



## A Study on the Impact of Cognitive Behavioral Therapy on Psychological Disorders: A Meta-Analysis Based on 32 Experimental Studies

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### **Abstract**

**Objective:** Cognitive behavioral therapy is one of the most mainstream psychological intervention methods at present. However, there are few studies on the differences in the effectiveness of cognitive behavioral therapy for different psychological disorders, as well as the differences between the effectiveness of online and offline cognitive behavioral therapy. **Method:** This paper makes a systematic quantitative analysis of 32 CBT experimental studies by using the meta-analysis method. **Results:** The results showed that the combined effect size of the random effects model was 0.373. **Conclusions:** The statistically significant level, indicating that cognitive behavioral therapy had a moderate positive effect on psychological disorders. There is no significant difference in the effect of cognitive behavioral therapy on different psychological disorders. Online CBT was less effective than offline CBT for anxiety disorders, and there was no significant difference in the effectiveness of online and offline CBT interventions for other psychological disorders. Therefore, CBT can be an effective option to intervene in psychological disorders such as anxiety and depression.

**Keywords:** *Cognitive-Behavioral Therapy (CBT) Meta-Analysis Psychological Disorders*

### **Introduction**

Cognitive-behavioral therapy (CBT) is a specialized psychological intervention that combines cognitive therapy and behavior therapy. It aims to alleviate negative emotions by gradually transforming irrational beliefs and behaviors, thereby improving patients' emotional well-being. CBT emphasizes increasing the flexibility of thinking processes and behaviors to better cope with challenges. Over the years, CBT has been problem-oriented, offering personalized interventions for various emotional issues and behavioral disorders such as cognitive restructuring, exposure therapy, and daily relaxation activities. Research has found that CBT has significant therapeutic effects on a variety of anxiety and depressive symptoms, especially for anxiety disorders, with an overall effect size of 0.25 according to a meta-

analysis (Roshanaei-Moghaddam et al., 2011). The overall treatment response rate for anxiety disorders averages at 49.5% post-treatment and 53.6% at follow-up (Loerinc et al., 2015). Regarding depression, a meta-analysis indicates an average effect size of 0.28 (Keles & Idsoe, 2018). Additionally, CBT has shown some intervention effects on attention deficit hyperactivity disorder (ADHD). Over ten randomized controlled trials (RCTs) and one meta-analysis have demonstrated that group or individual CBT can reduce core ADHD symptoms and comorbidities, such as emotional dysregulation, anxiety, and depression, while also improving functional impairments in various areas of daily life for adults with ADHD (Jensen, Amdisen, Rgensen, & Arnfred, 2016). In terms of reducing anger outbursts and recidivism among adult males, CBT-based treatments effectively reduce the risk of reoffending, particularly in cases of violent recidivism, with an overall impact of 0.72, indicating a risk reduction of 28% (Henwood et al., 2015). Furthermore, for individuals with morbid obesity, a study demonstrated that after receiving CBT-OB treatment for 12 months, the average weight loss was 15%, with no trend of weight regain observed between 6 to 12 months (Dalle Grave et al., 2020). These findings underscore the significant intervention effects of CBT on various emotional disorders.

However, it is essential to determine which psychological disorders respond more significantly to CBT, whether CBT can be used as a standalone treatment without relying on medication, and which psychological disorders are unsuitable for CBT. To address these questions, this study employs a meta-analysis approach to systematically and quantitatively analyze existing research. The aim is to explore the impact of cognitive-behavioral therapy on psychological disorders, examine the differential efficacy across different disorders, and provide insights into which disorders are better suited for CBT.

In addition, after the outbreak of the epidemic, the frequency of online CBT has increased more, and its development has received increasing attention. At present, most meta-analysis studies on psychological disorders such as anxiety and depression believe that remote CBT (R-CBT) has significant therapeutic benefits (Basile et al., 2022; Efron & Wootton, 2021; Winter et al., 2023), but few studies have compared the effectiveness of online and offline CBT. Only one meta-analysis of the effects of phone-based or cell-phone CBT (T-CBT) on multiple psychological outcomes (Altieri et al., 2023) collected studies within 2.5 years of the epidemic and reported some significant results. However, the study did not verify the effectiveness of R-CBT other than T-CBT. Therefore, in order to better investigate the differences in the efficacy of R-CBT and face-to-face CBT for different psychological disorders with the exception of T-CBT, we conducted a meta-analysis of the post-pandemic literature, that is, from 2020 to 2023.

The findings of this study intend to contribute to the current application and further development of cognitive-behavioral therapy by offering valuable references.

### ***Research Methodology and Process***

Meta-analysis is a statistical method of systematically integrating and analyzing previous studies by British educational psychologist Gene V. Glass (Jie, 2013). For the same research topic, differences in conclusions often arise due to factors such as research subjects, funding, environmental influences, and researchers themselves. Traditional descriptive literature reviews mostly describe without evaluation, making it impossible to quantitatively analyze these research findings (Zhiming & Zekui, 2010). Meta-analysis fills this gap by quantitatively synthesizing multiple studies with the same research topic. The basic process involves formulating research questions, comprehensively searching relevant literature, establishing strict inclusion and exclusion criteria, describing basic information, and conducting quantitative statistical analysis. Given the abundance of empirical research on the psychological effects of cognitive behavioral therapy (CBT) and the diversity of conclusions, this study uses meta-analysis to quantitatively synthesize these studies.

### ***Literature Search and Selection***

In this study, we conducted a precise search using Web of Science to retrieve relevant literature. The search was focused on the keywords "CBT" or "cognitive behavior therapy" and "RCT" or "randomized control trial." The search was limited to the timeframe from 2020 to 2023, resulting in a total of 53 articles.

Since not all retrieved articles met the inclusion criteria, a screening process was performed. The following criteria were applied to select the articles: (1) the study had to be an experimental research; review articles and theoretical articles were excluded, (2) the study investigated the therapeutic effects of cognitive-behavioral therapy on psychological disorders, so the articles should report intervention effect measures (scores on psychological disorder-related scales); articles without intervention effects were excluded, (3) the study aimed to compare the effects of cognitive-behavioral therapy with other interventions on psychological disorders, thus the articles should have both an experimental group and a control group; articles without a control group were excluded, (4) the articles provided sufficient data to calculate the effect sizes. Articles without calculable effect sizes were excluded. The following conditions were considered sufficient for effect size calculation: (a) means (Mean), standard deviations (SD), and sample sizes (N) for the experimental group and control group, (b) means (Mean), t-values, and sample sizes (N) for the experimental group and control group, (c) means (Mean), p-values, and sample sizes (N) for the experimental group and control group, (d) difference in means (Difference in means), common standard deviation (Common SD), and sample sizes (N) for the experimental group and control group, (e) standardized mean differences and sample sizes (N), (f) Hedges' g, sample sizes (N), and 95% confidence intervals, (g) Cohen's d, sample sizes (N), and 95% confidence intervals, (h) Cohen's d, variance, sample sizes (N). (5) Duplicate articles were excluded. If the same article was published in different journals or in different forms, only one version was included. After the screening process, a total of 32 articles that met the criteria were included.

### **Literature Coding**

After the literature search and selection process, the relevant articles were coded to facilitate subsequent analysis, statistical calculations, and effect size computation. The following characteristics were recorded for each included article: title, authors, year, journal, sample size, type of psychological disorder, type of control group, type of effect size, and effect size value. The coded information for the included articles is presented in Table 1.

Table 1. Document coding information

Number	Article Title	Publication Year	Source Title	Type of mental disorder (1)	Type of mental disorder (2)	Type of mental disorder (3)	Way	N
3	Online Education and Cognitive Behavior Therapy Improve Dementia-Caregivers' Mental Health: A Randomized Trial	2021	JOURNAL OF THE AMERICAN MEDICAL DIRECTORS ASSOCIATION	depression	anxiety		on line	107
4	One year follow-up and mediation in cognitive behavioral therapy and acceptance and commitment therapy for adult depression	2021	BMC PSYCHIATRY	depression			off line	82
6	The role of emotion dysregulation in cognitive behavioural group therapy for perinatal anxiety: Results from a randomized controlled trial and routine clinical care	2021	JOURNAL OF AFFECTIVE DISORDERS			other	off line	75
8	Internet-based CBT for adolescents with low self-esteem: a pilot randomized controlled trial	2022	COGNITIVE BEHAVIOUR THERAPY	depression	anxiety		on line	52
11	Culturally adapted trauma-focused CBT-based guided self-help (CacBT GSH) for female victims of domestic violence in Pakistan: feasibility randomized-controlled trial	2021	BEHAVIOURAL AND COGNITIVE PSYCHOTHERAPY	depression	anxiety		off line	50
13	A Pilot Randomized Controlled Trial (RCT) of Acceptance and Commitment Therapy Versus Cognitive Behavioral Therapy for Chronic Insomnia	2023	BEHAVIORAL SLEEP MEDICINE			other	off line	35
14	Exposure-Focused CBT Outperforms Relaxation-Based Control in an RCT of Treatment for Child and Adolescent Anxiety	2022	JOURNAL OF CLINICAL CHILD AND ADOLESCENT PSYCHOLOGY		anxiety		off line	102
15	Efficacy of Web-Based, Guided Self-help Cognitive Behavioral Therapy-Enhanced for Binge Eating Disorder: Randomized Controlled Trial	2021	JOURNAL OF MEDICAL INTERNET RESEARCH			other	on line	160
18	Results of the Optimum trial: A randomized controlled trial evaluating a novel internet intervention for breast cancer survivors	2021	PLOS ONE	depression	anxiety	other	on line	306
19	Adolescent Health Promotion Interventions Using Well-Care Visits and a Smartphone Cognitive Behavioral Therapy App: Randomized Controlled Trial	2022	JMIR MHEALTH AND UHEALTH	depression			on line	132
23	Changes in symptoms of anxiety, depression, and PTSD in an RCT-study of dentist-administered treatment of dental anxiety	2023	BMC ORAL HEALTH	depression	anxiety	other	off line	96
24	Immediate Effects of Mobile Phone App for Depressed Mood in Young Adults with Subthreshold Depression: A Pilot Randomized Controlled Trial	2023	NEUROPSYCHIATRIC DISEASE AND TREATMENT	depression			on line	32
27	Effects of Cognitive Behavioral Therapy and Cash Transfers on Older Persons Living Alone in India: A Randomized Trial	2023	ANNALS OF INTERNAL MEDICINE	depression			on line	753
28	Internet-based treatment for depressive symptoms in hemodialysis patients: A cluster randomized controlled trial	2022	GENERAL HOSPITAL PSYCHIATRY	depression	anxiety		on line	155
29	Mindfulness-Based Cognitive Therapy as Migraine Intervention: a Randomized Waitlist Controlled Trial	2022	INTERNATIONAL JOURNAL OF BEHAVIORAL MEDICINE	depression	anxiety	other	off line	48
30	Internet-Delivered Cognitive Behavioral Therapy for Insomnia Comorbid With Chronic Pain: Randomized Controlled Trial	2022	JOURNAL OF MEDICAL INTERNET RESEARCH	depression	anxiety	other	on line	47
31	Reward retraining: A pilot randomized controlled trial of a novel treatment approach for transdiagnostic binge eating	2023	INTERNATIONAL JOURNAL OF EATING DISORDERS			other	on line	59
32	Dentist-administered cognitive behavioural therapy versus four tablets/midazolam: An RCT study of dental anxiety treatment in primary dental care	2021	EUROPEAN JOURNAL OF ORAL SCIENCES		anxiety		off line	77
33	Effect of internet-based cognitive behaviour therapy among women with negative birth experiences on mental health and quality of life: a randomized controlled trial	2022	BMC PREGNANCY AND CHILDBIRTH			other	on line	131
35	Efficacy of metacognitive training for depression as add-on intervention for patients with depression in acute intensive psychiatric inpatient care: A randomized controlled trial	2022	CLINICAL PSYCHOLOGY & PSYCHOTHERAPY			other	off line	57
36	The effect of sleep-wake intraday variability in digital cognitive behavioral therapy for insomnia: a mediation analysis of a large-scale RCT	2021	SLEEP			other	off line	822
37	Treating Young Adult Depression With Text-Delivered Cognitive Behavioral Therapy: A Pilot Randomized Clinical Trial	2023	BEHAVIOR THERAPY	depression			on line	102
38	Evaluation of the effect of a midwife-led online program using cognitive behavioral therapy for pregnant women at risk for anxiety disorder in Japan: A pilot randomized controlled trial	2023	PLOS ONE		anxiety		on line	61
39	A Randomized Controlled Trial Examining CBT for College Students With ADHD	2021	JOURNAL OF CONSULTING AND CLINICAL PSYCHOLOGY			other	off line	197
40	The efficacy of the internet-based stress recovery intervention FOREST for nurses amid the COVID-19 pandemic: A randomized controlled trial	2023	INTERNATIONAL JOURNAL OF NURSING STUDIES	depression	anxiety	other	on line	120
41	How does early symptom change predict subsequent course of depressive symptoms during psychotherapy?	2022	PSYCHOLOGY AND PSYCHOTHERAPY-THEORY RESEARCH AND PRACTICE	depression			off line	138
44	A pilot randomized trial of CBT4CBT for women in residential treatment for substance use disorders	2022	JOURNAL OF SUBSTANCE ABUSE TREATMENT			other	off line	44
46	Behavioral and Cognitive Outcomes of an Online Weight Loss Program for Men With Low Mood: A Randomized Controlled Trial	2022	ANNALS OF BEHAVIORAL MEDICINE			other	on line	98
48	Effects of internet-delivered eating disorder prevention on reward-based eating drive: A randomized controlled trial	2021	EATING BEHAVIORS			other	on line	113
49	The efficacy of an internet-based cognitive behavioral program added to treatment-as-usual for alcohol-dependent patients in primary care: a randomized controlled trial	2023	ADDICTION	depression	anxiety	other	on line	234
50	Effects of a minimal-guided on-line intervention for alcohol misuse in Estonia: a randomized controlled trial	2022	ADDICTION			other	on line	589
52	Social recovery therapy for young people with emerging severe mental illness: the Prodigy RCT	2021	HEALTH TECHNOLOGY ASSESSMENT	depression	anxiety		off line	270

### Computation of Effect Sizes

Effect size is a measure of the strength of the experimental effect or the strength of the association between variables, which is not influenced by sample size (or has minimal influence) (Haoming, Zhonglin & Yian, 2011). Each study can yield one or more independent effect sizes. In the field of medicine, commonly used effect sizes for research include RD (risk difference), OR (odds ratio), RR (relative risk), RRR (relative risk reduction), ARR (absolute risk reduction), NNT (number needed to

treat). In psychology, effect sizes can be classified into three categories based on their statistical meaning: difference class, correlation class, and group overlap class. Among them, difference class effect sizes are generally used in experimental studies to compare means between two or more groups, including Cohen's *d*, Glass', and Hedges's *g*.

In cases where the sample size is large, Cohen's *d*, Glass', and Hedges's *g* values are almost indistinguishable. However, for small sample studies, Cohen's *d* may severely overestimate the effect size (Haoming, Zhonglin & Yian, 2011). Thus, Hedges et al. proposed correcting the *d* value by multiplying it with a correction factor (*J*), resulting in Hedges's *g* value (Hedges, 1981). Due to the small sample size and number of studies in this research, Hedges's *g* (referred to as *g* hereafter) will be used as the final effect size.

The computation of the effect size *g* follows the following steps: First, calculate the standardized mean difference (*d*), then multiply it by the correction factor (*J*). The formulas for calculation are as follows:

$$g = d * J \quad (1)$$

$$d = (M1 - M2) / S \quad (2)$$

In formula (2), *M1* represents the mean of the experimental group (cognitive-behavioral therapy), *M2* represents the mean of the control group (traditional therapy), and *S* represents the pooled standard deviation.

$$S = \sqrt{\frac{(n1-1)S1^2 + (n2-1)S2^2}{(n1+n2-1)}} \quad (3)$$

In formula (3), *n1* represents the sample size of the experimental group, *n2* represents the sample size of the control group, *S1* represents the standard deviation of the experimental group, *S2* represents the standard deviation of the control group, and *S* represents the pooled standard deviation.

$$J = 1 - 3 / (4df - 1) \quad (4)$$

$$df = n1 + n2 - 2 \quad (5)$$

In formula (4), *J* represents the correction factor, and *df* represents the degrees of freedom.

The effect size computation in this study was conducted using Comprehensive Meta-Analysis 2.0 software.

## Results Analysis and Discussion

### Overall Impact of CBT on Psychological Disorders

This study conducted a meta-analysis of 32 articles on the overall impact of cognitive-behavioral therapy (CBT) on psychological disorders. A total of 52 effect sizes were obtained, with 22 from blank controls and 30 from experimental controls. Table 2 displays the effect sizes for each sample. According to the statistical principles of meta-analysis, only data with good homogeneity can be merged. Therefore, it is necessary to test the heterogeneity of multiple study results in order to select an appropriate effect model based on the results of the heterogeneity analysis. When there is significant heterogeneity among



studies, a random effects model is used for analysis; when there is low heterogeneity among studies, a fixed effects model is used for analysis. The commonly used methods for heterogeneity testing are Q test and I<sup>2</sup> test. The significance level for the Q test is usually set at α = 0.10, and when p < 0.10, there is heterogeneity among the studies. The calculation formula for the Q statistic is as follows:

$$Q = \sum_{i=1}^n \left( \frac{\theta_i - \bar{\theta}}{se_i} \right)^2 \quad (6)$$

In equation (6), g<sub>i</sub> represents the effect size (g value) of the i<sup>th</sup> study (in this study), g represents the average effect size of all studies, and se<sub>i</sub> represents the standard error of the i<sup>th</sup> study. The I<sup>2</sup> statistic reflects the proportion of heterogeneity in the total variation of effect sizes, and its value ranges from 0 to 100. The larger the I<sup>2</sup> value, the greater the heterogeneity. When 0 < I<sup>2</sup> < 40, there is low heterogeneity; when 40 < I<sup>2</sup> < 60, there is moderate heterogeneity; when 60 < I<sup>2</sup> < 75, there is substantial heterogeneity; when 75 < I<sup>2</sup> < 100, there is considerable heterogeneity. The calculation formula for I<sup>2</sup> is as follows:

$$I^2 = \frac{Q - (K - 1)}{Q} \times 100\% \quad (7)$$

In equation (7), Q is the chi-square value of the heterogeneity test, and K is the number of studies included in the meta-analysis. Table 3 presents the combined effect sizes for each study. The results of the heterogeneity test show that Q = 99.812, P = 0.000 < 0.10, and I<sup>2</sup> = 48.904, indicating a moderate heterogeneity among the samples. Therefore, a random effects model should be used for the analysis. From the random effects model in Table 3, it can be observed that the combined effect size for the CBT group is 0.374, which is statistically significant (P < 0.001). This indicates that the CBT group has a positive and significant impact on improving psychological disorders in patients. According to Cohen's standards for effect sizes, when ES < 0.2, it is considered a small effect; when 0.2 < ES < 0.8, it is considered a moderate effect; when ES > 0.8, it is considered a large effect (Cohen, 1969). Therefore, it can be concluded that CBT has a moderate positive impact on the improvement of psychological disorders in patients.

Table 3. Effects of cognitive behavioral therapy on psychological disorders

all	data size	sample size	combined effect size	95% confidence		asymptotics		heterogeneity test			
				upper limit	lower limit	Z value	P value	Q	df	P	I <sup>2</sup>
fixed effects model	52	8460	0.388	0.344	0.432	17.151	0.000	99.812	51.000	0.000	48.904
random effects model	52	8460	0.374	0.305	0.444	10.557	0.000				
control	data size	sample size	combined effect size	95% confidence		asymptotics		heterogeneity test			
				upper limit	lower limit	Z value	P value	Q	df	P	I <sup>2</sup>
fixed effects model	23	3817	0.460	0.397	0.523	14.373	0.000	49.082	22.000	0.001	55.177
random effects model	23	3817	0.482	0.375	0.588	8.862	0.000				
treatment	data size	sample size	combined effect size	95% confidence		asymptotics		heterogeneity test			
				upper limit	lower limit	Z value	P value	Q	df	P	I <sup>2</sup>
fixed effects model	29	4644	0.482	0.253	0.379	9.884	0.000	40.590	28.000	0.059	31.018
random effects model	29	4644	0.288	0.205	0.372	6.790	0.000				

Table 2. Results of meta-analysis of original literature

number	group	author	n	Hedges's g	standard error	residual error	95%confidence interval		Z value	P value
							upper limit	lower limit		
3	Anxiety treatment group	Fossey, Jane	107	0.239	0.194	0.038	-0.142	0.619	1.230	0.219
3	Depression treatment group	Fossey, Jane	107	0.569	0.197	0.039	0.183	0.856	2.885	0.004
4	Depression treatment group	A-Tiak, Jacqueline G. L.	82	0.794	0.223	0.050	-0.143	0.730	1.320	0.187
6	Other control group	Aqako, Arela	75	0.596	0.237	0.056	0.132	1.058	2.520	0.012
8	Anxiety control group	Berg, Matilda	52	0.614	0.284	0.081	-0.058	1.171	2.164	0.030
8	Depression control group	Berg, Matilda	52	0.688	0.285	0.081	-0.129	1.248	2.412	0.016
11	Anxiety control group	Latif, Maderaha	50	0.891	0.300	0.090	-0.404	1.579	3.308	0.001
11	Depression control group	Latif, Maderaha	50	0.891	0.300	0.090	-0.404	1.579	3.308	0.001
13	Other treatment group	El Refhi-Ferreira	35	0.285	0.340	0.116	-0.382	0.851	0.837	0.403
14	Anxiety treatment group	Bitek, Emily	102	0.776	0.216	0.047	0.353	1.188	3.594	0.000
15	Other control group	Melissae, Bernou	160	0.971	0.168	0.028	0.642	1.300	5.781	0.000
18	Anxiety control group	Holdirik, Franziska	306	0.080	0.104	0.011	-0.114	0.294	0.864	0.388
18	Other control group	Holdirik, Franziska	306	0.230	0.107	0.011	0.021	0.439	2.155	0.031
18	Depression treatment group	Holdirik, Franziska	306	0.292	0.104	0.011	0.086	0.494	2.784	0.005
19	Depression treatment group	Nagamitsu, Shinichiro	132	0.138	0.174	0.030	-0.203	0.480	0.793	0.428
231	Anxiety treatment group	Hauge, Mariann Saanum	96	0.683	0.210	0.044	0.281	1.105	3.299	0.001
23	Anxiety treatment group	Hauge, Mariann Saanum	96	0.008	0.204	0.042	-0.392	0.408	0.040	0.968
23	Other treatment group	Hauge, Mariann Saanum	96	0.094	0.204	0.042	-0.306	0.494	0.461	0.645
23	Depression treatment group	Hauge, Mariann Saanum	96	0.281	0.205	0.042	-0.121	0.683	1.370	0.171
24	Depression control group	Ejiri, Hitomi	32	0.498	0.358	0.129	-0.205	1.202	1.388	0.165
27	Depression control group	McKelvey, Madeline	753	0.672	0.075	0.006	0.525	0.819	8.989	0.000
27	Depression treatment group	McKelvey, Madeline	753	0.605	0.092	0.008	0.425	0.785	6.595	0.000
28	Anxiety treatment group	Nadret, Ela	155	0.264	0.169	0.029	-0.068	0.595	1.557	0.119
28	Depression treatment group	Nadret, Ela	155	0.028	0.169	0.028	-0.303	0.358	0.164	0.870
29	Anxiety control group	Simshauser, K.	48	0.320	0.291	0.084	-0.249	0.890	1.102	0.270
29	Other control group	Simshauser, K.	48	0.220	0.857	0.734	-1.459	1.899	0.257	0.797
29	Depression control group	Simshauser, K.	48	0.470	0.293	0.086	-0.103	1.044	1.607	0.108
30	Anxiety treatment group	Wiklund, Tobias	47	0.192	0.296	0.087	-0.389	0.770	0.644	0.520
30	Other treatment group	Wiklund, Tobias	47	0.255	0.296	0.088	-0.326	0.835	0.850	0.390
30	Depression treatment group	Wiklund, Tobias	47	0.148	0.295	0.087	-0.431	0.727	0.501	0.616
31	Other treatment group	Jurascio, Adrienne S.	59	0.648	0.267	0.071	0.125	1.172	2.428	0.015
32	Anxiety treatment group	Hauge, Mariann Saanum	77	0.194	0.228	0.052	-0.255	0.643	0.847	0.397
33	Depression treatment group	Sjomark, Josefin	131	0.028	0.178	0.032	-0.320	0.376	0.160	0.873
35	Other treatment group	Heuscholdt, Marit	57	0.112	0.265	0.070	-0.408	0.632	0.422	0.673
36	Other treatment group	Vesteraard, Cecilie L.	822	0.405	0.070	0.005	0.267	0.543	5.746	0.000
37	Depression control group	Mason, Michael J.	102	0.672	0.204	0.041	0.273	1.071	3.299	0.001
38	Anxiety control group	Okatsu, Aiko	61	0.260	0.257	0.066	-0.245	0.764	1.008	0.313
39	Other control group	Anastopoulos, Arthur D.	197	0.340	0.144	0.021	0.058	0.621	2.365	0.018
40	Other control group	Dumarkaitė, Austėja	170	0.490	0.157	0.025	0.183	0.797	3.130	0.002
40	Depression control group	Dumarkaitė, Austėja	170	0.590	0.189	0.040	0.199	0.981	2.958	0.003
40	Anxiety control group	Dumarkaitė, Austėja	170	0.310	0.154	0.024	0.008	0.612	2.013	0.044
41	Depression treatment group	Fuhr, Kristina	138	0.183	0.171	0.028	-0.172	0.498	0.954	0.340
44	Other treatment group	Kelvin, Sydney S.	44	0.458	0.306	0.083	-0.142	1.057	1.496	0.135
46	Other control group	Drew, Ryan J.	98	0.531	0.206	0.042	0.128	0.934	2.583	0.010
48	Other control group	Haderlein, Taona P.	113	0.408	0.181	0.033	0.052	0.763	2.246	0.025
48	Other treatment group	Haderlein, Taona P.	113	0.102	0.189	0.036	-0.268	0.472	0.541	0.589
49	Anxiety treatment group	Hyland, Karin	234	0.065	0.132	0.017	-0.193	0.324	0.495	0.621
49	Other treatment group	Hyland, Karin	234	0.311	0.133	0.018	0.051	0.571	2.348	0.019
49	Depression treatment group	Hyland, Karin	234	0.230	0.132	0.017	-0.029	0.490	1.741	0.082
50	Other control group	Avgsburger, Mareike	589	0.475	0.084	0.007	0.312	0.639	5.687	0.000
52	Anxiety treatment group	Fowler, David	270	0.450	2.232	4.983	-3.925	4.825	0.202	0.840
52	Depression treatment group	Fowler, David	270	0.320	1.800	3.608	-3.403	4.043	0.168	0.866

## The Effects of CBT on Different Psychological Disorders

Different psychological disorders have distinct symptoms, diagnostic criteria, and etiologies. Major depressive disorder (MDD) is characterized by persistent sadness, loss of interest or pleasure, low energy, and even suicidal ideation (Li et al., 2021). Epidemiological and neurobiological research suggests that biological factors such as vascular and neural regression (e.g., reduced astrocyte pathology cell density and expression of its markers without significant neuronal loss) and alterations in cortisol levels, genetic vulnerability, psychological factors such as impaired emotion recognition and social cognition, and social factors such as exposure to bullying and social stress leading to inflammation (the inflammatory hypothesis) interact to explain the risk of MDD (Rajkowska & Stockmeier, 2013; Kennis et al., 2020; McIntyre et al., 2013; Slavich & Irwin, 2014; Kupferberg et al., 2016; Young et al., 2014).

Compared to mild impairments in emotion recognition, individuals with depression show significantly lower response inhibition and psychosocial development, which are strongly correlated with the severity of depressive symptoms (Bora & Berk, 2016; Bora et al., 2013). The social signal transduction theory of depression proposes that social threats and adversity upregulate immune system components involved in inflammation. Key mediators of this response, known as pro-inflammatory cytokines, can trigger depressive symptoms (Slavich & Irwin, 2014). Meta-analyses have found that pharmacological treatments have positive effects on delayed recall but do not have statistically significant effects on cognitive control and executive function (Rosenblat et al., 2016). Therefore, current interventions for depression not only aim to reduce depressive symptoms but also aim to improve cognitive functioning, psychosocial development, and other aspects of social cognition and interaction.

The main symptoms of anxiety include excessive fear and worry or avoidance of perceived ongoing threats. It can manifest in various forms such as separation anxiety, specific phobias, or social anxiety disorder (Penninx et al., 2021). It has been found to cause changes in structures like the medial temporal lobe and prefrontal cortex (Fonzo & Etkin, 2017). The genetic contribution to anxiety disorders is estimated to be around 35% (Meier & Deckert, 2019). A unique characteristic reaction in anxiety disorders is threat reactivity, which involves emotions, learning, and memory. This includes increased sensitivity to negative emotions related to errors and higher attention biases towards threats (Kircanski et al., 2018; LeDoux & Daw, 2018). Currently, both medication and psychological therapies for anxiety disorders have shown similar benefits (Bandelow et al., 2015). Cognitive Behavioral Therapy (CBT) has a larger effect on anxiety when compared to a waitlist control but has a small to moderate effect when compared to usual care or placebo (Penninx et al., 2021). Anxiety disorders often co-occur with other conditions, and research has found that inflammation responses occur not only in depression but also in anxiety disorders. Peripheral inflammation can affect brain regions involved in reward and threat sensitivity, such as the amygdala, as well as neurotransmitter systems like monoamines and glutamate in the presence of inflammatory cytokines (Felger, 2018).

It is not difficult to see that different psychological disorders have different causes, course and prognosis.

Does CBT work for all mental disorders? Does it have the same impact on different mental disorders? To address this question, this study divided the literature into three categories: depression disorders, anxiety disorders, and others. The analysis results can be found in Table 4.

The combined effect size of CBT interventions for mental disorders was 0.482 ( $p < 0.001$ ), with a effect size of 0.573 ( $p < 0.001$ ) for depression, 0.357 ( $p < 0.01$ ) for anxiety, and 0.478 ( $p < 0.001$ ) for other mental disorders. These results indicate that CBT has a moderate positive impact on different mental disorders.



Table 4. Effects of cognitive behavioral therapy on different psychological disorders

random effects model	group	data size	sample size	combined effect size	95% confidence interval		asymptotics	
					upper limit	lower limit	Z value	P value
					Anxiety	Blank control group	6	637
	Treatment control group	9	1184	0.290	0.104	0.475	3.062	0.002
Other	Blank control group	9	1717	0.478	0.332	0.623	6.439	0.000
	Treatment control group	9	1506	0.339	0.237	0.441	6.521	0.000
Depression	Blank control group	8	1463	0.573	0.409	0.736	6.869	0.000
	Treatment control group	11	1953	0.268	0.115	0.420	3.444	0.001

At the same time, we also compared the effect size of online and offline CBT for different psychological disorders. However, research has found that offline CBT is significantly less effective for anxiety than online CBT. See Table 5. A possible analysis and explanation for the lower effectiveness of online CBT interventions for anxiety could be attributed, in part, to the specific characteristics of the target population. In the control group, the overall effect was 0.229, and one study targeting internet interventions for cancer survivors did not significantly impact anxiety levels. After excluding this study, the overall effect became  $0.353 < 0.652$ . In the treatment group, the overall effect was 0.165, and an internet intervention targeting alcohol-dependent patients did not affect anxiety levels. After excluding this study, the overall effect became  $0.243 < 0.418$ . Even after adjustments, the online anxiety group's effect size remained significantly smaller than the offline anxiety group. Therefore, it is likely that the attention and sensitivity to threats inherent in individuals with anxiety disorders were further activated in the context of the COVID-19 pandemic from 2020 to 2023, leading to sustained high levels of anxiety. Additionally, patients struggling with anxious emotions may lack sufficient attentional resources to complete the corresponding treatment modules and ensure learning quality in an online intervention setting. Offline interventions allow for better completion of CBT intervention modules and provide supervision and feedback on intervention effects. The analysis results can be found in Table 5.

Table 5. Effects of offline and online cognitive behavioral therapy on different psychological disorders

random effects model	group	data size	sample size	combined effect size	95% confidence		asymptotics	
					upper limit	lower limit	Z value	P value
					Anxiety treatment offline group	5	641	0.418
Anxiety treatment online group	4	543	0.165	-0.007	0.336	1.880	0.060	
Depression treatment offline group	4	586	0.233	0.012	0.454	2.063	0.039	
Depression treatment online group	7	1367	0.269	0.057	0.480	2.490	0.013	
Other treatment offline group	5	1053	0.358	0.236	0.480	5.763	0.000	
Other treatment online group	4	453	0.295	0.109	0.482	3.100	0.002	
Anxiety control offline group	2	98	0.652	-0.006	1.309	1.942	0.052	
Anxiety control online group	4	539	0.229	0.041	0.418	2.381	0.017	
Depression control offline group	2	98	0.727	0.216	1.237	2.791	0.005	
Depression control online group	6	1365	0.550	0.370	0.730	5.992	0.000	
Other control offline group	3	320	0.405	0.167	0.643	3.332	0.001	
Other control online group	6	1397	0.499	0.310	0.687	5.184	0.000	
Online treatment group		15	2363	0.231	0.127	0.334	4.371	0.000
Offline treatment group		14	2280	0.334	0.223	0.445	5.899	0.000
Online tcontrol group		16	3301	0.464	0.341	0.588	7.378	0.000
Offline control group		7	516	0.545	0.330	0.760	4.967	0.000

### Publication Bias

Assessment Publication bias, also known as systematic error, refers to the deviation between research results or inference values and the true values. In the field of social science research, reporting

bias is commonly observed. It is essential to accurately evaluate the extent of reporting bias in order to minimize its impact on meta-analysis results. Therefore, evaluating publication bias is indispensable. Due to the relatively small sample size in this study, qualitative funnel plots and quantitative Begg's test were used to detect publication bias. Funnel plots provide a visual representation that allows researchers to visually assess the presence of bias in the research results. However, relying solely on visual assessment may lead to discrepancies among researchers. Begg's rank correlation test is a quantitative method to identify bias, which is suitable for small-sample studies. If  $Z > 1.96$  and  $P < 0.05$ , bias exists; if  $Z < 1.96$  and  $P > 0.05$ , bias does not exist (Jie, 2013). As shown in Figure 1, the points on the funnel plot are symmetrically scattered around the combined effect size of 0.482, indicating no apparent publication bias. The results of Begg's test showed  $Z = 1.54 < 1.96$  and  $P = 1.36 > 0.05$ , indicating the absence of publication bias. Therefore, the combined effect size obtained in this study is relatively robust.

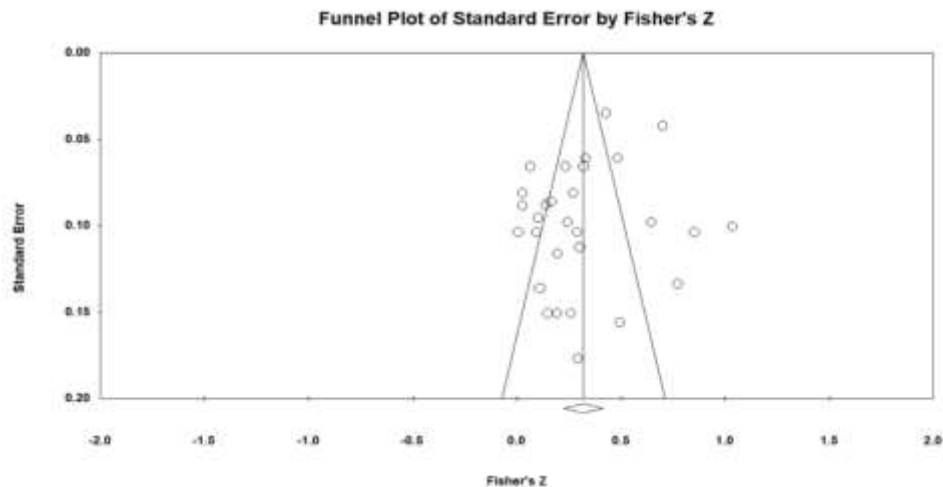


Figure 1. Cognitive Behavioral therapy rendering

## Conclusion

The research findings indicate that cognitive-behavioral therapy has a significant impact on improving psychological disorders. The meta-analysis of 32 relevant studies provides strong evidence confirming the positive effects of cognitive-behavioral therapy on individuals with psychological disorders. This finding offers important empirical support for the field of mental health, emphasizing the effectiveness of cognitive-behavioral therapy in treating psychological disorders.

However, despite the positive conclusions drawn in this study, there are limitations to consider. Firstly, this study is limited by the quantity and quality of the selected research, which may affect the generalizability of the results. Secondly, due to data availability constraints, the authors were unable to explore the effects of cognitive-behavioral therapy on different populations, types of disorders, and treatment durations. Therefore, more targeted research is needed to verify the effects of cognitive-behavioral therapy in specific populations and disorders.

In future research, investigators can further expand the sample size to obtain more compelling conclusions and strengthen research on different populations, various types of psychological disorders, and individual differences. Additionally, emphasis should be placed on exploring the working mechanisms of cognitive-behavioral therapy to better understand its role in treating psychological disorders. Furthermore, combining cognitive-behavioral therapy with other treatment approaches can be explored to develop more effective treatment plans. Through continued in-depth research and exploration, personalized and effective treatment options can be provided to individuals with psychological disorders, making a greater contribution to the field of mental health.

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