

Automation of Electronic Cognitive Behavioural Therapy (Automated-eCBT) in Adapting Psychotherapy in a Clinical Context: A Review

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How to cite this paper: Al-Wahedi, M., Ismail, S., AlKhofani, W., & Azman, A. (2024). Automation of Electronic Cognitive Behavioural Therapy (Automated-eCBT) in Adapting Psychotherapy in a Clinical Context: A Review. *Psychology*, 15, 1474-1503. <https://doi.org/10.4236/psych.2024.159087>

Received: August 5, 2024

Accepted: September 22, 2024

Published: September 25, 2024

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Abstract

Background: Conventional cognitive behavioral therapies (CBTs) have struggled to provide rapid emergency solutions for psychological patients, particularly those facing acute conditions such as anxiety, panic attacks, depression, and post-traumatic stress disorder (PTSD). The emergence of electronic cognitive behavioral therapy (e-CBT) has introduced automation in the treatment of these psychological disorders. However, existing literature on the benefits, efficacy, clinical applications, and limitations of automated e-CBT is limited and fragmented. This paper aims to provide a comprehensive evaluation of automated e-CBT in treating psychological disorders, specifically focusing on its benefits, limitations, and clinical implications. **Methodology:** A systematic descriptive analysis of 117 cross-sectional studies was conducted, following the Cochrane handbook guidelines and the PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) checklist. The review encompassed studies published after 2000, investigating various aspects of automated e-CBT. **Results:** The review delineates the concepts of CBT and psychotherapy, focusing on their application in clinical settings. It examines the automation process in psychotherapy and CBT, discussing both the benefits and limitations of e-CBT. The analysis offers a detailed exploration of the clinical implications of adopting automated e-CBT. **Conclusion:** Automated e-CBT demonstrates significant potential as an emergency treatment for individuals with severe depressive episodes, anxiety, and PTSD. It offers a promising alternative to traditional face-to-face therapies, particularly in contexts where rapid intervention is critical.

Keywords

Automated-eCBT, E-Cognitive Behavioral Therapies, E-Psychotherapy, Cognitive Behavioral Therapies

1. Introduction

Cognitive-behavioral therapy (CBT) is a structured form of psychotherapy that integrates behavioral modification strategies from behavioral science with cognitive therapy techniques aimed at addressing psychopathological cognitive processes (Schaeuffele et al., 2024). CBT focuses on developing personal coping strategies, resolving current problems, and modifying ineffective cognitive patterns such as thoughts, beliefs, and attitudes, as well as behaviors and emotional regulation (Nakao et al., 2021; Beck, 2011). It operates on the premise that emotional disorders, including Post-Traumatic Stress Disorder (PTSD), stem from learned responses that can be altered through new learning experiences (Bhattacharya et al., 2023). Teaching patients to modify overt behaviors and covert thought processes can significantly influence their problematic emotions and behaviors (Ellis et al., 2024).

CBT has been shown to be effective in treating a wide range of mental disorders, including depression, anxiety, PTSD, phobias, and obsessive-compulsive disorder (Schaeuffele et al., 2024; Hofmann, 2011). It has also demonstrated some success in treating non-epileptic seizures (PNES) (Goldstein et al., 2010; LaFrance et al., 2014). However, the traditional format of CBT can be limited in providing rapid emergency solutions, particularly for conditions like PNES, where adherence to treatment protocols is crucial (Baslet et al., 2015). This limitation has spurred interest in adapting psychotherapy to electronic formats, potentially enhancing accessibility and adherence (Mishkind et al., 2021a).

Traditionally delivered in a face-to-face setting, CBT has been adapted to electronic formats (e-CBT) to increase accessibility and convenience. Early studies from the early 2000s laid the foundation for this shift, demonstrating that e-CBT could replicate the efficacy of traditional CBT (Andersson et al., 2008b). However, recent years have seen significant advancements in the automation of e-CBT, driven by innovations in artificial intelligence, machine learning, and digital health technologies.

The evolution of psychotherapy to incorporate digital technologies has led to the concept of automated psychotherapy. Automation involves the use of machine agents to perform tasks, functions, or services (Bunnell, et al., 2019). These advancements have enabled the development of automated e-CBT systems that offer personalized interventions, real-time feedback, and enhanced scalability, making it possible to treat larger populations more efficiently (Schure et al., 2022). For example, Al-Wahedi studied the effectiveness of automated eCBT on a sample suffering from post-sexual abuse stress disorder during childhood. The results of the study showed significant differences between the diagnostic results before and

after the test regarding the level of symptom severity. Whereas pre-treatment, the average of PTSD symptoms among the treatment participants was 2.5793, and post-treatment the average became 2.1988, and the paired difference was 0.38053. Based on this study, he issued an operational definition stating that the automated e-CBT as a multi-processing program designed to diagnose, measure, evaluate, and treat PTSD cases, particularly those related to childhood sexual abuse. This system relies on an electronic pathway to implement the core stages of CBT without direct intervention from a therapist. The benefits of this approach include expedited treatment, broader access, and potentially reduced costs compared to traditional therapy (Al-Wahedi, 2020).

Recent research highlights significant advancements in the use of digital and automated tools to deliver CBT. These tools, including smartphone apps and online platforms, have evolved to provide more personalized interventions and real-time feedback. Studies such as those by Tng et al. (2024), Gros et al. (2022), and Andersson et al. (2019) have demonstrated the efficacy of these tools in delivering core CBT techniques like cognitive restructuring. These tools are particularly valuable for increasing accessibility and maintaining treatment gains post-therapy, a critical aspect in managing chronic conditions like PTSD and other severe mental illnesses.

Furthermore, a systematic review by Laurito et al. (2024) evaluated the feasibility, acceptability, and effectiveness of digital health behavior change (HBC) interventions for people with severe mental illness (SMI). The review found that digital interventions are not only feasible but also effective in improving both psychological and physical health outcomes in this population. This highlights the potential of automated e-CBT to be adapted for more complex psychiatric conditions, which traditionally required more resource-intensive, face-to-face interventions.

Automated e-CBT offers several advantages, including enhanced privacy and convenience, particularly for patients hesitant to attend in-person therapy due to stigma or logistical challenges. This modality is also valuable in culturally conservative societies, where discussing mental health issues, especially those related to sexual trauma, is often taboo. Additionally, automated e-CBT facilitates continuous patient monitoring and support, which is crucial for crisis prevention (Both et al., 2010; Vilaza & McCashin, 2021). Despite these benefits, automated psychotherapy remains a relatively new field and encounters challenges in meeting the needs of specific patient populations, such as those with severe psychiatric conditions, limited digital literacy, or elderly individuals (Andersson & Titov, 2014).

While there are recognized benefits and limitations to automated e-CBT, the existing literature often lacks a cohesive synthesis of these aspects. Much of the focus has been on the broader category of electronic CBT (e-CBT), rather than the specific automation aspects (Al-Wahedi, 2020; Barnett & Scheetz, 2003; Amichai-Hamburger et al., 2014). Challenges include inadequate accessibility to fully automated self-service clinics, the need for patient-therapist communication in many programs, and issues with time management for both therapists and patients (Smith et al., 2023).

This paper aims to fill this gap by systematically reviewing the effectiveness of automated e-CBT in treating psychological disorders, with a focus on recent developments and their clinical implications. By doing so, it seeks to provide a clear understanding of the current state of automated e-CBT, its benefits, limitations, and the areas that require further research.

2. Methods

2.1. Design

This study utilizes a systematic descriptive method of analysis to examine professional conceptual perspectives on the benefits, limitations, and clinical implications of automated electronic cognitive behavioral therapy (e-CBT). The review was conducted following the guidelines provided in the Cochrane Handbook for Systematic Reviews of Interventions and reported in accordance with the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) checklist (Moher et al., 2015). The focus was on cross-sectional studies that investigated various aspects of automated e-CBT.

Research materials were gathered through secondary data collection, including journals, published psychotherapy textbooks, and other relevant data sources.

2.2. Inclusion and Exclusion Criteria

The review included studies published after 2000. Exclusion criteria were as follows: studies published before 2000, letters to editors, studies of poor quality, and publications in non-English languages.

2.3. Search Strategy and Selection of Studies

The authors conducted a comprehensive search across multiple databases, including Scopus, Science Direct, Springer, Elsevier, APA PsycNet, Web of Science, and PubMed. This search was supplemented with highly cited papers from Google Scholar. The search terms used included “psycho disorder,” “CBT,” “cognitive behavioral therapies,” “automated CBT,” and “electronic CBT.” The initial search yielded 203 papers. After removing duplicates and irrelevant studies, 117 journal articles were selected for review, as detailed in **Table 1**. The selection process involved assessing the titles, abstracts, and full texts of studies based on the inclusion criteria. Data extracted from the studies included authorship, outcomes, deductions, inferences, and recommendations.

Table 1. Articles selection sources.

N	Journal Title	No. of Articles
1	Journal of Medical Internet Research	7
2	Behaviour Research and Therapy	6
3	Internet Interventions	5

Continued

4	JMIR Formative Research	4
5	Journal of Affective Disorders	4
6	American Psychologist	3
7	Behavior Therapy	3
8	BMJ Open	3
9	Cognitive Therapy and Research	3
10	JAMA Psychiatry	3
11	Psychological Medicine	3
12	Telemedicine and e-Health	3
13	BMC Psychiatry	2
14	Cognitive Behaviour Therapy	2
15	Current Psychiatry Reports	2
16	European Journal of Psychotraumatology	2
17	Frontiers in Psychiatry	2
18	JMIR Mental Health	2
19	Systematic Reviews	2
20	The British Journal of Psychiatry	2
21	World Psychiatry	2
22	Abhigyan	1
23	Acta Psychiatrica Scandinavica	1
24	American Journal of Occupational Therapy	1
25	arXiv preprint arXiv	1
26	Behavior Research Methods	1
27	Behavioural and Cognitive Psychotherapy	1
28	BioPsychoSocial Medicine	1
29	BMC Public Health	1
30	BMJ	1
31	BMJ Mental Health	1
32	Canadian Journal of Behavioural Science	1
33	Clinical EEG and neuroscience	1
34	Clinical Psychologist	1
35	Clinical Psychology Review	1

Continued

36	Cognitive Behaviour Therapist	1
37	Complementary Therapies in Medicine	1
38	Computers in Human Behavior	1
39	Digital Biomarkers	1
40	Digital Health Journal	1
41	Discover Psychology	1
42	European Journal of Psychotherapy & Counselling	1
43	European Psychologist	1
44	Frontiers in Digital Health	1
45	Frontiers in Human Neuroscience	1
46	Health Psychology Report	1
47	IAFOR Journal of Psychology & the Behavioral Sciences	1
48	IEEE Transactions on Technology and Society	1
49	Intercultural psychotherapy	1
50	International Journal of Advanced Computer Science and Applications	1
51	International Journal of Cognitive Therapy	1
52	International Journal of Mental Health Nursing	1
53	International Journal of Methods in Psychiatric Research	1
54	JAMA Network Open	1
55	JMIR Human Factors	1
56	JMIR mHealth and uHealth	1
57	JMIR research protocols	1
58	Journal of Anxiety Disorders	1
59	Journal of Behavioral Medicine	1
60	Journal of Cognitive Enhancement	1
61	Journal of Cross-Cultural Psychology	1
62	Journal of Psychological Therapy	1
63	Journal of Technology in Human Services	1
64	Nature Human Behaviour	1
65	Neurology	1
66	NPJ Digital Medicine	1

Continued

67	PeerJ	1
68	PLoS One	1
69	Psychotherapy	1
70	Psychotherapy Research	1
71	Psychotherapy: Theory, Research, Practice, Training	1
72	Scientific Reports	1
73	The Canadian Journal of Psychiatry	1
74	Trauma, Violence, & Abuse	1
Total Journal Articles		117

3. Results**3.1. Automation of Psychotherapy**

The integration of automation in psychotherapy has gained considerable attention in recent years, driven by advancements in artificial intelligence (AI) and digital health technologies. The growing body of research demonstrates that automated interventions can significantly enhance accessibility and reduce the cost of mental health treatment. For example, a study by [Omarov et al. \(2023\)](#) found that AI-driven chatbots could provide cognitive behavioral therapy (CBT) with a level of effectiveness comparable to that of human therapists in treating anxiety and depression, offering real-time responses and continuous patient monitoring. This automation has the potential to democratize access to mental health care, particularly in underserved populations.

Recent research has also shown that fully automated systems can effectively manage therapeutic processes for various mental health conditions. [Klein et al. \(2023\)](#) conducted a meta-analysis of 25 randomized controlled trials, which demonstrated that automated digital therapies, particularly those employing AI, resulted in significant reductions in symptoms of depression and anxiety compared to control groups, with effect sizes ranging from moderate to large (Hedges' $g = 0.53 - 0.76$). This evidence supports the claim that automation can enhance the scalability and efficiency of psychotherapy.

However, the automation of psychotherapy is not without challenges. Attrition rates in digital therapy programs remain high, often due to the lack of human interaction. [Karyotaki et al. \(2021\)](#) identified that adherence to automated programs could be improved through the incorporation of personalized feedback and automated reminders, which have been shown to increase engagement and reduce dropout rates.

Moreover, [Burley et al. \(2024\)](#) and [Tong et al. \(2022\)](#) emphasize the importance of maintaining a human-centered approach in automating psychotherapy. They

argue that while machines can assist in delivering therapy, the therapeutic alliance—a key component of effective therapy—cannot be fully replicated by automated systems. This underscores the need for a balanced integration of automation in psychotherapy, where technology supports but does not replace human therapists.

Overall, the automation of psychotherapy holds promise for expanding access and enhancing the efficiency of mental health care. However, further research is needed to optimize these systems, ensuring they are both effective and engaging for a diverse patient population.

3.2. Technological Adaptation of CBT

The integration of technology into psychotherapy has revolutionized mental health care, particularly through the development of online therapy platforms and mobile applications designed to deliver Cognitive Behavioral Therapy (CBT). This evolution has significantly enhanced the accessibility and convenience of mental health support, allowing individuals to receive treatment remotely, which has become increasingly critical in the digital age (Andersson et al., 2019; Titov et al., 2018).

Recent meta-analyses have shown that e-CBT can be as effective as traditional face-to-face CBT for treating various mental health disorders, including depression and anxiety (Carlbring et al., 2018). For instance, a study by Carlbring et al. (2018) reported that e-CBT demonstrated an average effect size of 0.78 for reducing symptoms of depression, which is comparable to face-to-face therapy. Similarly, Karyotaki et al. (2021) found that e-CBT for anxiety disorders yielded an effect size of 0.88, highlighting its effectiveness.

One of the key benefits of e-CBT is the privacy and anonymity it offers, which is particularly important for individuals reluctant to seek in-person therapy due to stigma or fear of judgment (March et al., 2018; Schmotz et al., 2024). This increased sense of privacy has been linked to higher engagement rates in online therapy programs (Staples et al., 2019). For instance, a study published in JAMA Network Open found that 74.7% of participants in a computer-assisted CBT (CCBT) program completed their treatment, which is higher than the 58.3% average completion rate reported in a meta-analysis for traditional CBT in primary care settings (Wright et al., 2022).

While technology enhances accessibility in mental health care, it also presents challenges. For example, the lack of in-person interaction in electronic cognitive-behavioral therapy (e-CBT) may limit a therapist's ability to capture subtle emotional cues, which are often critical for effective treatment (Richards et al., 2018). This concern is supported by findings that a significant majority of users (85.7%) still prefer face-to-face services over e-mental health options, suggesting that while e-CBT is an effective tool, it may not fully replace the therapeutic relationship in all cases (March et al., 2018). Although a study by Peynenburg et al. (2020) indicated that 15% of e-CBT users reported a need for additional face-to-face support,

the specific statistic is not directly corroborated by more recent data. Nevertheless, the preference for traditional therapy underscores the importance of offering additional support, such as face-to-face options, to ensure that the diverse needs of all users are met.

Furthermore, security concerns are paramount, as online platforms may be vulnerable to breaches, potentially compromising patient confidentiality (Jawad, 2024). These risks necessitate stringent security protocols to ensure patient data remains protected. Additionally, while e-CBT may reduce costs associated with traditional therapy, the variability in insurance coverage and the upfront costs of digital platforms can pose barriers to access for some populations (Hedman et al., 2014).

Maintaining user engagement is another critical factor in the success of e-CBT. Studies have shown that higher motivation, particularly in self-referral cases, correlates with improved outcomes and reduced treatment duration (Gyani et al., 2013). For example, a study by Karyotaki et al. (2018) reported that personalized e-CBT interventions, which allow users to proceed at their own pace, significantly enhance user engagement and treatment adherence. Despite these advantages, ongoing oversight is necessary to address issues such as user attrition and to ensure that interventions remain effective and engaging over time (Donkin & Glozier, 2012; Urech et al., 2018).

3.3. Electronic Psychotherapy and CBT

The landscape of psychological treatment has been fundamentally transformed by the widespread adoption of electronic technologies, such as computers, the internet, and mobile devices (e.g., smartphones and mobile applications) (Badawy et al., 2018). These technologies have expanded the reach and methods of psychological interventions, encompassing a broad range of applications, including self-help internet websites, computer-administered therapy, and virtual reality (Andersson et al., 2019; Badawy et al., 2019).

Internet-based self-help websites are among the most prominent forms of electronic psychotherapy, typically featuring independently completed modules with psycho-educational materials, behavioral activities, videos, and monitoring forms (Woodford et al., 2018). These platforms have been shown to be effective in reducing symptoms of mental health disorders such as depression, anxiety, and PTSD. For instance, a meta-analysis by Karyotaki et al. (2017) reported that internet-based interventions yielded a significant reduction in depressive symptoms, with an effect size of 0.53, while another study by Lewis et al. (2019) found that i-CBT is associated with a clinically significant reduction in PTSD symptoms compared to a waitlist control, with a standardized mean difference of -0.60 (95% confidence interval -0.97 to -0.24).

While many internet-based platforms are designed for independent use, they often include supplementary support options, such as therapist-guided sessions or automated feedback systems (Fairburn & Patel, 2018). The flexibility in format,

clinical type, content, functionality, and delivery methods makes these interventions highly adaptable to various user needs (Hermes et al., 2018). Notably, most of these platforms are grounded in forms of Cognitive Behavioral Therapy (CBT), which has been widely validated for its effectiveness in treating a range of mental health conditions (Andersson et al., 2019; Fairburn & Patel, 2017).

Despite the innovative nature of internet-based systems, many retain core elements of traditional treatments, often adapting face-to-face therapies or self-help approaches into digital formats (Kählke et al., 2019). These digital interventions frequently emphasize behavioral therapy components more than cognitive procedures, with some being presented more as educational programs than therapeutic sessions (Green et al., 2019). A study by Zhou et al. (2016) highlighted that behaviorally focused e-therapies led to a 45% improvement in anxiety symptoms, showcasing the potential of these digital tools.

In addition to CBT, other forms of digital psychotherapy are emerging, including Acceptance and Commitment Therapy (ACT), Behavioral Activation, Interpersonal Psychotherapy (IPT), Mindfulness-Based Interventions, and Problem-Solving Therapy (Ly et al., 2014; Donker et al., 2013; Kleiboer et al., 2015). Although these approaches have not received as much attention as CBT, they are increasingly being incorporated into digital platforms. For example, a randomized controlled trial by Pots et al. (2016) demonstrated that digital ACT reduced symptoms of depression by 38%, comparable to face-to-face interventions.

The retention of original treatment strategies and procedures in these digital formats varies, but their effectiveness in various forms remains promising (Fairburn & Patel, 2018; Spijkerman et al., 2016). The ongoing development of these technologies, combined with rigorous research, continues to enhance the efficacy and reach of electronic psychotherapy.

3.4. e-CBT in the Context of Clinical Psychopathology

E-CBT, a prominent form of electronic psychological treatment, has gained increasing traction for addressing a broad spectrum of mental health disorders. While many e-therapy platforms primarily target mild conditions such as depression, anxiety, PTSD, and various phobias, some interventions have been specifically developed for more severe cases, including patients with suicidal ideation (Starcevic, 2019: p. 170; Fairburn & Patel, 2018). Notably, transdiagnostic e-therapies, such as internet-delivered CBT (iCBT) and internet-based mindfulness treatments, have demonstrated efficacy across a wide range of clinical applications, making them highly versatile tools for mental health professionals (Kladnitski et al., 2020; Titov et al., 2011).

Technology also plays a critical role in understanding and addressing e-psychopathology. For example, a case study by Edmonds (2018) highlighted how technological tools facilitated the identification of depressive symptoms, enabling the therapist to provide targeted psychoeducation. Early electronic CBT interventions often resembled simple self-help materials (Bergmame & Shaw, 2018). However,

modern e-CBT programs have evolved significantly, incorporating sophisticated features such as interactive learning modules, self-monitoring tools, progress tracking, multimedia content, avatars, games, and quizzes. These features are particularly beneficial in treating complex conditions like social anxiety disorder and PTSD, where engagement and interactivity are crucial (Søgaard Neilsen & Wilson, 2019; Stott et al., 2013; Wild et al., 2016). For instance, Merry et al. (2012) demonstrated that gamified interventions significantly improved treatment adherence among younger users, leading to better clinical outcomes.

Innovation in virtual and direct psychotherapy is poised to transform CBT techniques further. Self-help therapy, in particular, is expected to benefit from real-time intelligent communication systems that enhance user interaction and treatment customization (Munoz et al., 2018; Fairburn & Patel, 2018). Additionally, indirect psychotherapy methods such as telehealth, telepsychology, and e-health have been shown to effectively manage conditions like depression, anxiety, and PTSD, providing a valuable alternative to traditional face-to-face therapy (Parsons, 2019). The integration of these technologies into psychotherapy and clinical supervision has made it essential for mental health clinicians to stay abreast of these advancements to deliver the best care possible (Barnett, 2017).

Web-based interventions offer several distinct advantages over traditional treatments, including cost-effectiveness, scalability, and anonymity, which are particularly appealing for individuals seeking privacy (Laine et al., 2019; Urech et al., 2018). For example, Ruggiero et al. (2006) found that internet interventions designed for psychiatric care were delivered with high fidelity and were well-accepted by users. Furthermore, literature reviews suggest that internet-based interventions, particularly those utilizing self-help methods, are effective in treating various mental health disorders (Purgato et al., 2019). As the internet becomes an increasingly common source of health information, the effectiveness of web-based interventions in addressing mental health issues continues to grow (Dodson et al., 2019; Christensen et al., 2010).

A key study by Ruwaard et al. (2012) evaluated the effectiveness of online CBT for a range of mental disorders in routine clinical practice. This study utilized an uncontrolled pre- and post-test design with follow-ups at 6 weeks and 1 year. The findings indicated that online therapist-assisted CBT was as effective as traditional CBT in clinical trials, with significant improvements in symptom reduction sustained over time.

3.5. Electronic and Automation Attributes of e-CBT

Guided Internet-based CBT (iCBT) has evolved from traditional bibliotherapy, which involves using specific texts or storytelling to facilitate healing. While bibliotherapy has its roots in more expensive, therapist-led interventions, guided iCBT has proven to be a cost-effective and accessible alternative for treating conditions such as depression and anxiety (Newby et al., 2019). Studies indicate that the benefits of guided iCBT are not only significant but also long-lasting, with

patients reporting sustained improvements in their mental health over time (Hamatani et al., 2019; Zhang et al., 2019).

The effectiveness of electronic and automated psychotherapy methods has been well-documented across various forms of telemedicine. For instance, research supports the success of remote diagnosis and treatment via telecommunications, showing that online CBT interventions can substantially enhance therapeutic outcomes, particularly in terms of patient engagement and adherence (Marcelle et al., 2019). One of the key advantages of online CBT is its capacity to provide written records of sessions, allowing patients to reflect on their thoughts and feelings, which can enhance the overall effectiveness of therapy (Ennis & Cartagena, 2020). This reflective practice is crucial in CBT, as it directly impacts the patient's ability to engage with their mental content, thereby influencing their current and future mental states (Crawford et al., 2018).

Further evidence suggests that internet-based cognitive behavioral writing therapy is particularly effective for PTSD patients. This method addresses specific needs and helps overcome barriers to treatment, such as geographic limitations or physical disabilities, by offering real-time communication between patients and therapists via instant messaging (Hiratsuka et al., 2019; Wilhelm et al., 2019). The flexibility and accessibility of e-CBT make it an attractive option for both patients and therapists, allowing for better utilization of time and resources (Urech et al., 2018). Additionally, the therapeutic value of writing about traumatic events has been supported by research, which shows that such practices can significantly enhance health outcomes (Hiratsuka et al., 2019).

In summary, while online therapy, digital psychotherapy, internet-based therapy, and e-therapy all represent forms of electronic applications in mental health care, they differ significantly in terms of their reliance on human intervention (Mucic & Hilty, 2019). Electronic processes play a crucial role in these therapies, but they do not always lead to automation, which is characterized by the use of technology to control processes without human input (Pacheco & Scheeringa, 2022). The distinction between electronic therapy and automation is important; although e-CBT incorporates electronic elements, it typically still requires human guidance and interaction, unlike fully automated systems (Paul, 2022).

3.6. Automation of E-CBT

The automation of psychotherapy, particularly through websites and mobile applications, epitomizes the concept of ambient intelligence, where software utilizes knowledge of human behaviors and psychological states to deliver personalized interventions (Burr et al., 2020). Fully automated e-CBT systems incorporate advanced features to enhance the therapeutic experience, starting with profiling the user's specific issues to tailor interventions. This customization ensures that users receive personalized feedback, optimizing their treatment outcomes (Osipov, 2019).

Research by Carlbring et al. (2018) supports the effectiveness of fully automated

e-CBT, finding that it was nearly as effective as therapist-led CBT in treating anxiety disorders. The study reported similar outcomes in symptom reduction and patient satisfaction, providing robust evidence for the clinical viability of automated systems. For example, if a user struggles with the thought, “I won’t be successful if I stutter,” the automated system might prompt them to challenge this belief by presenting counter-evidence. The user could respond with, “This is what my father once said to me,” which, while not legally valid, helps the user reassess their thoughts. Such feedback loops are designed to improve cognitive processing by encouraging users to critically evaluate and modify their unhelpful beliefs (Osipov, 2019). However, developing comprehensive databases to manage diverse user profiles requires significant clinical input and ongoing refinement.

A significant challenge remains in user engagement. A meta-analysis by Karyotaki et al. (2018) reported higher dropout rates in fully automated e-CBT compared to those with therapist support, underscoring the importance of developing strategies to maintain user involvement in these interventions. Automated messaging features in e-CBT, such as reminders to “log in to read new messages,” help establish and maintain therapeutic engagement (Danaher et al., 2019; Andersson, 2024). These systems range from sophisticated programs with automated reminders and interactive elements to simpler downloadable text files, known as net-Biblio CBT (Andersson, 2024; Marks et al., 2007). The versatility of these tools makes them accessible to a wide range of users, from those needing intensive support to those seeking more autonomous treatment options.

Self-administered psychotherapies, including automated CBT, have demonstrated effectiveness in treating depression and anxiety disorders (Song et al., 2015). In these programs, patients independently apply standardized psychological interventions, often following structured guides provided in digital or printed formats (Hayward et al., 2015; Both et al., 2010). Despite the benefits of self-administration, the absence of therapist support has been linked to higher dropout rates and diminished treatment efficacy (Chermahini et al., 2024; Christensen et al., 2006).

To address these challenges, guided self-therapy has emerged as a viable approach for conditions like depression, social anxiety, panic disorder, suicidal ideation, PTSD, ADHD, and insomnia (Kim et al., 2023). This method allows patients to engage in therapy from home while receiving remote guidance from a therapist, typically through internet-based platforms. Features such as multi-modal memory, visual timelines, and multimedia support (e.g., photos, music, text) are integrated to enhance the therapeutic process (Thew et al., 2022; Tielman et al., 2014).

In Internet-based CBT (ICBT), patients access secure websites to complete lessons or modules over a specified period. These platforms often include homework assignments and questionnaires, enabling therapists to monitor progress and ensure patient safety (Newby et al., 2019; Bonnert et al., 2019). ICBT can be categorized based on the level of therapist involvement, ranging from synchronous (real-

time, e.g., video calls) to asynchronous (delayed, e.g., email) interactions, depending on the needs and preferences of the patient (Braun et al., 2023). Combining both synchronous and asynchronous methods has been found to enhance the practicality and effectiveness of treatment (Andersson & Titov, 2014).

Recent findings underscore the importance of fully automated iCBT programs, such as Thrive, which have shown potential in addressing suicidal thinking and reducing depression symptoms. A study indicated that participants using Thrive experienced a 38.7% reduction in suicidal thinking compared to a waitlist control group. Significant differences in depression symptom slopes were also noted, favoring the Thrive program. This aligns with previous research suggesting that automated iCBT may effectively reduce depression symptoms among users, particularly in specific populations like rural US adults. The effectiveness of these programs depends partly on user engagement; adherence to lesson completion was related to lower depression and anxiety scores (e.g., PHQ-9 and GAD-7). Future studies should investigate strategies to enhance lesson completion rates to improve the efficacy of such programs in reducing suicide risk (Schure et al., 2022).

The automation of e-CBT has the potential to reduce the time therapists spend on face-to-face interactions while minimizing the risk of untrained practitioners providing suboptimal care (Mason & Andrews, 2014). However, this shift highlights the critical need for skilled designers of automated psychotherapy programs. These professionals must possess expertise in creating effective, disorder-specific treatments and developing interventions that encourage self-driven progress (Molden, 2024; Tong et al., 2022).

Automated e-CBT Application

The development and implementation of automated Cognitive Behavioral Therapy (CBT) have seen remarkable progress, with a proliferation of mobile health applications (mHealth apps) now incorporating these techniques. These advancements have transformed the role of CBT-based apps from mere patient education tools to comprehensive self-help platforms that integrate core psychotherapeutic techniques, including cognitive restructuring, behavioral activation, exposure, and problem-solving (Denecke et al., 2022b).

Key Features of Automated e-CBT Apps:

1) Cognitive Restructuring: Automated CBT apps provide users with tools for cognitive restructuring, such as journaling functions and support for modifying unhelpful thoughts. These features are designed to help users effectively manage and reframe their cognitive patterns, which is crucial in addressing conditions like anxiety and depression (Denecke et al., 2022a).

2) Behavioral Activation: These apps promote behavioral activation by offering resources on mental health conditions, activity tracking, goal setting, and assigning therapeutic exercises. This approach encourages users to engage in positive activities, which is a key component in managing depressive symptoms and improving overall mental health (Denecke et al., 2022b).

3) Interactive Elements: A significant advancement in automated e-CBT apps

is the inclusion of interactive elements. These may involve automatic responses to user inquiries, the ability to exchange messages with a treatment team, or interactions with virtual characters designed to provide guidance and clarification (Purkayastha et al., 2020). These interactive features aim to simulate aspects of traditional therapy, thereby enhancing user engagement and adherence to the treatment protocol.

4) Chatbots and Natural Language Processing (NLP): Approximately 8% of the surveyed apps incorporate conversational agents or chatbots, which are designed to support cognitive restructuring efforts. Utilizing NLP and machine learning, these chatbots analyze user input to deliver personalized recommendations, thus offering a more tailored therapeutic experience (Denecke et al., 2022a).

5) Multimedia and Gamification: To further enhance user experience and adherence, many apps integrate multimedia elements such as audio-visual content, meditation exercises, and gamification strategies like puzzles and rewards. Additionally, social network features are sometimes included to combat feelings of isolation and loneliness, which are often associated with mental health conditions like depression (Denecke et al., 2022b). These features not only make the therapeutic process more engaging but also help maintain user motivation over time.

3.7. Advantages of Automated e-CBT

Automated e-CBT offers several distinct advantages that make it a powerful tool for mental health treatment:

1) Unlimited Scalability: One of the most significant benefits of automated e-CBT is its ability to scale without limitations. Automated systems can simultaneously accommodate a virtually unlimited number of clients, a feature made possible by advancements in open-source web development platforms and cloud computing services such as Google App Engine and Amazon Web Services. This scalability is particularly crucial for addressing widespread mental health needs, making it feasible to deploy large-scale therapeutic systems that can reach a broad population (Alavi et al., 2021). Additionally, a study by Donker et al. (2015) highlights the cost-effectiveness of automated e-CBT, showing that it can reduce treatment costs by up to 50% compared to traditional face-to-face therapy while maintaining comparable effectiveness.

2) Enhanced Content Delivery: Unlike traditional printed materials, automated e-CBT programs can deliver rich multimedia content, including text, images, videos, animations, audio voiceovers, and interactive exercises. This dynamic and engaging format enhances the user experience by providing varied and immersive ways to interact with the therapeutic content, which can improve engagement and adherence to the treatment program (Andersson & Titov, 2014). The inclusion of multimedia elements allows for a more comprehensive and appealing therapeutic approach.

3) Evolving Content: Automated e-CBT programs have the advantage of being able to evolve continuously. Unlike printed manuals that can become outdated, these digital platforms can be regularly updated with the latest evidence-based treatment methods. This ensures that the content remains current and reflective of the most recent research and clinical practices, providing users with the most effective interventions available (Andersson et al., 2019). Research by Baumeister et al. (2014) demonstrated the benefits of continuously updated digital therapies, where frequent content updates based on new evidence led to improved treatment outcomes in users over time.

Risks and Considerations

While the advantages of automated e-CBT are substantial, they are not without risks. Tong and colleagues (Tong et al., 2022) highlight concerns such as the potential for information overload, poor information quality, and the possibility of harm from poorly designed interventions. Moreover, there is often a lack of rigorous scientific and scholarly evaluation for these digital therapies, which can lead to variability in their effectiveness and safety. Vilaza & McCashin (2021) further emphasize the ethical risks inherent in digital psychotherapy applications, noting that these platforms may not adequately address unexpected client reactions, which could compromise the therapeutic process.

4. Limitations of Automated e-CBT Intervention

While automated e-CBT presents innovative possibilities in mental health treatment, several limitations and challenges remain:

1) Effectiveness Compared to Human Therapists: Despite significant advancements in automated therapy, there is ongoing debate regarding whether these systems can match the effectiveness of human therapists. The nuanced, empathetic, and adaptive nature of human interaction is challenging to replicate through automation, particularly in complex cases requiring deep emotional understanding and personalized responses. Current evidence suggests that while automated e-CBT can be beneficial for many individuals, it may not fully replace human therapists, especially in situations requiring advanced clinical judgment and emotional intelligence (Andersson et al., 2019).

2) Patient Characteristics and Predictors: There is limited understanding of which patients are most likely to benefit from automated e-CBT. Although some studies have explored potential predictors, consistent and reliable factors have not been identified. This lack of clarity poses challenges in targeting the most appropriate patient populations for these interventions. More research is needed to determine the specific characteristics, such as age, severity of symptoms, and comorbidities, that influence the effectiveness of automated e-CBT (Nordgreen et al., 2012; Andersson et al., 2008a).

3) Risk of Negative Outcomes: The potential for negative outcomes associated with automated e-CBT is an often-overlooked aspect. Research in this area is

sparse, and there is insufficient data on how frequently negative outcomes occur, such as increased distress or dropout rates, and how these can be effectively detected and managed. The absence of direct therapist oversight can sometimes lead to situations where adverse reactions go unnoticed, highlighting the need for built-in mechanisms to monitor and address these risks (Arenas-Escaso et al., 2024; Barlow, 2010; Rozental et al., 2014). Supporting this concern, Klatte et al. (2018) and Ebert et al. (2018) investigated adverse effects in automated e-CBT and found that, while rare, negative outcomes were more prevalent in complex cases lacking human oversight. The study emphasizes the importance of integrating safety protocols into automated systems to mitigate these risks.

4) Recruitment and Information Gathering Challenges: Recruiting participants and gathering accurate information through electronic assessments can be complex and time-consuming. The initial screening interviews, multi-scale assessments for conditions like PTSD, and feedback forms used in automated e-CBT may lack the depth and reliability of traditional face-to-face evaluations. (Flemotomos et al., 2022) Furthermore, the transition from DSM-IV to DSM-5 diagnostic criteria poses additional challenges, particularly if updated measures are not readily available or integrated into the automated systems. This could undermine the overall effectiveness of the interventions (Seewer et al., 2024).

5) Communication Difficulties: Online communication methods, such as live chat rooms or asynchronous messaging, can be difficult for some patients to navigate, impacting their engagement with the therapy and the overall effectiveness of the intervention. Technical difficulties, discomfort with digital communication, or lack of familiarity with the platforms can lead to lower participation rates and may obscure the true effectiveness of automated e-CBT. Additionally, the absence of immediate human feedback can make it harder for patients to feel supported and understood (Dear et al., 2019; Titov et al., 2018).

6) Sample Size and Statistical Significance: Larger sample sizes are often required to detect statistically significant improvements in automated e-CBT programs. However, achieving these larger samples can be challenging due to recruitment difficulties, high dropout rates, and varying levels of participant engagement (Schmotz et al., 2024). Future research should focus on designing studies that can better control for participant reliability and ensure that the results are both statistically and clinically meaningful (Wright et al., 2022; Lin et al., 2023).

7) Generalizability and Cultural Considerations: The generalizability of automated e-CBT across diverse populations is still limited. Most research has focused on Western populations, and there is a lack of studies examining the effectiveness of these interventions in different cultural contexts. This gap is particularly concerning in societies with high levels of trauma, such as those affected by war or widespread sexual abuse. Future research should include direct comparisons between internet-based interventions and face-to-face therapy across diverse cultural settings to better understand the broader applicability of automated e-CBT (McDermott et al., 2024; Hofmann et al., 2012). For example, a cross-cultural

study by Mucic and Hilty (2019) and Atzor et al. (2024) found that while e-CBT is effective across different populations, adaptations are necessary to address cultural differences in treatment perception and engagement, underlining the importance of culturally sensitive design in automated interventions.

In summary, while automated e-CBT offers promising advancements in mental health treatment, addressing these limitations through targeted research and development is crucial for optimizing its effectiveness and broadening its applicability. Continued exploration into the unique challenges posed by automation in psychotherapy will help ensure that these interventions are safe, effective, and accessible to all who need them.

5. Implications of Automated e-CBT for Future Studies

The implications of automated e-CBT (electronic Cognitive Behavioral Therapy) for future research are significant and multifaceted:

1) Enhanced Freedom of Expression: Automated e-CBT offers a safe and private space for patients to express their problems freely, which is particularly beneficial for individuals dealing with shame or shyness. For example, individuals with a history of sexual abuse may find it easier to discuss their experiences through an online platform. The anonymity and reduced face-to-face interaction in automated e-CBT can lower the barriers to open communication, encouraging patients to share their thoughts and feelings more openly, which is crucial for effective therapy (Doarn, 2013; Al-Wahedi, 2020). Future research should explore how this enhanced freedom of expression impacts treatment outcomes, particularly in populations that traditionally struggle with in-person therapy.

2) Improvement in Psycho-disorder Symptoms: Automated e-CBT has the potential to mitigate symptoms of various psycho-disorders, particularly in populations that benefit from a self-guided approach. For instance, patients who have experienced child abuse may find automated e-CBT helpful in managing their symptoms at their own pace. The flexibility and accessibility of online self-help interventions allow patients to engage with the therapy when they feel ready, potentially leading to better symptom management and long-term outcomes. Future studies should focus on evaluating the long-term effectiveness of automated e-CBT across different psycho-disorders and patient demographics (Gere et al., 2020; Weisel et al., 2019).

3) Discussion of Negative Automatic Thoughts: Automated e-CBT is effective in facilitating the discussion of negative automatic thoughts, which are often central to conditions like depression and social anxiety. By providing a structured yet flexible environment, automated e-CBT encourages patients to confront and manage these thoughts independently, without continuous external support. This aspect of self-guided therapy can empower patients to develop coping strategies on their own, enhancing their sense of control and self-efficacy. Future research should investigate how the self-guided discussion of negative thoughts in automated e-CBT compares to traditional CBT in terms of patient outcomes (Gere et

al., 2020).

4) Self-repair of Negative Automatic Thoughts: One of the unique aspects of automated e-CBT is its capacity to facilitate self-dialogue and reflection, which can lead to the self-repair of negative automatic thoughts. The therapy often includes textual prompts that encourage patients to confront and correct their thinking patterns. As patients interact with the content, they may inadvertently recognize cognitive distortions and adjust their thoughts to align with more positive and supportive ideas. This process of self-correction is a key area for future research, particularly in understanding the mechanisms that make automated e-CBT effective for certain individuals (Martin, 2019).

5) Enhanced Management of CBT: Automated e-CBT improves the overall management of cognitive-behavioral therapy by streamlining clinical content delivery, coordination, and functionality. The automation of these processes can lead to more efficient therapy delivery, making CBT more accessible to a broader range of patients. Additionally, the ability to update and modify content in real-time ensures that the therapy remains relevant and evidence-based. Future studies should explore the impact of these enhancements on the overall effectiveness and scalability of CBT interventions, particularly in resource-limited settings (Graham et al., 2020).

In summary, the implications of automated e-CBT for future studies are vast, encompassing the exploration of new therapeutic mechanisms, the enhancement of patient engagement, and the refinement of therapy management. Continued research is essential to fully understand the potential of automated e-CBT and to address the challenges that accompany its implementation in diverse clinical settings.

6. Conclusion

Automated e-psychotherapy has demonstrated significant potential for supporting patients dealing with child sexual abuse and trauma, offering a platform where they can disclose their issues more freely, without the common barriers of shame and shyness. This paper has provided a comprehensive review of the automation of e-CBT, discussing its numerous benefits, limitations, and broader implications for future research and clinical practice.

Key Findings:

- **Effectiveness in Emergency Treatment:** Automated e-CBT has shown particular usefulness as an emergency intervention for severe depressive episodes, anxiety, sexual abuse trauma, and PTSD. The accessibility and immediacy of this form of therapy make it a valuable tool in urgent situations where traditional therapy might be delayed.
- **Scalability and Content Evolution:** Unlike traditional face-to-face CBT, automated systems have the advantage of scalability, allowing them to treat an unlimited number of clients simultaneously. These systems also offer rich, evolving content, which can be continuously updated to incorporate the latest

research and therapeutic techniques, ensuring that patients receive the most current and effective care.

- **Successful Communication Style:** The success of automated e-CBT often lies in its communication style, which is designed to encourage individuals to openly discuss and address their thoughts and issues. The structured, yet flexible, format of automated e-CBT facilitates self-expression and reflection, making it an effective tool for managing a variety of mental health conditions.

7. Challenges

- **Negative Outcomes and Patient Characteristics:** More research is needed to understand negative outcomes and identify which patients will benefit most from automated e-CBT.
- **Participant Recruitment and Communication Issues:** Difficulties in recruiting participants and ensuring effective communication via automated methods can undermine the effectiveness of e-CBT.

Authors' Contributions

- **MA:** Conceptualized the idea, prepared the abstract, introduction, methods, and psychotherapy practice review sections.
- **SI:** Addressed reviewer comments and made the necessary corrections.
- **WA:** Prepared the conclusion section and selected the articles required for the review.
- **AA:** Supervised the manuscript write-up and provided improvement suggestions.

Disclosure and Conflict of Interest

All authors have disclosed that there are no financial or other substantive conflicts of interest that could influence the results or interpretation of the manuscript.

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