

# Using apps in clinical practice: 8 studies

Ashish T. Khanchandani, MS, and Sy Ateaz Saeed, MD, MS | Department Editor: Sy Ateaz Saeed, MD, MS

**Mental health–related apps may help improve symptoms of depression, anxiety, and other disorders**

COVID-19's increased demand on the mental health care delivery system led to expanded utilization of technology-based solutions, including digital tools to deliver care.<sup>1</sup> Technology-based solutions include both synchronous telehealth (eg, real-time interactive audio/video visits) and asynchronous tools such as smartphone applications (apps). Both real-time telehealth and apps continue to gain popularity. More than 10,000 mental health–related apps are available, and that number continues to rise.<sup>2</sup> Numerous web- or mobile-based apps are available to aid in the treatment of various psychiatric conditions, including generalized anxiety disorder (GAD), major depressive disorder, insomnia, and posttraumatic stress disorder (PTSD).

Clinicians may find it challenging to choose the best psychiatry-related apps to recommend to patients. This dilemma calls for an approach to help clinicians select apps that are safe and effective.<sup>2</sup> The American Psychiatric Association provides information to help mental health professionals navigate these issues and identify which aspects to consider when selecting an app for clinical use.<sup>3</sup> The M-Health Index and Navigation Database also provides a set of objective evaluative criteria and offers guidance on choosing apps.<sup>4</sup>

In this article, we review 8 randomized controlled trials (RCTs) of mental health–related apps. We took several steps to ensure the RCTs we included were impactful and meaningful. First, we conducted a general search using mainstream search engines to

assess which psychiatric apps were most popular for use in clinical practice. Using this list, we conducted a scholarly search engine query of RCTs using the name of the apps as a search parameter along with the following keywords: “mobile,” “web,” “applications,” and “psychiatry.” This search yielded approximately 50 results, which were narrowed down based on content and interest to a list of 8 articles (*Table*,<sup>5-12</sup> *page 38*). These articles were then graded using the limitations of each study as the primary substrate for evaluation.

**1. Linardon J, Shatte A, Rosato J, et al. Efficacy of a transdiagnostic cognitive-behavioral intervention for eating disorder psychopathology delivered through a smartphone app: a randomized controlled trial. *Psychol Med.* 2022;52(9):1679-1690. doi:10.1017/S0033291720003426**

Many patients with eating disorders are unable to receive effective treatment due to problems with accessing health care. Smartphone apps may help bridge the treatment gap for patients in this position. Linardon et al<sup>5</sup> developed an app that uses the principles of cognitive-behavioral

Mr. Khanchandani is an MD candidate, East Carolina University Brody School of Medicine, Greenville, North Carolina. Dr. Saeed is Professor and Chair Emeritus, Department of Psychiatry and Behavioral Medicine, East Carolina University Brody School of Medicine, Greenville, North Carolina.

#### Disclosures

The authors report no financial relationships with any companies whose products are mentioned in this article, or with manufacturers of competing products.

doi: 10.12788/cp.0377

therapy (CBT) for treating eating disorders and conducted this study to evaluate its effectiveness.

### Study design

- This RCT assigned individuals who reported episodes of binge eating to a group that used a mobile app ( $n = 197$ ) or to a waiting list ( $n = 195$ ). At baseline, 42% of participants exhibited diagnostic-level symptoms of bulimia nervosa and 31% had symptoms of binge-eating disorder.

- Assessments took place at baseline, Week 4, and Week 8.

- The primary outcome was global levels of eating disorder psychopathology.

- Secondary outcomes were other eating disorder symptoms, impairment, and distress.

### Outcomes

- Compared to the control group, participants who used the mobile app reported greater reductions in global eating disorder psychopathology ( $d = -0.80$ ).

- Significant effects were also observed for secondary outcomes except compensatory behavior frequency.

- Overall, participants reported they were satisfied with the app.

### Conclusions/limitations

- Findings show this app could potentially be a cost-effective and easily accessible option for patients who cannot receive standard treatment for eating disorders.

- Limitations: The overall posttest attrition rate was 35%.

**2. Christoforou M, Sáez Fonseca JA, Tsakanikos E. Two novel cognitive behavioral therapy-based mobile apps for agoraphobia: randomized controlled trial. *J Med Internet Res.* 2017;19(11):e398. doi:10.2196/jmir.7747**

CBT is generally the most accepted first-line treatment for agoraphobia. However, numerous barriers to obtaining CBT can prevent successful treatment. Limited research has evaluated the efficacy of apps for treating

agoraphobia. Christoforou et al<sup>6</sup> conducted an RCT to determine the effectiveness of a self-guided smartphone app for improving agoraphobic symptoms, compared to a mobile app used to treat anxiety.

### Study design

- Participants ( $N = 170$ ) who self-identified as having agoraphobia were randomly assigned to use a smartphone app designed to target agoraphobia (Agoraphobia Free) or a smartphone app designed to help with symptoms of anxiety (Stress Free) for 12 weeks. Both apps were based on established cognitive behavioral principles.

- Assessment occurred at baseline, mid-point, and end point.

- The primary outcome was symptom severity as measured by the Panic and Agoraphobia Scale (PAS).

### Outcomes

- Both groups experienced statistically significant improvements in symptom severity over time. The differences in PAS score were  $-5.97$  (95% CI,  $-8.49$  to  $-3.44$ ,  $P < .001$ ) for Agoraphobia Free and  $-6.35$  (95% CI,  $-8.82$  to  $-3.87$ ,  $P < .001$ ) for Stress Free.

- There were no significant between-group differences in symptom severity.

### Conclusions/limitations

- This study is the first RCT to show that patients with agoraphobia could benefit from mobile-based interventions.

- Limitations: There was no waitlist control group. Limited information was collected about participant characteristics; there were no data on comorbid disorders, other psychological or physiological treatments, or other demographic characteristics such as ethnicity or computer literacy.

**3. Everitt N, Broadbent J, Richardson B, et al. Exploring the features of an app-based just-in-time intervention for depression. *J Affect Disord.* 2021;291:279-287. doi:10.1016/j.jad.2021.05.021**

## Clinical Point

**Participants who used an eating disorders app reported greater reductions in global eating disorder psychopathology**



Discuss this article at  
[www.facebook.com/MDedgePsychiatry](http://www.facebook.com/MDedgePsychiatry)

### Clinical Point

Individuals with agoraphobia who used either of 2 CBT-based apps saw significant improvements in symptom severity

Table

## Using apps in clinical practice: 8 studies

Study	Design	Outcomes
Linardon et al <sup>5</sup> (Grade: moderate)	Individuals who reported episodes of binge eating were randomly assigned to use a CBT-based eating disorders app (n = 197) or to a waitlist control group (n = 195) for 8 weeks	Participants who used the app reported greater reductions in global eating disorder psychopathology than those in the control group
Christoforou et al <sup>6</sup> (Grade: low)	Participants who self-identified as having agoraphobia (N = 170) were randomly assigned to use an app designed to target agoraphobia or an app designed to target anxiety for 12 weeks	Both groups experienced statistically significant improvements in panic and agoraphobia symptom severity over time
Everitt et al <sup>7</sup> (Grade: moderate)	Participants who said they wanted to improve their mood (N = 235) were randomly assigned to a waitlist control group or to use 1 of 3 mood apps for 3 weeks: MoodTracker, ImproveYourMood, or ImproveYourMood+	Compared to the waitlist control group, the ImproveYourMood group showed greater declines in depression, anxiety, and negative automatic thoughts
McLean et al <sup>8</sup> (Grade: low)	Veterans with clinically significant PTSD symptoms (N = 93) were randomly assigned to use an app (with or without support from a research staff member) or to a waitlist control group for 6 weeks	Compared to the control group, participants who used the app had a larger decrease in PCL-5 score, but the difference was not statistically significant and the effect size was small
Graham et al <sup>9</sup> (Grade: moderate)	Adult primary care patients (N = 146) who screened positive for depression or anxiety were randomly assigned to use IntelliCare (a coach-supported suite of apps) or to a waitlist control group for 8 weeks	Compared to waitlist controls, participants who used the IntelliCare platform had a greater reduction in depression and anxiety symptoms
Wilhelm et al <sup>10</sup> (Grade: moderate)	Adults (N = 80) with body dysmorphic disorder were assigned to use the CBT-based app Perspectives or to a waitlist control group for 12 weeks	Compared to the control group, patients who used the app had significantly lower body dysmorphic disorder severity
Kuhn et al <sup>11</sup> (Grade: moderate)	Fifty US veterans (mostly males) with moderate insomnia symptoms were randomly assigned to use the CBT-i-based app Insomnia Coach or to a waitlist control group for 6 weeks	At posttreatment, 28% of those who used Insomnia Coach achieved clinically significant improvement, compared to 4% in the control group
Dahne et al <sup>12</sup> (Grade: low)	Primary care patients (N = 52) with depressive symptoms were randomly assigned to use the Moodivate app (designed to help users reengage in positive, nondepressed activities), the CBT-based MoodKit app, or treatment as usual for 8 weeks	Compared to those who received treatment as usual, participants who used either app experienced significant decreases in depressive symptoms over time

CBT: cognitive-behavioral therapy; CBT-i: cognitive-behavioral therapy for insomnia; PCL-5: PTSD Checklist for DSM-5; PTSD: posttraumatic stress disorder

The apps MoodTracker, ImproveYourMood, and ImproveYourMood+ deliver content “just in time” (in response to acute negative symptoms) to help patients with depression. In an RCT, Everitt et al<sup>7</sup> evaluated delivering acute care for depressive mood states via a smartphone app. They sought to delineate whether symptom improvement was due to microintervention content, mood augmentation, or just-in-time prompts to use content.

### Study design

- Participants (N = 235) from the general population who said they wanted to improve their mood were randomly assigned to a waitlist control group (n = 55) or 1 of 3 intervention groups: MoodTracker (monitoring-only; n = 58), ImproveYourMood (monitoring and content; n = 62), or ImproveYourMood+ (monitoring, content, and prompts; n = 60).

- The microintervention content provided by these apps consisted of 4 audio files of brief (2- to 3-minute) mindfulness and relaxation exercises. Participants used the assigned app for 3 weeks.

- Depressive symptoms, anxiety symptoms, and negative automatic thoughts were assessed at baseline, immediately following the intervention, and 1 month after the intervention using the 9-item Patient Health Questionnaire (PHQ-9), 7-item GAD scale (GAD-7), and 8-item Automatic Thoughts Questionnaire, respectively.

### Outcomes

- Compared to the waitlist control group, participants in the ImproveYourMood group showed greater declines in depressive symptoms and anxiety symptoms (at follow-up only), and negative automatic thoughts (at both postintervention and follow-up).

- Those in the ImproveYourMood+ group only showed significantly greater improvements for automatic negative thoughts (at postintervention).

- MoodTracker participants did not differ from waitlist controls for any variables at any timepoints.

### Conclusions/limitations

- This study suggests that using microinterventions in acute settings can effectively reduce depressive symptoms both as they occur, and 1 to 2 months later.

- Limitations: The study featured a naturalistic design, where participants self-selected whether they wanted to use the program. Participants did not complete eligibility assessments or receive compensation, and the study had high dropout rates, ranging from 20% for the waitlist control group to 67% for the ImproveYourMood+ group.

4. McLean C, Davis CA, Miller M, et al. The effects of an exposure-based mobile app on symptoms of posttraumatic stress disorder in veterans: pilot randomized controlled trial. *JMIR Mhealth Uhealth*. 2022;10(11):e38951. doi:10.2196/38951

Veterans with PTSD face barriers when receiving trauma-focused treatments such as exposure therapy or CBT. Smartphone apps may help veterans self-treat and self-manage their PTSD symptoms. McLean et al<sup>8</sup> studied the efficacy of Renew, a smartphone app that uses exposure therapy and social support to treat PTSD.

### Study design

- In this pilot RCT, 93 veterans with clinically significant PTSD symptoms were randomly assigned to use the Renew app with and without support from a research staff member (active use group) or to a waitlist (delayed use group) for 6 weeks.

- The PTSD Checklist for DSM-5 (PCL-5) was used to measure PTSD symptoms at preintervention, postintervention, and 6-week follow-up.

- Most participants (69%) were women, and the mean age was 49.

### Outcomes

- Compared to the delayed use group, participants in the active use group experienced a larger decrease in PCL-5 score (-6.14

### Clinical Point

Compared to the control group, the ImproveYourMood app group had greater declines in depression and anxiety symptoms

## Clinical Point

**Patients who used the IntelliCare apps experienced a sustained reduction in depression and anxiety symptoms**

vs  $-1.84$ ). However, this difference was not statistically significant ( $P = .29$ ), and the effect size was small ( $d = -0.39$ ).

- There was no difference in engagement with the app between participants who received support from a research staff member and those who did not receive such support.

### Conclusions/limitations

- Renew may show promise as a tool to reduce PTSD symptoms in veterans.

- Educating family and friends on how to best support a patient using a mobile mental health app may help improve the efficacy of Renew and increase app engagement.

- Limitations: Because the study was conducted in veterans, the results may not be generalizable to other populations. Because most data collection occurred during the first wave of the COVID-19 pandemic in the United States, COVID-19–related stress may have impacted PTSD symptoms, app engagement, or outcomes.

**5. Graham AK, Greene CJ, Kwasny MJ, et al. Coached mobile app platform for the treatment of depression and anxiety among primary care patients: a randomized clinical trial. *JAMA Psychiatry*. 2020;77(9):906-914. doi:10.1001/jamapsychiatry.2020.1011**

Many cases of depression and anxiety are initially treated in primary care settings. However, these settings may have limited resources and inadequate training, and mobile interventions might be helpful to augment patient care. Graham et al<sup>9</sup> studied the mobile platform IntelliCare to determine its efficacy as a tool to be used in primary care settings to treat depression and anxiety.

### Study design

- This RCT randomly assigned adult primary care patients ( $N = 146$ ) who screened positive for depression on the PHQ-9 (score  $\geq 10$ ) or anxiety on the GAD-7 (score  $\geq 8$ ) to the coach-supported

IntelliCare platform, which consisted of 5 clinically focused apps, or to a waitlist control group. Interventions were delivered over 8 weeks.

- Overall, 122 (83.6%) patients were diagnosed with depression and 131 (89.7%) were diagnosed with anxiety.

- The primary outcomes were changes in depression (as measured by change in PHQ-9 score) and anxiety (change in GAD-7 score) during the intervention period.

### Outcomes

- Participants who used the IntelliCare platform had a greater reduction in depression and anxiety symptoms compared to waitlist controls, and changes were sustained over 2-month follow-up.

- The least square means (LSM) difference in depression scores at Week 4 was 2.91 (SE=0.83;  $d=0.43$ ) and at Week 8 was 4.37 (SE=0.83;  $d=0.64$ ). The LSM difference in anxiety scores at Week 4 was 2.51 (SE=0.78;  $d=0.41$ ) and at Week 8 was 3.33 (SE=0.76;  $d=0.55$ ).

- A median number of 93 and 98 sessions among participants with depression and anxiety were recorded, respectively, indicating high use of the IntelliCare platform.

### Conclusions/limitations

- The IntelliCare platform was shown to be effective in reducing depression and anxiety among primary care patients. Simple apps can be bundled together and used by patients in conjunction to treat their individual needs.

- Limitations: The study had a limited follow-up period and did not record participants' use of other apps. Slightly more than one-half (56%) of participants were taking an antidepressant.

**6. Wilhelm S, Weingarden H, Greenberg JL, et al. Efficacy of app-based cognitive behavioral therapy for body dysmorphic disorder with coach support: initial randomized controlled clinical trial. *Psychother Psychosom*. 2022;91(4):277-285. doi:10.1159/000524628**



Body dysmorphic disorder (BDD) is a severe yet undertreated disorder. Apps can improve access to treatment for patients experiencing BDD. Wilhelm et al<sup>10</sup> studied the usability and efficacy of a coach-supported app called Perspectives that was specifically designed for treating BDD. Perspectives provide CBT in 7 modules: psychoeducation, cognitive restructuring, exposure, response prevention, mindfulness, attention retraining, and relapse prevention.

### Study design

- Adults (N = 80) with primary BDD were assigned to use the Perspectives app for 12 weeks or to a waitlist control group. Participants were predominately female (84%) and White (71%), with a mean age of 27.

- Coaches promoted engagement and answered questions via in-app messaging and phone calls.

- Blinded independent evaluators used the Yale-Brown Obsessive Compulsive Scale Modified for BDD (BDD-YBOCS) to measure BDD severity at baseline, midtreatment (Week 6), and end of treatment (Week 12).

- Secondary outcomes included BDD-related insight, depression, quality of life, and functioning. Various scales were used to measure these outcomes.

### Outcomes

- In intent-to-treat analyses, patients who received CBT via the Perspectives app had significantly lower BDD severity at the end of treatment compared to the waitlist control group, with a mean (SD) BDD-YBOCS score of 16.8 (7.5) vs 26.7 (6.2), with  $P < .001$  and  $d = 1.44$ .

- Slightly more than one-half (52%) of those who used Perspectives achieved full or partial remission, compared to 8% in the waitlist control group.

### Conclusions/limitations

- CBT delivered via the Perspectives app and a coach proved to be effective treatment for adults with BDD.

- Adoption of the application was relatively high; 86% of Perspectives users were very or mostly satisfied.

- Limitations: Because the participants in this study were predominantly female and White, the findings might not be generalizable to other populations.

**7. Kuhn E, Miller KE, Puran D, et al. A pilot randomized controlled trial of the Insomnia Coach mobile app to assess its feasibility, acceptability, and potential efficacy. *Behav Ther.* 2022;53(3):440-457. doi:10.1016/j.beth.2021.11.003**

Insomnia remains a substantial problem among military veterans. First-line treatments for the disorder are sleep hygiene modification and CBT. Access to CBT is limited, especially for veterans. Kuhn et al<sup>11</sup> studied the effectiveness of using Insomnia Coach, a CBT for insomnia-based app, to improve insomnia symptoms.

### Study design

- Fifty US veterans who were mostly male (58%) with a mean age of 44.5 and moderate insomnia symptoms were randomized to use Insomnia Coach (n = 25) or to a waitlist control group (n = 25) for 6 weeks.

- All participants completed self-report measures and sleep diaries at baseline, posttreatment, and follow-up (12 weeks). Those who used the app (n = 15) completed a qualitative interview at posttreatment.

### Outcomes

- At posttreatment, 28% of participants who used Insomnia Coach achieved clinically significant improvement, vs 4% of waitlist control participants. There was also a significant treatment effect on daytime sleep-related impairment ( $P = .044$ ,  $d = -0.6$ ).

- Additional treatment effects emerged at follow-up for insomnia severity, sleep onset latency, global sleep quality, and depression symptoms.

- Based on self-reports and qualitative interview responses, participants' perceptions of Insomnia Coach were

## Clinical Point

**Full or partial remission of body dysmorphic disorder was achieved by 52% of those who used the Perspectives app vs 8% of controls**

## Clinical Point

Overall, 28% of veterans who used the Insomnia Coach app saw significant improvement in sleep, compared to 4% of controls

favorable. Three-fourths of participants used the app through 6 weeks and engaged with active elements.

### Conclusions/limitations

- Insomnia Coach may provide an accessible and convenient public health intervention for patients who aren't receiving adequate care or CBT.
- Limitations: Because this study evaluated only veterans, the findings might not be generalizable to other populations.

8. Dahne J, Lejuez CW, Diaz VA, et al. Pilot randomized trial of a self-help behavioral activation mobile app for utilization in primary care. *Behav Ther.* 2019;50(4):817-827. doi:10.1016/j.beth.2018.12.003

Previous mobile technologies have shown the ability to treat depression in primary care settings. Moodivate is a self-help mobile app based on the Brief Behavioral Activation Treatment for Depression, which is an evidence-based treatment. This app is designed to help the user reengage in positive, nondepressed activities by identifying, scheduling, and completing activities. Dahne et al<sup>12</sup> investigated the feasibility and efficacy of Moodivate for depressive symptoms in primary care patients.

### Study design

- Participants (N = 52) were recruited from primary care practices and randomized 2:2:1 to receive Moodivate, a CBT-based mobile app called MoodKit, or treatment as usual (no app). All participants had an initial PHQ-8 score >10.
- Participants completed assessments of depressive symptoms (PHQ-8) weekly for 8 weeks.
- App analytics data were captured to examine if the use of Moodivate was feasible. (Analytics were not available for MoodKit).

### Outcomes

- Participants who used Moodivate had a mean (SD) of 46.76 (30.10) sessions

throughout the trial, spent 3.50 (2.76) minutes using the app per session, and spent 120.76 (101.02) minutes using the app in total.

- Nearly 70% of Moodivate participants continued to use the app 1 month after trial enrollment and 50% at the end of the 8-week follow-up period.
- Compared to the treatment as usual group, participants who used Moodivate and those who used MoodKit experienced significant decreases in depressive symptoms over time.

### Conclusions/limitations

- The results show that for primary care patients with depression, the use of Moodivate is feasible and may reduce depressive symptoms.
- Limitations: For the first 3 months of enrollment, patients who met diagnostic criteria for a current major depressive episode were excluded. This study did not assess duration of medication use (ie, whether a study participant was stabilized on medication or recently started taking a new medication) and therefore could not ascertain whether treatment gains were a result of the use of the app or of possible new medication use.

### References

1. Torous J, Jän Myrick K, Rauseo-Ricupero N, et al. Digital mental health and COVID-19: using technology today to accelerate the curve on access and quality tomorrow. *JMIR Ment Health.* 2020;7(3):e18848. doi:10.2196/18848
2. Camacho E, Cohen A, Torous J. Assessment of mental health services available through smartphone apps. *JAMA Netw Open.* 2022;5(12):e2248784. doi:10.1001/jamanetworkopen.2022.48784
3. American Psychiatric Association. APP Advisor: An American Psychiatric Association Initiative. Accessed April 28, 2023. <https://www.psychiatry.org/psychiatrists/practice/mental-health-apps>
4. Lagan S, Aquino P, Emerson MR, et al. Actionable health app evaluation: translating expert frameworks into objective metrics. *NPJ Digit Med.* 2020;3:100. doi:10.1038/s41746-020-00312-4
5. Linardon J, Shatte A, Rosato J, et al. Efficacy of a transdiagnostic cognitive-behavioral intervention for eating disorder psychopathology delivered through a smartphone app: a randomized controlled trial. *Psychol Med.* 2022;52(9):1679-1690. doi:10.1017/S0033291720003426
6. Christoforou M, Sáez Fonseca JA, Tsakanikos E. Two novel cognitive behavioral therapy-based mobile apps for agoraphobia: randomized controlled trial. *J Med Internet Res.* 2017;19(11):e398. doi:10.2196/jmir.7747
7. Everitt N, Broadbent J, Richardson B, et al. Exploring the features of an app-based just-in-time intervention for depression. *J Affect Disord.* 2021;291:279-287. doi:10.1016/j.jad.2021.05.021

Psychiatry Journal Club  
continued from page 42

8. McLean C, Davis CA, Miller M, et al. The effects of an exposure-based mobile app on symptoms of posttraumatic stress disorder in veterans: pilot randomized controlled trial. *JMIR Mhealth Uhealth*. 2022;10(11):e38951. doi:10.2196/38951
9. Graham AK, Greene CJ, Kwasny MJ, et al. Coached mobile app platform for the treatment of depression and anxiety among primary care patients: a randomized clinical trial. *JAMA Psychiatry*. 2020;77(9):906-914. doi:10.1001/jamapsychiatry.2020.1011
10. Wilhelm S, Weingarden H, Greenberg JL, et al. Efficacy of app-based cognitive behavioral therapy for body dysmorphic disorder with coach support: initial randomized controlled clinical trial. *Psychother Psychosom*. 2022;91(4):277-285. doi:10.1159/000524628
11. Kuhn E, Miller KE, Puran D, et al. A pilot randomized controlled trial of the Insomnia Coach mobile app to assess its feasibility, acceptability, and potential efficacy. *Behav Ther*. 2022;53(3):440-457. doi:10.1016/j.beth.2021.11.003
12. Dahne J, Lejeuz CW, Diaz VA, et al. Pilot randomized trial of a self-help behavioral activation mobile app for utilization in primary care. *Behav Ther*. 2019;50(4):817-827. doi:10.1016/j.beth.2018.12.003

### Clinical Point

Nearly 70% of participants who used the Moodivate app continued using it 1 month after enrollment