

# Computer-Assisted CBT and Mobile Apps for Depression: Assessment and Integration Into Clinical Care

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A surge in the development of computer-assisted cognitive-behavioral therapy (CCBT) and mobile apps for depression has provided many tools with potential for enhancing treatment delivery. This article assesses progress in evaluation and implementation of CCBT and mobile apps for depression, with a focus on providing practical information on clinical applications. Advantage and disadvantages of these technologies are identified, outcome research is

reviewed, and recommendations are made for clinical use. With increasing use of computer technology in everyday life, it is likely that clinicians and patients will pursue opportunities to employ computer tools in treatment for depression.

*Focus 2020; 18:162–168; doi: 10.1176/appi.focus.20190044*

With increasing evidence of the effectiveness of computer-assisted cognitive-behavioral therapy (CCBT) and the proliferation of mobile apps for behavioral health, clinicians are beginning to integrate these resources into their treatment plans. CCBT has been developed as a way of helping patients build core CBT knowledge and skills while reducing reliance on traditional face-to-face sessions. Typically, CCBT is delivered in a series of six to 12 lessons or modules over an 8- to 16-week period. Although CCBT has been tried without clinician support, a recent meta-analysis concluded that unsupported CCBT has smaller effects than a hybrid delivery method in which a clinician or other helping professional guides treatment (1). Clinician involvement is usually reduced to a third or less of the time spent in standard CBT (1, 2). Most CCBT programs are administered via desktop computers, laptop computers, or tablets and are designed for use in sessions of 20 minutes or more, instead of “on the fly.” Some CCBT programs are becoming available for smartphones, but most research on CCBT has not employed this form of mobile delivery (1).

In contrast to CCBT, most mobile apps do not provide a full course of CBT, or other psychotherapy, but are limited to a specific coping method, such as breathing training, relaxation, or mood tracking (2). Concerns have been raised about the content, security, and efficacy of the mobile apps that have been designed for behavioral health (2). However, guidelines for evaluating and selecting apps can assist clinicians in sorting through the wide choice of available apps

(2). In this article, we review empirical support for CCBT and mobile apps used for depression, discuss features of some commonly used CCBT programs and mobile apps, and offer suggestions for using these methods in clinical practice.

## CCBT FOR DEPRESSION

### Advantages and Disadvantages of CCBT

Research on CCBT for depression has escalated dramatically in the past decade as developers and researchers have searched for ways to fulfill the promise of computer technology for making evidence-based psychotherapy more convenient, accessible, and cost-effective (1–7). Traditional methods of delivering CBT for depression have been shown to be effective (8–10), but standard CBT usually requires 12–20 sessions lasting 50 minutes each and is conducted in clinicians’ offices. Clinician-supported CCBT has been delivered with shorter and a smaller number of face-to-face sessions, but it more commonly uses telephone or e-mail support (1). With such methods, patients can do a considerable amount of the therapy by computer and spend much less time in clinicians’ offices and in transit to and from appointments. Also, CCBT with telephone, video-link, or e-mail support can help ameliorate access problems in rural settings and other areas where there is limited or no availability of trained cognitive-behavior therapists. Cost savings of CCBT have been documented in multiple investigations (11–16).

Although convenience, access, and cost savings have been primary drivers of interest in CCBT, it has other potential advantages. By employing multimedia elements and interactive exercises, CCBT can provide engaging learning opportunities that can enrich the therapy experience. In studies with Good Days Ahead, a multimedia program for depression, CCBT led to significantly greater acquisition of CBT knowledge, compared with standard CBT (17, 18). Data recording and analysis are other potential advantages of CCBT. Information such as symptom ratings, lesson completion rates, program comprehension scores, and work on self-help exercises (e.g., thought records, activity schedules, and coping cards) can be stored, provided to clinicians to help guide treatment, and used for program evaluation and research. The ability to provide a carefully designed, standardized “dose” of CBT is an additional advantage. Clinicians who prescribe an evidence-based CCBT program can be assured that patients will have the opportunity to build core skills in CBT.

Of course, CCBT also has limitations. No programs can show the empathy, genuineness, understanding, creativity, and wisdom of human therapists. Currently available CCBT programs typically are not tailored to account for variability in age, education level, symptom burden, cognitive capacity, sociocultural influences, and other differences that can influence participation in therapy. Programs may offer options, such as choosing a female or male narrator, and may take varied paths depending on answers to questions, but greater flexibility and personalization are goals for improving CCBT.

The program completion rate has been another liability for CCBT. Although some studies have reported completion rates of 80% or higher (1, 17, 18), much lower rates have been observed in other investigations (1). A meta-analysis of 40 studies of CCBT for depression found that the completion rate strongly influenced outcome (1). Poorer adherence or lack of reporting dropout percentages were associated with the least favorable results (1). Insurance coverage for the costs of computer programs remains a barrier to widespread dissemination. The costs of clinician time can be billed to insurance plans. However, additional expenses of providing a computer program, even though they reduce the overall cost of care, are not covered by traditional insurance at this time. In capitated, managed care plans, CCBT can be built into the care delivery model. Also, employee assistance programs and companies that provide telepsychiatry and digital behavioral health care as alternatives to traditional face-to-face treatment are beginning to employ CCBT. Nevertheless, financing can be an obstacle to implementation of computer-assisted therapy.

### **Effectiveness of CCBT for Depression**

Results of multiple meta-analyses have confirmed that CCBT is as effective as standard CBT (1, 3–7, 19). For example, a recent systematic review and meta-analysis of CCBT for depression (1) reported a moderately large effect size of 0.50 for all investigations. A larger effect size of 0.67 was found for

studies that included clinician support, whereas a considerably lower effect size of 0.24 was observed for unsupported CCBT. A direct comparison of supported CCBT versus a full course of 16–20 sessions of standard CBT for depression found no differences between the treatments, except for better performance of CCBT in improving CBT knowledge (18).

A systematic review found good study quality in most of 40 investigations of CCBT for depression (1). However, several concerns need to be considered in interpreting results of CCBT research. First, research subject populations and recruitment methods have varied widely. Some studies have focused on mild depression and have screened out persons with more severe symptoms, whereas others have required diagnosis of major depressive disorder and have included patients with severe and chronic disorders. Recruitment has ranged from selecting patients via Internet posts (thus tilting the sample toward those with Internet access and interest in online therapy) to requiring that participants be patients in primary care clinics (1, 20). Because of these differences in recruitment, questions can be raised about the applicability of CCBT for actual patients with diagnosed depression. However, evidence to date suggests that persons diagnosed as having major depressive disorder respond well to CCBT (1, 17, 18) and that patients having more severe depression gain as much benefit from CCBT as from standard CBT (18).

Second, there is some evidence that patients from primary care settings may respond less well to CCBT, compared with those from mental health or community settings (1, 21). The reasons for these differences are unclear, but it has been suggested that studies in primary care may recruit patients with more severe or complex conditions or that modifications in treatment methods might be needed to overcome barriers to using psychotherapy in this setting (1). A new study of CCBT in primary care that focuses on dissemination and implementation is nearing completion (22).

Third, the amount and type of clinician support required for effective CCBT require further research. Although there is strong evidence that some support improves outcome, the best range for clinician time is not known (1, 2). Details on the amount of support time (ranging from about 1 hour to 8 hours or more, with most studies employing 4 hours or less) used in a large number of studies of CCBT for depression have been reported in a review and meta-analysis by Wright et al. (1). This meta-analysis found that either face-to-face or telephone support was associated with better outcomes, compared with e-mail support (1)—a finding that suggests that visual or auditory contact with clinicians may be more effective than viewing text in e-mail messages. Fourth, very little CCBT research has been done with disadvantaged populations, such as those who are struggling with poverty, low educational levels, lack of access to the Internet, or other possible obstacles to using computer technology as part of psychotherapy (1, 22). Because such populations may be particularly affected by limitations in

**TABLE 1. Computer-assisted cognitive-behavioral therapy programs assessed in multiple randomized controlled trials**

Program and trials	Link
Beating the Blues (23–25)	<a href="http://www.beatingthebluesus.com">http://www.beatingthebluesus.com</a>
Deprexis (29–31)	<a href="https://us.deprexis.com">https://us.deprexis.com</a>
Good Days Ahead (17, 18, 22)	<a href="http://www.empower-interactive.com/solutions/good-days-ahead">http://www.empower-interactive.com/solutions/good-days-ahead</a>
Mood Gym (20, 25–28)	<a href="https://moodgym.com.au">https://moodgym.com.au</a>
Sadness Program (32–35)	<a href="https://www.c4tbh.org/program-review/the-sadness-program">https://www.c4tbh.org/program-review/the-sadness-program</a>

access to effective treatment, research needs to focus on ways to surmount barriers to receiving CCBT.

### Examples of CCBT Programs for Depression

CCBT for depression has been developed in a variety of formats and languages (1, 2). Although some use text only, many utilize multimedia and stimulating interactive learning exercises (1, 2). Table 1 lists examples of multimedia programs for CCBT of depression that have been studied in more than one randomized controlled trial and are available in English. Beating the Blues (23–25), developed in the United Kingdom, was found to be more effective than treatment as usual in an early study (23) that did not specify the amount of clinician support. In a more recent, large-scale investigation that offered only a small amount of technical support, CCBT with Beating the Blues did not show an advantage over treatment as usual (25). Similar results were observed with Mood Gym (20, 25–28), which was developed in Australia. Clinician-supported treatment with Mood Gym (27, 28) was found to result in greater improvement in depression, compared with unsupported CCBT with Mood Gym (20, 25, 26).

Deprexis (29–31), which was developed in Germany and is now available in an English translation, has been widely studied and found to be effective. The Sadness Program (32–35) from Australia has been evaluated in an interesting study that compared three groups of community volunteers with depression: some received support from a clinician, some received support from a technician, and some were placed on a wait list (control group) (33). In this investigation that provided about an hour of human support, both clinician- and technician-supported CCBT had large clinical effects, compared with the control condition, and no significant differences were found between the groups with the two types of support (33).

The Good Days Ahead program (17, 18, 22), which was developed in the United States, has been compared directly with standard CBT in two randomized controlled trials involving patients with major depressive disorder who were not taking antidepressant medications (17, 18). The program was found to be as effective as a full course of up to 20 sessions of traditional, face-to-face CBT. This program is being

investigated now in a primary care setting (22). Good Days Ahead has nine lessons that cover the basic concepts and methods of CBT, such as identifying and modifying automatic thoughts, activity scheduling, and revising maladaptive core beliefs. Typical implementation of this program includes fewer and briefer sessions with a clinician, compared with standard CBT. In a study of 154 patients with major depressive disorder, clinician time was reduced by about two-thirds in CCBT (18).

### Using CCBT in Clinical Practice

We suggest that you try programs yourself before recommending them to patients. By doing so, you will be able to educate patients on use of CCBT, build your own skills in using these technologies in clinical practice, and discern the advantages and limitations of the computer program. Table 1 provides links to websites for evidence-based programs described above. These websites can be accessed to request demonstration copies of the various CCBT options.

Safety is a key factor in evaluating CCBT programs. Because CCBT is specifically designed for treatment of psychiatric conditions, the quality and integrity of program content and security and confidentiality (HIPAA compliance for personal health information) have been top priorities of developers. Typically, a great amount of effort has been invested in designing programs that adhere to the core principles of CBT and that have high levels of security. Nevertheless, clinicians should ascertain the suitability and safety of CCBT programs that they recommend to their patients. Of course, a paramount consideration in selecting CCBT programs is evidence of effectiveness. Research on a wide variety of CCBT programs was summarized by Wright et al. (1) and in other meta-analyses (4–7, 19).

After a CCBT program is chosen, clinicians can do several things to increase patient adherence and outcome. To get started, give patients an introduction to the program. Explain how to access it with a user name and password, describe the core features of the learning experience, suggest a good pace of use for the particular patient (based on his or her symptoms, educational level, computer experience, and other variables that could affect comprehension and usability of the program), and describe your role in facilitating CCBT. Then ask about program participation at each subsequent visit or in other communications with patients. Show your interest, offer support and guidance, and troubleshoot difficulties the patient may have in understanding or using skills taught in the program. Another recommendation is to use the clinician interface, if one is provided with the program. Mood ratings, comprehension scores, and work on interactive exercises from the computer program can be brought into your sessions or other communications to help the patient gain optimal benefit from CCBT. Finally, integrate the computer work into a comprehensive treatment plan so that human and computer elements of treatment facilitate one another.

In summary, we suggest that these steps be followed when using CCBT in clinical practice (2): Try the program yourself. Choose programs with high levels of safety and quality content. Use CCBT programs with demonstrated effectiveness. Explain the CCBT program to patients. Orient them to key features. Provide support either in office sessions or by telephone, telemedicine, or secure e-mail. Use the clinician interface if the program has this feature. The clinician dashboard can help integrate computer-assisted therapy with the other components of the treatment plan. Employ a comprehensive treatment plan that integrates CCBT into clinical practice.

## MOBILE APPLICATIONS FOR DEPRESSION CARE

Mobile applications, hereafter referred to as apps, are software programs that are either preinstalled or downloaded—most commonly to a mobile device for a specific purpose. Smartphones may be defined as devices that incorporate a mobile phone, camera, and audio with computerized capabilities. Tablets are larger devices that operate in similar ways but may be too large to function as a traditional phone. Although smartphones and tablets are both included in the broader terminology of “mobile devices” and can be used similarly, tablets, because of their size, are often more suitable to use for video-chat telehealth capabilities (i.e., two-way synchronous audio and visual connections) and CCBT.

The use of mobile apps in daily life continues to increase, and there has been a proliferation of apps designed for health care, including those for depression. Recent reports suggest that almost 200 billion app downloads are made globally each year, with a total annual revenue of over US \$100 billion for apps stores and developers (36). Health apps are one of the fastest growing categories of apps. Up to 325,000 health and wellness apps are commercially available to patients, with more than 10,000 designed for mental health (37, 38). Surveys show that many patients would like to have mobile apps to help manage their symptoms and access clinical support (39, 40). Although a recent review found that studies of depression and anxiety constitute 13% of the literature on mobile apps in health care (41), concerns remain about the quality, security, and efficacy of mobile apps for depression.

In an analysis of 117 commercially available apps purportedly using CBT methods for depression, just 10% had content consistent with CBT methods (42). Also, the usability of many apps for depression was questioned, and privacy and safety policies were rarely specified (42). A review of apps for suicide risk found that only 25% provided a discussion of crisis support services (43). Unwanted surveillance also can occur with mobile apps. Commercial companies that distribute apps may hold and transmit data through many hands and service providers, with limited or no attention to protecting the privacy of users (44).

## Efficacy of Mobile Apps for Depression

Few apps have been studied in rigorous, randomized controlled trials (1, 2, 42). Therefore, compared with CCBT, much less is known about their effectiveness for specific psychiatric disorders. When apps for depression have been evaluated in research studies, they have generally been found to be helpful (45). However, many investigations were not conducted using carefully diagnosed samples of persons with major depressive disorder, lacked appropriate control groups (42), or were conducted by developers of the apps (2, 36).

A meta-analysis of 18 studies in which a depression outcome measure was used with a variety of participants found an overall moderate effect size (Hedges'  $g=0.38$ ) for the mobile apps, compared with control conditions (45). IntelliCare, a suite of apps, with some utilizing CBT principles, has shown significant reductions in depression measures when 8 weeks of coaching was provided (46). Virtual Hope Box is not a depression-specific app, but it does include functions, such as breathing exercises, diversions, and relaxation training, that may help alleviate symptoms of depression and inspire hope (2, 47). Developed by the Department of Defense, the Virtual Hope Box app has been shown to be significantly better than a control condition for increasing coping skills for unpleasant emotions and thoughts (47).

## Issues With Engagement

Despite some promising trends in findings supporting efficacy and reports of patients desire to use apps for their care, user engagement has remained relatively low (36, 48). Overall, about three-quarters of users stop engaging with a health app after 10 uses (49), and one study reported that 60% of patients in a study of apps for depression never downloaded the app (50). PTSD Coach, one of the few apps to report usage data, has reportedly been downloaded over 150,000 times; however, a study of its impact showed that only 14% of people had used the app the day after downloading it (51). Torous and colleagues (49) conducted a narrative review of the literature and categorized five themes for low engagement: poor usability, lack of user-centric design, concerns about privacy, lack of trust, and not being of help in emergencies. Another review of 40 studies with “user engagement indicators” for mental health apps found that 36 studies reported some form of subjective engagement criteria and that 25 studies used objective measures of engagement. Although all reported positive engagement, no studies used the same criteria to evaluate the app (52).

## Using Mobile Apps in Clinical Practice

As with CCBT, it is important to evaluate the quality and efficacy of an app, including its ability to meet the stated purpose, prior to recommending it to patients or other providers. Yet the process of evaluating an app can be challenging. There has been a lack of consensus about what constitutes mobile app usability, feasibility,

**TABLE 2. Useful mobile apps for depression**

App	Features	Source	Link
Breathe2Relax	Breathing training	U.S. Department of Defense	<a href="https://apps.apple.com/us/app/breathe2relax/id425720246">https://apps.apple.com/us/app/breathe2relax/id425720246</a>
Calm	Relaxation, meditation	Calm.com	<a href="http://www.calm.com">www.calm.com</a>
Day to Day	Daily tips on cognitive-behavioral therapy skills, such as challenging negative thoughts and behavioral activation	IntelliCare, Northwestern University	<a href="https://intelicare.cbitts.northwestern.edu/app/day-to-day">https://intelicare.cbitts.northwestern.edu/app/day-to-day</a>
Headspace	Mindfulness	Headspace.com	<a href="https://www.headspace.com/headspace-meditation-app">https://www.headspace.com/headspace-meditation-app</a>
My Mantra	Create a mantra	IntelliCare, Northwestern University	<a href="https://intelicare.cbitts.northwestern.edu/app/mantra">https://intelicare.cbitts.northwestern.edu/app/mantra</a>
Positive Activity Jackpot	Behavioral activation	U.S. Department of Defense	<a href="https://www.hprc-online.org/resources/positive-activity-jackpot-app">https://www.hprc-online.org/resources/positive-activity-jackpot-app</a>
Thought Challenger	Modifying negative thoughts	IntelliCare, Northwestern University	<a href="https://intelicare.cbitts.northwestern.edu/app/thoughtchallenger">https://intelicare.cbitts.northwestern.edu/app/thoughtchallenger</a>
Virtual Hope Box	Coping skills for unpleasant emotions and thoughts	U.S. Department of Defense	<a href="https://www.research.va.gov/research_in_action/Virtual-Hope-Box-smartphone-app-to-prevent-suicide.cfm">https://www.research.va.gov/research_in_action/Virtual-Hope-Box-smartphone-app-to-prevent-suicide.cfm</a>

satisfaction, and acceptability (52). The Mobile Application Rating Scale evaluates user engagement, function, aesthetics, and information quality and has shown some success in identifying shortcomings in medical mobile apps (53). The American Psychiatric Association (APA) has developed an evaluation framework available online for clinicians to use prior to prescribing an app to a patient (54). The APA framework recommends first gathering background information on the app developer and reasons for app development before evaluating the app's privacy and security, effectiveness, ease of use, and operability.

We recommend consideration of the following features when evaluating an app for clinical use: the app developer, motivation for app development, and cost; use of user-centered design methods; data safety and privacy practices for how data are stored, used, and shared, including partner sharing agreements; whether the app works and addresses clinical concerns as intended, has undergone rigorous review, and is regularly updated; and user adherence data.

Few practical guidelines exist to assist clinicians with proper implementation of mobile apps into clinical practice. One exception is the U.S. Department of Defense Mobile Health Practice Guide (55). A welcome future step would be a best practices guideline developed as an official consensus document under a professional association. Table 2 presents information on some apps that we have been found to be useful in depression care.

After you have chosen an app for clinical use, you can enhance its impact by taking time to explain its goals and functions to patients and discuss how it can be employed in daily life. For example, if you are recommending the Virtual Hope Box described above, you could access the app on your mobile phone and demonstrate how photos can be placed in the "hope box" to stimulate thoughts and emotions of

hopefulness and well-being. Then you could develop a homework assignment to look at the "hope box" daily or when feelings of despair are triggered.

Many patients find apps through social media and word of mouth or decide which app to use on the basis of ratings and reviews in the app store (36), instead of obtaining recommendations from their providers (48). Lower-priced mental health apps generate higher ratings than more expensive apps (56); thus, price may drive choice. Because patients risk being misled about potential benefits and usefulness of apps, we suggest that clinicians ask patients about all apps they may be using to determine whether these apps are helpful.

In parallel with our recommendations for CCBT, we suggest that mobile apps be used as part of a multifaceted, comprehensive treatment plan. Apps, and other technology-based services, should be conceptualized as part of the overall health delivery system rather than treated as stand-alone products (41, 46). One recent study found that most people who would consider using app-based care interventions were skeptical of completely self-guided interventions (57). We suspect that implementation of mobile apps, as with CCBT, will be most effective when there is a therapeutic relationship with a human clinician who conceptualizes the technology aid as a valuable addition to the traditional elements of clinical care (2, 58).

In summary, our recommendations for using mobile apps in clinical care and fostering ongoing patient engagement include the following: evaluate the app before suggesting that patients use it, support the patient's use of your recommended app, ask patients about other apps they may be using and help them determine whether these apps are reliable sources of assistance, and use apps as part of an integrated system of care.

## CONCLUSIONS

Many advances in the development of CCBT and mobile apps suggest these technologies offer potential for enhancing the treatment of depression. CCBT has been studied in a large number of randomized controlled trials demonstrating that its effectiveness matches that of standard, face-to-face CBT while it offers advantages of improved efficiency, reduction of clinician effort, lowered cost, and greater convenience for patients. These strengths of CCBT could yield benefits in broadening access to evidence-based psychotherapy for depression. However, issues such as variable rates of completion of CCBT programs, dissemination in primary care and disadvantaged populations, and defining optimal or necessary amounts and types of clinician support need to be addressed. Goals for future development of and research on CCBT include improved personalization of program content and use of artificial intelligence to make programs more intuitive and humanlike in their communications with patients. We believe that the evidence for the effectiveness and efficiency of CCBT is sufficient to justify increased support from funding agencies and foundations and more widespread dissemination in clinical practice. Together with mobile apps, CCBT could become a basic tool in individual therapy and team-based care.

Although several mobile apps for depression have been developed, inadequacies of data management policies and security protection, in addition to the limited number of randomized controlled trials with actual patient populations, raise concern about their clinical use. Because progress is anticipated in the development, evaluation, and empirical study of apps, we predict their increased acceptance and use in psychiatric treatment.

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Dr. Wright is an author of the Good Days Ahead program and has an equity interest in Empower Interactive and Mindstreet, developers and distributors of the program. He receives no income from program sales. He also reports receipt of book royalties from American Psychiatric Press, Inc., Guilford Press, and Simon and Schuster and receipt of grant support from the Agency for Healthcare Research and Quality and the Oticon Foundation. Dr. Mishkind reports receipt of payments for service on an advisory board for Meta Pro.

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