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Artificial Intelligence-Powered Cognitive Behavioral Therapy Chatbots, a Systematic Review

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Abstract

Objective: This review identifies the characteristic features of artificial intelligence (AI) chatbots and their therapeutic effect; assesses their efficacy in treatment of depression, anxiety, and other mental health disorders; and establishes levels of user engagement and satisfaction.
Method: Searches were conducted on the PubMed, Embase, MEDLINE, CENTRAL, CINAHL, PsycINFO, and Google Scholar databases using a set of keywords such as, not limited to, AI cognitive behavioral therapy (AI CBT), Youper, Wysa, Woebot, and other related terms. We included studies that were empirical, peer-reviewed, conducted between January 2017 and June 2024, and primarily focused on efficacy regarding the interventions and therapeutic outcomes. Data were then extracted and analyzed using both qualitative and quantitative methods concerning the mental health outcome.
Results: Our review identified large improvements across the three chatbots in symptoms of mental health, as supported by the 10 included studies: five on Woebot, four on Wysa, and one on Youper. Woebot showed remarkable reductions in depression and anxiety with high user engagement; Wysa demonstrated similar improvements, especially in users with chronic pain or maternal mental health challenges; Youper also presented a significant symptom reduction, including a 48% decrease in depression and a 43% decrease in anxiety. Common benefits of all chatbots were the therapeutic alliance and a high rate of satisfaction among users. We have also discussed the included studies' limitations; that is, study design shortcomings and lack of sample diversity.
Conclusion: AI CBT chatbots, including but not limited to Woebot, Wysa, and Youper, are highly promising because of their availability and effectiveness in mental health support. They provide a useful complement to standard therapy when professional help is unavailable, and offer constant engagement with tailored interventions. However, it is necessary that further studies investigate their potential impact as long-term intervention models and explore how they may be integrated into holistic mental health care systems.

Key words: *Anxiety; Artificial Intelligence; Cognitive Behavioral Therapy; Depression; Substance-Related Disorders*

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Mental disorders are among the leading public health concerns, as they drastically reduce the quality of life and impose substantial economic burdens on societies. One in ten people globally, between the ages of 5 and 24 (approximately 293 million people) suffer from mental health problems; the most prevalent of which include anxiety disorders, depression, post-traumatic stress disorder (PTSD), and obsessive-compulsive disorder (OCD) (1). In Iran, 8.35% and 4.29% of individuals are afflicted with anxiety or mood disorders respectively (2). These disorders not only undermine personal well-being, but also cause massive costs within societies due to lost productivity, increased healthcare utilization, and significant increase of demands on social services. Mental disorders account for more than 418 million disability-adjusted life years (DALYs), accounting for an economic monetary burden of around 5 trillion US dollars (3). Therefore, the urgency to develop effective, accessible, and scalable interventions for mental health issues has never been greater.

Traditionally, pharmacological intervention and psychotherapy have been the dominating treatment options for psychiatric disorders. Among these, cognitive-behavioral therapy (CBT) has emerged as one of the most researched and widely implemented approaches (4). The cognitive model of emotional response, upon which CBT is based, postulates that maladaptive thoughts and beliefs contribute significantly to emotional distress and behavioral challenges (5). By focusing on identifying and restructuring these cognitive distortions, individuals can develop healthier thinking patterns and coping mechanisms. Numerous studies have established CBT's effectiveness across a range of mental health disorders, especially as first-line treatment for anxiety and depression (6-9).

Despite its proven efficacy, access to traditional therapy remains a leading barrier. Many individuals face major obstacles when seeking mental health support, including the stigma associated with mental illnesses, high costs of treatment, limited availability of qualified therapists, and geographical restrictions (10, 11). These inevitable barriers often make patients delay or forgo treatment, thereby exacerbating their conditions. This gap between supply and demand highlights the urgent need for innovative solutions to expand access to psychological support (12). Recent technological developments are shifting this landscape and present several exciting solutions for these challenges. Of the latest innovations, artificial intelligence (AI)-driven chatbots delivering CBT have received significant attention (13, 14). These chatbots deliver therapeutic interventions in an accessible, scalable, and user-friendly manner. Being available 24 hours a day seven days a week, they grant users the opportunity to engage with therapeutic content at their convenience without requiring appointments. Further, the anonymity within chatbot interactions reduces the stigma in seeking help for mental health, which encourages individuals who might otherwise hesitate to reach out for help.

AI-powered CBT chatbots offer a unique opportunity to make mental health interventions more inclusive and efficient. These chatbots can interactively engage the users in a dialogue while being guided through CBT techniques such as cognitive restructuring, behavioral activation, and mindfulness practices. Some applications also incorporate mood tracking and personalized feedback, allowing users to monitor their progress and adjust their strategies over time. The convenience and immediacy of these tools can empower individuals to take an active role in managing their mental health, promoting self-efficacy and resilience.

Despite their potential benefits, AI CBT chatbots also have limitations. Concerns remain regarding the quality of user interactions, particularly in terms of emotional nuance and complexity. While chatbots can handle straightforward cognitive strategies, they may struggle to provide the depth of understanding and empathy that a human therapist offers, particularly regarding trauma or severe psychological distress (15). Furthermore, the effectiveness of chatbot-based interventions may vary depending on several factors, such as the specific mental health disorder being addressed, the user's level of engagement, and the design of the chatbot itself. Therefore, while these tools may hold promise, they are best conceived as complementary to, rather than replacements for, traditional therapy.

Among the notable CBT chatbots currently available are Woebot, Youper, and Wysa, each employing different methodologies to support users in their mental health journeys. Woebot uses a conversational interface, engaging users in CBT techniques through friendly and relatable interactions (16-22). Wysa establishes evidence-based methods tailored to users' needs, therefore encouraging self-help and emotional well-being (23-26). Youper focuses on tracking emotional states through brief interactions to let users gain insight into their feelings (27). While there is an increasing interest in such platforms, no comprehensive review has explored their effectiveness for user engagement and feasibility across various mental health disorders.

This lack of systematic evaluation poses a significant gap in understanding the practical applications of AI chatbots in mental health treatment. Clinicians, researchers, and individuals seeking mental health support would benefit from a clear overview of the efficacy, limitations, and suitability of these technologies for various conditions. Consequently, this review aims to provide a thorough examination of the current landscape of AI chatbots designed for CBT, exploring their effectiveness and user engagement, as well as generalizing the findings across different mental health disorders. By investigating the existing literature and evidence, we hope to guide future research directions and clinical practices in the integration of AI-driven

mental health interventions within broader mental health care strategies.

Materials and Methods

Overview

This systematic review was conducted from March to June 2024 to evaluate the effectiveness and features of AI-powered CBT chatbots: Youper, Wysa, and Woebot. The review adhered to the Cochrane guidelines for systematic reviews and followed the standards of the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) (28, 29).

Search Strategy

A comprehensive search was performed across multiple academic databases, including PubMed, Embase, MEDLINE, CENTRAL, CINAHL, PsycINFO, and Google Scholar. Search terms included "Artificial intelligence cognitive behavioral therapy" (AI CBT), "Youper", "Wysa", "Woebot", "digital mental health", "cognitive behavioral therapy", "CBT", and "effectiveness." Additionally, we searched the official websites of Youper, Wysa, and Woebot, to gather further detailed information on their features.

Inclusion and Exclusion Criteria

Peer-reviewed articles published between January 2017 and June 2024 were included in our review. The following exclusion criteria were also applied:

- Review articles, expert opinions, and conference proceedings
- Studies not directly addressing the AI CBT chatbots' features and efficacy (e.g., studies focusing on unrelated topics such as the pandemic's effect on mental health)
- Articles without available full texts (Efforts were made to contact authors, but studies were excluded if access could not be obtained.)
- Publications in languages other than English
- Low-quality studies (assessed using the Critical Appraisal Skills Programme (CASP) checklist)

Article Selection Process

The review process that followed the PRISMA guidelines, is presented schematically in the PRISMA flow diagram (Figure 1). Two trained reviewers screened the gathered articles independently. Duplicate articles were then removed, and those meeting the inclusion criteria were further evaluated. A total of 10 articles were included in the final analysis: five on Woebot, four on Wysa, and one on Youper.

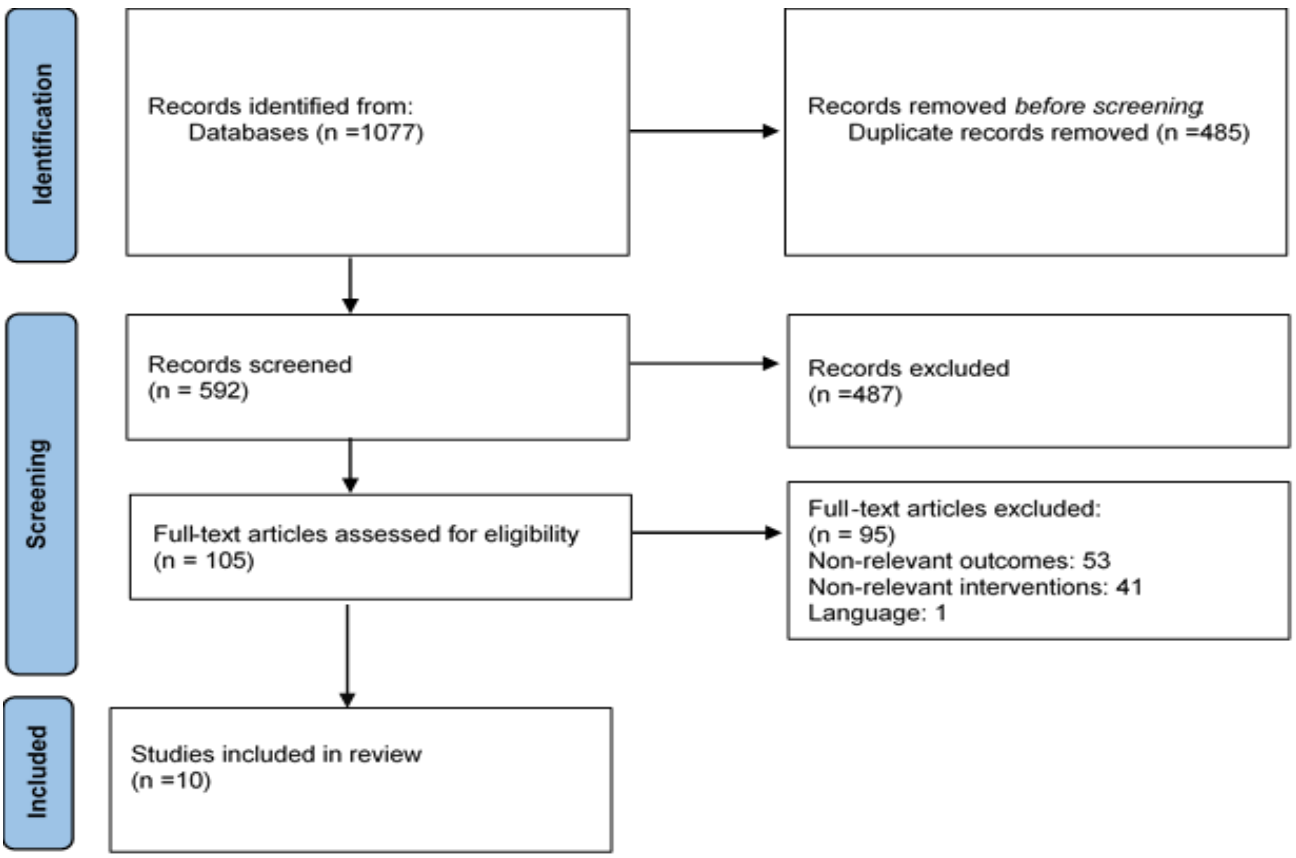

Figure 1. Preferred Reporting Items for Systematic Reviews and Meta-Analyses Flow Diagram: Screening and Selection of Studies for a Systematic Review on Artificial Intelligence-Powered Cognitive Behavioral Therapy Chatbots, Woebot, Wysa and Youper

Data Extraction and Synthesis

Data extraction targeted the outcome measures used to assess the effectiveness and therapeutic alliance of AI-powered CBT chatbots. Information from each study included: 1) Instruments or scales employed (e.g., effect sizes, statistical significance, means, and standard deviations). 2) Methodological details such as sample size and intervention duration. We performed a qualitative synthesis of the extracted data for the identification of similar themes concerning strengths and weaknesses among the chatbots. Quantitative data were described summarily using tables to compare effectiveness among the chatbots.

Quality Assessment

The quality of included studies was assessed using the CASP checklist to ensure that only studies meeting rigorous methodological standards were considered in the review and reported in the results section.

Ethical Consideration

As a systematic review of existing literature, this study consists of no primary data collection from human participants. However, ethical considerations regarding the use of AI in mental health – such as user privacy, data security, and informed consent – were considered when discussing the findings and implications of the reviewed studies.

Results

The rising prevalence of mental health issues has prompted the exploration of innovative digital interventions. In this review, we examined the efficacy of three prominent AI-driven CBT-based mental health tools: Woebot, Wysa, and Youper. Our comprehensive search identified a total of 10 studies (Tables 1, 2, 3), with five focusing on Woebot (50%), four on Wysa (40%), and one on Youper (10%). The overall sample size across these studies was 44,773 participants, with Woebot accounting for the majority at 36,677 (81.91%), followed by Wysa with 3,579 (7.99%) and Youper with 4,517 (10.08%). Notably, Despite Youper's representation by only two studies, its sample size was relatively substantial.

Among the total sample, only 127 participants (0.28%) were in the control groups, all of which originated from the three Woebot studies. This highlights a significant gap, as no other studies in this review included control groups. Of the included studies, two (20%) were randomized controlled trials (RCTs), all featuring control groups for Woebot. Additionally, five studies (50%) were non-randomized open-label trials, including two on Woebot, two on Wysa, and one on Youper. The review also included one cross-sectional study (10%) and two mixed-methods studies (20%), both related to Wysa.

In terms of measurement tools, most studies used the Patient Health Questionnaire (PHQ-2, PHQ-8 or PHQ-9) to assess depressive symptoms, with one study employing PHQ-2, two using PHQ-8, and four using PHQ-9 (n = 7; 70%). Four (40%) of these studies also used the Generalized Anxiety Disorder scale (GAD-7).

Additionally, several studies incorporated in-app questionnaires to evaluate the efficacy and assess depressive and anxiety symptoms. One study used the Burnout Scale Revision (BSR), a single-item measure for burnout, alongside the Perceived Stress Scale (PSS). Two studies (20%) employed the Working Alliance Inventory-Short Revised (WAI-SR) to measure the therapeutic alliance. This diverse array of measurement tools reflects the multifaceted approach to evaluating the effectiveness of these digital interventions in addressing mental health concerns.

Four studies targeted specific populations such as those dealing with substance misuse (20, 21), health-related mental health problems (26), and maternal event experience (24). This varied methodological landscape underscores the need for a deeper understanding of the effectiveness and applicability of these digital mental health interventions across diverse populations.

The quality of the included studies was assessed using the CASP checklist for RCTs, cohort studies and observational studies (Accessed: 05/2024) (30). Six studies (60%) were rated as having high methodological quality, meeting most of the CASP criteria, with clear research questions, appropriate study designs, and robust data collection methods. However, four studies (40%) demonstrated moderate quality, primarily due to bias in participant selection and lack of transparency in data analysis methods (17, 24, 26, 27). Overall, the assessment indicated that most of the studies had a strong methodological foundation, and a few were limited regarding the reliability and generalizability of their findings.

Woebot

Five studies evaluated the effectiveness of Woebot (Table 1); collectively examining its impact across diverse populations. These studies consisted of two RCTs, two non-randomized open-label trials, and one cross-sectional study. The findings of these studies consistently indicate that Woebot serves as an effective digital therapeutic tool for various mental health challenges .

The RCT by Fitzpatrick *et al*. (2017) (18) evaluated Woebot among 70 young adults with symptoms of depression and anxiety. The study demonstrated significant reductions in PHQ-9 scores (F = 6.47; P = 0.01) after two weeks of daily chatbot interactions, compared to the control group. Prochaska *et al*. (2021) conducted two studies focusing on substance use (20, 21), the first assessing usability and user engagement, revealing high satisfaction and a 50% reduction in substance use cravings (86% reporting cravings on the app, odds ratio 0.48, 95% CI 0.32-0.73). Their second study, involving 180 participants, showed a notable decrease in past-month substance use occasions relative to waitlist (M = -3.3, SE = 1.8; P = 0.39 vs M = -9.1, SE:

2.0). These findings correlated with improvements in self-confidence and reductions in cravings, although no significant changes in overall depression or anxiety levels were reported.

A cross-sectional study by Darcy *et al*., involving over 36,000 users, reported that Woebot achieved WAI-SR scores comparable to traditional CBT methods (3.03; SD = 0.8), which suggests high acceptability across various demographic groups (16). Similarly, Durden *et al*. (2023) reported significant reductions in perceived stress and burnout, and increased resilience, after eight weeks of daily Woebot interactions among 256 adults (17).

Table 1. Overview of Studies on Woebot, Artificial Intelligence-Powered Cognitive Behavioral Therapy for Mental Health Support

Study	Focus	Study Design	Population	Control Group	Measures	Outcomes
Fitzpatrick *et al*. 2017	Effectiveness on depression and anxiety	RCT	18-28 year old adults (N = 70)	Receiving CBT e-book	PHQ-9, GAD-7	Decrease in depression and anxiety
Prochaska *et al*. 2021	Effectiveness on substance use behaviors	Non-randomized open-label trial	Adults with substance misuse (N = 101)	N/A	In-app patients' reports, PHQ-8, GAD-7	Decrease in craving, depression and anxiety, increase in confidence to resist urges
Prochaska *et al*. 2021	Effectiveness on substance use behaviors, depression and anxiety	RCT	Adults with substance misuse (N = 180)	Waiting list	In-app patients' reports, PHQ-8 9 GAD-7	Fewer substance use occasions, no changes in mood or secondary substance use
DARCY *et al*. 2021	Alliance of the chatbot	Cross-sectional	General (N = 36,070)	N/A	WAI-SR PHQ-2	High user bond with the chatbot
Durden *et al*. 2023	Effectiveness on stress, burnout and resilience	Non-randomized open-label trial	General (N = 256)	N/A	PSS, a single item burnout measure BRS	Decrease in stress and burnout, increase in resilience

Abbreviations: BSR: Burnout Scale Revision. /GAD-7: Generalized Anxiety Disorder scale. / N: Sample size. / N/A:Not Applicable. / PHQ-2, 8, 9: Patient Health Questionnaire2, 8 or 9 questions form. / PSS: Perceived Stress Scale. / WAI-SR: Working Alliance Inventory - Short Revised.

Wysa

Four studies evaluated the effectiveness of Wysa, underscoring its role in enhancing mental health outcomes in various contexts such as depression, anxiety, chronic pain, and maternal mental health (24). These studies uniformly reported that higher level of user engagement with Wysa was associated with significant symptom improvements including reductions in depressive symptoms. Inkster *et al*. (25) found that frequent users experienced greater mood improvements compared to less frequent users (mean 5.84, SD = 6.66) (25). In another study they also approved the same theme, showing that highly-engaged users exhibited better symptom improvements (M-W, P = 0.004) with a high effect size (CL = 0.736) (24).

A mixed-methods study (23) also revealed that users formed therapeutic bonds with Wysa comparable to those with human therapists. Participants reported feeling understood and validated, emphasizing the chatbot's ability to foster a supportive therapeutic environment that enhances intervention effectiveness.

Two other studies focused on more specific populations. In one study, patients with chronic pain engaged significantly more with Wysa ($P < 0.001$) than those without chronic pain (26). The other study by Inkster *et al*. (24) explored Wysa's impact on maternal mental health, showing promising results for highly engaged users.

Table 2. Overview of Studies on Wysa, Artificial Intelligence-Powered Cognitive Behavioral Therapy for Mental Health Support

	Focus	Study Design	Population	Control Group	Measures	Outcomes
inkster *et al*. 2018	Effectiveness on depression and feasibility	Non-randomized open-label trial	General (N = 129)	N/A	PHQ-9, Thematic analysis, Patients' in-app ratings	Better improvement in depression of highly-engaged users, High feasibility
meheli *et al*. 2022	Effectiveness on users with chronic pain	Mixed methods observational study	Users with health-related mental health problems (N = 2194)	N/A	PHQ-9 GAD-7	Decrease in depression and anxiety
beatty *et al*. 2022	The alliance of the app	Mixed methods, comparing results to similar studies on CBT modalities	Early users (N = 1205)	N/A	WAI-SR	No difference between the alliance of Wysa and traditional methods
inkster *et al*. 2023	Maternal mental health	Non-randomized open-label trial	Users experiencing maternal event (N = 51)	N/A	PHQ-9	Better improvement in depression of highly engaged users

Abbreviations: GAD-7: Generalized Anxiety Disorder scale. / N: Sample size. / N/A: Not Applicable. / PHQ-9: Patient Health Questionnaire 9 questions form. / WAI-SR: Working Alliance Inventory - Short Revised.

Youper

The efficacy of Youper was assessed in a single longitudinal study, demonstrating its effectiveness in improving emotional well-being and providing accessible mental health support.

The study was conducted by Mehta *et al*. (2021), involving 4,517 users over four weeks. Users reported high satisfaction, with an average rating of 4.36 out of 5 stars. Significant improvements were also recorded among the users regarding anxiety (d = 0.57) and depression (d = 0.46) symptoms, although some regression in depressive symptoms was noted post-treatment. The study underscored the importance of emotional regulation strategies facilitated by Youper, linking them to improved therapeutic outcomes.

Table 3. Overview of Studies on Youper, Artificial Intelligence-Powered Cognitive Behavioral Therapy for Mental Health Support

	Focus	Study Design	Population	Control Group	Measures	Outcomes
mehta *et al*. 2021	Acceptability, effectiveness on depression and anxiety	Non-randomized open-label trial	Paying users (4517)	N/A	In-app anxiety and depression symptom measures	High acceptability, decrease in depression and anxiety

Abbreviations: N: Sample size. / N/A: Not Applicable.

Discussion

Among the studies reviewed, those focusing on Woebot exhibited the highest methodological rigor, with RCTs and larger sample sizes providing strong evidence for its effectiveness. Similarly, research on Wysa and Youper used sufficiently large sample sizes, suggesting that the findings may be applicable to a wider audience. Despite variations in methodology, all three chatbots showed notable potential in addressing diverse mental health conditions, highlighting their promise as scalable AI-

driven CBT tools. However, more research is necessary to determine the specific conditions under which these chatbots are most effective, assessing their long-term benefits, and optimizeing user interaction strategies.

Engagement, consistently linked to improved mental health outcomes, emerged as a common theme across the reviewed chatbots (24, 25). This agrees with the results of prior studies reporting that engagement has a very important role in digital interventions, similar to that in analog psychotherapy (31). For example, therapeutic alliance – an important part of in-person therapy – translates rather well onto digital platforms (32, 33). Studies have shown that people attach to chatbots in much the same way they do to human therapists, thereby creating a support group that provides emotional wellness (23).

Another commonality is the emphasis on evidence-based therapeutic techniques, such as CBT and mindfulness. All three chatbots incorporate these approaches, demonstrating that AI can effectively deliver structured interventions that are typically associated with face-to-face therapy.

Most studies investigating AI-powered CBT chatbots have primarily focused on assessing their efficacy in the treatment of anxiety and depression, aligning with contemporary research trends that underscore the high prevalence and significant morbidity associated with these disorders. This pinpoints commonly shared burdens of these disorders and the increasing demand for scalable, accessible psychological interventions. Symptom improvements in anxiety and depression had also been mostly assessed in those interventions that targeted certain demographic groups (20, 21, 24, 26). Overall, these findings indicate promising trends of symptom reduction in a way consistent with the efficacy seen in other sophisticated psychotherapy modalities such as telepsychiatry (34).

Nevertheless, several limitations are evident in the existing literature. Specifically, the extent to which AI-powered CBT chatbots can provide meaningful and sustained therapeutic benefit, particularly for individuals with more severe or clinically significant symptoms, remains understudied. It is not known at what symptom threshold these chatbots are most effective, which seriously constrains their clinical utility. This is a serious limitation, as it complicates the clinicians' ability to translate such tools into valid interventions for the patients with symptoms in the range from moderate to severe. Most studies conducted in terms of substance use report reductions in substance use occasions; however, the overall impact of AI-powered chatbots for individuals affected with substance use disorders remains inconclusive. The heterogeneity of the study populations—often comprising individuals in various stages of either addictions or recovery in general—introduces variability in outcomes. Treatment of addiction will need much more focused and intensive research regarding the role of chatbots, since the procedure is multilayered and encompasses behavioral, psychological, and social dimensions. The literature available today suggests that such interventions might be most useful in managing comorbid anxiety and depression conditions and promoting life skills and coping mechanisms (20, 21).

Limitation

This systematic review has several limitations that should be considered when interpreting the findings. First, it focused exclusively on three AI-based CBT chatbots —Youper, Woebot, and Wysa— without encompassing all available CBT chatbots. Consequently, the findings may lack generalizability, as other emerging AI CBT tools were not included in the analysis.

Second, only 10 studies met the inclusion criteria for this review. This relatively small number limits the strength and depth of the conclusions and reduces the power to identify subtler or more nuanced effects that may exist in the broader literature on AI CBT interventions.

Additionally, the results were synthesized qualitatively rather than quantitatively due to the nature of the available data. While this approach allowed for summarizing trends and identifying key themes, it precluded more rigorous statistical analyses, such as meta-analyses, which could have provided stronger evidence regarding the effectiveness of these chatbots.

Finally, the inclusion criteria may have excluded studies employing alternative methodologies or focusing on other chatbot platforms, which could have offered a more comprehensive perspective on the benefits and limitations of AI-based CBT tools. Future research should include a broader range of studies and incorporate quantitative synthesis methods to better evaluate these interventions.

Conclusion

AI-powered CBT chatbots, such as Woebot, Wysa, and Youper, are scalable, accessible, and effective tools for mental health management. Their capacity to provide continuous support, track mood patterns, and deliver evidence-based interventions makes them valuable supplements to traditional therapy. Despite existing challenges, the growing body of evidence highlights their potential to improve mental health outcomes and address critical gaps in the current mental health care system.

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Conflict of Interest

None.

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