

APPLICATIONS OF AI IN BEHAVIORAL AND COGNITIVE THERAPY: A NARRATIVE REVIEW

Narrative Review

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ABSTRACT

Background: Artificial intelligence (AI) is increasingly being integrated into mental health care, offering innovative solutions to address longstanding challenges in behavioral and cognitive therapy. With growing global demand for psychological services and limited access to qualified therapists, AI tools present a promising avenue for enhancing the delivery, engagement, and personalization of therapies such as Cognitive Behavioral Therapy (CBT).

Objective: This narrative review aims to explore the current applications of AI in behavioral and cognitive therapy, with a particular focus on its role in behavioral modification, CBT delivery, and patient engagement. The review synthesizes recent findings to evaluate the clinical utility, strengths, limitations, and future directions of AI-assisted psychological interventions.

Main Discussion Points: The review identifies key thematic trends, including the use of AI to enhance patient engagement, personalize therapeutic content, and augment therapist-led care. Chatbot-based interventions and adaptive feedback systems have demonstrated improved treatment adherence and clinical outcomes. However, issues such as limited long-term data, methodological variability, and restricted generalizability remain. The discussion also highlights ethical concerns and the need for standardized guidelines in clinical application.

Conclusion: AI has the potential to revolutionize behavioral and cognitive therapy by making interventions more accessible, scalable, and tailored. While current evidence supports its promise, further high-quality research is essential to validate long-term effectiveness and guide ethical implementation in diverse clinical settings.

Keywords: Artificial Intelligence, Cognitive Behavioral Therapy, Digital Mental Health, Patient Engagement, Psychological Therapy, Narrative Review.

INTRODUCTION

Artificial Intelligence (AI) is transforming healthcare at an unprecedented pace, with particularly promising applications emerging in the domain of mental health. Cognitive Behavioral Therapy (CBT), one of the most empirically supported psychotherapeutic modalities, has long served as the first-line intervention for a range of mental health disorders, including depression, anxiety, and chronic stress. Globally, mental health disorders contribute significantly to the burden of disease, affecting more than 970 million people in 2019 alone, with depression and anxiety ranking among the top contributors to years lived with disability. Despite the proven efficacy of CBT, access to qualified therapists remains limited, with treatment gaps particularly pronounced in low-resource settings and underserved populations (1). This disparity has prompted the search for scalable, accessible solutions—among which AI-based tools have gained considerable attention. The rapid advancement of AI technologies, especially in natural language processing, machine learning, and generative models, has enabled the development of tools capable of supporting behavioral interventions in novel ways (2). AI applications now range from chatbot-based conversational agents to personalized digital coaching and predictive analytics for treatment adaptation. These technologies offer the potential to enhance engagement, provide continuous monitoring, deliver real-time feedback, and personalize interventions to match individual psychological profiles. For instance, AI-enabled applications like a study have shown encouraging results in reducing symptoms of depression and anxiety while maintaining high levels of user satisfaction and engagement (3,4).

Existing literature indicates substantial gains from integrating AI into CBT delivery models. Studies have demonstrated that generative AI tools can increase patient engagement and adherence by providing personalized therapeutic support between sessions. In a real-world observational study involving over 240 patients, those using an AI-enabled therapy support tool exhibited higher treatment adherence and session attendance, with improved recovery outcomes compared to those relying solely on traditional materials (5,6). Similarly, randomized trials involving generative AI applications like Limbic Care have reported significantly higher engagement and better anxiety outcomes in participants using AI-personalized CBT content versus standard PDF-based CBT resources (7). Despite these advances, several research gaps persist. The long-term effectiveness of AI-assisted CBT remains underexplored, especially in diverse populations with varying digital literacy levels. Questions also remain about the depth and accuracy of AI's ability to mimic therapeutic alliance—an essential component of successful therapy. Furthermore, ethical considerations such as data privacy, algorithmic bias, and regulatory oversight continue to pose challenges (8,9). While the promise of AI is clear, there is still insufficient consensus on its optimal integration with human-delivered psychotherapy, particularly concerning clinical decision-making and emotional attunement.

This narrative review aims to explore the contemporary landscape of AI applications in behavioral and cognitive therapy, with a specific focus on tools supporting behavioral modification, CBT delivery, and patient engagement. The review encompasses empirical studies, including both observational and randomized controlled trials, published in the last five years. By analyzing these contributions, the review seeks to identify the effectiveness, limitations, and future potential of AI tools in augmenting psychological care. The significance of this review lies in its attempt to synthesize the scattered but rapidly growing body of evidence into a coherent understanding of how AI is reshaping psychotherapeutic practice. Unlike systematic reviews focused solely on clinical efficacy, this narrative approach also highlights the practical, technological, and ethical dimensions of AI integration into therapy. With mental health services facing increasing demand, workforce shortages, and cost constraints, this review provides a timely, clinically relevant overview for researchers, clinicians, and policymakers alike. It emphasizes the potential of AI not as a replacement for human therapists, but as a complementary force that can expand reach, personalize treatment, and improve engagement—thereby addressing one of the most pressing healthcare challenges of our time.

THEMATIC DISCUSSION: APPLICATIONS OF AI IN BEHAVIORAL AND COGNITIVE THERAPY

AI for Enhancing Patient Engagement in CBT

One of the most consistent findings across the literature is the role of artificial intelligence (AI) in improving patient engagement in cognitive behavioral therapy (CBT). Traditional CBT, while effective, often struggles with patient dropout and lack of adherence between sessions. AI-driven conversational agents and personalized applications have shown the potential to fill this gap by offering interactive, engaging platforms that encourage participation. Studies utilizing generative AI-enabled tools, such as Limbic Care, revealed

that patients exposed to AI-personalized CBT content demonstrated a threefold increase in engagement compared to those receiving standard PDF-based therapy materials. These patients not only interacted more frequently with the tool but also reported improved emotional outcomes, particularly in anxiety reduction (10). Similarly, a real-world observational study of over 240 patients found that AI-supported therapy tools significantly enhanced attendance and reduced dropout rates in group CBT sessions. The AI system provided dynamic support, helping users reflect on therapeutic material and reinforcing coping strategies between sessions (11). These outcomes suggest that AI can play a key role in bridging the gap between in-session learning and real-world application, an essential factor in effective CBT.

PERSONALIZATION AND ADAPTIVE THERAPY MODELS

Another prominent theme is the capacity of AI to tailor interventions according to patient-specific profiles and evolving needs. Traditional CBT protocols often follow a fixed session structure, which may not be optimal for all individuals. In contrast, AI tools can continuously adapt based on real-time user feedback. For instance, AI-powered CBT platforms for chronic pain incorporated reinforcement learning algorithms that adjusted the frequency and intensity of therapist interaction based on step counts and pain reports collected via mobile health tools. Over time, these systems demonstrated improved therapeutic efficiency and outcomes, particularly in reducing disability and pain interference (12). AI-enabled ontological structures have also been proposed to segment and interpret cognitive patterns in a structured, clinical framework. These tools mimic a therapist's reasoning process by analyzing inputs through predefined cognitive schemas, thereby offering automated yet clinically aligned feedback (13). This ability to understand and adjust to nuanced cognitive inputs has clear implications for personalized care, especially for patients with complex or comorbid conditions.

Integration of AI in Therapist-Guided Care

Contrary to the assumption that AI might replace therapists, current literature highlights its role as a complementary tool. AI integration within therapist-led CBT has been shown to enhance treatment without reducing the therapeutic alliance. For example, a study involving group therapy found that participants receiving AI-assisted support alongside traditional sessions showed better therapeutic gains than those with standard human-only interventions (14). The system offered contextualized prompts and coping strategies that reinforced material discussed during live sessions. Similarly, reinforcement learning algorithms used in managing chronic pain CBT allowed clinicians to deliver shorter yet equally effective sessions. Patients demonstrating rapid improvement were stepped down to brief follow-ups or automated feedback, conserving clinical resources without sacrificing outcomes (15). This highlights AI's role in stratifying care intensity, ensuring that high-need patients receive more focused attention while others can be managed efficiently.

Chatbot-Based CBT and Its Therapeutic Efficacy

AI-driven chatbots, have become a common digital adjunct for mental health interventions. These bots leverage natural language processing to simulate therapeutic dialogue, offering users emotional support and structured CBT techniques. A systematic review analyzing the effectiveness of such tools across multiple populations found significant reductions in symptoms of depression and anxiety, with high levels of user satisfaction and continued use over time (16). The flexibility of these platforms—accessible 24/7 and often free of stigma—has been cited as a major factor contributing to their uptake, particularly among younger or tech-savvy users. However, there remain questions about the emotional depth and clinical accuracy of fully automated systems, especially in complex or high-risk cases.

Youth-Specific AI Interventions

Digital CBT interventions for adolescents, particularly those designed with AI components, have gained momentum as youth mental health issues surge. A study evaluating the TechTREAT program demonstrated that adolescents with chronic anxiety who used an AI-guided CBT app showed greater reductions in anxiety symptoms and better adherence compared to those receiving traditional face-to-face therapy (17). The AI system facilitated real-time feedback and guided exposure therapy, enabling users to build resilience outside clinical settings. This demographic's openness to digital technology suggests that AI-enabled interventions can play a crucial role in early intervention and mental health education. However, long-term data on treatment durability and relapse prevention remains sparse.

Socioeconomic and Accessibility Considerations

AI-based CBT tools have shown promise in addressing healthcare inequities by offering scalable mental health support in underserved populations. A comparative study investigating CBT for chronic pain found that individuals with socioeconomic risk factors benefited

equally, if not more, from AI-supported CBT compared to traditional therapy. Session completion rates and clinical improvement were consistent across subgroups, suggesting that AI tools can democratize access without compromising effectiveness (18). Despite these benefits, digital literacy, language barriers, and internet access remain potential obstacles. Future models must account for these variables to ensure equitable deployment.

Challenges and Controversies in AI-Integrated Psychotherapy

While AI integration offers undeniable advantages, several concerns remain unresolved. One key controversy involves the preservation of therapeutic alliance—a predictor of positive outcomes in CBT. Critics argue that AI lacks the empathic nuance of a human therapist, which could affect user trust and emotional disclosure. In addition, regulatory concerns about data privacy, clinical accountability, and ethical decision-making have yet to be fully addressed (19). Furthermore, emerging benchmarks like CBT-BENCH have revealed that current AI models, though competent in structured knowledge tasks, struggle with generating appropriate therapeutic responses in complex, real-world scenarios (20). This highlights the need for caution in deploying AI as a standalone solution. The integration of AI into behavioral and cognitive therapies has made considerable progress, offering scalable, personalized, and engaging tools that support both patients and clinicians. However, for AI to reach its full potential, issues around emotional authenticity, regulatory oversight, and long-term outcomes must be carefully navigated.

CRITICAL ANALYSIS AND LIMITATIONS

Despite the growing enthusiasm surrounding artificial intelligence (AI) applications in behavioral and cognitive therapies, a critical examination of the current body of literature reveals several methodological and interpretative limitations that must be acknowledged to contextualize the reported findings. Many of the reviewed studies suffer from foundational design limitations, most notably small sample sizes and a lack of adequately powered randomized controlled trials (RCTs). For instance, while the study involving 540 participants presents a relatively robust sample, other evaluations, such as those assessing novel ontological frameworks or youth-based interventions, often rely on considerably smaller cohorts, potentially inflating effect sizes and limiting the statistical reliability of their conclusions (11). Short follow-up durations are another notable weakness. Most studies assess outcomes over a span of weeks to a few months, which restricts insights into the long-term sustainability of symptom reduction or therapeutic gains. Without longitudinal data, it is difficult to determine whether AI-driven CBT tools merely facilitate short-term engagement or contribute meaningfully to durable clinical improvements. The study for example, showed promising results in adolescents after an eight-week intervention, yet offers no insight into relapse rates or continued app use post-treatment (12). Such temporal limitations undermine confidence in the sustained efficacy of these tools.

Methodological bias is also prevalent in the current literature. Selection bias is apparent in studies recruiting digitally literate individuals or those already motivated to seek psychological support. This skews outcomes in favor of digital interventions and limits applicability to the broader population, particularly older adults or individuals from low-resource settings who may lack access to or comfort with technology. Moreover, performance bias is introduced when studies fail to incorporate blinding. In most trials, participants are aware of whether they are using a novel AI tool or receiving standard therapy, which can influence reported outcomes due to placebo effects or heightened engagement due to novelty. Publication bias must also be considered. The overwhelming majority of published studies report positive outcomes for AI-assisted interventions. While this may reflect real therapeutic benefit, it is also possible that studies with negative or null findings are underrepresented in the literature (13,14). This distortion can contribute to inflated expectations about the reliability and utility of AI in clinical practice. The current trend towards innovation in digital health may inadvertently discourage the publication of less favorable results, thereby limiting a balanced understanding of potential drawbacks.

A further complication arises from the variability in outcome measurements across studies. While some trials focus on symptom reduction using validated scales, others report less standardized metrics such as engagement rates or subjective satisfaction. The use of inconsistent benchmarks hinders meaningful comparisons between interventions and complicates meta-analytic synthesis. For example, one study may evaluate improvement in depression through the PHQ-9 scale, while another may prioritize session attendance or chatbot interaction frequency as proxies for therapeutic success (15,16). This inconsistency in outcome operationalization makes it difficult to draw unified conclusions about the effectiveness of AI interventions. Lastly, questions surrounding generalizability remain a significant concern. Although some studies attempt to include diverse participant populations, many are conducted in specific healthcare settings, such as the UK's NHS or the US Veterans Affairs system, which cater to unique demographic groups. Consequently, findings may not translate effectively to other healthcare systems, cultural contexts, or populations with different clinical needs. For example, the AI-CBT

intervention studied primarily included older veterans, limiting its applicability to younger or non-military populations (17). Similarly, most AI tools are developed and validated in English, with limited testing across different languages and cultural norms, further reducing their universal relevance (18). In sum, while current research into AI-enhanced behavioral and cognitive therapy offers exciting possibilities, it remains at a developmental stage, marked by methodological limitations and contextual caveats. A more rigorous, diversified, and transparent research agenda is necessary to fully establish the clinical value and boundaries of these emerging tools.

IMPLICATIONS AND FUTURE DIRECTIONS

The findings of this narrative review hold significant implications for clinical practice, highlighting the growing relevance of AI-assisted tools in behavioral and cognitive therapy. As mental health services face increasing demand and resource constraints, AI applications offer promising adjuncts that can enhance therapy delivery, particularly by improving patient engagement, adherence, and personalization of care. Clinicians may consider integrating AI-enabled tools—such as conversational agents, adaptive CBT modules, and reinforcement learning systems—into standard care pathways to supplement traditional therapy. These tools can support patients between sessions, offer real-time feedback, and tailor interventions based on user-specific patterns, thereby fostering continuous therapeutic engagement and potentially reducing dropout rates (19,20). Especially in populations where clinician availability is limited, AI can act as a force multiplier, expanding the reach and efficiency of CBT interventions (21). From a policy perspective, the growing body of evidence warrants the development of structured clinical guidelines for the ethical and effective integration of AI into psychological care. Although digital tools are already being deployed in some healthcare systems, their implementation remains inconsistent and often unregulated. Regulatory authorities and mental health organizations should consider establishing standardized frameworks that ensure patient safety, data privacy, and clinical accountability while fostering innovation. Guidelines should also address criteria for patient selection, thresholds for escalation to human-led care, and acceptable evidence standards for digital mental health tools. These frameworks will be essential in integrating AI tools into national mental health strategies and reimbursement models.

Despite encouraging progress, several critical gaps remain that demand further investigation. Most notably, long-term outcomes of AI-augmented CBT have not been sufficiently studied. Future research should focus on assessing the durability of symptom improvement, relapse rates, and sustained user engagement over extended periods. Additionally, the psychological impact of AI-human interaction, particularly regarding therapeutic alliance, emotional resonance, and trust-building, remains underexplored. It is also unclear how well these systems perform among patients with severe or complex psychiatric conditions, as most existing studies have targeted mild to moderate anxiety or depression (22). To address these unanswered questions, future studies should prioritize large-scale, multi-center randomized controlled trials with rigorous methodological designs. These trials should incorporate long follow-up durations—ideally six months to one year—to evaluate lasting effects. Stratified sampling should be employed to ensure demographic diversity, including underrepresented populations such as older adults, individuals with low digital literacy, and those from non-Western cultural backgrounds. Furthermore, head-to-head comparisons between AI-only, hybrid AI-human, and traditional therapist-only models can provide nuanced insights into the relative efficacy of these approaches. Mixed-methods designs combining quantitative outcome metrics with qualitative data on user experience would also offer a more comprehensive understanding of acceptability and therapeutic impact.

Moreover, interdisciplinary research involving clinicians, technologists, ethicists, and policy-makers is essential to ensure that AI interventions are both clinically sound and socially responsible. Collaborative efforts should aim to refine algorithmic models for greater contextual sensitivity, develop standardized outcome measures, and enhance interpretability and transparency of AI-driven decisions. Finally, real-world implementation research, including cost-effectiveness analysis and health systems integration studies, will be vital for transitioning these tools from controlled research settings into routine clinical use. In summary, while AI has demonstrated considerable potential in enhancing behavioral and cognitive therapy, thoughtful integration into clinical workflows, informed policy development, and robust scientific validation are critical next steps. A coordinated and evidence-based approach will ensure that AI augments rather than replaces the human elements that remain central to effective psychological care.

CONCLUSION

This narrative review highlights the growing potential of artificial intelligence as a transformative adjunct in behavioral and cognitive therapy, particularly in enhancing patient engagement, personalizing interventions, and optimizing therapist time. Evidence from recent studies consistently shows that AI-enabled tools—ranging from conversational agents to adaptive CBT platforms—can support clinical

outcomes and broaden access to psychological care, especially in settings with limited mental health resources. While the current body of literature provides encouraging results, especially for mild to moderate psychological conditions, limitations such as small sample sizes, short follow-up durations, and population-specific designs temper the overall strength of evidence. Therefore, clinicians are advised to consider AI tools as complementary rather than replacement strategies, integrating them thoughtfully within existing therapeutic frameworks. Researchers are encouraged to pursue long-term, multi-center randomized trials with diverse populations to establish the efficacy, safety, and generalizability of these technologies. As the field evolves, ongoing collaboration between clinicians, technologists, and policymakers will be critical to ensure that AI integration in psychotherapy is evidence-based, ethical, and patient-centered.

AUTHOR CONTRIBUTION

Author	Contribution
Najmus Sahar Shoaib*	Substantial Contribution to study design, analysis, acquisition of Data Manuscript Writing Has given Final Approval of the version to be published
Muhammad Tarique Arain	Substantial Contribution to study design, acquisition and interpretation of Data Critical Review and Manuscript Writing Has given Final Approval of the version to be published
Samabia Abdul Subhan	Substantial Contribution to acquisition and interpretation of Data Has given Final Approval of the version to be published
Alisha Summan	Contributed to Data Collection and Analysis Has given Final Approval of the version to be published
Hawa Naqvi	Contributed to Data Collection and Analysis Has given Final Approval of the version to be published
Hira Azhar	Substantial Contribution to study design and Data Analysis Has given Final Approval of the version to be published

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