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# Cognitive Behavior Therapy for Mental Disorders in Adults
## A Unified Series of Meta-Analyses

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**IMPORTANCE** Cognitive behavior therapy (CBT) is a first-line treatment for most mental disorders. However, no meta-analytic study has yet integrated the results of randomized clinical trials on CBT across different disorders, using uniform methodologies and providing a complete overview of the field.

**OBJECTIVE** To examine the effect sizes of CBT for 4 anxiety disorders, 2 eating disorders, major depression, obsessive-compulsive disorder (OCD), posttraumatic stress disorder (PTSD), and psychotic and bipolar disorders on symptoms of the respective disorders using uniform methodologies for data extraction, risk of bias (RoB) assessment, and meta-analytic techniques.

**DATA SOURCES** Major bibliographical databases (PubMed, PsycINFO, and Embase for all disorders) were searched up to January 1, 2024, for each disorder separately. Data analysis was performed from August 2024 to January 2025.

**STUDY SELECTION** Randomized clinical trials comparing CBT with inactive control conditions in adults with 1 of the mental disorders established through a clinical interview were included.

**DATA EXTRACTION AND SYNTHESIS** Basic characteristics of patients, CBT, and studies were extracted. RoB was assessed with the Cochrane RoB tool 2. Meta-analyses were conducted using random-effects models.

**MAIN OUTCOMES AND MEASURES** The primary outcome was the standardized mean difference (Hedges *g*) indicating the difference between CBT and controls at posttreatment on symptoms of the respective disorders.

**RESULTS** A total of 375 trials (423 comparisons) between CBT and controls were included among 32 968 patients. The overall mean (SD) patient age was 43.4 (13.7) years, and the mean (SD) proportion of women was 0.68 (0.24). Effect sizes for CBT compared to all control conditions (*g*) were lower than 0.5 for bipolar and psychotic disorder; between 0.5 and 1.0 for panic, social anxiety, and generalized anxiety disorders, bulimia nervosa, binge eating disorders, depression, and OCD; and larger than 1.0 for PTSD and specific phobias (range of effect sizes: 0.31 for bipolar disorder to 1.27 for PTSD). Large effect sizes ($g > 0.94$) were observed in waitlist-controlled trials, a control condition mostly used in anxiety and eating disorders, PTSD, and OCD. Trials using care as usual showed more modest effect sizes (0.22-1.13). Study dropout rates within the CBT conditions ranged from 8% for specific phobia to 24% for PTSD.

**CONCLUSIONS AND RELEVANCE** In this unified series of meta-analyses, CBT was probably effective in the treatment of mental disorders, including major depression, anxiety disorders, PTSD, OCD, and eating disorders, and possibly effective in psychotic and bipolar disorders. However, the effect sizes depended on the type of control condition.

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Multimedia

Supplemental content

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Since its development more than 50 years ago, cognitive behavior therapy (CBT) has proven effective for many mental health conditions through hundreds of randomized clinical trials (RCTs) and meta-analyses.[1,2] Cognitive restructuring, aimed at changing maladaptive cognitions about the world, the self, and the future, is one of the core treatment mechanism of CBT, next to more behavioral components, like exposure and behavioral activation.[3] Many previous meta-analyses have integrated the results of RCTs on CBT for specific disorders, but they do not give a complete overview of the effects of CBT on a wide range of mental disorders.

Umbrella reviews have summarized the efficacy of CBT across mental disorders,[3-6] but they have several limitations.[7] These reviews rely on previous meta-analyses, which may be outdated, miss parts of a research area not covered by previous meta-analyses, and use different methodologies, inclusion criteria, study periods, and analytic strategies.

To our knowledge, no comprehensive meta-analysis has integrated the results of RCTs on CBT across different mental disorders using uniform methods for data extraction, bias assessment, and meta-analytic techniques. Such a study is crucial for several reasons. It ensures uniform methods, enabling better comparability across disorders; it is also more complete and up to date than umbrella reviews, because it covers the whole field and is based on recent searches. In addition, it allows for the examination of effect modifiers across disorders. This approach makes it possible to examine CBT acceptability across different disorders by comparing dropout rates across trials. The latter is important, because dropout is very important from a clinical perspective,[8,9] but there are also many unclarities about the definition and the proportion of dropouts in CBT.[10]

Such a unified series of meta-analyses has been logistically very challenging in the past. The Metapsy initiative[11] has made this possible. This initiative is aimed at the development of meta-analytic datasets of psychological treatments for mental health problems using standardized approaches. This article examines the effect sizes of CBT across 11 major mental disorders: depressive disorder (MDD), posttraumatic stress disorder (PTSD), obsessive-compulsive disorder (OCD), psychotic disorder (PSY), bipolar disorder (I, II, or both) (BIP), 4 anxiety disorders (panic disorder with or without agoraphobia [PAN], generalized anxiety disorder [GAD], social anxiety disorder [SAD], and specific phobia [PHOB]), and 3 eating disorders (anorexia nervosa, bulimia nervosa [BN], and binge eating disorder [BED]).

### Key Points

**Question** Is cognitive behavior therapy (CBT) associated with reductions in mental disorders in adults compared with controls?

**Findings** In this series of uniform meta-analyses of 375 trials comparing CBT and controls, CBT was associated with significant reductions in mental health problems, with small effect sizes for bipolar and psychotic disorders; large effect sizes for major depression, panic disorder, social anxiety disorder, generalized anxiety disorder, bulimia nervosa, binge eating disorder, and obsessive-compulsive disorder; and very large effect sizes for PTSD and specific phobia.

**Meaning** The evidence supports CBT as a first-line treatment for many mental disorders, although the quality of the evidence is limited.

## Methods

### Search Strategy and Selection Criteria

A series of living systematic reviews included in the Metapsy initiative were conducted following the Preferred Reporting Items for Systematic Reviews and Meta-analyses (PRISMA) reporting guidelines. All included datasets are updated at least annually (current deadline: January 1, 2024). PubMed, PsycINFO, and Embase were searched for all mental disorders by combining terms indicative of each of the disorders and psychotherapies, with filters for randomized trials. More details on the searches, an overview of all the databases searched for each disorder, and the full search strings for each disorder are available in eAppendix 1 in Supplement 1.

The searches (record screening, full-text selection, and study inclusion), data extraction, and risk of bias (RoB) assessment were conducted by 2 independent researchers. Disagreements were resolved through consensus and, if needed, consultation with a third researcher.

We included randomized trials comparing CBT with a control condition (waiting list, care as usual [CAU], pill placebo, or other) in adults with 1 of the mental disorders as established through a clinical diagnostic interview (such as the Mini-International Neuropsychiatric Interview [MINI], the Composite International Diagnostic Interview [CIDI], or the Structured Clinical Interview for DSM Disorders [SCID], but an unstructured interview by a clinician was also accepted). We did not include studies comparing CBT to another active treatment (eg, another therapy or drug treatment). CBT was defined as any psychological intervention in which cognitive restructuring was one of the core components. Any treatment format (individual, group, digital, self-help, or telephone) was accepted as long as there was human support intended to be therapeutic in nature.

We excluded studies examining treatments without cognitive restructuring, such as exposure-only treatments in anxiety disorders, trials in which patients were included only based on self-rated instruments, inpatient participants, studies with supportive counseling as control (often called psychological placebos), and mindfulness-based CBT. We excluded studies comparing combined CBT and pharmacotherapy with pharmacotherapy alone, but the use of medication in BIP and PSY was allowed, because that is part of usual care in these disorders. Disorders with less than 5 included trials were excluded.

### RoB and Data Extraction

RoB was assessed by pairs of independent reviewers using the revised Cochrane RoB tool for randomized trials (RoB 2),[12]

which comprises 5 domains: (1) bias arising from the randomization process; (2) bias due to deviations from intended interventions; (3) bias due to missing outcome data; (4) bias in the measurement of outcome; and (5) bias in the selection of the reported result. Several other characteristics of the trials, patients, and interventions were extracted (**Table 1**).

### Outcomes

For each comparison between CBT and control, the standardized mean difference (SMD) at posttreatment was calculated and adjusted for small sample size (Hedges *g*). All validated outcome measures indicating the symptoms of the disorder were included. Because most trials in BIP did not report 1 overall outcome, but rather separate outcomes for mania and depression, both were calculated. When means and standard deviations were not reported, we used change scores, converted binary outcomes to the SMD,[13] or used other statistics to calculate the SMD.

Study dropout for any reason was a secondary outcome. Dropout rates were calculated separately for the treatment and control groups, along with the relative risk (RR) of dropping out for each study.

### Meta-Analyses

The main analyses were conducted using the metapsyTools R package version 1.0.11 (the R Foundation),[14] which was specifically developed for our meta-analytic project and imports functionalities of the meta,[15] metafor,[16] and dmetar packages.[17]

SMDs were pooled using a random-effects model separately for each of the included disorders. Between-study heterogeneity variances were estimated using restricted maximum likelihood. The Knapp-Hartung method was applied to obtain robust confidence intervals and significance tests of the overall SMD.[18] $I^2$ was calculated as an indicator of heterogeneity,[19] as well as prediction intervals. In our main analyses, all SMDs available in a specific study were aggregated within that study before pooling across studies (intrastudy correlation coefficient: $\rho = 0.5$).

Several sensitivity analyses were conducted. First, the pooled SMD was estimated using a 3-level correlated and hierarchical effects model.[20] Second, SMDs were pooled while excluding outliers.[21] Third, SMDs were pooled while excluding influential studies using the procedures from Viechtbauer and Cheung.[22] Fourth, a meta-analysis was conducted in which we only included the smallest SMD from a study and another in which we only included the largest SMD. Fifth, the pooled SMD was estimated excluding studies with high RoB. Publication bias was evaluated by visual inspection of the funnel plots, the Egger test, and with 3 different methods to adjust for potential publication bias: (1) Duval and Tweedie's "trim and fill" procedure,[23] (2) Rücker and colleagues' "limit meta-analysis,"[24] and (3) a 3-parameter selection model.[25] The number needed to treat (NNT) was estimated for each disorder using the formulas provided by Furukawa,[26] using the control group's event rate reported by Cuijpers and colleagues.[27]

The dropout rates were pooled separately for CBT and control conditions with the meta package in R (the R Foundation).[15] The binary outcome data were synthesized using a normal-normal random-effects pooling model after performing a logit transformation. The summary results were converted to the raw proportion scale, and the estimates and their 95% confidence intervals were presented. The relative risk (RR) was also calculated for dropout of CBT compared with controls.

Subgroup analysis was conducted using mixed-effects models. For pragmatic reasons, subgroup analyses were only conducted for subgroups with at least 5 studies per subgroup. Subgroups with fewer studies were merged with other subgroups, and if that was not possible, we only reported the outcomes for the subgroups with more than 5 studies.

Meta-regression analysis was conducted separately for each disorder, but also with all trials for all disorders together. As predictors, we entered the extracted patient, intervention, and study characteristics. The strength of evidence was assessed with GRADE.[28]

## Results

### Selection, Inclusion, and Characteristics of Included Studies

The searches across all disorders resulted in 105 697 records (69 567 after removal of duplicates), 10 184 full-text papers retrieved, and 375 included studies (Table 1; eAppendix 2 in Supplement 1 presents the flowcharts for each disorder). The number of included studies ranged from 123 (for MDD) to 8 (for PHOB). Too few studies were available for the inclusion of anorexia nervosa. Because several studies compared 2 or more interventions with 1 control group, we included 423 comparisons between CBT and controls. The studies included 32 968 patients (18 037 in treatment and 14 931 in control conditions), ranging from 454 patients in PHOB to 14 081 in MDD. Selected characteristics of included studies and references are described in eAppendices 3 and 4, respectively, in Supplement 1.

The overall mean (SD) patient age was 43.4 (13.7) years, and the mean (SD) proportion of women was 0.68 (0.24) (Table 1). The proportion of patients exclusively recruited from clinical settings was 34% (range: 0% for PHOB to 100% for PSY). The type of control condition varied considerably across disorders. Waitlist control was used in most trials (>60%) for all anxiety disorders, eating disorders, PTSD, and OCD, but less frequently in MDD (38%) and rarely in PSY (13%) and BIP (7%). CAU was most used in MDD (55%), PSY (88%), and BIP (67%). Most trials were conducted in North America (39%) or Europe (36%).

Almost half of the interventions (47%) used an individual format (range: 7% for BED to 94% for PSY). Group therapies were used in less than 10% of trials in PTSD, PHOB, and PSY and ranged in the other disorders from 20% (BIP) to 67% (BED) (mean: 26%). Guided self-help was not used in PSY, BIP, or PHOB and ranged from 7% for PTSD to 28% for SAD and PAN (mean: 21%). The mean number of sessions across all disorders was 11 (range: 5 for PHOB to 18 for BIP).

Only 10% of studies had an overall low RoB (range: 0% for BIP and OCD to 21% for PTSD). RoB of individual studies is presented in eAppendix 2, for all trials across all disorders in

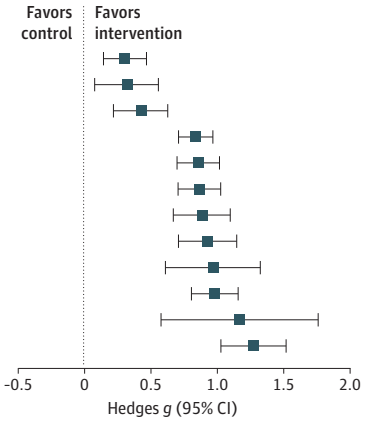
Table 1. Overview of the Searches and Included Studies

| Characteristic | MDD | PAN | SAD | GAD | PHO | PTSD | OCD | BN | BED | PSY | BIP | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Searches, No. | | | | | | | | | | | | |
| Identified records | 35 518 | For all anxiety disorders: 21 193 | | | | 27 679 | 12 297 | BN + BED: 756 | | 6248 | 2006 | 105 697 |
| After removal of duplicates | 25 309 | For all anxiety disorders: 13 192 | | | | 15 493 | 8639 | BN + BED: 505 | | 5176 | 1253 | 69 567 |
| Full texts assessed | 4439 | For all anxiety disorders: 1490 | | | | 2302 | 552 | BN + BED: 309 | | 796 | 296 | 10 184 |
| Included studies, No. | | | | | | | | | | | | |
| Included in current MA | 123 | 39 | 45 | 39 | 8 | 38 | 19 | 11 | 22 | 16 | 15 | 375 |
| Comparisons | 142 | 39 | 57 | 39 | 11 | 41 | 22 | 13 | 27 | 17 | 15 | 423 |
| Total patients | 14 081 | 2441 | 3329 | 3311 | 454 | 2873 | 1118 | 614 | 1764 | 1715 | 1268 | 32 968 |
| Patients in therapy | 7377 | 1505 | 1997 | 1782 | 260 | 1615 | 629 | 322 | 1026 | 918 | 606 | 18 037 |
| Patients in control | 6704 | 936 | 1332 | 1529 | 194 | 1258 | 489 | 292 | 738 | 797 | 662 | 14 931 |
| Aggregated characteristics of included studies, No. (%) | | | | | | | | | | | | |
| Clinical recruitment | 43 (35.0) | 14 (35.9) | 6 (13.3) | 13 (33.3) | 0 | 17 (44.7) | 6 (31.6) | 1 (9.1) | 1 (4.5) | 16 (100) | 10 (66.7) | 127 (33.9) |
| Specific group | 59 (48.0) | 0 | 3 (6.7) | 9 (23.1) | 0 | 28 (73.7) | 1 (5.3) | 0 | 0 | 0 | 2 (13.3) | 102 (27.2) |
| Age, mean (SD), y | 43.4 (13.7) | 37.3 (4.4) | 34.4 (5.3) | 43.2 (13.7) | 37.4 (6.9) | 40.3 (9.6) | 34.6 (4.5) | 26.7 (2.6) | 40.7 (6.9) | 37.3 (6.3) | 40.3 (2.4) | 43.4 (13.7) |
| Proportion women, mean (SD) | 0.70 (0.22) | 0.70 (0.12) | 0.56 (0.12) | 0.68 (0.22) | 0.72 (0.20) | 0.67 (0.35) | 0.58 (0.18) | 1.00 (0.01) | 0.94 (0.08) | 0.41 (0.15) | 0.59 (0.07) | 0.68 (0.24) |
| Type of control, No. (%) | | | | | | | | | | | | |
| Waiting list | 47 (38.2) | 28 (71.8) | 38 (84.4) | 30 (76.9) | 5 (62.5) | 28 (73.7) | 14 (73.7) | 10 (90.9) | 18 (81.8) | 2 (12.5) | 1 (6.7) | 221 (58.9) |
| Care as usual | 60 (48.8) | 6 (15.4) | 3 (6.7) | 7 (17.9) | 1 (12.5) | 4 (10.5) | 4 (21.1) | 0 | 2 (9.1) | 14 (87.5) | 10 (66.7) | 111 (29.6) |
| Pill placebo | 5 (4.1) | 5 (12.8) | 4 (0.09) | 2 (5.1) | 0 | 1 (2.6) | 1 (5.3) | 0 | 0 | 0 | 0 | 18 (0.05) |
| Other | 11 (8.9) | 0 | 4 (8.9) | 7 (17.9) | 2 (25.0) | 5 (13.2) | 0 | 1 (9.1) | 2 (9.1) | 0 | 4 (26.7) | 43 (11.5) |
| Country, No. (%) | | | | | | | | | | | | |
| North America | 34 (27.6) | 18 (46.2) | 16 (35.6) | 17 (43.6) | 5 (62.5) | 21 (55.3) | 7 (36.8) | 5 (45.5) | 15 (68.2) | 4 (25.0) | 5 (33.3) | 147 (39.2) |
| Europe | 45 (36.6) | 15 (38.5) | 20 (44.4) | 13 (33.3) | 3 (37.5) | 7 (18.4) | 4 (21.1) | 3 (27.3) | 7 (31.8) | 9 (56.2) | 8 (53.3) | 134 (35.7) |
| Other | 44 (35.8) | 6 (15.4) | 9 (20.0) | 9 (23.1) | 0 | 10 (26.3) | 8 (42.1) | 3 (27.3) | 0 | 3 (18.8) | 2 (13.3) | 94 (25.1) |
| High risk of bias, No. (%) | 64 (52.0) | 25 (64.1) | 29 (64.4) | 13 (33.3) | 5 (62.5) | 23 (60.5) | 17 (89.5) | 8 (72.7) | 13 (59.1) | 4 (25.0) | 9 (60.0) | 210 (56.0) |
| Low risk of bias, No. (%) | 13 (10.6) | 2 (5.1) | 2 (4.4) | 8 (20.5) | 1 (12.5) | 8 (21.2) | 0 | 1 (9.1) | 1 (4.5) | 3 (18.8) | 0 | 39 (10.4) |
| Aggregated characteristics of interventions | | | | | | | | | | | | |
| Format, No. (%) | | | | | | | | | | | | |
| Individual | 57 (40.1) | 19 (48.7) | 16 (28.1) | 19 (48.7) | 10 (90.9) | 32 (78.0) | 9 (40.9) | 5 (38.5) | 2 (7.4) | 16 (94.1) | 12 (80.0) | 197 (46.6) |
| Group | 35 (24.6) | 9 (23.1) | 20 (35.1) | 9 (23.1) | 1 (9.1) | 2 (4.9) | 8 (36.4) | 5 (38.5) | 18 (66.7) | 1 (5.9) | 3 (20.0) | 111 (26.2) |
| Guided self-help | 35 (24.6) | 11 (28.2) | 15 (26.3) | 11 (28.2) | 0 (0.0) | 3 (7.3) | 3 (13.6) | 3 (23.1) | 7 (25.9) | 0 | 0 | 88 (20.8) |
| Other or mixed | 15 (10.6) | 0 | 6 (10.5) | 0 | 0 | 4 (9.8) | 2 (9.1) | 0 | 0 | 0 | 0 | 27 (6.4) |
| No. of sessions, mean (SD) | 10.4 (4.6) | 10.0 (4.2) | 11.4 (4.7) | 10.3 (4.7) | 5.3 (4.4) | 10.9 (4.1) | 12.1 (6.8) | 14.6 (6.9) | 11.6 (3.5) | 17.6 (10.2) | 18.1 (5.7) | 11.3 (5.6) |

Abbreviations: BED, binge eating disorder; BIP, bipolar disorder; BN, bulimia nervosa; GAD, generalized anxiety disorder; MA, meta-analysis; MDD, depressive disorder; OCD, obsessive-compulsive disorder; PAN, panic disorder; PHO, specific phobia; PSY, psychotic disorder; PTSD, posttraumatic stress disorder; SAD, social anxiety disorder.

Figure. Pooled Effect Sizes of Cognitive Behavior Therapy vs Control Conditions Across Mental Disorders in Adults

| Mental disorders | Effectiveness, Hedges *g* (95% CI) |
|---|---|
| Bipolar disorder (depression) | 0.31 (0.15 to 0.47) |
| Bipolar disorder (mania) | 0.32 (0.08 to 0.56) |
| Psychotic disorder | 0.43 (0.22 to 0.63) |
| Depression | 0.84 (0.71 to 0.97) |
| Panic disorder | 0.86 (0.70 to 1.02) |
| Social anxiety disorder | 0.87 (0.71 to 1.03) |
| Binge eating disorder | 0.89 (0.67 to 1.10) |
| Generalized anxiety disorder | 0.93 (0.71 to 1.15) |
| Bulimia nervosa | 0.97 (0.61 to 1.33) |
| Obsessive compulsive disorder | 0.98 (0.81 to 1.16) |
| Specific phobia | 1.17 (0.58 to 1.76) |
| Posttraumatic stress disorder | 1.27 (1.03 to 1.52) |




eAppendix 5, and for each disorder separately in eAppendices 7-16, all in Supplement 1.

## Effects of CBT

The SMDs for CBT compared to all control conditions in the main analyses ranged from 0.31 for BIP (depression) to 1.27 for PTSD, with SMDs lower than 0.5 for BIP and PSY, SMDs higher than 1.00 for PTSD and PHOB, and SMDs between 0.50 and 1 for the other disorders. A plot with all SMDs is presented in the **Figure**, and details of the results are in **Table 2**. All SMDs were significant. Heterogeneity was modest ($I^2$ <50%) for BIP and OCD, high (50%-75%) for PAN, BN, BED and PSY, and very high (>75%) for the other 5 disorders. The NNT for most disorders was between 2.5 and 5 but was notably higher for BIP (8-9) and PSY (16).

eAppendices 7 through 16 in Supplement 1 provide all sensitivity analyses, forest plot, funnel plot, subgroup, and meta-regression analyses for each disorder separately. Table 2 also presents the results after excluding studies with high RoB. In these analyses, SMDs were no longer significant for OCD and BIP. Table 2 also presents the SMDs separately for waitlist and CAU control groups. The SMDs in waitlist-controlled trials were large (all *g*s >0.90), while the SMDs were modest for all anxiety disorders, eating disorders, PTSD, and OCD. The other sensitivity analyses are in eAppendix 17 in Supplement 1.

The Egger test indicated significant asymmetry of the funnel plot for MDD, SAD, GAD, PTSD, BED, and BIP but not for PAN, PHOB, OCD, BN, and PSY (eAppendix 17 in Supplement 1). Adjustment for publication bias through Duval and Tweedie's "trim and fill" procedure resulted in smaller SMDs in all disorders (except for PHOB) and suggested that 20% of studies were missed.

The strength of the evidence was rated according to GRADE as moderate for PAN, OCD, and BN, very low for BIP and MDD, and low for the other disorders (eAppendix 6 in Supplement 1).

## Subgroup and Meta-Regression Analyses

The subgroup and meta-regression analyses for each disorder separately are listed in eAppendices 7 through 16 in Supplement 1, and the meta-regression analyses across all disorders are in **Table 3**. Waitlist control groups resulted in higher SMDs in the overall analyses, as well as in the subgroup and meta-regression analyses for MDD and SAD. Treatment format was also associated with differences in SMDs, with a smaller SMD for individual therapy compared with group therapy in the overall meta-regression analysis. In the subgroup and meta-regression analyses for MDD, it was found that individual and guided self-help formats were less effective than group therapy, and guided self-help was less effective than group therapy in the meta-regression analyses in SAD. The SMDs were larger in countries outside Europe, North America, Australia, and East Asia, but only in the overall meta-regression analyses, in the subgroup analyses for MDD, and in the meta-regression analyses on GAD. For GAD, it was also found that the SMDs were larger in North America compared with Europe. RoB was associated with lower SMDs in some disorders (MDD and BIP) but not in the overall meta-regression analyses. Age was significantly associated with outcome in SAD and year of publication in BED.

## Study Dropout

Study dropout within CBT ranged from 8% for PHOB to 24% for PTSD, with most other disorders showing rates between 13% and 19% (only PTSD, BED, and BIP >20%) (**Table 4**). Dropout in the control conditions ranged from 2% for PHOB to 27% for BIP, while most other disorders had rates between 11% and 17% (only BN >20%). The risk of dropping out from CBT compared to control conditions was significantly higher in PTSD (RR, 1.72; 95% CI, 1.32-2.25) and in BED (RR, 1.90; 95% CI, 1.39-2.60). None of the other RRs were significant.

A meta-regression analysis with all disorders and all predictors showed that the relative risk of dropping out was significantly lower in some disorders (BN, MDD, GAD, OCD, and SAD) compared with others (eAppendix 18 in Supplement 1). The RR of dropping out was significantly lower in waitlist-controlled trials. Guided self-help was associated with higher RR of dropping out.

Table 2. Main Outcomes of Cognitive Behavior Therapy (CBT) for Mental Disorders in Adults

| Outcome | Studies, No. | *g* (95% CI) | *P* value | $I^2$ (95% CI) | 95% PI | NNT |
|---|---|---|---|---|---|---|
| **Main outcomes** | | | | | | |
| Depression | 142 | 0.84 (0.71 to 0.97) | <.001 | 85.00 (82.75 to 86.96) | −0.49 to 2.17 | 3.39 |
| Panic disorder | 39 | 0.86 (0.7 to 1.02) | <.001 | 67.11 (54.1 to 76.43) | 0.06 to 1.66 | 4.04 |
| Social anxiety disorder | 57 | 0.87 (0.71 to 1.03) | <.001 | 75.1 (67.85 to 80.71) | −0.12 to 1.86 | 3.85 |
| Generalized anxiety disorder | 39 | 0.93 (0.71 to 1.15) | <.001 | 79.59 (72.65 to 84.77) | −0.22 to 2.08 | 3.18 |
| Specific phobia | 11 | 1.17 (0.58 to 1.76) | .001 | 88.00 (80.49 to 92.62) | −0.79 to 3.13 | 2.72 |
| Posttraumatic stress disorder | 41 | 1.27 (1.03 to 1.52) | <.001 | 83.95 (79.04 to 87.71) | −0.17 to 2.72 | 2.52 |
| Obsessive compulsive disorder | 22 | 0.98 (0.81 to 1.16) | <.001 | 44.27 (7.84 to 66.3) | 0.39 to 1.57 | 4.91 |
| Bulimia nervosa | 13 | 0.97 (0.61 to 1.33) | <.001 | 66.08 (39.05 to 81.12) | −0.13 to 2.08 | 3.59 |
| Binge eating disorder | 27 | 0.89 (0.67 to 1.1) | <.001 | 74.99 (63.68 to 82.78) | −0.08 to 1.85 | 3.88 |
| Psychotic disorder | 17 | 0.43 (0.22 to 0.63) | <.001 | 61.11 (34.03 to 77.07) | −0.23 to 1.09 | 16.14 |
| Bipolar disorder (depression) | 15 | 0.31 (0.15 to 0.47) | .001 | 30.59 (0 to 62.64) | −0.1 to 0.72 | 8.87 |
| Bipolar disorder (mania) | 13 | 0.32 (0.08 to 0.56) | .01 | 47.78 (0.76 to 72.52) | −0.25 to 0.9 | 8.42 |
| **High risk of bias excluded** | | | | | | |
| Depression | 67 | 0.74 (0.57 to 0.91) | <.001 | 83.70 (79.96 to 86.80) | −0.49 to 1.96 | 3.94 |
| Panic disorder | 14 | 0.71 (0.43 to 1.00) | <.001 | 71.96 (51.96 to 83.63) | −0.24 to 1.66 | 5.17 |
| Social anxiety disorder | 20 | 1.02 (0.79 to 1.25) | <.001 | 70.30 (53.13 to 81.14) | 0.17 to 1.88 | 3.13 |
| Generalized anxiety disorder | 26 | 0.97 (0.72 to 1.21) | <.001 | 81.40 (73.52 to 86.88) | −0.11 to 2.04 | 3.04 |
| Specific phobia | 3 | 1.25 (−1.2 to 3.69) | <.001 | 88.10 (66.79 to 95.73) | −12.52 to 15.01 | 1.47 |
| Posttraumatic stress disorder | 16 | 1.34 (0.86 to 1.81) | <.001 | 88.30 (82.69 to 92.15) | −0.53 to 3.20 | 2.37 |
| Obsessive compulsive disorder | 2 | 0.77 (−0.64 to 2.17) | .09 | 0 (-) | - | 7.15 |
| Bulimia nervosa | 3 | 1.08 (0.25 to 1.91) | .03 | 51.90 (0 to 86.10) | −2.99 to 5.14 | 3.14 |
| Binge eating disorder | 9 | 0.90 (0.45 to 1.35) | .002 | 80.70 (64.25 to 89.58) | −0.41 to 2.21 | 3.81 |
| Psychotic disorder | 13 | 0.30 (0.12 to 0.49) | .004 | 42.20 (0 to 69.87) | −0.14 to 0.74 | 25.00 |
| Bipolar disorder (depression) | 6 | 0.14 (−0.09 to 0.38) | .18 | 39.03 (0 to 75.79) | −0.06 to 0.35 | 19.72 |
| Bipolar disorder (mania) | 6 | 0.13 (−0.09 to 0.35) | 0.20 | 26.43 (0 to 69.36) | −0.08 to 0.34 | 21.77 |
| **CBT compared with waiting list**[a] | | | | | | |
| Depression | 63 | 1.00 (0.82 to 1.19) | <.001 | 75.8 (69.1 to 80.9) | −0.22 to 2.23 | 2.78 |
| Panic disorder | 28 | 1.00 (0.82 to 1.18) | <.001 | 63.7 (45.6 to 75.8) | 0.24 to 1.77 | 3.33 |
| Social anxiety disorder | 49 | 0.95 (0.78 to 1.11) | <.001 | 70.2 (60.2 to 77.7) | 0.04 to 1.85 | 2.91 |
| Generalized anxiety disorder | 30 | 1.02 (0.77 to 1.28) | <.001 | 75.1 (64.5 to 82.5) | −0.14 to 2.19 | 2.86 |
| Specific phobia | 7 | 1.01 (0.04 to 1.98) | .04 | 91.28 (84.61 to 95.06) | −1.76 to 3.78 | 2.76 |
| Posttraumatic stress disorder | 30 | 1.19 (0.95 to 1.42) | <.001 | 76.9 (67.3 to 83.7) | 0.09 to 2.28 | 2.75 |
| Obsessive compulsive disorder | 16 | 0.98 (0.79 to 1.16) | <.001 | 28 (0 to 60.6) | 0.54 to 1.41 | 2.82 |
| Bulimia nervosa | 12 | 1.07 (0.75 to 1.38) | <.001 | 47 (0 to 72.8) | 0.30 to 1.83 | 3.16 |
| Binge eating disorder | 23 | 0.94 (0.71 to 1.18) | <.001 | 75.4 (63.1 to 83.5) | −0.02 to 1.91 | 3.61 |
| **CBT compared with CAU**[b] | | | | | | |
| Depression | 62 | 0.69 (0.51 to 0.86) | <.001 | 87.9 (85.2 to 90.1) | −0.55 to 1.91 | 4.25 |
| Panic disorder | 6 | 0.56 (0.13 to 0.98) | .02 | 57.5 (0 to 82.8) | −0.45 to 1.56 | 7.02 |
| Generalized anxiety disorder | 7 | 0.50 (0 to 0.99) | .049 | 77.16 (52.32 to 89.06) | −0.80 to 1.8 | 6.17 |
| Posttraumatic stress disorder | 5 | 1.13 (0.07 to 2.18) | .04 | 80.0 (52.8 to 91.5) | −1.49 to 3.74 | 2.94 |
| Psychotic disorder | 15 | 0.44 (0.21 to 0.68) | .001 | 65.8 (41 to 80.2) | −0.31 to 1.19 | 15.59 |
| Bipolar disorder (depression) | 10 | 0.37 (0.13 to 0.6) | .006 | 43.5 (0 to 72.9) | −0.23 to 0.96 | 7.37 |
| Bipolar disorder (mania) | 10 | 0.22 (0.02 to 0.42) | .04 | 19.6 (0 to 60.2) | −0.16 to 0.60 | 12.59 |

Abbreviations: CAU, care as usual; NNT, number needed to treat; PI, prediction intervals.

[a] For psychotic disorders, only 2 studies comparing CBT with waiting list were available, and for bipolar disorders, only 1 study; these disorders are therefore not included in this part of the Table.

[b] For social anxiety disorder and obsessive-compulsive disorder, only 3 studies comparing CBT with CAU were available; for binge eating disorder, only 2 studies; for specific phobias, only 1 study; and for bulimia, 0 studies. These disorders are therefore not included in this part of the Table.

## Discussion

A uniform series of meta-analyses of trials comparing CBT to control conditions in 11 mental disorders showed that SMDs were small for BIP and PSY, large for PTSD and PHOB, and in between (SMDs between 0.5 and 1) for all other disorders. Although these findings confirm that CBT is effective in treating mental disorders, caution is needed because of considerable risk of bias, high levels of heterogeneity, and potential publication bias in several disorders. Although the largest umbrella review up to now found an overall SMD of 0.34 for psychological treatments and 0.36 for pharmacological treatments across mental disorders,[5] this study found substantially larger effects for CBT.

CBT effect sizes varied by type of control group. Trials with waitlist control groups result in larger SMDs than those using CAU, which is in line with previous research.[29-31] This is important because in most disorders (all anxiety disorders, eating disorders, PTSD, and OCD), most trials used waitlist controls, while in other disorders (bipolar and psychotic disorders), mainly CAU control groups were used, potentially leading to an overestimation of SMDs for some disorders. Furthermore, CAU in some disorders allowed medications in all patients, while this was not the case for other disorders, meaning that CAU conditions were also highly heterogeneous. In the multivariate metaregression analysis across all disorders in which we adjusted for the control condition, we did not find that SMDs were smaller for PSY and BIP compared to other disorders. We also found that waitlists had lower dropout rates compared to CAU, and that the relative risk of dropping out from CBT compared to controls was lower in waitlist-controlled trials. This may be one of the explanations for the larger SMDs in these trials.

The overall dropout rate from CBT ranged from 8% to 24%. The RR of dropping out from CBT compared to controls was significantly increased in PTSD and BED, but not in other disorders. However, in the multivariate metaregression analyses, we found that the relative risk of dropping out was significantly lower in BIP, BN, MDD, GAD, OCD, and SAD. We also found that the relative risk of dropping out was higher in trials examining guided self-help compared to trials examining other formats, which is line with other research.[32,33] It is important to examine the reasons for dropping out more extensively in future research.

The number of trials differed considerably between disorders, with hardly any research on anorexia and more than 120 studies for depression. One can wonder whether, at some point, there is enough research comparing specific therapies to control groups to step away from such trials, which would allow for the examination of other research questions that are relevant to improve outcomes.

Table 3. Meta-Regression Analysis Across All Disorders

| Predictor or category | Coeff (SE) | *P* value |
|---|---|---|
| Disorder | | |
| Binge eating | Ref | NA |
| Bipolar | −0.25 (0.24) | .31 |
| Bulimia | −0.04 (0.23) | .87 |
| MDD | −0.08 (0.16) | .63 |
| GAD | 0.05 (0.18) | .79 |
| OCD | −0.10 (0.21) | .65 |
| Panic | 0.00 (0.18) | .98 |
| Phobia | 0.56 (0.26) | .03[a] |
| Psychosis | −0.28 (0.25) | .27 |
| PTSD | 0.05 (0.21) | .79 |
| SAD | −0.06 (0.18) | .73 |
| Age, mean (SD) | −0.01 (0.00) | .10 |
| Proportion women | 0.04 (0.21) | .86 |
| Adults vs specific group | −0.33 (0.11) | .003[a] |
| Recruitment | | |
| Clinical | Ref | NA |
| Community | −0.17 (0.09) | .07 |
| Other | −0.16 (0.13) | .20 |
| Control | | |
| CAU | Ref | NA |
| Other | 0.17 (0.12) | .15 |
| Waiting list | 0.49 (0.09) | <.001[a] |
| Country | | |
| Australia | Ref | NA |
| East Asia | 0.14 (0.16) | .41 |
| Europe | −0.14 (0.12) | .24 |
| North America | −0.11 (0.12) | 034 |
| Other | 0.37 (0.17) | .02[a] |
| RoB | | |
| High | Ref | NA |
| Low | −0.08 (0.11) | .47 |
| Some concerns | 0.05 (0.08) | .53 |
| Format | | |
| Group | Ref | NA |
| GSH | −0.19 (0.11) | .07 |
| Individual | −0.18 (0.09) | .03[a] |
| Other | −0.15 (0.14) | .31 |
| No. of sessions | 0.00 (0.01) | .82 |

Abbreviations: CAU, care as usual; coeff, coefficient; GAD, generalized anxiety disorder; GSH, guided self-help; NA, not applicable; OCD, obsessive-compulsive disorder; PTSD, posttraumatic stress disorder; Ref, reference; MDD, major depressive disorder; RoB, risk of bias.

[a] Significant outcome.

### Strengths and Limitations

This study has several strengths: it is the largest meta-analytic study of CBT to date, covering 11 major mental disorders and including only patients with a diagnosed mental disorder. Additionally, it analyzes trial characteristics associated with outcomes across all disorders. However, the study also has limitations. First, the quality of many included trials was suboptimal, heterogeneity was high, and publication bias was found for several disorders. Second, because of the size of the study, we focused on outcomes at posttreatment and were unable to examine longer-term effects. We also were not

Table 4. Dropout in Trials on Cognitive Behavior Therapy (CBT) for Mental Disorders in Adults

| Mental disorder | Studies, No. | Dropout (95% CI) | $I^2$ (95% CI) |
|---|---|---|---|
| **Dropout rate in CBT** | | | |
| Depression | 123 | 0.16 (0.14-0.19) | 82 (78-84) |
| Panic disorder | 36 | 0.17 (0.13-0.22) | 72 (60-80) |
| Social anxiety disorder | 51 | 0.19 (0.16-0.22) | 67 (56-76) |
| Generalized anxiety disorder | 38 | 0.14 (0.11-0.17) | 43 (17-62) |
| Specific phobia | 11 | 0.08 (0.04-0.14) | 7 (0-63) |
| Posttraumatic stress disorder | 36 | 0.24 (0.18-0.31) | 78 (70-84) |
| Obsessive compulsive disorder | 17 | 0.13 (0.09-0.19) | 53 (19-73) |
| Bulimia nervosa | 13 | 0.19 (0.13-0.27) | 44 (0-71) |
| Binge eating disorder | 21 | 0.21 (0.16-0.26) | 59 (33-74) |
| Psychotic disorder | 16 | 0.14 (0.11-0.18) | 45 (2-70) |
| Bipolar disorder | 15 | 0.22 (0.16-0.29) | 61 (32-78) |
| **Dropout rate in controls** | | | |
| Depression | 108 | 0.16 (0.13-0.19) | 81 (77-84) |
| Panic disorder | 36 | 0.13 (0.09-0.18) | 62 (46-74) |
| Social anxiety disorder | 41 | 0.14 (0.10-0.19) | 78 (71-84) |
| Generalized anxiety disorder | 38 | 0.12 (0.09-0.16) | 47 (23-64) |
| Specific phobia | 8 | 0.02 (0.01-0.06) | 0 (0-67) |
| Posttraumatic stress disorder | 34 | 0.14 (0.10-0.19) | 70 (57-79) |
| Obsessive compulsive disorder | 14 | 0.11 (0.06-0.19) | 73 (55-84) |
| Bulimia nervosa | 11 | 0.24 (0.18-0.31) | 33 (0-67) |
| Binge eating disorder | 21 | 0.11 (0.07-0.15) | 51 (20-71) |
| Psychotic disorder | 15 | 0.17 (0.12-0.23) | 66 (42-80) |
| Bipolar disorder | 15 | 0.27 (0.20-0.35) | 66 (41-80) |
| **Mental disorder** | **Studies, No.** | **RR (95% CI)** | **$I^2$ (95% CI)** |
| **RR of dropout** | | | |
| Depression | 123 | 1.05 (0.94-1.18) | 18 (0-35) |
| Panic disorder | 36 | 1.22 (0.96-1.56) | 0 (0-38) |
| Social anxiety disorder | 51 | 1.08 (0.91-1.29) | 7 (0-33) |
| Generalized anxiety disorder | 38 | 1.12 (0.86-1.47) | 21 (0-47) |
| Specific phobia | 11 | 1.83 (0.75-4.49) | 0 (0-60) |
| Posttraumatic stress disorder | 36 | 1.72 (1.32-2.25)[a] | 36 (4-57) |
| Obsessive compulsive disorder | 17 | 0.95 (0.52-1.75) | 0 (0-51) |
| Bulimia nervosa | 13 | 0.75 (0.42-1.34) | 37 (0-67) |
| Binge eating disorder | 21 | 1.90 (1.39-2.60)[a] | 0 (0-47) |
| Psychotic disorder | 16 | 0.80 (0.54-1.19) | 56 (22-75) |
| Bipolar disorder | 15 | 0.84 (0.68-1.04) | 0 (0-54) |

Abbreviation: RR, relative risk.

[a] Significant outcome.

able to differentiate between types of CAU, which may vary considerably within and between disorders. Third, although we included 11 major mental disorders, we were unable to include all disorders. Fourth, we used a broad definition of CBT and included all interventions in which cognitive restructuring was a core component and excluded trials with only behavioral approaches. However, this means that CBT could vary considerably across disorders and within disorders. Fifth, the searches we conducted were done independently for each disorder, and that may have resulted in differences in inclusions across disorders. Because of these limitations, the results of this study should be interpreted with caution.

## Conclusions

Despite these limitations, we can conclude that CBT is probably effective in the treatment of mental disorders, including MDD, anxiety disorders, PTSD, OCD, and eating disorders, and is possibly effective in PSY and BIP.

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