



Virtual Reality Therapy as an Innovative Intervention in Mental Health: A Literature Review

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Abstract: Recent developments in digital technology have contributed to the emergence of innovative approaches in mental health care, including Virtual Reality Therapy (VRT), which allows patients to interact with immersive and controlled three-dimensional virtual environments. This literature review examines the concepts and clinical effectiveness of VRT in the management of mental health disorders. Current evidence suggests that VRT may help alleviate psychological symptoms associated with anxiety, depressive disorders, PTSD, and substance-related conditions. VRT is frequently combined with exposure therapy and cognitive behavioral therapy (CBT), enabling gradual and supervised exposure to fear-related stimuli within a safe environment. Furthermore, the use of smartphone-based applications may improve patient engagement and expand access to mental health services. Despite these potential benefits, challenges remain due to differences in study methodologies and the limited availability of long-term data. Further studies are needed to assess sustained therapeutic outcomes and support broader clinical implementation. Overall, VRT has considerable potential as both a complementary and alternative intervention in mental health treatment.

Keywords: virtual reality therapy, mental health, anxiety, depression, PTSD, social anxiety disorder, GAD, psychosis, and substance use disorder.

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Introduction

The fast growth of digital technologies has driven significant innovation in mental health interventions through the integration of technological tools into psychological therapies (Caponnetto & Casu, 2022; Fairburn & Patel, 2017). This approach not only enhances the flexibility of service delivery but also addresses limitations in access associated with geographical barriers and financial constraints (Dar et

al., 2023). Furthermore, technology facilitates continuous patient monitoring and supports the development of more personalized and structured interventions (Dong et al., 2025).

One emerging innovation is Virtual Reality (VR), which enables the development of immersive and interactive 3D visual environments (Caponnetto & Casu, 2022). Concerning mental health care, this technology is applied in the form of Virtual Reality Therapy (VRT),

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allowing patients to directly engage in therapeutic scenarios within a safe and controlled setting (Emmelkamp & Meyerbröcker, 2021; Bell et al., 2024). This approach offers distinct advantages over conventional therapeutic methods, particularly in delivering exposure to stimuli that are difficult to replicate in practical contexts (Freeman et al., 2017; Bell et al., 2024).

VRT has been applied in various therapeutic approaches, particularly exposure therapy and cognitive behavioral therapy (CBT), and has shown beneficial outcomes in managing conditions such as anxiety, depression, and PTSD (Maples-Keller et al., 2017; Hawajri et al., 2023). Even so, limitations in the existing body of scientific evidence remain, particularly concerning long-term effectiveness and methodological variability across studies (Geraets et al., 2021; Naran, 2025). Therefore, this literature review aims to examine the conceptual foundations, underlying mechanisms, types, and effectiveness of Virtual Reality Therapy in the context of mental health.

Materials and Methods

This study used a qualitative descriptive approach through a literature review. The literature search was conducted using the PubMed and Google Scholar databases in April 2026, with publications from 2016 to 2026 considered. The search strategy used the keywords "virtual reality therapy" AND "mental health disorders" AND (intervention OR treatment OR therapy), with additional terms related to specific mental health conditions, including anxiety, depression, post-traumatic stress disorder (PTSD), social anxiety disorder, generalized anxiety disorder (GAD), psychosis, and substance use disorder. The Boolean operators AND and OR were used to combine the search terms. The initial search identified 723 records from PubMed and 1,200 records from Google Scholar, resulting in 1,923 records.

Articles published in English or Indonesian that discussed the application of Virtual Reality Therapy or virtual reality-based therapeutic interventions in mental health were considered eligible. Duplicate records, conference abstracts, editorials, unrelated studies, and studies that did not meet the objectives of the review were excluded. Before screening, 423 duplicate records were removed, leaving 1,500 records for title and abstract screening. A total of 1,415 records were excluded based on title and abstract, and 85 reports were sought for retrieval. Of these, 10 reports could not be retrieved, while 75 reports were assessed for eligibility through full-text review. Following full-text assessment, 40 reports were excluded, primarily because they did not meet the predefined eligibility criteria or were not

sufficiently relevant to the objectives of the review. A total of 35 studies were included in the final review. The study identification, screening, eligibility assessment, and inclusion processes are presented in the PRISMA 2020 flow diagram (Figure 1).

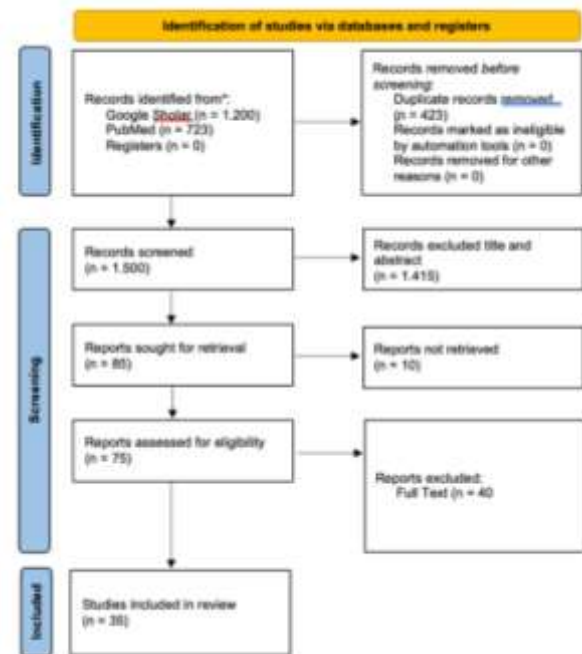


Figure 1. PRISMA flow diagram of the literature search and study selection process.

Data were extracted from the included studies, including authors, year of publication, study design, study population, type of Virtual Reality Therapy intervention, target mental health disorder, comparator when available, outcome measures, and main findings. The included literature comprised various study designs, including randomized controlled trials (RCTs), clinical trials, observational studies, systematic reviews, meta-analyses, and other relevant review articles. Study design and level of evidence were identified to provide an overview of the strength and characteristics of the available evidence. The methodological characteristics of each study, including study design, intervention characteristics, study population, outcome measures, and reported findings, were considered descriptively when interpreting the evidence.

The findings were synthesized qualitatively and descriptively because of the heterogeneity of study designs, populations, interventions, outcome measures, and follow-up periods. The evidence was compared across studies to identify consistent findings, differences in treatment effects, potential explanations for variations in effectiveness, and limitations of the available evidence. The findings were organized into four main themes: (1) the concept of Virtual Reality Therapy, (2)

types of intervention, (3) mechanisms of action, and (4) effectiveness of Virtual Reality Therapy in mental health.

Results and Discussion

Basic Concepts of Virtual Reality Therapy

Virtual Reality is a type of digital technology that allows individuals to engage with interactive virtual settings and simulated three-dimensional environments in realtime (Caponnetto & Casu, 2022). From a mental health perspective, VR functions as a therapeutic tool capable of delivering controlled psychological stimuli. This helps patients confront anxiety-related experiences in a protected environment, without exposure to real-world risks (Bell et al., 2024). VR technology develops immersive settings that foster a strong feeling of presence, leading individuals to perceive themselves as physically situated within the simulated setting. This condition elicits emotional responses comparable to those experienced in real-life situations, thereby enhancing therapeutic effectiveness (Rubio-Tamayo et al., 2017; Zhang et al., 2025).

VRT adapts established psychotherapeutic approaches, such as exposure therapy and CBT, in which patients are gradually exposed to specific stimuli according to their level of anxiety (Hawajri et al., 2023).

Types and Forms of Virtual Reality Therapy

Virtual Reality Therapy (VRT) encompasses a range of intervention modalities that are developed in accordance with therapeutic objectives and patient conditions. One of the most widely utilized approaches is Virtual Reality Exposure Therapy (VRET), which employs immersive environments to deliver exposure to stimuli associated with psychological disorders. Through interactive simulations, individuals can slowly face anxiety provoking scenarios in a secure and regulated environment. This method is commonly utilized in treating anxiety disorders, phobias, and PTSD, with research indicating enhancements in symptoms related to anxiety (Maples-Keller et al., 2017; Freeman et al., 2017).

Another prominent approach is VR-CBT, which integrates the principles of cognitive behavioral therapy into virtual environments. This form of therapy is typically conducted over multiple sessions, incorporating anxiety management training alongside exposure to relevant stimuli. The virtual setting enables patients to directly experience emotionally evocative situations, thereby facilitating cognitive and behavioral changes more effectively than conventional therapeutic methods (Utami et al., 2021; Lee et al., 2025).

Furthermore, VR-based relaxation therapy has emerged as an alternative intervention, utilizing calming virtual environments such as natural landscapes or dedicated relaxation spaces. This approach aims to reduce stress, anxiety, and emotional tension through immersive experiences that promote relaxation. Empirical studies indicate that this method is effective in enhancing psychological well-being and supporting regulation of emotional responses (Riches et al., 2023; Ma et al., 2025).

Furthermore, avatar-based therapy represents another evolving modality, employing digital representations or avatars as interactive agents within virtual environments. This approach allows patients to engage in real-time interactions with virtual objects or characters, thereby increasing engagement and enhancing the therapeutic experience. It has been widely implemented in treating substance use illnesses and psychotic disorders, with findings indicating reductions in symptoms and advancements in social skills (Giguere et al., 2024; Monaghesh et al., 2022).

Moreover, technological advancements have facilitated the development of smartphone-based VR therapy, which utilizes mobile devices and simple VR headsets. This approach enables self-guided therapy and significantly improves accessibility to mental health services. Research suggests that this modality is effective in reducing social anxiety and psychological distress, while also demonstrating high levels of user acceptability (Kan et al., 2025).

Table 1. Types and Effectiveness of Virtual Reality Therapy

Study Focus	Author (Year)	Type of VR	Effectiveness	Target Disorder
VR exposure therapy for PTSD with cognitive enhancement	Difede et al. (2022)	Virtual Reality Exposure (VRE) + D-cycloserine	Reduced PTSD severity and depressive symptoms, with favorable treatment outcomes (ES = 0.14; p = 0.004)	PTSD
Avatar-based VR intervention for	Giguere et al. (2024)	Avatar-based VR	Significantly effective in reducing cannabis use (d =	Substance use disorder

cannabis use disorder				0.804; $p < 0.001$), with sustained effects up to 12 months	
Smartphone-based VR exposure therapy for social anxiety in college students	Kan et al. (2025)	Smartphone-based VRET	Effective in reducing social anxiety and psychological distress, with effects maintained for up to 1 month; studies report moderate to large effect sizes ($g = 0.6-0.9$)	Social anxiety disorder	
VR-based CBT for major depressive disorder and suicidality	Lee et al. (2025)	VR-based CBT	Significant reductions in depression and suicidality scores, with effectiveness comparable to pharmacotherapy	Major depressive disorder	
VR nature therapy for anxiety and negative mood	Ma et al. (2025)	VR nature-based therapy	Effective in reducing anxiety, stress, and negative mood, with sustained effects at a 2-week follow-up	Anxiety, stress	
VR relaxation therapy for generalized anxiety disorder	Malbos et al.(2025)	VR relaxation therapy	Beneficial in lowering anxiety levels and worry, while supporting improved heart rate variability and adherence to therapy	Generalized anxiety disorder (GAD)	
Use of VR technology in anxiety and psychiatric disorders	Maples-Keller et al. (2017)	Immersive VR / VRET	Marked reduction in anxiety symptoms with large effect sizes; outcomes comparable to conventional therapy and sustained at follow-up	Anxiety, phobias	PTSD,
VR therapy for phobia and post-traumatic stress disorder	Spytska L. (2024)	Immersive VR (head-mounted display, interactive simulation)	Improved anxiety-related outcomes and quality of life in phobia and PTSD treatment	Phobias, anxiety disorder	PTSD,
Immersive VR for cognitive therapy in stress and depression	Khoirunisa et al. (2025)	Immersive VR + Cognitive Therapy (VR-based CBT)	Effective in reducing stress and depression, while enhancing patient engagement	Stress and depression	
VR-based interventions for paranoia and psychosis	Monaghesh et al. (2022)	Immersive VR (HMD + Unity3D, social virtual environment)	Effective in reducing paranoia and anxiety, and improving social functioning	Paranoia, psychosis, and schizophrenia	
Application of VRET in emotional and anxiety-related disorders	Hawajri et al. (2023)	Virtual Reality Exposure Therapy (VRET)	Reported positive therapeutic outcomes and improved treatment participation	Anxiety disorders, depression, PTSD, and phobias	
VR in Evaluating and Treating Mental Disorders	Freeman et al. (2017)	Immersive VR (HMD, CAVE, interactive VR), especially VR Exposure Therapy (VRET)	Large effects in reducing anxiety, with stable outcomes that generalize to real-world settings	Anxiety and trauma-related disorders	

VR relaxation for individuals with mental health issues	Riches et al. (2023)	VR relaxation (nature-based VR), HMD, sometimes biofeedback, interactive & non-interactive	Effective in reducing stress and anxiety; approximately 65% of studies report significant improvements	Stress reduction, anxiety, depression, eating disorders, and psychosis (low-intensity intervention)
Virtual reality interventions in geriatric mental health care	Li & Muschalla (2024)	Immersive VR (HMD/CAVE), divided into: entertainment-oriented (passive) & function-oriented (active/interactive)	The majority of studies indicate improvements in well-being and cognitive functioning	Geriatric rehabilitation, cognitive support, emotional well-being, and mental health in older adults

Overall, the findings presented in Table 1 indicate that Virtual Reality Therapy (VRT) has demonstrated beneficial effects across a wide range of mental health disorders. However, the magnitude of these effects varies according to the target disorder and the type of intervention used (Bell et al., 2024; Hawajri et al., 2023). The most consistent evidence was observed in anxiety disorders, particularly with Virtual Reality Exposure Therapy (VRET) (Maples-Keller et al., 2017; Freeman et al., 2017; Carl et al., 2019). This finding may be explained by the mechanism of graded exposure, which directly targets avoidance behavior, one of the core features of anxiety disorders (Carl et al., 2019). Through repeated exposure to feared situations in a safe virtual environment, patients gradually become less sensitive to anxiety-provoking stimuli, resulting in sustained reductions in anxiety symptoms (Freeman et al., 2017; Hawajri et al., 2023). Similar findings were also reported in PTSD, where virtual simulations provide a structured and controlled setting for trauma-related exposure (Difede et al., 2022; Spytska, 2024). Meanwhile, studies on depression suggest that VR-based Cognitive Behavioral Therapy (VR-CBT) may improve depressive symptoms by facilitating cognitive restructuring and behavioral modification, although the available evidence remains less extensive than that for anxiety disorders (Lee et al., 2025; Hawajri et al., 2023).

The effectiveness of VRT appears to be more variable in psychotic disorders. While several studies reported improvements in paranoia, anxiety, and social functioning, the effects on core psychotic symptoms such as hallucinations and delusions were less consistent (Monaghesh et al., 2022; Bell et al., 2024). This may be related to the complex nature of psychotic disorders, which involve multiple cognitive and perceptual disturbances that cannot be addressed through exposure-based interventions alone (Bell et al., 2024). In addition, different VRT modalities appear to have different clinical applications. VRET is most commonly used for anxiety-related disorders, whereas VR-CBT has

shown promising results in depression (Maples-Keller et al., 2017; Lee et al., 2025). Avatar-based therapy appears to be particularly beneficial for substance use disorders and psychosis by improving engagement and social interaction (Giguere et al., 2024; Monaghesh et al., 2022), while VR relaxation therapy is mainly used to reduce stress, anxiety, and emotional tension (Riches et al., 2023; Ma et al., 2025; Malbos et al., 2025).

Another important finding is the difference between immersive VR and smartphone-based VR. Immersive VR generally provides a stronger sense of presence, allowing patients to become more emotionally engaged during therapy (Freeman et al., 2017; Bell et al., 2024). In contrast, smartphone-based VR offers greater accessibility, lower costs, and the possibility of self-guided treatment while still demonstrating encouraging results, particularly in social anxiety disorder (Kan et al., 2025). Nevertheless, direct comparisons between these approaches remain limited because the included studies differed in study design, sample size, intervention duration, outcome measures, and follow-up periods (Geraets et al., 2021; Wiebe et al., 2022; Pedram & Piatkowski, 2025). These methodological differences should be considered when interpreting the current evidence, and further well-designed comparative studies are needed to determine the long-term effectiveness of different VRT modalities across various mental health disorders (Bell et al., 2024; Pedram & Piatkowski, 2025).

Mechanisms of Virtual Reality Therapy

VRT manages primarily through a mechanism of graded exposure to stimuli that elicit emotional responses, particularly anxiety. This approach enables patients to confront previously avoided situations within a safe and controlled virtual environment. Repeated exposure facilitates processes of habituation and desensitization, leading to a progressive reduction in anxiety responses (Carl et al., 2019; Maples-Keller et al., 2017). In addition, engaging visual environments are

capable of generating a strong immersive sensation, defined as the feeling of physically being in a place within the simulated setting. This condition evokes emotional responses that are more realistic and clinically relevant compared to imagination-based techniques commonly used in conventional therapy (Freeman et al., 2017). Consequently, VRT effectively bridges the gap between therapeutic settings and real-life situations. During the therapeutic process, patients are encouraged to gradually reduce avoidance behaviors, which are a key factor in the maintenance of anxiety disorders. Through structured exposure, patients learn that feared stimuli do not necessarily result in harmful consequences, thereby facilitating cognitive restructuring and reducing negative emotional responses. Furthermore, successful experiences in

confronting stimuli within the virtual environment can enhance self-efficacy and improve emotional regulation. This is particularly important, as increased confidence in managing challenging situations contributes to overall psychological functioning. These therapeutic gains may also generalize to real-world contexts, enabling patients to better manage situations that were previously avoided (Freeman et al., 2017).

Figure 2 shows how Virtual Reality Therapy (VRT) works. Patients are gradually exposed to realistic virtual situations that trigger emotional and cognitive responses in a safe environment. As therapy progresses, avoidance behavior decreases, while coping skills, emotional regulation, and self-efficacy gradually improve. These changes help reduce anxiety and support better treatment outcomes.

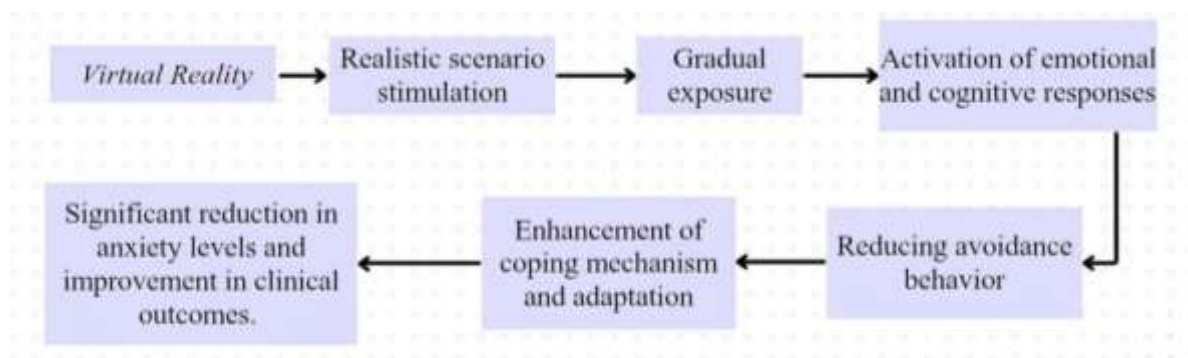


Figure 2. Mechanism of Virtual Reality Therapy (VRT): graded exposure to virtual stimuli reduces avoidance behavior, enhances coping skills, emotional regulation, and self-efficacy, leading to reduced anxiety and improved therapeutic outcomes.

Effectiveness of Virtual Reality Therapy

VRT has demonstrated significant effectiveness across various mental health disorders. Among the most extensively studied applications is in anxiety disorders, where VRT is implemented in the form of VRET. This approach enables patients to progressively face anxiety-inducing stimuli in a secure virtual setting, thereby decreasing anxiety levels, alleviating fear, and decreasing avoidance behaviors (Maples-Keller et al., 2017; Freeman et al., 2017).

Beyond anxiety disorders, VRT has also shown effectiveness in patients with depression. Approaches such as VR-CBT assist patients in modifying unhealthy thought patterns and enhancing coping strategies in response to stress. Additionally, immersive virtual environments can serve as relaxation tools to improve mood and reduce emotional distress (Lee et al., 2025; Ma et al., 2025).

In PTSD, VRT is utilized to help patients re-engage with traumatic experiences through virtual simulations that closely resemble real-life conditions.

This method enables patients to undergo gradual exposure within a structured virtual setting and has been associated with improvements in PTSD-related symptoms comparable to standard therapeutic interventions (Difede et al., 2022). Furthermore, VRT has begun to be applied in interventions for substance use disorders, where individuals are exposed to simulated environments that stimulate substance cravings. Through this method, patients can develop greater control over cravings and enhance self-regulation. Research indicates that avatar-based therapy and virtual simulations can reduce substance use and improve patients' quality of life (Giguere et al., 2024).

VR-based approaches have also demonstrated promising results in improving accessibility to mental health services. The use of smartphone-based VR therapy enables self-guided and flexible interventions, allowing broader reach among individuals. Studies indicate that this intervention is beneficial in lowering social anxiety levels, and psychological distress, with

effects that persist beyond the completion of therapy (Kan et al., 2025).

Conclusion

Virtual Reality Therapy (VRT) has emerged as a promising approach in the management of mental health disorders by providing an immersive and controlled therapeutic environment. Various forms of VRT, including Virtual Reality Exposure Therapy (VRET), VR-based Cognitive Behavioral Therapy (VR-CBT), relaxation-based VR interventions, avatar-assisted therapy, and smartphone-based VR applications, have demonstrated beneficial effects across several mental health conditions, particularly anxiety disorders, depression, post-traumatic stress disorder (PTSD), and substance use disorders.

The findings of this review indicate that VRT may serve as an adjunct to conventional mental health treatment, particularly by improving patient engagement and expanding access to psychological interventions. Smartphone-based VR may also support the expansion of digital mental health services, particularly for individuals with limited access to face-to-face therapy. From a health policy perspective, the integration of VRT into digital mental health services should consider accessibility, clinical supervision, and standardized implementation.

However, the available evidence remains limited by differences in study design, intervention modalities, and the lack of long-term follow-up. Future studies should use standardized methodologies, larger populations, longer follow-up periods, and direct comparisons between different VRT modalities to strengthen evidence regarding its long-term effectiveness and implementation in routine mental health care.

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