only a small number of

studies that contributed to the between group effect size at follow-up, subgroup analyses for follow-up outcomes were not conducted.

Discussion

This meta-analysis examined the effects of CBT for eating disorders on QoL. From pre-treatment to post-treatment and follow-up, medium to large effect sizes were observed for subjective and HRQoL improvements following CBT for eating disorders. The magnitude of QoL improvements for eating disorders is larger than the effect size observed from a meta-analysis of pre-post changes in QoL (d = 0.36) following CBT for bipolar disorder[31], but similar to the effect size reported on QoL improvements following CBT (g = 0.54) for anxiety disorders[32]. Thus, it seems that CBT for eating disorders produces similar improvements in QoL as does CBT for other psychiatric conditions. Moreover, given that a previous meta-analysis of CBT for BED[33] has observed much larger pre-post effect sizes for improvements in eating disorder psychopathology (*d's* range from 0.98 to 1.46) it seems that CBT is not as effective at improving QoL as it is at reducing eating disorder symptoms. This is not unexpected, as CBT is designed specifically to target eating disorder symptoms[28], and improvements in QoL are a likely consequence of this symptom improvement.

Moderators were observed for *pre-post* QoL improvements. First, subjective QoL improvements were greatest when CBT was therapist-led as opposed to when CBT was delivered in a group or in self-help format. Unlike group or self-help formats, many therapist-led protocols are implemented flexibly [29], meaning that the treatment is tailored toward specific psychological an progress. A more focused treatment where the content and duration is determined by the particular psychopathology might therefore account for these effects. Also, more treatment sessions were consistently provided in studies that delivered therapist-led CBT ($M_{sessions}$= 19.40, SD=0.52) as opposed to studies that delivered group-based ($M_{sessions}$=13.87, SD=5.31) or guided self-help CBT ($M_{sessions}$=8.75, SD=2.50), suggesting that

a dose-response relationship might also exist. That is, more client-therapist contact might be an important factor contributing to greater subjective QoL improvements, though this is an empirical question that warrants further investigation. Second, HRQoL improvements were larger when Fairburn and colleagues' CBT-BN or CBT-E was delivered. The cognitive model underlying CBT-BN and CBT-E has received extensive empirical support[34], and the efficacy of this treatment has been consistently established[9]. Because pre-post symptom improvement following this manualized CBT tends to be greater and more rapid than other CBT protocols, the current results suggest that the short-term beneficial effects of CBT-BN and CBT-E also extend to HRQoL indices.

These moderation effects, however, were not observed at follow-up. Since a smaller number of studies contributed to the analyses at follow-up relative to post-treatment, we may have lacked sufficient statistical power to detect significant effects[24]. Alternatively, QoL improvements from other CBT modalities or protocols might "catch up" to therapist-led CBT or manualized CBT-BN (or CBT-E) in the long-term. For instance, several studies have shown that while therapist-led CBT produces significantly greater rates of recovery at *post-treatment* than guided self-help CBT for BED, this difference generally disappears at 12 month follow-up[35, 36]. Indeed, the observed effect sizes of QoL improvements for self-help and group-based CBT were larger at follow-up than at post-treatment, providing preliminary support for the idea other CBT modalities take longer than therapist-led manualized CBT to achieve its beneficial effects.

We also observed greater pre-post HRQoL improvements in transdiagnostic samples as oppose to AN or BED samples. The difficulty in engaging and treating AN with CBT[37] might explain why we observed a non-significant, small pre-post effect size on HRQoL for this population. Moreover, individuals with AN tend to report similar levels of HRQoL impairment than healthy controls, which is said to be a result of the egosyntonicity of

behaviours associated with AN[2]. Thus, QoL scores might have less room for improvement in AN relative to other eating disorders. On the other hand, individuals with BED tend to report the poorest HRQoL across the eating disorders[2], which has been attributed to impairments in physical functioning due to overweight and the experiences of weight-related stigma. The findings that weight loss following CBT for BED is modest at best [38], and that HRQoL impairment in BED has shown to be a result of obesity-related factors[2], may also explain why CBT results in small HRQoL improvements relative to transdiagnostic samples.

Critically, the pre-post effect sizes discussed above were based on both uncontrolled and controlled studies. Including uncontrolled studies means that it is not possible to identify which proportion of the effect size can be attributed to the intervention and which to other extraneous variables (e.g., expectations, spontaneous recovery) [16]. Since RCTs are necessary to establish CBTs efficacy on QoL improvements, we ensured that our controlled effect sizes were only based on the available RCTs. Thus, interpretations regarding the efficacy of CBT for eating disorders on QoL should be primarily based on our findings from these controlled effect sizes.

For controlled effect sizes, CBT was compared against comparison conditions (i.e., active psychological comparisons and wait-list controls) to observe its relative effect on QoL. A small effect favouring CBT over any comparison was observed for subjective QoL and HRQoL. However, publication bias was evident for HRQoL outcomes due to the small number of comparisons, which means that this finding is only preliminary and warrants further investigation. The observed effect sizes for subjective QoL and HRQoL is much smaller than the between-groups effect sizes reported in meta-analyses on the effect of CBT for depression and anxiety on QoL (g's = 0.48-0.56)[32, 39]. Together, this suggests that the

effects of CBT for eating disorders on QoL reported in controlled trials are not as strong as the effects of CBT for depression and anxiety on QoL observed in controlled trials.

We also compared CBT to both inactive (e.g., wait-list) and active (e.g., psychotherapy, psychoeducation) comparisons. CBT was superior to inactive and active comparison conditions on subjective QoL, suggesting that CBT has a unique effect on increasing general wellbeing and life satisfaction. CBT was only superior to inactive comparisons on HRQoL improvements. Although CBT was not superior to active comparisons on HRQoL scores, this analysis included only three studies, which means that this analysis was likely underpowered. To better understand the impact of CBT on HRQoL relative to other psychological treatments, future trials of CBT should assess changes in both generic and eating disorder-specific HRQoL.

Certain limitations to this meta-analysis need to be considered. First, the limited number of studies prevented us from analysing specific QoL domains (e.g., physical health, mental health). Therefore, we could not pinpoint precisely which QoL domain did or did not improve following CBT. Understanding which QoL does not improve following CBT is important for treatment planning, as adjunctive treatments could be offered alongside CBT. Second, the limited number of RCTs prevented us from comparing CBT to specific psychological treatments (e.g., IPT, supportive therapy). This means that we cannot conclude that CBT is the most effective psychotherapy approach for improving QoL in individuals with eating disorders. Similarly, analyses were based on studies that delivered different CBT modalities and intensities to a variety of eating disorder diagnoses. Although eating disorders share common features (e.g., shape and weight over-evaluation), many characteristics also differ across diagnoses (e.g., weight status, starvation syndrome), meaning that, at times, certain eating disorder types require, and even respond better to, more intensive treatment programs [10, 11]. The limited number of included studies therefore prevented us from

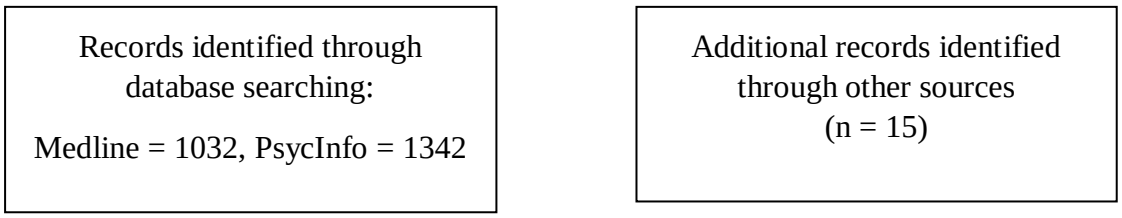
examining whether the effects of specific intensities of CBT on QoL differs systematically across eating disorder diagnoses.

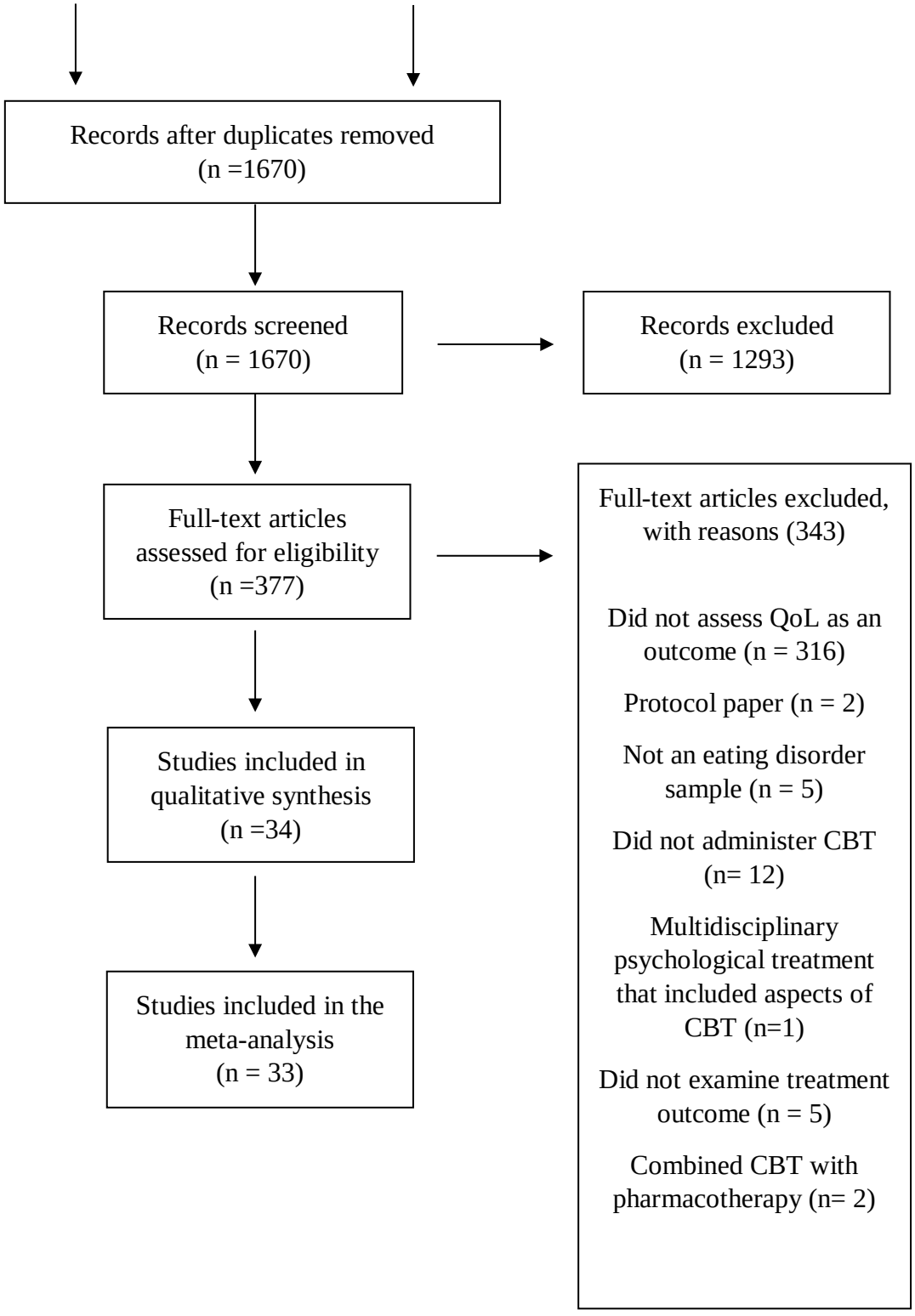
Another important limitation was that all included studies assessed QoL change via participant self-report. While the self-report questionnaires used had adequate psychometric properties, the assessment of QoL change depended solely on the participants self-report, thereby introducing potential biases. The biases are prominent in individuals who lack insight into the nature of their eating disorder – a feature that is very common in individuals with AN and BN [40]. When assessed, these individuals may not therefore provide accurate information. Because of this, other objective indicators might provide a better assessment of QoL. For instance, assessing the effect of CBT in the long-term on disability adjusted life years or occupational or educational absenteeism might provide a more accurate assessment of QoL change following eating disorder treatments.

In summary, this study provides preliminary evidence that CBT leads to modest improvements in QoL in individuals with eating disorders. This study also provides initial evidence to suggest that CBT is more effective than inactive and active comparisons at improving specific domains of QoL (e.g., subjective QoL). However, the small number of RCTs that have assessed QoL changes prevent robust conclusions regarding the efficacy of CBT for eating disorders on QoL. Future RCTs of CBT for eating disorders should assess incorporate subjective, objective and HRQoL measures so that comparisons between various CBT formats to specific psychological treatments (CBT, behaviour therapy) can be made.

Conflict of Interest: The authors declare no conflict of interest.

Figure 1. Flow Chart of Literature Search

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Records screened
(n = 1670)
Records excluded
(n = 1293)
Full-text articles
assessed for eligibility
(n =377)
Full-text articles excluded, with reasons (343)
Did not assess QoL as an outcome (n = 316)
Protocol paper (n = 2)
Not an eating disorder sample (n = 5)
Did not administer CBT (n= 12)
Multidisciplinary psychological treatment that included aspects of CBT (n=1)
Did not examine treatment outcome (n = 5)
Combined CBT with pharmacotherapy (n= 2)
Studies included in qualitative synthesis
(n =34)
Studies included in the meta-analysis
(n = 33)

Table 1

Characteristics of the RCTs that Met Full Inclusion Criteria

Study	Study Quality Rating							Design	Sample	CBT intervention (n)	Comparison (n)	Measure	QoL type
	D1	D2	D3	D4	D5	D6	G						
Agras, Walsh 41	M	S	W	M	S	M	M	RCT	BN	Individual therapist-led CBT-BN (110)	Individual therapist-led IPT (110)	SAS	Subjective
Banasiak, Paxton 42	W	S	S	M	S	M	M	RCT	BN	CBT GSH (54)	Wait-list (55)	SAS	Subjective
Carrard, Crépin 43	M	S	W	W	S	M	W	RCT	BED	CBT internet-based GSH (37)	Wait-list (37)	IWQOL	HRQoL (disease-specific)
Chen, Touyz 44	M	S	S	S	S	M	S	RCT	BN	Group CBT-BN (30) Individual therapist-led CBT-BN (30)	-	SAS	Subjective
Davis, McVey 45	M	S	M	M	S	M	S	RCT	BN	Individual therapist-led CBT (39)	Psychoeducation only (19)	SAS	Subjective
Durand and King 46	W	S	S	W	S	M	W	RCT	BN	CBT GSH (34)	Specialist treatment (34)	SAS	Subjective
Fairburn, Bailey-Straebler 47	M	S	S	M	S	M	S	RCT	Mixed	Individual therapist-led CBT-E (65)	Individual therapist-led IPT (65)	CIA	HRQoL (disease-specific)

Table 1

Characteristics of the RCTs that Met Full Inclusion Criteria

Study	**Study Quality Rating**							**Design**	**Sample**	**CBT intervention (n)**	**Comparison (n)**	**Measure**	**QoL type**
	D1	**D2**	**D3**	**D4**	**D5**	**D6**	**G**						
Fairburn, Jones 48	M	M	M	M	S	S	S	RCT	BN	Individual therapist-led CBT-BN (25)	Individual therapist-led IPT (25)	SAS	Subjective
Fairburn, Kirk 49	M	S	W	M	S	S	M	RCT	BN	Individual therapist-led CBT-BN (11)	Individual STFP (11)	SAS	Subjective
Fischer, Meyer 50	M	M	M	W	S	S	M	RCT	BED	Group CBT (20)	Wait-list (21)	QLS	Subjective
Garner, Rockert 51	M	M	S	W	S	S	M	RCT	BN	Individual therapist-led CBT (30)	SET (30)	SAS	Subjective
Ghaderi and Scott 52	W	M	S	M	S	M	M	RCT	Mixed	CBT GSH (15) CBT PSH (16)	-	SAS	Subjective
Goldbloom, Olmsted 53	M	S	W	M	S	M	M	RCT	BN	Individual therapist-led CBT-BN (24)	Fluoxetine (23) Fluoxetine + CBT-BN (29)	SAS	Subjective
Lavender, Startup 54	M	S	S	M	S	M	S	RCT	Mixed	Group CBT (35)	ESMT (35)	CIA	HRQoL (disease-specific) Subjective
Ljotsson, Lundin 55	W	S	S	M	S	S	M	RCT	Mixed	CBT internet GSH (35)	Wait-list (34)	SLS	

Table 1

Characteristics of the RCTs that Met Full Inclusion Criteria

Study	**Study Quality Rating**							**Design**	**Sample**	**CBT intervention (n)**	**Comparison (n)**	**Measure**	**QoL type**
	D1	**D2**	**D3**	**D4**	**D5**	**D6**	**G**						
Mitchell, Crosby 56	M	S	W	M	S	M	M	RCT	Mixed	Individual therapist-led CBT-BN (66) CBT-BN Telemedicine (66)	-	SF-36	HRQoL (generic)
Munsch, Biedert 57	W	M	S	W	S	M	W	RCT	BED	Group CBT (44)	Group BWL (36)	QLS	Subjective
Peterson, Mitchell 58	M	S	W	M	S	M	M	RCT	BED	Individual therapist-led CBT-BN (60) Individual therapist-assisted CBT-BN (63) CBT GSH (67)	Wait-list (69)	IWQOL	HRQoL (disease-specific)
Sánchez-Ortiz, Munro 59	M	S	S	M	S	S	S	RCT	Mixed	CBT internet GSH (38)	Wait-list (38)	WHO-QOL	HRQoL (generic)
Schlup, Munsch 60	W	M	W	W	S	M	W	RCT	BED	Group CBT (18)	Wait-list (18)	SWLS	Subjective
Striegel-Moore, Wilson 61	M	S	S	M	S	M	S	RCT	Mixed	CBT GSH (59)	TAU (64)	WSAS	Subjective
ter Huurne, de Haan 62	W	S	M	M	S	M	M	RCT	Mixed	CBT GSH (108)	Wait-list (106)	EQ-5D VAS	Subjective

Table 1

Characteristics of the RCTs that Met Full Inclusion Criteria

Study	**Study Quality Rating**							**Design**	**Sample**	**CBT intervention (n)**	**Comparison (n)**	**Measure**	**QoL type**
	D1	**D2**	**D3**	**D4**	**D5**	**D6**	**G**						
Touyz, Le Grange 63	M	S	S	M	S	S	S	RCT	AN	Individual therapist-led CBT-AN (31)	SSCM (32)	SF-36	HRQoL (generic)
Wilfley, Welch 64	W	S	S	M	S	S	M	RCT	BED	Group CBT-BN (81)	Group IPT (81)	SAS	Subjective

Note: M= Moderate; S = Strong; W= weak rating; D= domain; D1= selection bias; D2= Study design; D3= Confounders; D4= Blinding; D5= Data collection method; D6= Withdrawal and dropouts; G= Global quality rating; n = the number of participants allocated to treatment condition; BED = Binge eating disorder; AN = anorexia Nervosa; BN = Bulimia nervosa; IPT= interpersonal psychotherapy; BWL= behavioural weight loss; SSCM=Specialist supportive clinical management; SET= Supportive expressive therapy; TAU= treatment as usual; STFT= short-term focal psychotherapy; PSH= pure self-help; TA= therapist-assisted; TL= therapist-led; QLS= questionnaire on life satisfaction; SLS= Satisfaction with life scale; CIA= clinical impairment assessment; SF-36= short-form 36; SWS= satisfaction with life scale; IWQOL= Impact of weight on quality of life; WSAS= work and social adjustment scale

Table 2

Characteristics of non-RCTs that Met Full Inclusion Criteria

Study	**Study Quality Rating**							**Design**	**Sample**	**CBT intervention (n)**	**Measure**	**QoL type**
	D1	D2	D3	D4	D5	D6	G					
Abilés, Rodríguez-Ruiz 65	M	M	NA	NA	S	W	M	PrePost	BED	Group CBT-BN (49)	QoL Index	Subjective
Byrne, Fursland 66	M	M	NA	NA	S	W	M	PrePost	Mixed	Individual therapist-led CBT-E (125)	QLESQ	Subjective
Carrard, Crépin 67	W	M	S	W	S	S	W	Non-RCT	BED	CBT internet-based GSH (22)	IWQOL	HRQoL (disease-specific)
Carter, Yanykulovitch-Levy 68	W	M	NA	NA	S	W	W	PrePost	Mixed	Group CBT-BN (64)	CIA	HRQoL (disease-specific)
Hepburn and Clark-Stone 69	M	M	NA	NA	S	M	M	PrePost	Mixed	Group CBT day program (52)	CIA	HRQoL (disease-specific)
Morgan, Lazarova 70	M	M	NA	NA	S	S	S	PrePost	AN	Individual CBT body image therapy (55)	EDQOL	HRQoL (disease-specific)
Turner, Marshall 71	M	M	NA	NA	S	W	M	PrePost	Mixed	Individual therapist-led CBT-E (117)	CIA	HRQoL (disease-specific)
Vancampfort, Probst 72	M	M	NA	NA	S	S	S	PrePost	BED	Group CBT + physical activity (34)	SF-36	HRQoL (generic)
Watson, Allen 73	M	M	NA	NA	S	W	M	PrePost	Mixed	Individual therapist-led CBT-E (196)	QLESQ	Subjective

Zandberg and Wilson 74	M	M	NA	NA	S	M	S	PrePost	BED	CBT GSH (34)	CIA	HRQoL (disease-specific)

Note: M= Moderate; S = Strong; W= weak rating; D= domain; D1= selection bias; D2= Study design; D3= Confounders; D4= Blinding; D5= Data collection method; D6= Withdrawal and dropouts; G= Global quality rating; n = the number of participants allocated to treatment condition; BED = Binge eating disorder; AN = anorexia Nervosa; BN = Bulimia nervosa; PSH= pure self-help; TA= therapist-assisted; TL= therapist-led; QLS= questionnaire on life satisfaction; SLS= Satisfaction with life scale; CIA= clinical impairment assessment; SF-36= short-form 36; SWS= satisfaction with life scale; IWQOL= Impact of weight on quality of life; WSAS= work and social adjustment scale

Group by QoL Measurement	Study name	Hedges's g	Variance	Lower limit	Upper limit	p-Value
HRQOL	Touyz et al 2013	0.17	0.07	-0.33	0.67	0.508
HRQOL	Mitchell et al 2008a	0.55	0.12	-0.13	1.23	0.113
HRQOL	Vancampfort et al 2014	0.60	0.02	0.32	0.87	0.000
HRQOL	Sanchez et al 2011	0.61	0.03	0.26	0.95	0.001
HRQOL	Carrard et al 2011b	0.65	0.01	0.49	0.81	0.000
HRQOL	Carter et al 2016	0.77	0.00	0.66	0.89	0.000
HRQOL	Hepburn et al 2016	0.81	0.00	0.69	0.94	0.000
HRQOL	Fairburn et al 2015	1.52	0.00	1.39	1.65	0.000
HRQOL	Peterson et al 2009a	0.25	0.00	0.16	0.34	0.000
HRQOL	Carrard et al 2011a	0.29	0.00	0.17	0.40	0.000
HRQOL	Peterson et al 2009c	0.29	0.00	0.20	0.38	0.000
HRQOL	Peterson et al 2009b	0.30	0.00	0.21	0.40	0.000
HRQOL	Mitchell et al 2008b	0.31	0.05	-0.14	0.76	0.182
HRQOL	Morgan et al 2014	0.48	0.00	0.38	0.58	0.000
HRQOL	Turner et al 2015	0.52	0.00	0.45	0.59	0.000
HRQOL	Zandberg et al 2013	0.53	0.00	0.41	0.66	0.000
HRQOL		0.55	0.00	0.42	0.69	0.000
Subjective QoL	Chen et al 2003a	0.17	0.01	-0.06	0.41	0.144
Subjective QoL	Durand et al 2003	0.21	0.01	-0.01	0.43	0.065
Subjective QoL	Abiles et al 2013	0.27	0.01	0.05	0.49	0.015
Subjective QoL	Fischer et al 2014	0.27	0.03	-0.06	0.60	0.110
Subjective QoL	Byrne et al 2011	0.37	0.00	0.30	0.44	0.000
Subjective QoL	Munsch et al 2007	0.38	0.02	0.08	0.69	0.015
Subjective QoL	Striegel-Moore et al 2010	0.38	0.01	0.19	0.57	0.000
Subjective QoL	ter Huurne et al 2015	0.38	0.01	0.23	0.53	0.000
Subjective QoL	Ghaderi et al 2003	0.44	0.03	0.07	0.80	0.019
Subjective QoL	Watson et al 2011	0.48	0.00	0.43	0.54	0.000
Subjective QoL	Banasiak et al 2005	0.49	0.01	0.32	0.65	0.000
Subjective QoL	Schlup et al 2009	0.54	0.04	0.15	0.93	0.007
Subjective QoL	Garner et al 1993	0.58	0.02	0.27	0.88	0.000
Subjective QoL	Ljotsson et al 2007	0.59	0.01	0.37	0.80	0.000
Subjective QoL	Wilfley et al 2002	0.59	0.01	0.44	0.75	0.000
Subjective QoL	Chen et al 2003b	0.64	0.02	0.39	0.90	0.000
Subjective QoL	Davis et al 1999	0.71	0.01	0.48	0.94	0.000
Subjective QoL	Agras et al 2000	0.74	0.01	0.56	0.92	0.000
Subjective QoL	Fairburn et al 1991	0.87	0.03	0.55	1.20	0.000
Subjective QoL	Fairburn et al 1986	1.13	0.06	0.65	1.61	0.000
Subjective QoL		0.50	0.00	0.38	0.62	0.000

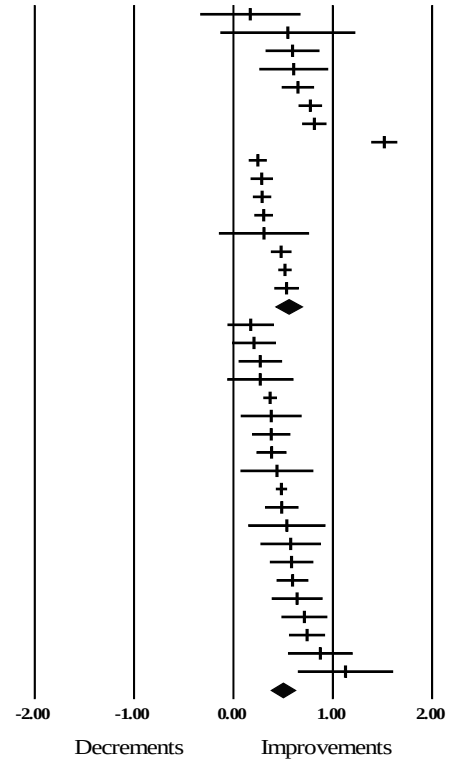

Figure 2: Meta-analysis of studies that contributed to the effect size on pre-post subjective and HRQoL improvements.

Group by QoL Measurement	Study name	Hedges's g	Variance	Lower limit	Upper limit	p-Value
HRQoL	Carrard 2011a	-0.01	0.05	-0.46	0.45	0.980
HRQoL	Peterson	0.08	0.01	-0.13	0.30	0.451
HRQoL	Touyz 2013	0.12	0.02	-0.16	0.40	0.397
HRQoL	Lavender 2012	0.16	0.09	-0.42	0.74	0.597
HRQoL	Fairburn 2015	0.49	0.03	0.13	0.86	0.008
HRQoL	Sanchez-Ortiz 2011	0.74	0.04	0.35	1.14	0.000
HRQoL	Carrard 2011b	0.80	0.10	0.17	1.43	0.013
HRQoL		0.31	0.01	0.07	0.54	0.010
Subjective	Durand 2003	0.00	0.06	-0.47	0.47	1.000
Subjective	Munsch 2007	0.18	0.08	-0.38	0.74	0.530
Subjective	Wilfley 2002	0.20	0.03	-0.11	0.51	0.210
Subjective	Davis 1999	0.23	0.08	-0.32	0.77	0.412
Subjective	Ter Huurne 2015	0.25	0.02	-0.02	0.51	0.072
Subjective	Agras 2000	0.25	0.03	-0.10	0.59	0.157
Subjective	Fairburn 1991	0.25	0.09	-0.34	0.85	0.407
Subjective	Ljotsson 2007	0.37	0.06	-0.11	0.84	0.133
Subjective	Garner 1993	0.39	0.10	-0.21	1.00	0.205
Subjective	Fairburn 1986	0.41	0.17	-0.41	1.22	0.328
Subjective	Banasiak 2005	0.57	0.04	0.19	0.95	0.004
Subjective	Schlup	0.83	0.14	0.09	1.58	0.028
Subjective	Striegel-Moore 2010	1.23	0.04	0.84	1.61	0.000
Subjective		0.39	0.01	0.20	0.57	0.000

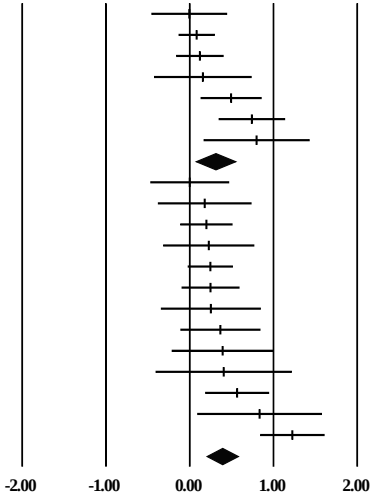

Figure 3: Meta-analysis of RCTon QoL at Post-treatment

Table 3
Moderator Analyses for Within-Group Effects at Post-Treatment and Follow-Up

		Subjective QoL				HRQoL			
Moderator		**N_{comp}**	**g (95% CI)**	**$Q_{between}$**	**p**	**N_{comp}**	**g (95% CI)**	**$Q_{between}$**	**p**
Study Design									
Pre-Post treatment[2]									
	RCT	17	.51 (.43, .59)			9	.48 (.25, .72)		
	Pre-Post	4	.44 (.29, .55)			6	.64 (.36, .91)		
				1.17	.279			.69	.405
Diagnosis									
Pre-Post treatment									
	Transdiagnostic	7	.45 (.34, .55)			7	.77 (.54, 1.00)		
	BN	9	.56 (.45, .68)			-	-		
	BED	5	.42 (.26, .59)			6	.39 (.16, .61)		
	AN	-	-			2	.37 (-.07, .81)		
				2.89	.235			**6.37**	**.041**
Pre to follow-up									
	Transdiagnostic	-	-			2	.94 (.52, 1.36)		
	BN	6	.69 (.47, .92)			2	.29 (-.23, .81)		
	BED	4	.87 (.56, 1.17)			5	.47 (.21, .74)		
	AN	-	-					5.49	.139
				3.73	.154				
Treatment type									
Pre-post treatment									
	Individual therapist-led	8	.61 (.49, .73)			5	.68 (.34, 1.02)		
	Group therapist-led	6	.37 (.23, .52)			6	.54 (.26, .31)		
	Self-help	7	.43 (.32, .55)			4	.43 (.09, .77)		
				7.29	**.026**			1.02	.600

[2] Study design was not tested as a moderator at follow-up because there were no pre-post studies that assessed QoL changes at follow-up.

Table 3
Moderator Analyses for Within-Group Effects at Post-Treatment and Follow-Up

		Subjective QoL				HRQoL			
Moderator		**N_{comp}**	**g (95% CI)**	**$Q_{between}$**	**p**	**N_{comp}**	**g (95% CI)**	**$Q_{between}$**	**p**
Pre to follow-up									
	Individual therapist-led	4	.74 (.41, 1.08)			6	.43 (.07, .79)		
	Group therapist-led	5	.86 (.54, 1.17)			-	-		
	Self-help	2	.86 (.40, 1.33)			4	.64 (.21, 1.06)		
				.28	.868			.51	.476
Analysis									
Pre-post treatment									
	ITT	13	.42 (.35, .49)			8	.36 (.21, .53)		
	Completer	8	.65 (.53, .75)			7	.82 (.63, 1.01)		
				11.21	**.001**			**13.32**	**<.001**
Pre to follow-up									
	ITT	6	.83 (.57, 1.09)			5	.33 (.11, .55)		
	Completer	5	.79 (.50, 1.08)			5	.77 (.52, 1.02)		
				.04	.830			**6.95**	**.008**
CBT type									
Pre-post treatment									
	Fairburn's CBT	13	.52 (.43, .61)			6	.79 (.52, 1.09)		
	Other	8	.43 (.31, .55)			9	.44 (.25, .64)		
				1.31	.452			**3.80**	**.050**
Pre to follow-up									
	Fairburn's CBT	6	.83 (.57. 1.07)			3	.71 (.32, 1.09)		
	Other	5	.79 (.50, 1.08)			7	.46 (.23, .68)		
				.03	.855			1.17	.279
Study Quality									
Pre-post treatment									
	Strong	6	.53 (.39, .65)			5	.73 (.43, 1.02)		

Table 3
Moderator Analyses for Within-Group Effects at Post-Treatment and Follow-Up

		Subjective QoL				HRQoL			
Moderator		**N_{comp}**	**g (95% CI)**	**$Q_{between}$**	**p**	**N_{comp}**	**g (95% CI)**	**$Q_{between}$**	**p**
	Moderate	12	.49 (.41, .58)			7	.43 (.18, .67)		
	Weak	3	.34 (.12, .55)			3	.56 (.21, .92(		
				2.28	.319			2.29	.317
Pre to follow-up									
	Strong	4	.75 (.44, 1.07)			3	.73 (.45, .99)		
	Moderate	4	1.03 (.69, 1.36)			5	.24 (.02, .46)		
	Weak	3	.61 (.22, .99)			2	.86 (.54, 1.18)		
				2.83	.243			**12.76**	**.002**

Table 4
Moderator Analyses for Between-Group Effects at Post-Treatment

		Subjective QoL				HRQoL			
Moderator		**N_{comp}**	**g (95% CI)**	**$Q_{between}$**	**p**	**N_{comp}**	**g (95% CI)**	**$Q_{between}$**	**p**
Comparison type									
	Active	9	.36 (.11, .61)			3	.26 (-.13, .65)		
	Inactive	4	.45 (.09, .80)			4	.35 (.01, .69)		
				.17	.678			.12	.735
Diagnosis									
	Transdiagnostic	3	.60 (.22, .97)			2	.35 (-.19, .90)		
	BN	7	.29 (.01, .57)			-	-		
	BED	3	.33 (-.09, .76)			4	.36 (-.01, .72)		
	AN	-	-			-	-		
				1.67	.443			.38	.825
Treatment type									
	Individual therapist-led	5	.29 (-.06, .64)			2	.30 (-.18, .78)		
	Group therapist-led	3	.33 (-.10, .77)			-	-		
	Self-help	5	.48 (.18, .79)			3	.49 (.04, .94)		
				.77	.678			1.24	.742
Analysis									
	ITT	5	.47 (.18, .76)			3	.08 (-.07, .24)		
	Completer	8	.32 (.06, .58)			4	.56 (.33, .79)		
				.54	.461			**11.42**	**.001**
CBT type									
	Fairburn's CBT	6	.48 (.20, .77)			2	.36 (-.11, .83)		
	Other	7	.31 (.06, .56)			5	.29 (.02, .56)		
				.85	.357			.07	.796
Quality Rating									
	Strong	3	.67 (.31, 1.04)			4	.38 (.04, .72)		
	Moderate	7	.32 (.11, .55)			-	-		

Table 4
Moderator Analyses for Between-Group Effects at Post-Treatment

	Subjective QoL				HRQoL			
Moderator	**N_{comp}**	**g (95% CI)**	**$Q_{between}$**	**p**	**N_{comp}**	**g (95% CI)**	**$Q_{between}$**	**p**
Weak	3	.25 (-.15, .65)			2	.33 (-.21, .88)		
			3.07	.215			.73	.693

Note: HRQoL = health-related quality of life; RCT= Randomised controlled trial; BN= bulimia nervosa; AN= anorexia nervosa; BED= Binge eating disorder; ITT= Intention to treat; Ncomp = number of comparisons.

References

1. Fairburn CG, Harrison PJ. Eating disorders. The Lancet 2003;361:407-416.

2. Jenkins PE, Hoste RR, Meyer C, Blissett JM. Eating disorders and quality of life: A review of the literature. Clinical psychology review 2011;31:113-121.

3. De la Rie S, Noordenbos G, Van Furth E. Quality of life and eating disorders. Quality of Life Research 2005;14:1511-1521.

4. Keilen M, Treasure T, Schmidt U, Treasure J. Quality of life measurements in eating disorders, angina, and transplant candidates: are they comparable? Journal of the Royal Society of Medicine 1994;87:441-444.

5. WHOQOL group. The World Health Organization quality of life assessment (WHOQOL): position paper from the World Health Organization. Social science & medicine 1995;41:1403-1409.

6. Holloway F, Carson J. Quality of life in severe mental illness. International Review of Psychiatry 2002;14:175-184.

7. Engel SG, Adair CE, Hayas CL, Abraham S. Health-related quality of life and eating disorders: A review and update. International Journal of Eating Disorders 2009;42:179-187.

8. Williams SE, Watts TKO, Wade TD. A review of the definitions of outcome used in the treatment of bulimia nervosa. Clinical Psychology Review 2012;32:292-300.

9. Hay PJ, Bacaltchuk J, Stefano S, Kashyap P. Psychological treatments for bulimia nervosa and binging. Cochrane Database of Systematic Reviews 2009;2009:1-170.

10. Fairburn CG, Cooper Z, Shafran R. Cognitive behaviour therapy for eating disorders: A "transdiagnostic" theory and treatment. Behaviour Research and Therapy 2003;41:509-528.

11. National Institue of Clinical Excellence. Eating disorders: Core interventions in the treatment and management of anorexia nervosa, bulimia nervosa and related eating disorders. London, UK: The Brtish Psychological Society and Gaskell; 2004.

12. Bohn K, Doll HA, Cooper Z, O'Connor M, Palmer RL, Fairburn CG. The measurement of impairment due to eating disorder psychopathology. Behaviour Research and Therapy 2008;46:1105-1110.

13. Ljotsson B, Lundin C, Mitsell K, Carlbring P, Ramklint M, Ghaderi A. Remote treatment of bulimia nervosa and binge eating disorder: a randomized trial of Internet-assisted cognitive behavioural therapy. Behaviour Research And Therapy 2007;45:649-661.

14. Watson HJ, Allen K, Fursland A, Byrne SM, Nathan PR. Does enhanced cognitive behaviour therapy for eating disorders improve quality of life? European Eating Disorders Review 2012;20:393-399.

15. Moher D, Liberati A, Tetzlaff J, Altman DG. Preferred reporting items for systematic reviews and meta-analyses: The PRISMA statement. Ann Intern Med 2009;151:264-269.

16. Cuijpers P, Weitz E, Cristea I, Twisk J. Pre-post effect sizes should be avoided in meta-analyses. Epidemiology and Psychiatric Sciences 2016:1-5.

17. Goldbloom DS, Olmsted M, Davis R, Clewes J, Heinmaa M, Rockert W, et al. A randomized controlled trial of fluoxetine and cognitive behavioral therapy for bulimia nervosa: Short-term outcome. Behaviour Research and Therapy 1997;35:803-811.

18. Thomas B, Ciliska D, Dobbins M, Micucci S. A process for systematically reviewing the literature: providing the research evidence for public health nursing interventions. Worldviews on Evidence-Based Nursing 2004;1:176-184.

19. Armijo-Olivo S, Stiles CR, Hagen NA, Biondo PD, Cummings GG. Assessment of study quality for systematic reviews: a comparison of the Cochrane Collaboration Risk of

Bias Tool and the Effective Public Health Practice Project Quality Assessment Tool: methodological research. Journal of evaluation in clinical practice 2012;18:12-18.

20. Hofmann SG, Wu JQ, Boettcher H. Effect of cognitive-behavioral therapy for anxiety disorders on quality of life: a meta-analysis. J. Consult. Clin. Psychol 2014;82:375-391.

21. Lipsey MW, Wilson D. Practical meta-analysis. London, UK: Sage Publications; 2001.

22. Hedges LV, Olkin I. Statistical methods for meta-analysis. New York; NY: Academic Press; 1985.

23. Fairburn CG, Jones R, Peveler RC, Carr SJ, Solomon RA, O'Connor ME, et al. Three psychological treatments for bulimia nervosa: A comparative trial. Archives of General Psychiatry 1991;48:463-469.

24. Borenstein M, Hedges LV, Higgins JP, Rothstein HR. Introduction to meta-analysis United Kingdom: John Wiley & Sons; 2009.

25. Higgins J, Thompson SG. Quantifying heterogeneity in a meta-analysis. Stat. Med. 2002;21:1539-1558.

26. Cornell JE, Mulrow CD, Localio R, Stack CB, Meibohm AR, Guallar E, et al. Random-effects meta-analysis of inconsistent effects: a time for change. Annals of internal medicine 2014;160:267-270.

27. Kliem S, Kröger C, Kosfelder J. Dialectical behavior therapy for borderline personality disorder: a meta-analysis using mixed-effects modeling. Journal of consulting and clinical psychology 2010;78:936.

28. Fairburn CG, Marcus MD, Wilson T. Cognitive-behavioral therapy for binge eating and bulimia nervosa: A comprehensive treatment manual. In: Fairburn CG, Wilson GT, editors. Binge eating: Nature, assessment and treatment. New York, NY: Guilford Press 1993. p. 361-404.

29. Fairburn CG. Cognitive behavior therapy and eating disorders. New York, NY: Guilford Press; 2008.

30. Rosenthal R. Meta-analytic procedures for social research. London, United Kingdom: Sage; 1991.

31. Szentagotai A, David D. The efficacy of cognitive-behavioral therapy in bipolar disorder: a quantitative meta-analysis. The Journal of clinical psychiatry 2009;71:66-72.

32. Hofmann SG, Wu JQ, Boettcher H. Effect of cognitive-behavioral therapy for anxiety disorders on quality of life: a meta-analysis. Journal of consulting and clinical psychology 2014;82:375.

33. Vocks S, Tuschen-Caffier B, Pietrowsky R, Rustenbach SJ, Kersting A, Herpertz S. Meta-analysis of the effectiveness of psychological and pharmacological treatments for binge eating disorder. International Journal of Eating Disorders 2010;43:205-217.

34. Linardon J, de la PieDad Garcia X, Brennan L. Predictors, moderators and mediators of treatment outcome following manualised cognitive-behavioural therapy for eating disorders: A systematic review. European Eating Disorders Review 2016;25:3-12.

35. Peterson CB, Mitchell JE, Crow SJ, Crosby RD, Wonderlich SA. The efficacy of self-help group treatment and therapist-led group treatment for binge eating disorder. The American Journal of Psychiatry 2009;166:1347-1354.

36. Peterson CB, Mitchell JE, Engbloom S, Nugent S, Mussell MP, Miller JP. Group cognitive-behavioral treatment of binge eating disorder: A comparison of therapist-led versus self-help formats. International Journal of Eating Disorders 1998;24:125-136.

37. Fairburn CG. Evidence-based treatment of anorexia nervosa. International Journal of Eating Disorders 2005;37:S26-S30.

38. Grilo C, Masheb RM. A randomized controlled comparison of guided self-help cognitive behavioral therapy and behavioral weight loss for binge eating disorder. Behav Res Ther 2005;43:1509-1525.

39. Newby JM, Twomey C, Yuan Li SS, Andrews G. Transdiagnostic computerised cognitive behavioural therapy for depression and anxiety: A systematic review and meta-analysis. Journal of Affective Disorders 2016;199:30-41.

40. Konstantakopoulos G, Tchanturia K, Surguladze S, David A. Insight in eating disorders: clinical and cognitive correlates. Psychological Medicine 2011;41:1951-1961.

41. Agras WS, Walsh BT, Fairburn CG, Wilson GT, Kraemer HC. A multicenter comparison of cognitive-behavioral therapy and interpersonal psychotherapy for bulimia nervosa. Arch. Gen. Psychiatry 2000;57:459-466.

42. Banasiak SJ, Paxton SJ, Hay P. Guided self-help for bulimia nervosa in primary care: a randomized controlled trial. Psychol. Med. 2005;35:1283-1294.

43. Carrard I, Crépin C, Rouget P, Lam T, Golay A, Van der Linden M. Randomised controlled trial of a guided self-help treatment on the Internet for binge eating disorder. Behav Res Ther 2011;49:482-491.

44. Chen E, Touyz SW, Beumont PJ, Fairburn CG, Griffiths R, Butow P, et al. Comparison of group and individual cognitive-behavioral therapy for patients with bulimia nervosa. Int J Eat Disord. 2003;33:241-254.

45. Davis R, McVey G, Heinmaa M, Rockert W, Kennedy S. Sequencing of cognitive-behavioral treatments for bulimia nervosa. Int J Eat Disord. 1999;25:361-374.

46. Durand MA, King M. Specialist treatment versus self-help for bulimia nervosa: a randomised controlled trial in general practice. Br J Gen Pract 2003;53:371-377.

47. Fairburn CG, Bailey-Straebler S, Basden S, Doll HA, Jones R, Murphy R, et al. A transdiagnostic comparison of enhanced cognitive behaviour therapy (CBT-E) and

interpersonal psychotherapy in the treatment of eating disorders. Behav Res Ther 2015;70:64-71.

48. Fairburn CG, Jones R, Peveler RC, Carr SJ, Solomon RA, O'Connor ME, et al. Three psychological treatments for bulimia nervosa: A comparative trial. Arch. Gen. Psychiatry 1991;48:463-469.

49. Fairburn CG, Kirk J, O'Connor M, Cooper PJ. A comparison of two psychological treatments for bulimia nervosa. Behav Res Ther 1986;24:629-643.

50. Fischer S, Meyer AH, Dremmel D, Schlup B, Munsch S. Short-term cognitive-behavioral therapy for binge eating disorder: long-term efficacy and predictors of long-term treatment success. Behav Res Ther 2014;58:36-42.

51. Garner DM, Rockert W, Davis R, Garner MV, Olmsted MP, Eagle M. Comparison of cognitive-behavioral and supportive-expressive therapy for bulimia nervosa. Am J Psychiatry 1993;150:37-46.

52. Ghaderi A, Scott B. Pure and guided self-help for full and sub-threshold bulimia nervosa and binge eating disorder. Br. J. Clin. Psychol 2003;42:257-269.

53. Goldbloom DS, Olmsted M, Davis R, Clewes J, Heinmaa M, Rockert W, et al. A randomized controlled trial of fluoxetine and cognitive behavioral therapy for bulimia nervosa: Short-term outcome. Behav Res Ther 1997;35:803-811.

54. Lavender A, Startup H, Naumann U, Samarawickrema N, Dejong H, Kenyon M, et al. Emotional and social mind training: a randomised controlled trial of a new group-based treatment for bulimia nervosa. Plos One 2012;7:e46047-e46047.

55. Ljotsson B, Lundin C, Mitsell K, Carlbring P, Ramklint M, Ghaderi A. Remote treatment of bulimia nervosa and binge eating disorder: a randomized trial of Internet-assisted cognitive behavioural therapy. Behav Res Ther 2007;45:649-661.

56. Mitchell JE, Crosby RD, Wonderlich SA, Crow S, Lancaster K, Simonich H, et al. A randomized trial comparing the efficacy of cognitive-behavioral therapy for bulimia nervosa delivered via telemedicine versus face-to-face. Behav Res Ther 2008;46:581-592.

57. Munsch S, Biedert E, Meyer A, Michael T, Schlup B, Tuch A, et al. A Randomized Comparison of Cognitive Behavioral Therapy and Behavioral Weight Loss Treatment for Overweight Individuals with Binge Eating Disorder. Int J Eat Disord. 2007;40:102-113.

58. Peterson CB, Mitchell JE, Crow SJ, Crosby RD, Wonderlich SA. The efficacy of self-help group treatment and therapist-led group treatment for binge eating disorder. The American journal of psychiatry 2009;166:1347-1354.

59. Sánchez-Ortiz VC, Munro C, Stahl D, House J, Startup H, Treasure J, et al. A randomized controlled trial of internet-based cognitive-behavioural therapy for bulimia nervosa or related disorders in a student population. Psychol. Med. 2011;41:407-417.

60. Schlup B, Munsch S, Meyer AH, Margraf J, Wilhelm FH. The efficacy of a short version of a cognitive-behavioral treatment followed by booster sessions for binge eating disorder. Behav Res Ther 2009;47:628-635.

61. Striegel-Moore RH, Wilson GT, DeBar L, Perrin N, Lynch F, Rosselli F, et al. Cognitive behavioral guided self-help for the treatment of recurrent binge eating. J. Consult. Clin. Psychol 2010;78:312-321.

62. ter Huurne ED, de Haan HA, Postel MG, van der Palen J, VanDerNagel JEL, DeJong CAJ. Web-Based Cognitive Behavioral Therapy for Female Patients With Eating Disorders: Randomized Controlled Trial. J. Med. Internet Res. 2015;17:e152-e152.

63. Touyz S, Le Grange D, Lacey H, Hay P, Smith R, Maguire S, et al. Treating severe and enduring anorexia nervosa: a randomized controlled trial. Psychol. Med. 2013;43:2501-2511.

64. Wilfley DE, Welch RR, Stein RI, Spurrell EB, Cohen LR, Saelens BE, et al. A randomized comparison of group cognitive-behavioral therapy and group interpersonal psychotherapy for the treatment of overweight individuals with binge-eating disorder. Arch. Gen. Psychiatry 2002;59:713-721.

65. Abilés V, Rodríguez-Ruiz S, Abilés J, Obispo A, Gandara N, Luna V, et al. Effectiveness of cognitive-behavioral therapy in morbidity obese candidates for bariatric surgery with and without binge eating disorder. Nutrición Hospitalaria 2013;28:1523-1529.

66. Byrne SM, Fursland A, Allen KL, Watson H. The effectiveness of enhanced cognitive behavioural therapy for eating disorders: an open trial. Behav Res Ther 2011;49:219-226.

67. Carrard I, Crépin C, Rouget P, Lam T, Van der Linden M, Golay A. Acceptance and efficacy of a guided internet self-help treatment program for obese patients with binge eating disorder. Clin Pract Epidemiol Ment Health 2011:8-18.

68. Carter R, Yanykulovitch-Levy D, Wertheim H, Gordon-Erez S, Shahimov M, Weizman A, et al. Group cognitive behavioral treatment in female soldiers diagnosed with binge/purge eating disorders. Eating Disorders 2016;24:338-353.

69. Hepburn ZM, Clark-Stone S. The short term effectiveness of day treatment for eating disorders in reducing psychosocial impairment: utilizing the clinical impairment assessment in routine practice. Mental Health Review Journal 2016;21:11-22.

70. Morgan JF, Lazarova S, Schelhase M, Saeidi S. Ten session body image therapy: Efficacy of a manualised body image therapy. Eur Eat Disord Rev 2014;22:66-71.

71. Turner H, Marshall E, Stopa L, Waller G. Cognitive-behavioural therapy for outpatients with eating disorders: effectiveness for a transdiagnostic group in a routine clinical setting. Behav Res Ther 2015;68:70-75.

72. Vancampfort D, Probst M, Adriaens A, Pieters G, De Hert M, Stubbs B, et al. Changes in physical activity, physical fitness, self-perception and quality of life following a

6-month physical activity counseling and cognitive behavioral therapy program in outpatients with binge eating disorder. Psychiatry Research 2014;219:361-366.

73. Watson HJ, Allen K, Fursland A, Byrne SM, Nathan PR. Does enhanced cognitive behaviour therapy for eating disorders improve quality of life? Eur Eat Disord Rev 2012;20:393-399.

74. Zandberg LJ, Wilson GT. Train-the-trainer: implementation of cognitive behavioural guided self-help for recurrent binge eating in a naturalistic setting. Eur Eat Disord Rev 2013;21:230-237.