App-based Third Wave Therapy as a Treatment Option for Depressive Symptoms: A Scoping Review

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Abstract

Introduction. As prior research mostly focused on app-based cognitive behavioural therapy (CBT), only limiting literature exists on depression treatment with mainly third wave therapies (TWT). TWT is mostly focused on the function and acceptance of emotions and the relationship to own experiences. TWT has shown to significantly reduce depressive symptoms, with comparable effect sizes to CBT. The aim of this paper is to provide an overview of existing research in the field of app-based TWT for depression reduction. ***Methods.*** A scoping review among randomised controlled trials was conducted, adhering to the PRISMA guidelines for reporting. PsychINFO, PubMed and Web of Science were searched with the search string structured according to the PICO grouping. Records were screened via Covidence and Excel, adhering to predefined in- and exclusion criteria. ***Results.*** Of the 6549 screened records, 15 studies were included for analysis. Studies mostly included female, western adults with 6734 participants in total. Most common interventions were Mindfulness (n = 11), CBT (n = 9) and BA (n = 8). While Mindfulness was more common in a non-clinical sample, CBT and BA were more common in sub-clinical- and clinical samples. The studies mostly included techniques that are in practice used more by TWT therapists, and depression significantly decreased compared to the control group among 10 studies. ***Discussion.*** In past literature, different intervention combinations were found, which might be attributable to no prior research focussing on app-based TWT for depression treatment. The included techniques have shown to not be exclusively used within one intervention or one therapy wave, but instead are often adapted and used across differing contexts, consistent with a process-based view of therapy. Future research should test stand-alone interventions among differing samples and address the content and aim of specific techniques, while taking individual differences into account.

Keywords: Third Wave Therapy, Depression, App-based, Treatment, Digital Mental Health

App-based Third Wave Therapy as a Treatment Option for Depressive Symptoms: A Scoping Review

Depression is among the leading causes of disability and one of the most common mental health disorders around the globe (Vos et al., 2016). It has shown to affect a rising number of individuals, with incident cases increasing from 172 million to 258 million (a 49.86% increase) between 1990 and 2017 (Liu et al., 2020). Depression is categorised as a mood disorder, associated with constant sadness and a loss of interest (Chand & Arif, 2023). Other symptoms of depression include "emptiness or irritable mood, accompanied by somatic and cognitive changes that significantly affect the individual's capacity to function" (Chand & Arif, 2023, p. 1). Diagnosis of depression can for example include major depressive disorder or persistent depressive disorder (Uher et al., 2013). In the clinical context, depression can be diagnosed according to diagnostic manuals, such as the DSM-5 or the ICD-10, which contain descriptions, symptoms and other criteria regarding diagnosis of different mental illnesses (Paniagua, 2018). Furthermore, different depression scales can be applied to measure depression levels and compare scores prior - to post treatment. Scales that are often used for assessment include Beck's Depression Inventory (BDI) (Beck, 1961), the patient health questionnaire (PHQ-8 & PHQ-9) (Kroenke et al., 1999), the Center for Epidemiologic Studies Depression Scale (CES-D) (Radloff, 1977) or the Depression Anxiety Stress Scale (DASS-21) (Lovibond & Lovibond, 1995). Due to the negative impact depressive symptoms can have on affected peoples' lives, various treatment options are available for depression reduction. Though, the evidence regarding their effectiveness has been controversial in previous literature (Ormel et al., 2021), suggesting a potential for optimisation.

The Three Waves of Therapy

The treatment of mental health disorders, including depression, often involves cognitive behavioural therapy (CBT), which has evolved throughout the years and can be categorised into three waves. The first wave of therapy was behaviour therapy, based on the concepts of Skinner and Watson, who discovered operant conditioning (Hayes, 2004). This was the dominant form of treatment between the years 1928 – 1974 and mainly focused on observable behaviour (Hayes, 2004).

The second wave of therapy, namely CBT, was influenced by the research of cognitions by Bandura in 1969 and developed into CBT through the research of Beck (1960), regarding cognitive distortions (Chand et al., 2023). This form of therapy mostly focuses on uncovering underlying beliefs that shape how the individual perceives situations and challenging automatic negative thoughts with the goal of correcting them with adaptive thoughts. Furthermore, in CBT the interplay of cognitions, emotions and behaviour is taken into account to analyse different situations based on the interaction of these three components (Chand et al., 2023).

Third Wave Therapy

Third wave therapy (TWT) started forming in the late 1990s- 2000 (Hayes, 2004), though, only in recent years the benefits and integration of the third wave into therapeutic practices has gained popularity. TWT evolved due to an identified gap in CBT, namely that the focus in traditional CBT is mainly on replacing the emotions and cognitions that lead to maladaptive behaviour, rather than accepting them and focusing on their functions as in TWT (Hayes & Hofmann, 2021). Therefore, “instead of trying to change the form, frequency, or situational sensitivity of so-called “negative” emotions or thoughts, as might be done in traditional CBT, “third-wave” methods more frequently targeted the relationship of the client to his/her own experience.” (Hayes & Hofmann, 2021, p. 366).

TWT can be seen as a new movement in therapy, emphasising “issues such as mindfulness, emotions, acceptance, the relationship, values, goals, and meta-cognition” (Hayes & Hofmann, 2017, p.01). While these new focus areas emerged, TWT also builds on effective practices that were already established in the first and second wave of therapy and expands them. While TWT can be seen as a new wave, it can also be defined as an extension to CBT, or an evolution of CBT due to missing features (Martell & Kanter, 2011). An example is behavioural activation (BA), which has previously been described as a first-wave therapy (as in Katte and Naugle, 2022) and as a second wave therapy (as in Furukawa et al., 2025). Though in recent years it has been categorised within TWT due to its focus on mindfulness and awareness of the present moment and encouragement of the client to accept their emotions within the context, rather than changing them (Martell and Kanter, 2011). Furthermore, BA has evolved from the first wave to include cognitive components, which were focussed on the content of negative thinking in CBT, while focussing on the process of negative thinking in the context of TWT (Dimidjian et al., 2016).

As it has been found that many treatments share similar core concepts and are effective for numerous disorders, a process-based view emerged, which can be found in TWT as well. The focus of this view is on psychological processes such as the individuals’ “cognition, affect, attention, self, motivation and overt behavior” (Hayes & Hofmann, 2021, p.1). By focussing on these psychological processes, it is easier to treat comorbid disorders, as the underlying processes that are often shared across disorders are targeted, instead of the overall disorder. This approach has been found to be a predictor for a successful treatment (Hayes & Hofmann, 2021). In comparison, traditional CBT often relied on diagnosing a persons’ disorder according to a diagnostic manual and applying disorder specific treatments (Schaeuffele et al., 2020).

BA within TWT can also be understood as process-based, as the focus is on different psychological processes, instead of the disorder itself, such as overt behaviour and motivation (Hayes & Hofmann, 2021). Overt behaviour is targeted by setting goals, increasing value-based activities, and increasing motivation by breaking avoidance cycles (Quigley & Dobson, 2017). BA within TWT is therefore focused on the motivation of the client, while taking aspects such as the attentional focus and the self into account. As these psychological processes are core components of different mental health disorders, the application is not limited to depression treatment.

Overall, numerous TWT have emerged with different, but partly overlapping focus areas. The most popular TWT according to Dimidjian et al. (2016), who compared occurrences of TWT across empirical literature investigating multiple meta-analysis, include: ACT (Acceptance and Commitment Therapy), BA (Behavioural Activation), DBT (Dialectical Behaviour Therapy), MBCT (Mindfulness-Based Cognitive Therapy) and FAP (Functional-Analytical Psychotherapy). A meta-analysis about TWT in depression treatment has additionally found Metacognitive Therapy, Positive Psychotherapy and Schema Therapy to be included in previous literature (Schefft et al., 2023).

TWT have gained increasing evidence of effectiveness over the last two decades (Cunha et al., 2024). Numerous meta-analyses have found TWT to be an effective treatment option. Perkins et al. (2022), found that TWT overall was significantly more effective than control conditions among 50 randomised controlled trial studies. Schefft et al. (2023) confirmed this finding in a meta-analysis including 55 trials about depression treatment with TWT. In addition, the meta-analysis found none of the TWT to be more effective than CBT, but instead yielding comparable effect sizes among different studies. Though, when specific populations were taken into account, some differences were found, such as a tendency for TWT to be a better treatment

option compared to CBT regarding patients with persistent depressive disorder or treatment resistant depression (Schefft et al., 2023). This suggests that individual differences should be taken into account when deciding on the treatment.

Treatment Medium

For the treatment of depression, numerous options regarding treatment media have been established in prior literature. Overall, for individuals with mild depression symptoms, in-person psychotherapy is recommended (Muraoka et al., 2022), while for severe subtypes, psychotherapy is often combined with pharmacotherapy (Chiappini et al., 2025). For acute phases of a severe subtype of major depressive disorder, pharmacotherapy has proven to be effective for initial symptom reduction (Karrouri et al., 2021; Stachowicz & Sowa-Kućma, 2022). A meta-analysis conducted by Cuijpers et al. (2023), confirmed that finding while also identifying group therapy to be effective, which were also common in non-western countries (Cuijpers et al., 2018)

Though, numerous barriers to receiving mental healthcare treatment in-person exist. Barriers include high costs, time constraints, location of treatment, or difficulties with self-disclosure about private topics (Mohr et al., 2006). As a result, digital mental healthcare has been rising in popularity in recent years (Himle et al., 2021). Delivering treatment remotely addresses most perceived barriers of in-person treatment and has proven to be an effective alternative in reducing depression (Himle et al., 2021).

Especially with the rise of technology use in recent years and a growing number of smartphone users worldwide with unlimited access to the internet (Statista, 2025), the advantages of app-based treatment should be further investigated. Benefits of app-based mental health care include for example a reduced stigma to seek therapy, as it can be kept private easier if it is accessed through a phone (Luxton et al., 2011). Furthermore, the patient has a better overview about the therapy process and psychoeducational material and can therefore also monitor their

own progress better and feel more empowered (Luxton et al., 2011). Additional advantages of app-based psychotherapy models are the lower cost associated compared to traditional mental health care. The better accessibility due to place and time independence of treatment and the ease of use are further benefits (Linardon et al., 2019). Moreover, serving as an alternative to long waiting lists of traditional psychotherapy.

A meta-analysis conducted by Linardon et al. (2019) found app-based mental health interventions to significantly reduce depression and anxiety compared to a control group. App-based interventions in the meta-analysis, which included guidance by a mental healthcare professional or included app features that reminded the user to engage, yielded higher effect sizes. All in all, similar effect sizes were observed for app-based and in-person interventions (Linardon et al., 2019). Though, no systematic reviews in previous literature have targeted app-based TWT interventions specifically.

Combinations of Depression Interventions

In depression treatment it is common to combine different interventions to yield the best outcome. Though, depending on the context, different interventions have found to be the most common choice among different studies. A combination often used in in-person treatment is CBT and BA (as in Cuijpers et al., 2015; Cuijpers et al., 2019). While a meta-analysis by Cuijpers et al. (2011), found CBT alone to be the most common treatment method in self-guided depression treatment. In app-based research on the other hand, such as in the meta-analysis by Linardon et al. (2024), combinations of CBT, Mindfulness and cognitive training were found. Furthermore, a meta-analysis focussing on web-based interventions of TWT found BA and ACT to be used most (Sierra et al., 2018). While most systematic reviews focussed on app-based depression treatment with mainly CBT, others focussed on TWT depression treatment but were mainly web-based.

Populations Within Depression Treatment

Populations in previous meta-analysis investigating depression treatments included for example individuals with moderate to severe depression (as in Bae et al., 2023), depressed adults in general (as in Cuijpers et al., 2011 and Serrano-Ripoll et al., 2022) or targeted the general population to use depression treatment as a prevention measure (as in Edge et al., 2023). The continents in which studies were administered included for example North America, Europe, Asia and Australia (as in Bae et al., 2023 and Serrano-Ripoll et al., 2022), with research in low-income countries being scarce. Additionally, it is still unexplored which interventions are most common for app-based depression treatment with TWT and among which populations it has been implemented so far.

Therapeutic Techniques in CBT vs. TWT

While TWT has added a new treatment focus, some techniques used in TWT have already been used within different waves, but with different foci. For example, exposure techniques traditionally work based on habituation, meaning getting used to a feared stimulus, which originated in the first wave of therapies, with principles that are based on classical conditioning (Vinograd & Craske, 2020). Though, generally exposure techniques have also widely been implemented in CBT, especially in anxiety-related disorders (Thoma et al., 2015). In TWT, exposure is applied as a value-based process, which promotes learning about and accepting the feared stimulus (Hayes & Hofmann, 2021). Another example is thought records, which are used in CBT to challenge negative thoughts and alter them (Chand et al., 2023). In comparison, TWT makes use of thought records to observe own thoughts without evaluating them and accepting them as part of a situation (Hayes & Hofmann, 2021). They are used to detach oneself from own thoughts and emotions and observe them from afar in a process called cognitive defusion (Hayes & Hofmann, 2021).

Due to these adaptations of traditional techniques, it is difficult to classify a specific technique to a specific wave of therapy without knowing the content and aim of a technique. In an attempt to separate the techniques, Brown et al. (2011), conducted a study among therapists of the second and third wave investigating in which wave specific techniques are applied more often. The findings of that study indicated that cognitive restructuring and relaxation techniques were more frequently applied by CBT therapists, while family systems -, mindfulness/acceptance -, existential/humanistic – and exposure techniques were significantly more applied by TWT therapists. Though, it should be noted, that this is not an indication that the techniques are specific to one of the waves but instead only provides an overview of the context in which techniques are used more frequently. Thus, making it difficult to strictly separate techniques without knowing the specific content and focus of how a technique is used.

Research Gap

With limited prior research focussing on the use of TWT in app-based depression treatment, numerous research gaps were identified. While multiple synthesis of population characteristics regarding app-based CBT therapy exist, an overview of population characteristics focussing on TWT in that context is not available. Therefore, it is unclear in which countries TWT is mostly studied and which age groups and which genders are researched more frequently. Furthermore, no overview or comparison regarding intervention characteristics is available in prior research, making it difficult to gain an overview of app content across different app-based TWT. It is also unclear which depression levels are mostly targeted and whether differences in depression levels of participants have an influence on the intervention design or intervention combinations within the treatment. Additionally, prior research regarding the differentiation of techniques being primarily used in CBT or TWT is scarce. With no prior literature reviews focussing on app-based TWT specifically, it is difficult to gain an overview of different studies'

effectiveness across different contexts. To address these literature gaps the following research questions were formulated:

Research Questions

RQ1: What are population characteristics within studies investigating app-based TWT in depression treatment?

RQ2: What treatment was included within studies investigating app-based TWT for depression reduction?

RQ3: Is there a difference in included app-based interventions in a sample with sub-clinical and clinical depression levels, compared to non-clinical depression levels?

RQ4: Which interventions are most combined in app-based depression treatment in the included studies?

RQ5: In which waves are techniques that are applied in app-based depression treatment used more often according to CBT therapists and TWT therapists?

RQ6: In studies using app-based TWT for depression treatment, how does depression severity change in treatment groups compared to control groups?

Methods

To answer these research questions, a scoping review was conducted. The current research paper was part of a larger study, which was pre-registered on the 20th of December 2024 with the review protocol being published in OSF (Kraiss et al., 2024). Throughout the paper, the "preferred reporting items for systematic reviews and meta-analysis extension for Scoping Reviews (PRISMA-ScR) checklist" for reporting health interventions was adhered to (Tricco et al., 2018, p.1).

Data Collection

Relevant studies were found by searching the databases PsychINFO, PubMed and Web of Science as recommended for research in Psychology (Carvalho et al., 2019). Data collection took place on the 12th of April 2024. The search string, adapted from Linardon et al. (2019), was adjusted and repeated due to constant advancements of technology and different focus areas within the current study and can be found in Table 1. The search string was structured according to the PICO (Population, Intervention, Comparison, Outcome) grouping (Cumpston et al., 2021). Furthermore, only studies that used a randomised controlled trial (RCT) as their study design were considered for inclusion, due to a decreased bias of outcomes (Hariton & Locascio, 2018). Due to the current scoping review being part of a larger project the three focus areas included some additional items, such as JITAIs and additional outcome measures, which will not be discussed in the current paper. The three areas include the setting of the intervention (hereby representing the population), intervention design/comparator and outcome measure of studies. Furthermore, the search string was adapted to the specific databases while titles, abstracts and keywords were searched including all years of publication.

Table 1

The Complete Search String Divided by Focus Areas for a Better Overview.

Focus	Search Terms
Setting of the intervention	"smartphone*" OR "mobile phone" OR "cell phone" OR "mobile app*" OR "iphone" OR "android" OR "mhealth" OR "m-health" OR "cellular phone" OR "mobile device*" OR "mobile-based" OR "mobile health" OR "tablet-based" **OR "JITAI" OR "just-in-time adaptive"** AND
Intervention design/ Comparator	"random*" OR "trial*" OR "allocat*" **OR "RCT" OR "MRT"** AND
Outcome measure	"anxiety" OR "agoraphobia" OR "phobia*" OR "panic" OR "post-traumatic stress" OR "mental health" OR "mental illness*" OR "depress*" OR "affective disorder*" OR "bipolar" OR "mood disorder*" OR "psychosis" OR "psychotic" OR "schizophre*" OR "well-being" OR "wellbeing" OR "quality of life" OR "self-harm" or "self-injury" OR "stress*" OR "distress*" OR "mood" OR "body image" OR "eating disorder*"**OR "sleep*" OR "insomnia" OR "pain" OR "fatigue" OR "psychosomatic" OR "emotion regulation"**

Note. Words marked in bold were added to the search string from Linardon et al. (2019).

For the screening process of all found articles the systematic review software Covidence was used (Veritas Health Innovation, 2024). Consequently, the articles were uploaded to the software platform and duplicates were removed. The screening process was split up into two main phases with the first phase including a broader focus for a larger study. After concluding that phase, the second screening phase continued, which was specific to the current paper. During the first phase, the screening process included two reviewers screening titles and abstracts of 10% of the studies according to the initial inclusion and exclusion criteria (Table 2). On that basis, the interrater reliability was calculated using Cohen's Kappa to assess the level of agreement between raters (McHugh, 2012). After a sufficient level of agreement was reached (>0.7), titles and abstracts of the remaining articles were individually screened by the two reviewers. Consequently, the full-text of articles that were still included, were screened by three reviewers and included studies were extracted to a Microsoft Excel sheet (Microsoft Corporation, 2024). In

Excel the second screening phase commenced, during which an individual reviewer screened the articles that were included after the first screening phase according to the additional inclusion and exclusion criteria specific to the current research article, which can be found marked in italics in Table 2.

Table 2

Inclusion and Exclusion Criteria for Study Screening

Inclusion Criteria	Exclusion Criteria
The study that is screened, …	The study that is screened, …
1. … includes an app-based mental health treatment delivered via smartphone, which is mainly self-guided	1. … is not a randomised controlled trial
2. ... aims to reduce depression levels by means of a mental health intervention considered part of TWT	2. … includes only treatments that are mainly web-based, or delivered in-person
3. ... includes a validated questionnaire measuring depression	3. … includes no validated questionnaire assessing a mental health related outcome
4. ... measures depression at least before and after the delivery of a mental health intervention	4. …only includes text messaging as a treatment
	5. … is not peer-reviewed
	6. … is of qualitative nature
	7. … is a secondary analysis
	8. ... does not include a therapy form that is considered a TWT
	9. ... does not measure depression, or includes depression as a secondary outcome measure
	10. ... focusses on a population with a comorbid physical or mental condition other than depression

Note. The initial inclusion criterion is item 1, while the initial exclusion criteria are represented by items 1-7. The criteria marked in italics represent the additional criteria, screened for after conclusion of the initial screening process and are specific to this paper. Abbreviation: TWT = third wave therapy.

Data Extraction

Data of relevant studies was extracted manually using Microsoft Excel (Microsoft Corporation, 2024). Data was extracted to answer each research question, which can be found in Table 3.

Table 3

Information Extracted per Research Question.

Research Questions	Data Extracted
1.What are population characteristics within studies investigating app-based TWT in depression treatment?	Country, population, included depression levels, age, gender, sample size
2. What treatment was included within studies investigating app-based TWT for depression reduction?	App name, included intervention, intervention duration, intended frequency of app-use
3. Is there a difference in included app-based interventions in a sample with sub-clinical and clinical depression levels, compared to non-clinical depression levels?	Quantity of studies including each intervention separated by sub-clinical and clinical samples vs. non-clinical samples
4. Which interventions are most combined in app-based depression treatment in the included studies?	Quantity of combinations of different interventions across all included studies
5. In which waves are techniques that are applied in app-based depression treatment used more often according to CBT therapists and TWT therapists?	All therapeutic techniques mentioned within each study
6. In studies using app-based TWT for depression treatment, how does depression severity change in treatment groups compared to control groups?	Scale measuring depression, depression severity of treatment and control group before and after treatment, significance, control group used per study

Note. Abbreviations: TWT = third wave therapy, CBT = cognitive behavioural therapy.

Materials

As in prior literature different terms have been used for the concepts within this review a short explanation about the terms is provided. Namely, for the purpose of this review, “treatment” entails all aspects within the mental health app, which are used to decrease the participants' depression level. Within this treatment numerous “interventions” are included, such as e.g. CBT, BA or Mindfulness. Within these interventions, different “techniques” are made use of to reach

the goals of the intervention, which is depression reduction. Techniques could e.g. be exposure, homework, or breathing exercises.

In research question three, a “clinical” sample refers to participants which were diagnosed with a major depressive disorder in a clinical context (e.g. by a general practitioner or psychiatrist). Furthermore, a “sub-clinical” sample refers to participants needing to score above a study-specific threshold on a depression scale to be included in the study. A “non-clinical” sample refers to participants of the study not needing to have a specific depression level as an inclusion criterion to enter the study.

An additional software was used to answer research question four. Within the visualisation software Flourish, a radial network was created, which displayed the quantity of interventions being included among all studies and the quantity of different interventions being used together within the same treatment (Flourish, 2025). Within the software an exhaustive list of interventions within the included studies was created, indicating each existing combination of treatments appearing within the same study. A pair of treatments appearing in more studies was displayed by a larger connection line within the radial network.

To answer research question five, the study by Brown et al. (2011) served as a basis to separate different techniques into being used significantly more by CBT therapists vs. TWT therapists (Table 4). The techniques mentioned in each included study were categorised based on the techniques by Brown et al. (2011) they corresponded to, based on the explanation of the techniques mentioned in Table 5.

Table 4

Techniques According to Brown et al. (2011) With a Significant Difference in Usage by CBT or TWT Therapists.

Techniques	CBT	TWT
Cognitive restructuring techniques	x	
Existential/ humanistic techniques		x
Exposure techniques		x
Family systems techniques		x
Mindfulness/acceptance techniques		x
Relaxation	x	

Note. "x" indicates that usage of the technique by therapists of the specific wave is significantly higher compared to usage of the technique by therapists of the other wave. No significant difference in usage patterns of CBT and TWT therapists was detected regarding following techniques: Power/energy techniques, Radical Behavioural techniques, Analytic/dynamic techniques, Homework, Breathing retraining, Social skills work.

Table 5

Explanations of Techniques Assessed by Brown et al. (2011).

Technique	Explanation
1. Analytic/ Dynamic	It is also called psychodynamic therapy and focusses on unconscious processes rooted in the past and how they influence behaviour. Also, a focus on own emotions and interpersonal relationships is included (Gabbard, 2004).
2. Breathing Retraining	Breathing retraining involves learning breathing techniques to regulate breathing patterns, such as diaphragmatic breathing or paced slow breathing (Bentley et al., 2023)
3. Cognitive Restructuring	Cognitive restructuring involves identifying maladaptive beliefs, challenging them and finding adaptive alternatives (Beck et al., 1979).
4. Existential/ Humanistic	Existential and humanistic therapies focus on self-awareness, present experiences and future goals, rather than on underlying symptoms (Center for Substance Abuse Treatment, 1999). While existential therapy emphasizes personal freedom, responsibility, meaning and value of life (Prasko et al., 2012), humanistic therapy embraces optimism and growth (Schneider, 2016).
5. Exposure	Exposure therapy is based on conditioning and involves facing a feared stimulus with the goal of converting the feared stimulus into a neutral stimulus and thereby reducing anxiety (Hamlett et al., 2023).

6. Family Systems	Family systems theory revolves around the individuals 'relation to family members and the families' interaction within different contexts. The individuals is hereby assessed based on its' role within this context (Watson, 2012).
7. Homework	Homework in this context are activities or assignments taken by the client in between therapy sessions or modules, that facilitate the learning process by integrating new knowledge into daily routines (Ryum et al., 2023).
8. Mindfulness/ Acceptance	In Mindfulness practices, the own focus is directed towards internal or external stimuli without judgement, which is closely related to acceptance, during which negative situations are experienced without avoidance. Examples of interventions in that field are ACT, DBT and MBSR (Baer & Huss, 2008).
9. Power/ Energy	Power and Energy techniques are rooted in the belief that the body and mind are connected through energy fields, and with sources such as light, sound or magnets these fields are attempted to be put into balance (Rogers et al., 2021).
10. Radical Behavioural	Radical Behaviourism was introduced by Skinner (1945), and concerns the study of behaviour (Leigland, 2010). Therapies in this field focus on behaviour being learned through reinforcement and punishment.
11. Relaxation	Relaxation techniques can have different formats, such as breathing techniques or guided imagination exercises. Among the most common interventions for relaxation is PMR (Hamdani et al., 2022).
12. Social Skills Work	Social skills can be learned by practicing communication skills, and interpersonal skills, learning how to ask for help and help others and improving own self-confidence (Hua et al., 2022). Interventions include for example SST and IPT.

Note. Techniques 3. and 11. were significantly more used by CBT therapists. Techniques 4., 5., 6. and 8. were significantly more used by TWT therapists. The rest of the Techniques showed no significant difference in usage patterns of CBT and TWT therapists. Abbreviations: ACT= Acceptance and Commitment Therapy, DBT= Dialectical Behaviour Therapy, MBSR= Mindfulness Based Stress Reduction, PMR= Progressive Muscle Relaxation, SST= Social Skills Training, IPT= Interpersonal Therapy.

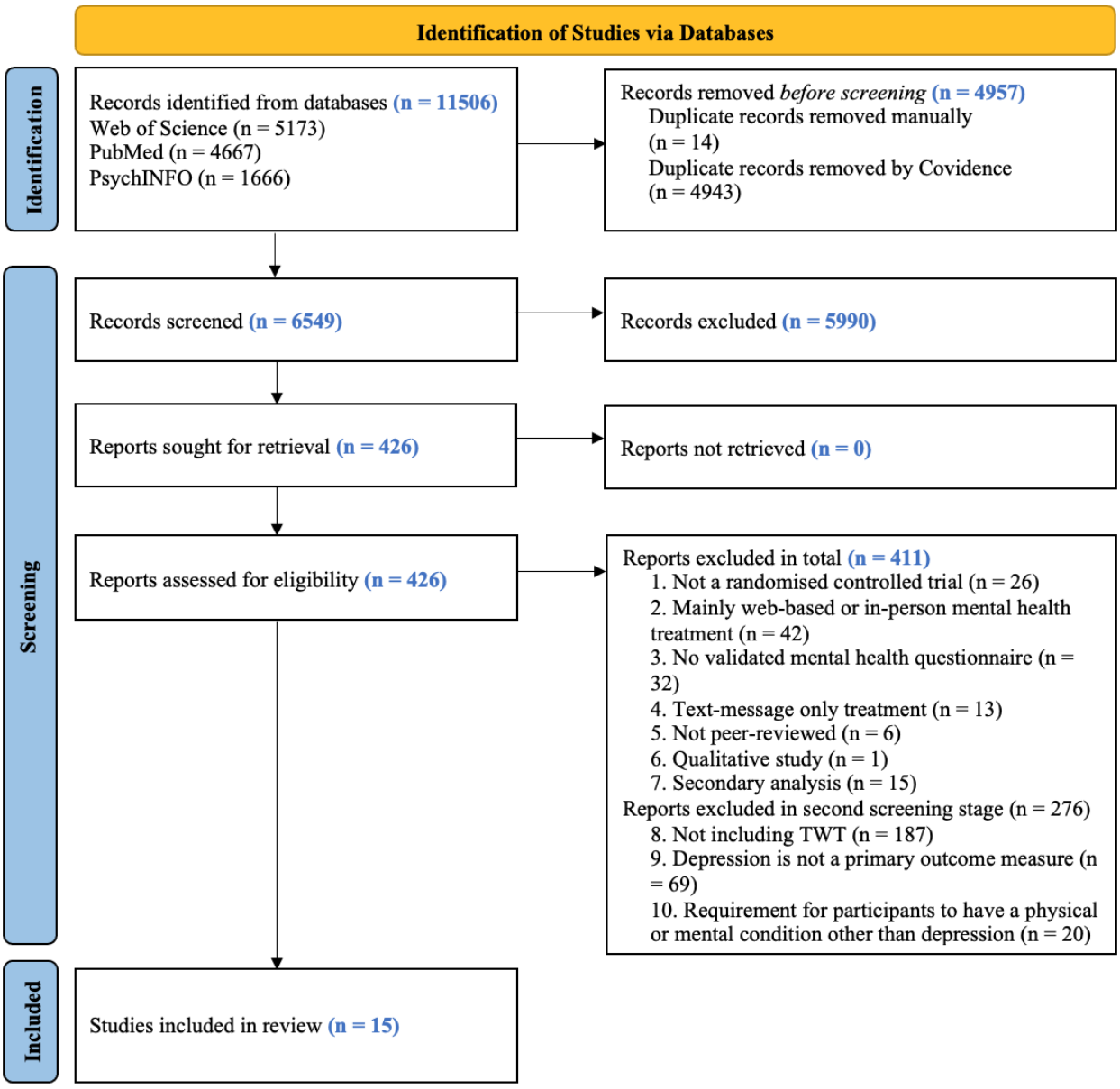
For research question six, Excel is utilised for the computation of Cohen's d to compare effect sizes of included studies. It is calculated by taking the different depression scores between intervention groups and control groups of pre- and post-treatments into account, while considering the respective standard deviations (Lakens, 2013).

Results

The process of finding included studies is summarised in the PRISMA flowchart in Figure 1. From the 11506 records that were originally identified on different databases, 6549 records remained for screening after removing duplicates. After screening titles and abstracts for eligibility, 426 articles remained which were full-text screened. Finally, 411 articles were excluded due to different exclusion criteria, of which 135 were excluded in the first screening phase and 276 were excluded in the second screening phase, which was specific to the current paper. This resulted in 15 studies, which met all inclusion criteria and were included for the analysis.

Figure 1

PRISMA Flowchart of Study Inclusion Process



RQ1: What are Population Characteristics Within Studies Investigating App-based TWT in Depression Treatment?

The included studies aiming at reducing depression with a TWT were mostly designed for the general population (n = 7), while also targeting university students (n = 4), employees (n = 2, caregivers (n = 1) and adolescents (n = 1). A complete overview of population characteristics can

be found in Table 6. The mean age of participants differed with most studies only including adults, except one study targeting adolescence (Peake et al., 2024). Mean ages ranged between 16.79 and 44.57 (*Mdn* = 34.54). Additionally, participants among studies were predominantly female, with only one study including more male participants. The percentages of female participants ranged between 25.80% and 95.08% (*Mdn* = 70.30%). The sample sizes of studies included between 81 and 2271 participants, with the total number of participants within all 15 studies being 6734 (*Mdn* = 183). In three of the included studies, all participants were diagnosed with a major depressive disorder of which two studies' participants were diagnosed according to DSM-IV criteria, which were established based on a diagnostic interview (Ly et al., 2015; Ly et al., 2014) and participants of one study being diagnosed by a general practitioner or psychiatrist (Raevuori et al., 2021). In five additional studies an elevated depression level was an inclusion criterion for participation (Forman-Hoffman et al., 2024; Bruhns et al., 2021; Peake et al., 2024; Roepke et al., 2015; Lüdtke et al., 2018). The depression level of participants entering studies was most often classified as moderate depression (n = 6) or mild depression (n = 4). All in all, most studies included a non-clinical sample (n = 7), while five studies included a sub-clinical sample and only three studies a clinical sample. Furthermore, the main objective of all included studies was to reduce depression levels with at least one intervention being a TWT. The study locations included different countries within the continents of North America (n = 6), Europe (n = 5) and Australia (n = 4). Overall, the research question is answered by addressing that populations of app-based TWT for depression treatment predominantly included female adults within the general population, with moderate depression levels when entering the study, while the studies were only conducted among western cultures.

RQ2: What Treatment was Included Within Studies Investigating App-based TWT for Depression Reduction?

Within the included studies a variety of interventions belonging to TWT were implemented across all studies, including BA, Mindfulness, Mindfulness-Based Stress Reduction (MBSR), Mindfulness-Based Cognitive Therapy (MBCT), Acceptance and Commitment Therapy (ACT), Metacognitive Therapy (MCT), Positive Psychology (PP), Dialectical Behaviour Therapy (DBT) and Motivational Interviewing (MI), general TWT techniques (TWT), which were not further specified within the study, in addition to CBT from the second wave of therapies. An overview of treatment characteristics per study can be found in Table 6. The most common interventions across all studies were Mindfulness (n = 11), CBT (n = 9) and BA (n = 8). Within 11 out of the total 15 studies, more than one intervention was implemented in the treatment, often being combined within the app content. The apps for treatment mostly differed between studies, while two apps were each used in two studies, namely “Viary” and “MHP”. Treatment duration ranged between 10 days and 12 weeks, with the most common duration being 4 weeks (n = 5). In the majority of the studies daily use of the apps was recommended (n = 12). To answer the research question, it can be concluded that a large variety of different treatments with a median treatment duration of four weeks were included to reduce depression symptoms. Mindfulness, CBT and BA were the most included interventions and Viary and MHP the most commonly used apps with the recommendation of daily usage.

Table 6

Population and Treatment Information of Included Studies

Authors (year)	Population						Treatment			
	Country	Population	Included Depression Levels	Age M (SD)	% Female	Sample Size I+C= T, I+I+C= T, I+I+I+C= T	App Name	Included Interventions	Duration	Intended Frequency
Ly et al. (2015)	Sweden	General population	Clinical	30.6 (11.4)	69.90	46+47= 93	Viary	BA	9 weeks	not reported
Ly et al. (2014)	Sweden	General population	Clinical	36.1 (10.8)	70.00	40+41= 81	Viary & Meditationer	BA, M	8 weeks	>once/ week
Raevuori et al. (2021)	Finland	University students	Clinical	25.1 (4.5)	72.60	63+61= 124	MHP	MBSR, MBCT, BA (+CBT)	8 weeks	daily
Forman-Hoffman et al. (2024)	US	General population	Sub-clinical	I: 36.80 (13.22) C: 37.80 (12.4)	95.00	54+46= 100	MHP	MBSR, MBCT, BA (+CBT)	12 weeks	daily
Bruhns et al. (2021)	Germany	University students	Sub-clinical	22.98 (3.36)	88.50	90+135=225	MCT and More	M, ACT, MCT (+CBT)	4 weeks	daily
Peake et al. (2024)	US	Adolescence	Sub-clinical	I: 16.89 (2.50) C: (16.79 (2.59)	63.13	80+80= 160	Spark	BA, M (+CBT)	5 weeks	one module/ week

Roepke et al. (2015)	US	General population	Sub-clinical	40.15 (12.40)	69.60	93+97+93 = 283	SuperBetter	BA, PPT (+CBT)	4 weeks	daily
Lüdtke et al. (2018)	Germany	General population	Sub-clinical	I: 41.20 (11.86) C: 44.57 (10.69)	78.41	35+39= 88	Be Good to Yourself	TWT (+CBT)	4 weeks	daily
Vereschagin et al. (2024)	Canada	University students	Non-clinical	20	70.30	743+746= 1489	Minder	DBT, M, MCT, MI (+CBT)	4 weeks	not reported
Deady et al. (2022)	Australia	Employees	Non-clinical	40.26 (10.63)	25.80	1128+1143= 2271	HearGear	BA, M	5 weeks	daily
Everitt et al. (2021)	Australia	General population	Non-clinical	32.97 (10.92)	85.50	58+62+60 +55= 235	MoodTracker, Improve YourMood& Improve YourMood+	M	3 weeks	numerous times/ day
Al-Refae et al. (2021)	Canada	General population	Non-clinical	25.24 (8.74)	78.80	78+87= 165	Serene	M, MBCT (+CBT)	4 weeks	daily
Flett et al. (2019)	New Zealand	University students	Non-clinical	20.08 (2.8)	70.20	72+63+73 = 208	Headspace & Smiling Mind	M	10 days	daily

Huberty et al. (2022)	US	Employees	Non-clinical	not reported	50.58	585+444= 1029	Calm	M	8 weeks	daily
Fuller-Tyszkiewicz et al. (2020)	Australia	Caregivers	Non-clinical	I: 40.29 (6.51) C: 39.21 (5.86)	95.08	73+110= 183	StressLess	M, PPT, BA (+CBT)	5 weeks	one module/ week + self-monitoring daily

Note. Abbreviations: M = Mean, SD = Standard Deviation, I = Intervention group, C = Comparison group, T = Total, BA = Behavioural Activation, M = Mindfulness, MBSR = Mindfulness-Based Stress Reduction, MBCT = Mindfulness-Based Cognitive Therapy, CBT = Cognitive Behavioural Therapy, ACT = Acceptance and Commitment Therapy, MCT = Metacognitive Therapy, PPT = Positive Psychology Therapy, TWT = general Third Wave Therapy techniques, DBT = Dialectical Behaviour Therapy, MI = Motivational Interviewing. All populations with included depression levels marked as "clinical" and "sub-clinical" had the condition of having a depression level as inclusion criterion. All populations marked as "non-clinical" did not have that condition as an inclusion criterion.

RQ3: Is There a Difference in Included App-based Interventions in a Sample with Sub-clinical and Clinical Depression Levels, Compared to Non-clinical Depression Levels?

The current research included eight studies with interventions designed for participants with sub-clinical and clinical depression levels and seven studies for individuals with non-clinical depression levels (Table 7). The two target groups showed differences in inclusion of interventions. In studies with sub-clinical or clinical depression levels, CBT and BA was included most (n = 6), meaning 75% of studies in that group made use of these interventions. Mindfulness was included in 50 % of studies (n = 4), while MBSR and MBCT was included in 25% (n = 2). In comparison, samples with non-clinical depression levels made use of Mindfulness in all included studies within the group (n = 7), while including CBT only in 43% of studies (n = 3) and BA in 29% of studies (n = 2). An overview of the three most used interventions per group can be found in Figure 2. All in all, it can be said that there is a difference in app-based interventions designed to reduce depression among individuals with sub-clinical and clinical depression levels, as the most used interventions in that group are CBT and BA in comparison to a population with non-clinical depression levels, in which Mindfulness was included most, namely in all included studies.

Table 7

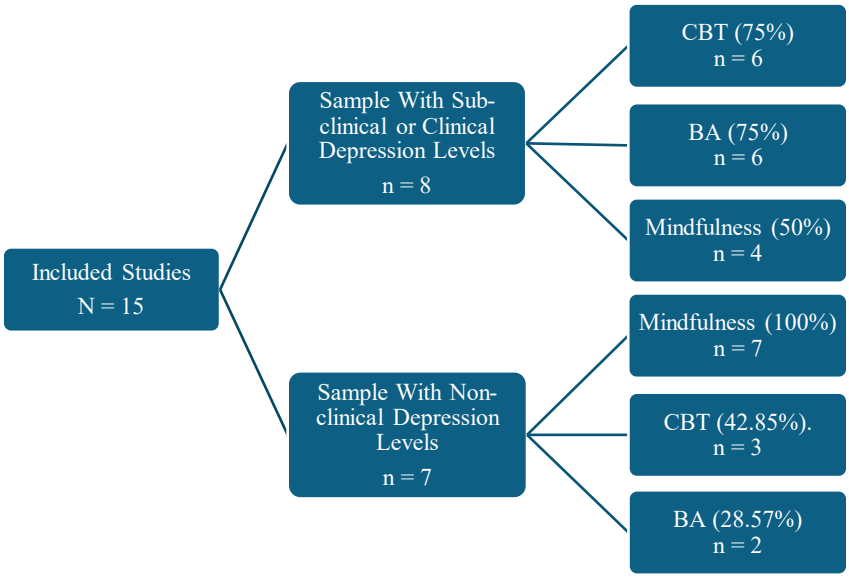
All Interventions Including Percentages About Frequency of Inclusion in Different Study Populations

Intervention	Authors Including the Intervention	Number of Studies Including the Intervention (Total Number of Studies: 15)	Studies With Sub-clinical or Clinical Sample (Total Number of Studies: 8)	Studies With Non-clinical Sample (Total Number of Studies: 7)
CBT	Raevuori et al. (2021), Forman-Hoffman et al. (2024), Bruhns et al. (2021), Peake et al. (2024), Roepke et al. (2015), Lüdtke et al. (2018), Vereschagin et al. (2024), Al- et al. (2021), Fuller-Tyszkiewicz et al. (2020)	9 (60%)	6 (75%)	3 (42.85%)
BA	Ly et al. (2015), Ly et al. (2014), Raevuori et al. (2021), Forman-Hoffman et al. (2024), Peake et al. (2024), Roepke et al. (2015), Deady et al. (2022), Fuller-Tyszkiewicz et al. (2020)	8 (53.33%)	6 (75%)	2 (28.57%)
M	Ly et al. (2014), Bruhns et al. (2021), Peake et al. (2024), Roepke et al. (2015), Vereschagin et al. (2024), Deady et al. (2022), Everitt et al. (2021), Al-Refae et al. (2021), Flett et al. (2019), Huberty et al. (2022), Fuller-Tyszkiewicz et al. (2020)	11 (73.33%)	4 (50%)	7 (100%)
MBSR	Raevuori et al. (2021), Forman-Hoffman et al. (2024)	2 (13.33%)	2 (25%)	0 (0%)
MBCT	Raevuori et al. (2021), Forman-Hoffman et al. (2024), Al-Refae et al. (2021)	3 (20%)	2 (25%)	1 (14.29%)
ACT	Bruhns et al. (2021)	1 (6.67%)	1 (12.5%)	0 (0%)
MCT	Bruhns et al. (2021), Vereschagin et al. (2024)	2 (13.33%)	1 (12.5%)	1 (14.29%)
PPT	Roepke et al. (2015), Fuller-Tyszkiewicz et al. (2020)	2 (13.33%)	1 (12.5%)	1 (14.29%)
DBT	Vereschagin et al. (2024)	1 (6.67%)	0 (0%)	1 (14.29%)
MI	Vereschagin et al. (2024)	1 (6.67%)	0 (0%)	1 (14.29%)
TWT	Lüdtke et al. (2018), Fuller-Tyszkiewicz et al. (2020)	2 (13.33%)	1 (12.5%)	1 (14.29%)

Note. Abbreviations: CBT = Cognitive Behavioural Therapy, BA = Behavioural Activation, M = Mindfulness, MBSR = Mindfulness-Based Stress Reduction, MBCT = Mindfulness-Based Cognitive Therapy, ACT = Acceptance and Commitment Therapy, MCT = Metacognitive Therapy, PPT = Positive Psychology Therapy, DBT = Dialectical Behaviour Therapy, MI = motivational interviewing, TWT = TWT techniques, not further specified. The percentages represent the number of studies including an intervention relative to the total amount of studies included within one section.

Figure 2

Three Most Common Interventions Divided by Depression Level of the Sample.



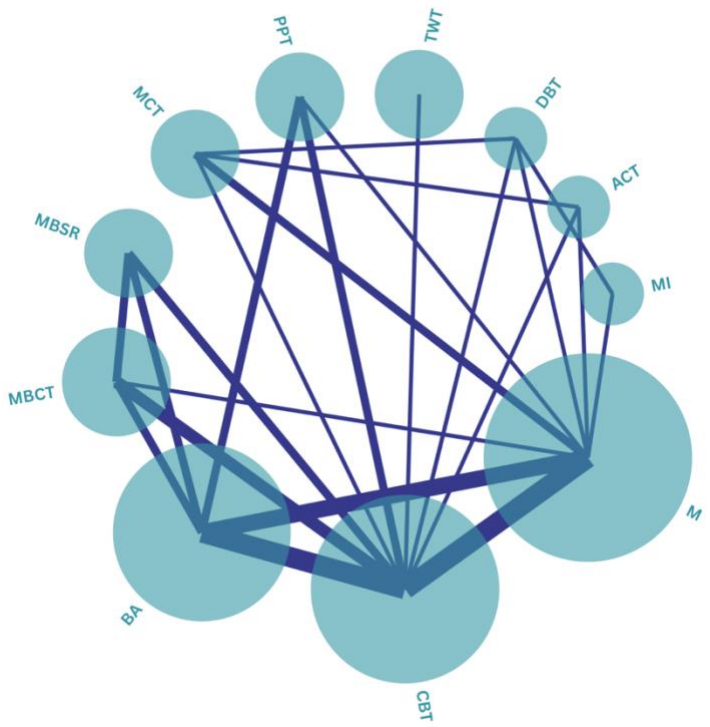
Note. Abbreviations: CBT = Cognitive Behavioural Therapy, BA = Behavioural Activation

RQ4: Which Interventions are Most Combined in App-based Depression Treatment in the Included Studies?

To gain an overview of intervention combinations within app-based depression treatment a radial network of all intervention combinations was created (Figure 3). The intervention being included most across all studies was Mindfulness (n = 11), and the interventions being used in the fewest number of studies were DBT, ACT and MI (n = 1). The most common combinations of interventions within studies were CBT + BA (n = 5) and CBT + Mindfulness (n = 5). Other combinations were BA + Mindfulness (n = 4) and CBT + MBCT (n = 3). Seven other combinations appeared together in two studies, while the remaining 12 combinations only appeared in one study. To answer the research question, two intervention combinations were most common among all studies, namely CBT + BA and CBT + Mindfulness.

Figure 3

Radial Network of Intervention Combinations



Note. A larger circle indicates the intervention being included in more studies. A larger connecting link indicates the combination of interventions being used in more studies. Abbreviations: BA= Behavioural Activation, M= Mindfulness, MBSR= Mindfulness-Based Stress Reduction, MBCT = Mindfulness-Based Cognitive Therapy, ACT= Acceptance and Commitment Therapy, MCT= Metacognitive Therapy, PPT= Positive Psychology Therapy, TWT= general Third Wave Therapy techniques, DBT= Dialectical Behaviour Therapy, MI= Motivational Interviewing, CBT= Cognitive Behavioural Therapy.

RQ5: In Which Waves are Techniques That are Applied in App-based Depression Treatment Used More Often According to CBT Therapists and TWT Therapists?

To answer this research question information about the praxis of which therapeutic techniques are used more by therapists of CBT and TWT are taken into consideration. A framework of therapy techniques was created based on the results of the study of Brown et al. (2011), which can be found in Table 8. Treatment techniques used within apps were categorised based on the most suitable category within Brown's framework. According to the categorisation, 10 studies described techniques within the categories of cognitive restructuring and relaxation, which are significantly used more by CBT therapists according to Brown. On the other hand, 14 studies included techniques significantly used more by TWT therapists with 14 studies using techniques of the Mindfulness/ Acceptance category and nine studies using techniques categorised within the Existential/ Humanistic category. Furthermore, categories that did not have a significantly different amount of usage between CBT and TWT therapists according to Brown et al. (2011), were Radical behavioural therapy (n = 10), homework (n = 10), breathing (n = 6), social skills (n = 5) and others (n = 7). An overview of included categories within different studies can be found in the Appendix. Concluding, according to the framework created based on Brown et al. (2011), most studies (n = 14), included techniques that were identified as being used more by TWT therapists.

Table 8

Techniques of Included Studies Categorised Based on Being Used More in CBT, TWT or Both Practices According to the Study by Brown et al. (2011).

	CBT		TWT		Both				
Author (year)	Cognitive Restructuring	Relaxation	Existential/ Humanistic	Mindfulness/ Acceptance	Breathing	Homework	Radical Behavioural	Social Skills	Other
Ly et al. (2015)						Psychoeducation	Activity Plan		
Ly et al. (2014)			Reflection	Mindfulness		Psychoeducation	Activity Plan		
Raevuori et al. (2021)				Mindfulness		Journalling, Psychoeducation			
Forman-Hoffman et al. (2024)				Mindfulness		Journalling, Psychoeducation			
Bruhns et al. (2021)	Cognitive strategies		Imagination	Mindfulness			Positive activities	Communication, Interaction	Metacognitive training
Peake et al. (2024)	Problem solving		Mood reflection	Mindfulness		Psychoeducation	Activity scheduling, Reward system		Interactive activities
Roepke et al. (2015)	Cognitive restructuring		Mood boosting, 3 good things, strengths, self-esteem	Acceptance			BA	listing social support	Goal setting
Lüdtke et al. (2018)	Cognitive strategies			Mindfulness			Activating	Social competence skills	

Vereschagin et al. (2024)	managing impulsiveness and time, problem solving, challenging thoughts	Sleep	Managing emotions, Reflection, self-care	Mindfulness, Grounding		Psychoeducation		Relationships, Communication, setting boundaries	Coping
Deady et al. (2022)	Problem solving, resilience	Sleep	Value driven goal-setting	Meditation, Mindful awareness, Grounding, Attention, Acceptance, Cognitive defusion, Body scan	Breathing	Mood tracking, Skills toolbox, Psychoeducation, Exercises	Increasing activities, Positive reinforcement of activities, BA	Assertiveness training	Coping
Everitt et al. (2021)		Relaxation	Gratitude exercise	Mindfulness, Meditation, Body scan	Breathing	Mood tracking	JITAI		
Al-Refae et al. (2021)	Cognitive restructuring	Sleep	Gratitude	Self-compassion, Mindfulness, Meditation, Acceptance, Body scan, Awareness	Breathing	Journalling	Action plan		Coping
Flett et al. (2019)				Mindfulness, Meditation, body scan, non-judgement of thoughts& emotions	Breathing				

Huberty et al. (2022)		Sleep		Mindfulness, Body scan, Vipassana	Breathing			
Fuller-Tyszkiewicz et al. (2020)	Cognitive restructuring		Value clarification, PP techniques	Mindfulness, Cognitive diffusion, Acceptance, Body scan	Breathing	Psychoeducation	BA	Interactive exercises, goal setting

Note. Exposure Techniques, Family Systems-, Power/Energy- and Analytic/Dynamic Techniques were excluded from the table, as none of the included studies used techniques of these categories within their interventions. Abbreviations: BA = Behavioural Activation, JITAI = just in time adaptive interventions, Vipassana = the objective observation of physical body sensations, PP = positive psychology.

RQ 6: In Studies Using App-based TWT for Depression Treatment, how Does Depression Severity Change in Treatment Groups Compared to Control Groups?

Within 10 of the 15 included studies, depression severity was significantly reduced in comparison to the control group. The exact changes in depression severity scores comparing pre- to post-treatment within studies can be found in Table 9. Some variations in effect sizes, denoted by Cohen's d between different treatment groups occurred. Most common was a small effect of the intervention group in reducing depressive symptoms (n = 8), while a medium effect of the intervention group was also common (n = 6). In two studies the control group achieved higher depression reductions compared to the intervention group, while two other intervention groups yielded a large effect. Control groups mostly comprised waitlist control groups (n = 8). Regarding scales used to measure depressive symptom severity, it was found that the PHQ-9 is the most common measure among included studies (n = 9). All other measures were only implemented within one to three studies. The scale being used in three studies was the DASS-21, though it should be noted that it was only used in studies with non-clinical samples. To conclude, the depression severity significantly decreases compared to the control group in most studies focussing on app-based interventions with TWT with mostly a small to medium effect size.

Table 9

Change in Depression Scores Before and After the Treatment Reported as M (SD) and Significance Compared to the Control Group

Authors	Depression Score Baseline		Depression Score Post Treatment		Scale	Effect Size (Cohen's d)	Significance Treatment Compared to Control Group	Control Group
	Treatment	Control	Treatment	Control				
Ly et al. (2015)	15.39 (4.73)	15.30 (4.49)	7.13 (5.78)	7.21 (6.27)	PHQ-9	0.03	Not significant	BA treatment (in person)
Ly et al. (2014)	12.53 (4.43)	13.22 (4.81)	5.83 (3.85)	7.19 (5.84)	PHQ-9	0,14	Not significant	Mindfulness
Raevuori et al. (2021)	12.44 (0.58)	11.56 (0.59)	9.89 (0.65)	8.57 (0.64)	PHQ-9	-0,68	Not significant	TAU
Forman-Hoffman et al. (2024)	15.02 (0.81)	15.73 (0.88)	8.66 (0.90)	13.87 (0.94)	PHQ-9	4,90	Significant	WLC
Bruhns et al. (2021)	11.27 (5.03)	11.10 (4.42)	9.30 (5.22)	10.17 (4.32)	PHQ-9	0,22	Significant	WLC
Peake et al. (2024)	14.36 (4.78)	13.29 (4.51)	9.51 (5.91)	10.43 (5.39)	PHQ-8	0,35	Significant	Psychoeducation app
Roepke et al. (2015)	34.48 (9.24) 33.07 (8.81)	32.62 (10.15)	23.55 (13.73) 19.06 (10.30)	27.36 (10.63)	CES-D	0,46 0,84	Significant	WLC
Lüdtke et al. (2018)	11.61 (6.14)	12.77 (6.40)	10.23 (5.56)	10.72 (6.05)	PHQ-9	-0,12	Not significant	WLC
Vereschagin et al. (2024)	9.6 (5.9)	8.9 (5.6)	8.6 (6.2)	8.8 (5.8)	PHQ-9	0,15	Significant	WLC

Everitt et al. (2021)	6.28 (4.90) 7.85 (6.03) 7.25 (5.35)	7.53 (4.85)	5.36 (4.90) 6.42 (5.20) 5.56 (3.43)	7.50 (4.97)	PHQ-9	0,18 0,27 0,39	Not significant	WLC
Al-Refae et al. (2021)	16.11 (10.25)	14.75 (10.18)	10.93 (10.14)	14.1 (11.16)	DASS-21	0,42	Significant	WLC
Flett et al. (2019)	15.56 (10.00) 15.52 (9.21)	13.36 (6.99)	13.00 (9.38) 13.51 (9.44)	15.05 (8.47)	CES-D	0,48 0,41	Significant	Evernote app (attention control)
Huberty et al. (2022)	5.96 (4.93)	6.47 (5.12)	3.91 (4.25)	5.13 (5.22)	DASS-21	0,15	Significant	WLC
Fuller-Tyszkiewicz et al. (2020)	11.33 (8.67)	10.95 (8.00)	9.66 (7.71)	10.87 (8.58)	DASS-21	0,19	Significant	StressMonitor (self-monitoring app/ attention control)

Note. Abbreviations: BA = Behavioural Activation, TAU = treatment as usual, WLC = waitlist control group. Depression scores pre and post treatment were not reported in the study of Deady et al., 2022, though the study reported significant depression reduction in comparison to an attention control group. Depression score interpretation for: PHQ-8 and PHQ-9: 0-4 (minimal), 5-9 (mild), 10-14 (moderate), 15-19 (moderately severe), 20-27 (severe) (Kroenke et al., 2001; Kroenke et al., 2008). CES-D: 15 and <15 (mild), 16-23 (moderate), 24 and >24 (severe) (Radloff, 1977). DASS-21: 0-9 (normal), 10-13 (mild), 14-20 (moderate), 21-27 (severe), 28 and >28 (extremely severe) (Lovibond & Lovibond, 1995). Cohen's d interpretation benchmarks: 0.2 = small effect, 0.5 = medium effect, 0.8 = large effect (Cohen, 1988). Cohen's d signs were reverted, meaning higher positive values indicate that depression reduction was greater in the treatment group compared to the control group, while negative values indicate that depression reduction was greater in the control group compared to the treatment group.

Discussion

The current scoping review focussed on providing a systematic overview of research available regarding app-based treatment of depression symptoms with mainly TWT. A systematic literature search was conducted and resulted in 15 studies that provided more insights into the topic. The findings will be discussed in the following section.

Study Findings and Future Directions

Within the first RQ, population characteristics of included studies were examined. Mostly the general population with non-clinical depression levels was targeted, with the most common baseline depression level being moderate depression. Furthermore, mostly female adults participated in treatments. The aim of all studies was to reduce depression levels with mainly TWT and studies were conducted in North America, Europe and Australia. As no prior literature review focussed on app-based TWT for depression treatment, this cannot be directly compared to prior literature, though it is contrary to app-based reviews targeting CBT mostly. In these studies, focus was mostly on depressed populations (Cuijpers et al., 2011; Serrano-Ripoll et al., 2022). The gender differences in treatment participation might be explained by the higher ratio of females having depression diagnosed, which is estimated to be 2:1 in comparison to males (Bromet et al., 2011). The continents of study administration were in line with prior research, with the additional continent of Asia being included (Bae et al., 2023; Serrano-Ripoll et al., 2022). More studies in prior literature focussing on clinical depression levels, might be explained by the finding of depression apps having a bigger impact on individuals with higher baseline depression levels (Sextl-Plötz et al., 2024). On the contrary, patients with severe depression, as well as physicians have found to be sceptical about the implementation of apps for treatment, and instead favour apps focussing on mild to medium depression levels (Patoz et al., 2021). However, future studies should compare treatment effects among different baseline depression levels.

Furthermore, app-based treatment could provide an opportunity for cost-effective treatment in developing countries, due to mental health stigma and limited access to the healthcare system (Rojas et al., 2019), which should be further researched. Additionally, due to high depression rates among people with diverse gender (Pellicane & Ciesla, 2021), and many unreported depression cases among men (Shi et al., 2021), research should focus on these groups to gain better insight of individual differences regarding efficacy of app-based TWT treatment for depression.

With the second RQ, information about the treatment to decrease depression was gathered. Treatment mostly comprised four weeks with intended daily app usage. The most included interventions were Mindfulness, CBT and BA across all studies. This is partly in line with prior research, as for example Serrano-Ripoll et al. (2022) found CBT was included most. Also, Sierra et al. (2018) identified intervention combinations, but found BA and ACT to be commonly used together across TWT studies. The different findings of the current paper including Mindfulness, CBT and BA most, could be attributable to the mobile treatment delivery, a difference in targeted populations or to the focus on mainly TWT, meaning CBT-only interventions were not included in the current study. To gain a better overview of app-based treatment options for depression with TWT, further research including a larger variety of interventions is needed.

To answer the third RQ, interventions of studies designed for participants with sub-clinical or clinical depression levels were compared to studies targeting participants with non-clinical depression levels. It was found that studies with sub-clinically and clinically depressed participants mostly used CBT and BA (in 75% of studies), while in studies with non-clinically depressed participants, Mindfulness was included most (in all studies). Literature on the topic confirms CBT and BA to be a common combination in depression treatment (e.g. Cuijpers et al.,

2015; Cuijpers et al., 2019). But the difference between the two target groups was unexpected. This suggests that different interventions are used depending on the population that is being treated. A meta-analysis conducted by Linardon et al. (2023), found that Mindfulness is an effective tool to decrease depression, while including mostly adults from the general population as study participants. The different application of interventions could indicate that for depressed populations CBT and BA is the most common treatment method, while for non-depressed individuals Mindfulness is more popular. A study by Ly et al. (2014), confirmed this hypothesis, as it was found that BA was more efficacious than Mindfulness for participants with high initial depression symptoms, while Mindfulness was more efficacious among participants with lower initial depression symptoms Though, more research comparing similar interventions across participants with different initial depression levels is needed to confirm these findings.

With the fourth RQ, common combinations of interventions within depression treatment were assessed. The most common combinations were CBT and BA, as well as CBT and Mindfulness in five studies. Another common combination that was used in four studies was BA and Mindfulness. Prior research confirmed CBT and BA to be a common combination (Cuijpers et al., 2015; Cuijpers et al., 2019). And also, CBT and Mindfulness have previously been found to be combined (Linardon et al., 2024). The combination of BA and Mindfulness was less common in previous literature, though has also been applied before (Potsch & Rief, 2024). Finding this combination in four studies in the current review might indicate a possible new trend in comparison to the other two well-established combinations, which should be further explored. A possible explanation could be a rise in popularity of the process-based approach to therapy. As BA and Mindfulness are both interventions which can be individually adapted to psychological dimensions of the participant, instead of focussing on the disorder, combining them within app-based treatment could become more common. Another explanation could be that

BA has been found to decrease depression more effectively for higher depression severity, while Mindfulness has shown to be more effective for lower depression symptoms (Ly et al., 2014). By combining both interventions, the treatment might be better suitable for multiple depression levels and therefore maximise treatment effects for a larger variety of people. The inclusion of CBT with either intervention to be most common could be based on CBT being among the most accepted practices with a well-researched evidence base (David et al., 2018). To test these hypotheses, future studies should focus on researching additional intervention combinations, while also testing stand-alone interventions, to find the best combination for depression reduction depending on the population.

In the fifth RQ, it was assessed in which wave included techniques were used more often, according to CBT and TWT therapists. A study conducted by Brown (2011), served as the basis by providing information about techniques that are significantly used more by CBT or TWT therapists. In the current review it was found that 10 of the studies included techniques, which are significantly used more by CBT therapists in the categories of cognitive restructuring and relaxation. Furthermore, 14 studies included techniques that were significantly used more by TWT therapists in the categories of Mindfulness/ Acceptance and Existential/ Humanistic. Further techniques in the categories of radical behavioural, homework, breathing and social skills were also included, but Brown et al. (2011), found them to not have a significantly different usage pattern between CBT and TWT therapists. Furthermore, it was observed that most techniques were categorised in the Mindfulness/ Acceptance category, which is consistent with Mindfulness being identified as the most used intervention across all studies. To understand the included techniques and their roles within CBT and TWT better, future research should investigate the content and aim of each technique in more detail.

Interestingly, 14 studies were identified to include techniques within the Mindfulness/ Acceptance category, while only 11 studies were described by the authors as Mindfulness-based interventions. Similar patterns were observed regarding different techniques. One example is that techniques that were labelled as being used more by CBT therapists were detected in 10 studies, while only nine studies declared to use CBT. Also, while BA was labelled to be included in eight studies in total, 10 studies included techniques within the radical behavioural category, which BA was originally rooted in, according to the principles of operant conditioning established by Skinner (1953) (Kanter et al. 2010). Due to this finding, it can be noted that techniques are not always exclusively used in one intervention but might also be included in other interventions. Another reason might be the adaptation of many techniques, due to expanding knowledge in the field. For example, TWT therapists make use of some techniques that originated in another wave of therapy but were adapted to the rationale of TWT (Hayes and Hofmann, 2021). This finding can also be understood within the background of the process-based view, meaning that the techniques do not have to be categorised as one specific treatment for one specific disorder (Hayes & Hofmann, 2021). According to that view the techniques can be used across multiple treatments and therapy waves and are applied depending on the patients' unique profile. In the process-based view the function of the technique is seen as the central point, instead of the origin. Therefore, future research should focus on specific functions and contents of effective techniques for depression, investigating which techniques are essential as core components in depression treatment.

To answer the last RQ, the effectiveness of treatments compared to control conditions within the included studies was summarised. In 10 studies depression levels were significantly reduced, while in five that was not the case. Though, it should be noted, that in three of these studies the control groups were BA treatment in-person, a Mindfulness intervention and

treatment as usual. As these are also treatment options that have been found to significantly reduce depressive symptoms, the non-significant difference of depression scores in app-based treatment compared to these treatments is comprehensible. Though, it should be noted that most of these treatments significantly reduced depressive symptoms, while the control group showed the same trends. The effect sizes of most treatments are partly in line with prior research. The current study mostly found small to medium effect sizes, while for example Sierra et al. (2018), found medium to large effect sizes of online TWT as a treatment option. To gain a broader overview of the treatments' effectiveness, more research is needed to confirm the findings across different contexts, while controlling for individual differences of participants.

Implications

The findings of this scoping review offer valuable insights into app-based depression treatments with TWT, which can be useful for people with depressive symptoms to gain an overview of available treatment options, as well as for clinicians and overall healthcare providers. This research highlighted the most used TWT interventions in app-based depression treatment, which were BA and Mindfulness, while CBT was often included as an addition to the TWT treatment. Understanding the variety and commonality of included interventions and intervention combinations can give therapists an overview of treatment options that have already been implemented in an app-based setting and build a basis for future depression app development. The finding, that for a sub-clinical and clinical sample BA and CBT were implemented most, while for a non-clinical sample Mindfulness was the most common choice, is an indicator for app-developers tailoring the interventions to their target groups. This finding should be taken into consideration when designing future apps, as these solutions have proven to significantly reduce depressive symptoms in most studies of the current review. Additionally, the overview of techniques used within the apps can give information about the therapy content within different

intervention combinations, as well as providing an overview of whether techniques are used more by CBT or TWT therapists. This categorisation goes beyond the theoretical categorisation of techniques, by providing practical insights of therapists' usage within CBT and TWT. The insight that techniques are not always specific to one wave of therapy also provides evidence for a process-based view on therapy, rather than a strict distinction between waves. Finally, by providing an overview of apps which significantly reduce depressive symptoms with TWT, better judgement for implementation in clinical settings can be made. A practical implementation could for example follow a stepped-care approach in which patients start with a low intensity treatment, which increases its intensity over the treatment course (van Straten et al., 2015). The app-based therapy could in this model be offered as a low intensity treatment, while the client is on the waiting list for another high intensity treatment or serve as an alternative to traditional mental health care for clients (Linardon et al., 2019). Therefore, people can reduce symptoms through the app interventions and therefore create more live-therapy places for people with symptoms that cannot be managed through an app. Overall, the research provided an overview of the current scope of research regarding app-based TWT for depressive symptoms, while also highlighting research gaps, which should be addressed in further research. This scoping review can provide valuable insights to patients, clinicians, overall healthcare providers and app developers.

Strengths and Limitations

The strengths and limitations of this work should be considered when interpreting its results. Strengths of the study included that only RCTs were considered for the analysis. Therefore, possible bias of studies was reduced, and validity was increased (Hariton & Locascio, 2018). Moreover, while reporting the PRISMA guidelines were adhered to, which improves transparency across the paper and facilitates replicability (Page et al., 2021). Another strength of the study is that 11 out of the 15 included studies were conducted after the year of 2019,

underlining the decision to adapt and repeat the search string of Linardon et al. (2019), as app-based interventions have gained popularity in recent years. The study overall gave an overview of research in the field of app-based depression treatment with mainly TWT, including different intervention combinations and practical insights into techniques being used more by CBT therapists or TWT therapists.

Furthermore, limitations regarding the current review should be taken into consideration. Limitations include that the second screening phase was conducted by only one researcher, making the screening process less reliable, as the inter-rater reliability could not be calculated. This study also did not assess the quality of included studies, which is used to identify and reduce risk of bias which might occur due to a poor study design (Gebrye et al., 2023).

Additionally, limitations regarding the included studies should be considered. None of the studies were implemented in a developing country, which limits the generalisability of findings across cultures. Moreover, most studies on app-based depression treatment did not differentiate between different therapies and techniques, but instead mixed them. For that reason, it is difficult to attribute the outcome to a specific form of therapy, or a specific technique, but instead it is only possible to make assumptions about the combination of therapies included in the studies.

The research about apps reducing depression with TWT is still scarce, as not enough variety and comparisons between depression levels and effective app-based TWT treatment have been researched. Another concern is the variety of TWT being administered as a stand-alone treatment. In the included studies only BA and Mindfulness were tested as such, with all other TWT being administered in combination only with other TWT or CBT, making it hard to draw conclusions on the treatments' effectiveness and contributing factors.

Conclusion

This study provided an overview of app-based depression treatment with mainly TWT. Main findings were that studies have only been conducted in Western cultures, with high percentages of female participants with moderate depression levels when entering the studies. The most common included interventions were Mindfulness, CBT and BA, while Mindfulness was more common among a non-clinical sample and the combination of CBT and BA was more common among sub-clinical and clinical samples. Categorising techniques into a specific wave of therapy has proven to be difficult, due to their changing focus in recent years and not enough information about their content being available, requiring the consideration of a process-based view. Though, in the current study more techniques were categorised as being part of TWT. Finally, most treatments significantly reduced depression levels among participants. Future studies should focus on less represented interventions, while also including stand-alone interventions to distinguish what techniques and technique content, effects might be attributable to, while taking individual differences of participants into account.

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Appendix

Techniques of Included Studies Categorised Based on Being Used More in CBT, TWT or Both Practices According to the Study by Brown et al. (2011).

Author (year)	CBT		TWT		Both				
	Cognitive Restructuring	Relaxation	Existential/ Humanistic	Mindfulness / Acceptance	Breathing	Homework	Radical Behavioural	Social Skills	Other
Ly et al. (2015)						x	x		
Ly et al. (2014)			x	x		x	x		
Raevuori et al. (2021)				x		x			
Forman-Hoffman et al. (2024)				x		x			
Bruhns et al. (2021)	x		x	x			x	x	x
Peake et al. (2024)	x		x	x		x	x		x
Roepke et al. (2015)	x		x	x			x	x	x
Lüdtke et al. (2018)	x			x			x	x	
Vereschagin et al. (2024)	x	x	x	x		x		x	x
Deady et al. (2022)	x	x	x	x	x	x	x	x	x
Everitt et al. (2021)		x	x	x	x	x	x		
Al-Refae et al. (2021)	x	x	x	x	x	x	x		x
Flett et al. (2019)				x	x				
Huberty et al. (2022)		x		x	x				
Fuller-Tyszkiewicz et al. (2020)	x		x	x	x	x	x		x

Note. Exposure Techniques, Family Systems-, Power/Energy- and Analytic/Dynamic techniques were excluded from the table, as none of the included studies used techniques of these categories within their interventions.