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Virtual reality-based psychological counseling and psychotherapy for mental health conditions: a systematic review of randomized controlled trials on applications and therapeutic effectiveness

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Abstract: Virtual reality (VR) has moved from laboratory prototypes into clinical counseling, yet its therapeutic value relative to conventional approaches remains debated. This systematic review mapped the counseling and psychotherapeutic applications of VR evaluated in randomized controlled trials and appraised their effectiveness against conventional or control conditions. Following PRISMA 2020 and a PICOS-structured strategy, Scopus was searched with Boolean combinations of VR and counseling or psychotherapy terms, yielding 981 records. Eligible studies were English-language, open-access, final-stage journal articles published between 2016 and 2025 that randomized people with mental health conditions to a VR-based psychological intervention; protocols, reviews, non-randomized designs, and non-psychotherapeutic uses of VR were excluded. After removing 14 duplicates and 542 records outside the search limiters, 425 records were screened and 17 trials were included. Applications clustered into depression, anxiety and fear, substance use, trauma, and transdiagnostic stress. VR consistently outperformed usual care or no-VR conditions, whereas comparisons with active conventional therapies mostly indicated equivalence or non-inferiority. VR therefore appears to extend rather than replace established counseling models. Future research should prioritize adequately powered comparative trials, longer follow-up, and implementation studies in counseling settings.

Keywords: Virtual reality, Psychological counseling, Psychotherapy, Mental health, Randomized controlled trials.

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INTRODUCTION

Mental health conditions are among the most pressing public health challenges of this decade, and the gap between the need for psychological care and its provision continues to widen. In the United States, more than 40% of the population has experienced a mental health disorder since the COVID-19 pandemic began, and many received no treatment because of stigma, cost, and limited services in isolated or rural communities (Tacca et al., 2024). Digital technologies have therefore been proposed as a structural response to this treatment gap. Bibliometric evidence

shows that publications combining technology and psychotherapy have grown steadily over four decades (Zale et al., 2021), and recent syntheses suggest that digitally supported therapies can improve accessibility and effectiveness, particularly for anxiety, depression, and posttraumatic stress disorder (Orzeł & Strzałek, 2025; S.-A. Lee et al., 2023).

Within this transformation, virtual reality (VR) occupies a distinctive position because it reconstructs the environment in which therapeutic learning occurs rather than merely transmitting content. Immersive VR presents stereoscopic 360° scenarios through head-mounted displays, allowing clients to experience emotionally meaningful situations under a degree of control impossible in everyday settings (Wrzus et al., 2024). Psychophysiological research shows that VR can reliably induce and subsequently reduce stress reactions at experiential and autonomic levels (Kosonogov et al., 2023). The sense of presence generated by immersion also appears clinically relevant, as higher presence has been associated with greater symptom reduction in VR-based therapy for treatment-resistant schizophrenia (Augustin et al., 2024). These properties explain why VR has been framed as a medium capable of overcoming several shortcomings of talk-based and in vivo interventions (Ma et al., 2021; Valmaggia et al., 2016).

A considerable body of research has examined VR within clinical psychology. An early systematic review of controlled studies concluded that VR treatment outperformed treatment as usual and performed similarly to conventional treatments (Valmaggia et al., 2016). Network meta-analytic evidence later ranked VR coach-delivered psychotherapy as the most effective of 19 acrophobia interventions, although VR-based cognitive behavioral therapy showed higher dropout than control conditions (Chou et al., 2021). In addiction medicine, VR provokes craving with high ecological validity, whereas treatments relying solely on virtual cue exposure have produced heterogeneous results (Segawa et al., 2020). During the COVID-19 crisis, VR interventions reportedly reduced stress, anxiety, depression, and posttraumatic symptoms, although most supporting studies were uncontrolled (S.-A. Lee et al., 2023). Trauma-focused applications have also been integrated into motion-assisted frameworks for treatment-resistant posttraumatic stress disorder (van Gelderen et al., 2018).

Recent developments have shifted the field from therapist-operated exposure environments toward automated, embodied, and socially mediated counseling. Automated programs guided by a virtual coach now deliver complete cognitive interventions without a therapist present (Freeman et al., 2018), and members of the public regard coach-guided therapy as acceptable, especially at home (Gomez Bergin et al., 2024). Embodied self-dialogue paradigms let clients alternate between their own virtual body and that of a counselor avatar, producing greater perceived change than scripted dialogue (Slater et al., 2019), and the identity of the counseling avatar appears to shape anxiety outcomes (Yamashita & Yamamoto, 2024). Social VR and metaverse platforms have also hosted student counseling and full counseling sessions, in which processes such as client laughter relate to session outcomes (Kang et al., 2024; Kristiansen & Lauridsen, 2025).

Despite this expansion, the evidence base remains fragmented in ways that limit its usefulness for counseling practice. Existing reviews have typically addressed a single disorder, intervention type, or period, such as controlled studies published up to 2015 (Valmaggia et al., 2016), acrophobia treatments (Chou et al., 2021), addictive disorders (Segawa et al., 2020), or pandemic-related distress (S.-A. Lee et al., 2023). Much counseling-oriented work relies on qualitative, experimental, or single-session designs with non-clinical samples (Kristiansen & Lauridsen, 2025; Slater et al., 2019; Yamashita & Yamamoto, 2024). Moreover, technology-mediated counseling alters the emotional experience of the therapeutic encounter (Schaarschmidt & Koehler, 2021), yet few syntheses have asked whether VR performs comparably to the conventional formats it is meant to augment. Experts have consequently called for consolidating existing knowledge and standardizing theory and practice (Ma et al., 2021).

Clarifying this question is urgent because adoption in routine care remains low. Among 694 surveyed clinical psychologists and psychotherapists, only 10 used therapeutic VR, citing gaps in

knowledge and training, costs, and doubts about the authenticity of the therapeutic relationship (Felnhofer et al., 2025). Counselors' acceptance of VR exposure therapy depends on performance expectations and workplace conditions, including job stress and resistance to change (Kim et al., 2025). Patients, by contrast, report greater interest in and comfort with VR exposure than in vivo exposure (Levy et al., 2023), although cybersickness remains pervasive and can undermine the user experience and adoption intentions (Garrido et al., 2022). Comparative evidence from randomized trials is therefore needed to show practitioners and service planners where VR adds value and where conventional counseling remains preferable (Orzeł & Strzałek, 2025; Wrzus et al., 2024).

Accordingly, this systematic review synthesizes randomized controlled trials published between 2016 and 2025 that evaluated VR-based counseling and psychotherapy for people with mental health conditions. Two research questions guided the review: RQ1: Which psychological counseling and psychotherapeutic applications of virtual reality have been evaluated in randomized controlled trials, and for which mental health conditions? RQ2: How effective are virtual reality-based counseling and psychotherapy in improving psychological outcomes compared with conventional counseling, usual care, or other control conditions? RQ1 yields a map of therapeutic models and clinical domains, while RQ2 yields a comparator-sensitive appraisal distinguishing superiority over inactive controls from equivalence with active treatments. This counseling-oriented synthesis thus moves beyond disorder-specific reviews (Ma et al., 2021; Valmaggia et al., 2016).

METHOD

Research Design and Framework

A systematic literature review design was adopted because it offers a transparent, replicable, and bias-minimizing procedure for synthesizing evidence on a focused question (Tranfield et al., 2003). The review followed the PRISMA 2020 statement (Page et al., 2021), which updates earlier PRISMA guidance (Liberati et al., 2009). Narrative and thematic synthesis was preferred over statistical pooling because the trials differed substantially in population, VR modality, comparator, and outcome.

Search Strategy

Because the review examines the effectiveness of a deliberate intervention against comparators within a specified study design, PICOS was selected as the review framework. PEO was unsuitable because VR is a planned intervention rather than an exposure, SPIDER because the focus is quantitative effectiveness, PCC because the aim is not scoping, and SPICE because setting and stakeholder perspective were not the central units of analysis. The PICOS elements are presented in Table 1.

Table 1. PICOS framework applied in this review

Element	Description	Operationalization
Population (P)	People aged 16 years or older with a diagnosed or clinically significant mental health condition	Applied during screening
Intervention (I)	Counseling or psychotherapy delivered or enhanced through VR	VR terms combined with counseling and psychotherapy terms
Comparison (C)	Conventional therapy, non-VR formats, pharmacotherapy, usual care, waitlist, or no intervention	Applied during screening

Element	Description	Operationalization
Outcomes (O)	Psychological symptoms, craving or abstinence, stress, quality of life, and feasibility	Applied during screening
Study design (S)	Randomized controlled trials, including pilot, crossover, and secondary analyses	Applied during screening

Each PICOS element was translated into keyword clusters. Only the intervention and counseling clusters entered the Boolean string; the other elements were applied during screening to preserve sensitivity. The final string was:

TITLE-ABS-KEY ("virtual reality" OR VR OR "immersive virtual reality") AND TITLE-ABS-KEY ("psychological counseling" OR psychotherapy OR "mental health counseling" OR counseling OR counselling OR "psychological therapy") AND PUBYEAR > 2015 AND PUBYEAR < 2026 AND (LIMIT-TO (DOCTYPE , "ar")) AND (LIMIT-TO (LANGUAGE , "English")) AND (LIMIT-TO (SRCTYPE , "j")) AND (LIMIT-TO (PUBSTAGE , "final")) AND (LIMIT-TO (OA , "all"))

The TITLE-ABS-KEY field code restricted retrieval to titles, abstracts, and keywords. American and British spellings were combined with OR. Truncation was not applied to VR to avoid retrieving unrelated strings. Limiters restricted results to English-language, open-access journal articles in the final publication stage published from 2016 to 2025, ensuring peer-reviewed, retrievable evidence from the consumer-headset era. The string was piloted; an initial version limited to "psychological counseling" retrieved too few trials, so broader synonyms were added.

Database and Information Sources

Scopus was the sole information source because of its broad coverage of psychology, psychiatry, and health technology journals and its export of complete records with abstracts and keywords. The search was executed on 15 September 2026. No supplementary databases, grey literature, or reference list searches were used.

Eligibility Criteria

Eligibility criteria are summarized in Table 2.

Table 2. Inclusion and exclusion criteria

Criterion	Inclusion	Exclusion
Publication period	2016–2025	Published before 2016 or after 2025
Document type	Original research article	Reviews, protocols, conference papers, book chapters, and editorials
Language	English	Non-English
Source type and stage	Journal article in the final publication stage	Other source types and articles in press
Accessibility	Open access with full text available	Full text inaccessible
Population	Individuals with a diagnosed or clinically significant mental health condition	Non-clinical samples, trainees, or primarily physical conditions
Intervention	VR-based psychological counseling or psychotherapy	VR for pain distraction, rehabilitation, education, or training

Criterion	Inclusion	Exclusion
Study design	Randomized controlled trial of any variant	Non-randomized, single-arm, qualitative, or cross-sectional designs
Outcomes	Reports psychological, clinical, or feasibility outcomes	No outcome data reported

Study Selection Process

Duplicate records were identified by comparing DOIs, titles, and author lists and removed before screening. Two reviewers then independently screened titles and abstracts and subsequently assessed full texts against the eligibility criteria. Disagreements were resolved through discussion, with a third reviewer consulted when needed. Reasons for full-text exclusion were documented in the PRISMA 2020 flow diagram.

Quality Assessment

Methodological quality was appraised independently of the search strategy using design-specific tools. Each study was first classified by design, and the corresponding instrument was selected: Cochrane Risk of Bias 2 (RoB 2) for randomized trials, ROBINS-I or the JBI quasi-experimental checklist for non-randomized interventions, JBI checklists for observational designs, and the Mixed Methods Appraisal Tool for mixed-methods studies. Because all included studies were randomized, RoB 2 was applied throughout, using its crossover variant where relevant (Sterne et al., 2019).

Each trial was judged on five domains: randomization process (D1), deviations from intended interventions (D2), missing outcome data (D3), outcome measurement (D4), and selection of the reported result (D5), using the original response options (low risk, some concerns, high risk) and the RoB 2 algorithm for overall judgments. Studies were not excluded on quality grounds; instead, findings from high-risk trials were interpreted more cautiously,. Two reviewers appraised studies independently, resolving disagreements through discussion or a third reviewer, and agreement was quantified using Cohen's kappa (κ = [to be inserted by the authors]) interpreted according to Landis and Koch (1977).

Data Extraction Procedure

A piloted standardized form captured author(s), year, country, journal, population, sample size, design, VR intervention (therapeutic model, modality, dose, therapist involvement), comparator, outcome measures, follow-up, and key findings. One reviewer extracted data, and a second verified all entries.

Network and Bibliometric Analysis

A keyword co-occurrence analysis of the author and indexed keywords of the included trials complemented the synthesis. Synonyms were merged, demographic descriptors removed, and the terms "virtual reality" and "randomized controlled trial" excluded because they were present in almost all records by design. Terms occurring in at least two trials were mapped following the co-occurrence logic of VOSviewer (van Eck & Waltman, 2010), with node size reflecting frequency and edge thickness reflecting co-occurrence.

Data Analysis and Synthesis

Findings were synthesized using the three-stage thematic synthesis of Thomas and Harden (2008): line-by-line coding of therapeutic model, clinical target, comparator, and direction of effect; organization of codes into descriptive themes representing clinical domains; and development of analytical themes answering the research questions, with effectiveness stratified by comparator type. A second reviewer cross-checked all themes.

Reporting and Documentation

The review complied with the PRISMA 2020 checklist (Page et al., 2021), and search strings, screening decisions, extraction forms, and appraisal records were archived for transparency.

RESULTS AND DISCUSSION

Study Selection Results

The Scopus search yielded 981 records. Before screening, 14 duplicates and 542 records not meeting the year, document type, language, source type, publication stage, or open access limiters were removed, leaving 425 records. Title and abstract screening excluded 373 records, mostly because VR served non-psychological purposes such as training or pain distraction. Of 52 reports sought, three were inaccessible, and 49 were assessed in full. Thirty-two were excluded as protocols without outcome data (n = 11), non-randomized or single-arm designs (n = 10), or out of scope because of non-clinical samples or non-psychotherapeutic VR use (n = 11). Seventeen randomized trials were included (Figure 1).

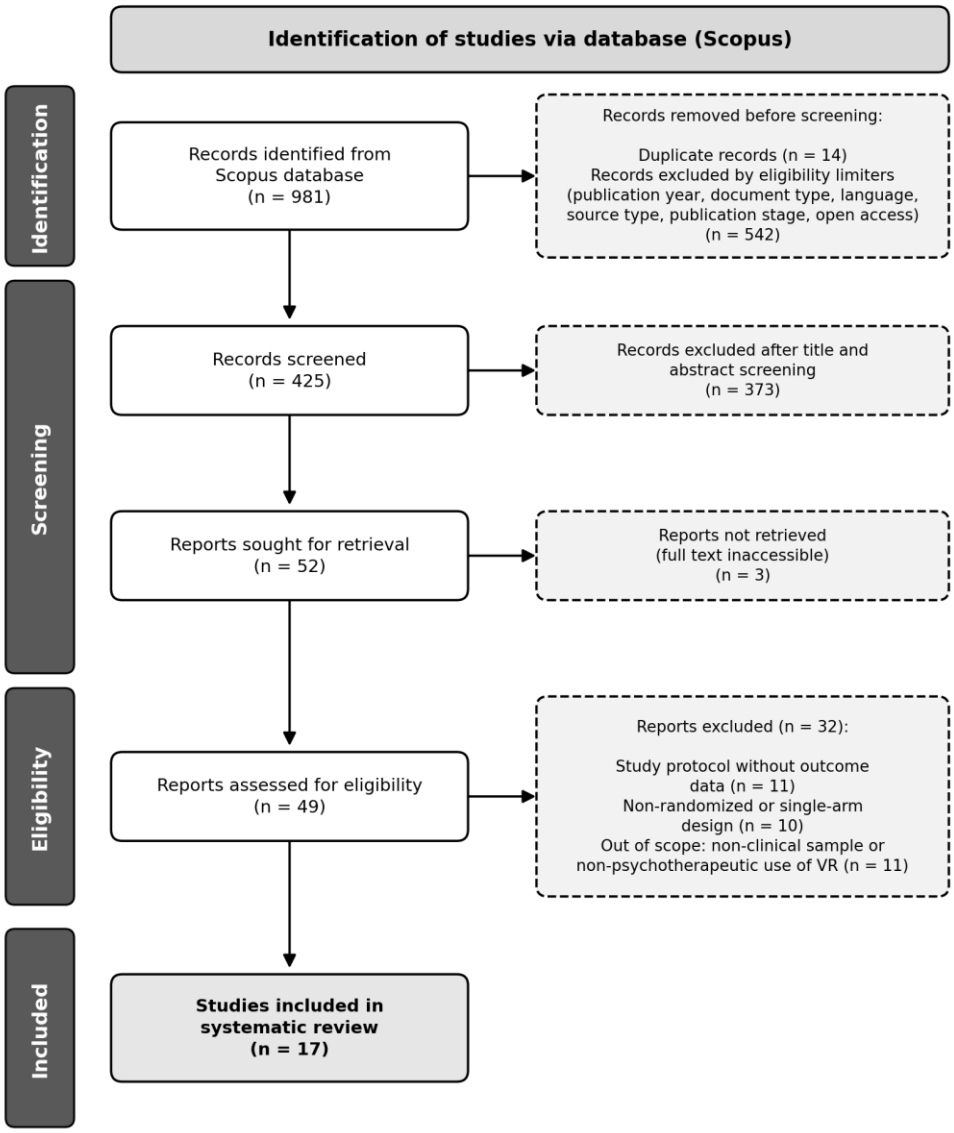

Figure 1. PRISMA 2020 flow diagram of the identification, screening, eligibility, and inclusion process (adapted from Page et al., 2021)

Descriptive Characteristics

Tables 3 and 4 summarize and classify the included trials.

Table 3. Summary of included studies

No	Title	Author(s)	Year	Country	Method	Key Findings
1	Randomized controlled trial of prolonged exposure using imaginal exposure vs. virtual reality exposure in active duty soldiers with deployment-related posttraumatic stress disorder (PTSD)	Reger et al.	2016	USA	Three-arm RCT; n = 162	PE and VRE both reduced PTSD versus waitlist; VRE was not superior, and PE was better at 3 and 6 months.
2	Automated psychological therapy using immersive virtual reality for treatment of fear of heights: A single-blind, parallel-group, randomised controlled trial	Freeman et al.	2018	United Kingdom	Single-blind RCT; n = 100	Coach-guided automated VR greatly reduced fear of heights (d = 2.0), sustained at follow-up, without adverse events.
3	Analysis of usage data from a self-guided app-based virtual reality cognitive behavior therapy for acrophobia: A randomized controlled trial	Donker et al.	2020	Netherlands	Secondary RCT analysis; n = 96	Self-guided VR CBT consistently reduced fear, with an optimal exposure dose.
4	Psychophysiology during exposure to trauma memories: Comparative effects of virtual reality and imaginal exposure for posttraumatic stress disorder	Gramlich et al.	2021	USA	Secondary RCT analysis; n = 61	PE elicited higher arousal than VRE; skin conductance habituation predicted improvement, mainly with PE.

No	Title	Author(s)	Year	Country	Method	Key Findings
5	Virtual reality relaxation for patients with a psychiatric disorder: Crossover randomized controlled trial	Veling et al.	2021	Netherlands	Crossover RCT; n = 50	VRelax reduced negative affect more than standard relaxation; stress and symptoms did not differ.
6	Virtual therapeutic garden: A promising method supporting the treatment of depressive symptoms in late-life: A randomized pilot study	Szczepańska-Gieracha et al.	2021	Poland	Randomized pilot; n = 25	Eight VR sessions reduced depression by 36%, with lower stress and anxiety.
7	Automated virtual reality therapy to treat agoraphobic avoidance and distress in patients with psychosis (gameChange): A multicentre, parallel-group, single-blind, randomised, controlled trial in England with mediation and moderation analyses	Freeman et al.	2022	United Kingdom	Multicentre single-blind RCT; n = 346	Automated VR reduced avoidance and distress, mediated by threat cognitions and largest in severe avoidance.
8	Virtual reality behavioral activation for adults with major depressive disorder: Feasibility randomized controlled trial	Paul et al.	2022	USA	Three-arm feasibility RCT; n = 13	VR BA was feasible and safe, with a clinically meaningful PHQ-9 reduction.
9	Examining the efficacy of extended reality–enhanced behavioral activation for adults with major depressive disorder: Randomized controlled trial	Paul et al.	2024	USA	Nonblinded RCT; n = 26	XR-BA was non-inferior to traditional BA, and both reduced depression.

No	Title	Author(s)	Year	Country	Method	Key Findings
10	Efficacy of a remote virtual reality and EEG enabled psychotherapy system for the treatment of depressive symptoms	Tacca et al.	2024	USA	RCT; n = 30	VR-EEG was more restorative than Zoom counseling and comparable in session quality.
11	Virtual reality-assisted cognitive behavioral therapy for patients with alcohol use disorder: A randomized feasibility study	Thaysen-Petersen et al.	2024	Denmark	Randomized feasibility study; n = 10	VR-CBT was feasible and showed preliminary greater reductions in drinking and craving.
12	Effect of relaxation-based virtual reality on psychological and physiological stress of substance abusers under detoxification: A randomized controlled trial	Lotfinia et al.	2024	Iran	Three-arm RCT; n = 60	One nature VR session reduced psychological and physiological stress; other conditions did not.
13	Evaluation of virtual reality-based guided imagery stabilization intervention for post-traumatic stress symptoms: A randomized controlled trial	Dai et al.	2025	South Korea	RCT; n not reported in source record	VR reduced PTSS more than the app and uniquely improved growth, quality of life, and HRV.
14	App-based psychotherapy of panic disorder with self-guided exposure in virtual reality	Schultz et al.	2025	Germany	Non-blinded RCT; n = 124	Self-guided VR exposure improved anxiety (d = −0.46), panic, and depression, but not quality of life.
15	Virtual reality-based cognitive behavior therapy for major depressive disorder: An alternative to pharmacotherapy for reducing suicidality	M. Lee et al.	2025	South Korea	Assessor-blinded exploratory RCT; n = 57	VR-CBT matched pharmacotherapy for depression and uniquely reduced suicidality.

No	Title	Author(s)	Year	Country	Method	Key Findings
16	Virtual reality cue exposure as an add-on to smoking cessation group therapy: A randomized controlled trial	Kroczek et al.	2025	Germany	Two-arm RCT; n = 246	VR cue exposure did not increase 6-month abstinence; craving decreased in both arms.
17	The effect of aversive therapy using virtual reality on craving, depression, and self-efficacy: A pilot study in patients under methadone maintenance treatment	Sadeghi et al.	2025	Iran	Three-arm randomized pilot; n = 90	VR aversion therapy outperformed counseling and methadone alone on craving, depression, and self-efficacy.

Note. BA = behavioral activation; CBT = cognitive behavioral therapy; EEG = electroencephalography; HRV = heart rate variability; PE = prolonged exposure; PTSS = post-traumatic stress symptoms; RCT = randomized controlled trial; VRE = virtual reality exposure; XR = extended reality.

Table 4. Classification of included studies by theme, design, intervention, and outcome

No	Author(s), Year	Population	Research Design	Theme/Focus	Technology /Intervention	Comparator	Outcome
1	Reger et al., 2016	Soldiers with PTSD	Three-arm RCT	Trauma; exposure therapy	Therapist-led VR exposure	Prolonged exposure; waitlist	VRE equal to PE post-treatment; inferior at follow-up
2	Freeman et al., 2018	Adults with fear of heights	Single-blind RCT	Anxiety/fear; cognitive therapy	Automated VR with virtual coach (HMD)	Usual care	Large reduction in fear of heights
3	Donker et al., 2020	Adults with acrophobia	Secondary analysis of RCT	Anxiety/fear; exposure-based CBT	Self-guided app with cardboard viewer	VR arm usage analysis	Fear reduction
4	Gramlich et al., 2021	Soldiers with PTSD	Secondary analysis of RCT	Trauma; exposure mechanisms	Therapist-led VR exposure	Imaginal prolonged exposure	Lower arousal in VRE

No	Author(s), Year	Population	Research Design	Theme/Focus	Technology /Intervention	Comparator	Outcome
5	Veling et al., 2021	Psychiatric outpatients	Crossover RCT	Transdiagnostic; relaxation	360° nature VR (VRelax)	Standard relaxation exercises	Greater reduction in negative affect
6	Szczepańska-Gieracha et al., 2021	Older women with depressive symptoms	Randomized pilot	Depression; supportive therapy	Immersive virtual therapeutic garden	Multimodal program only	Reduced depression
7	Freeman et al., 2022	Patients with psychosis	Multicentre single-blind RCT	Anxiety/fear; cognitive therapy	Automated VR (gameChange)	Usual care	Small reductions in avoidance and distress
8	Paul et al., 2022	Adults with major depressive disorder	Three-arm feasibility RCT	Depression; behavioral activation	VR headset for BA homework	Traditional BA; TAU	Feasible and safe
9	Paul et al., 2024	Adults with major depressive disorder	Nonblinded RCT	Depression; behavioral activation	XR-enhanced BA (Meta Quest 2)	Traditional BA via telehealth	Non-inferior to traditional BA
10	Tacca et al., 2024	Adults with depressive symptoms	RCT	Depression; solution-focused counseling	Remote VR with EEG integration	Zoom counseling	Comparable session quality
11	Thaysen-Petersen et al., 2024	Patients with alcohol use disorder	Randomized feasibility study	Substance use; CBT	VR high-risk restaurant simulations	Conventional CBT	Feasible; favorable preliminary trend
12	Lotfinia et al., 2024	Patients in detoxification	Three-arm RCT	Substance use; relaxation	360° nature video	City 360° video; no VR	Reduced stress

No	Author(s), Year	Population	Research Design	Theme/Focus	Technology /Intervention	Comparator	Outcome
13	Dai et al., 2025	Adults with PTSS	RCT	Trauma; stabilization	VR guided imagery	Audio and imagery app	Greater PTSS reduction
14	Schultz et al., 2025	Patients with panic disorder	Non-blinded RCT	Anxiety/fear; exposure therapy	Self-guided VR exposure app	Care as usual	Moderate improvement in anxiety and panic
15	M. Lee et al., 2025	Adults with major depressive disorder	Assessor-blinded exploratory RCT	Depression; CBT and suicidality	VR mental health training program	Pharmacotherapy (TAU)	Equivalent for depression
16	Kroczek et al., 2025	Smokers	Two-arm RCT	Substance use; cue exposure	VR cue exposure plus group CBT	Group CBT plus PMR	No difference in abstinence
17	Sadeghi et al., 2025	Methadone patients	Three-arm randomized pilot	Substance use; aversion therapy	VR aversion simulations	Psychological counseling; methadone only	Lower craving and depression

Note. GSR = galvanic skin response; HMD = head-mounted display; PMR = progressive muscle relaxation; TAU = treatment as usual; other abbreviations as in Table 3.

The trials randomized at least 1,435 participants, excluding one secondary analysis that appears to reuse an already counted sample and one trial without a reported sample size; samples ranged from 10 to 346. Publication accelerated recently, with nine trials (53%) appearing in 2024 and 2025 (Figure 2). Substance use trials appeared only from 2024.

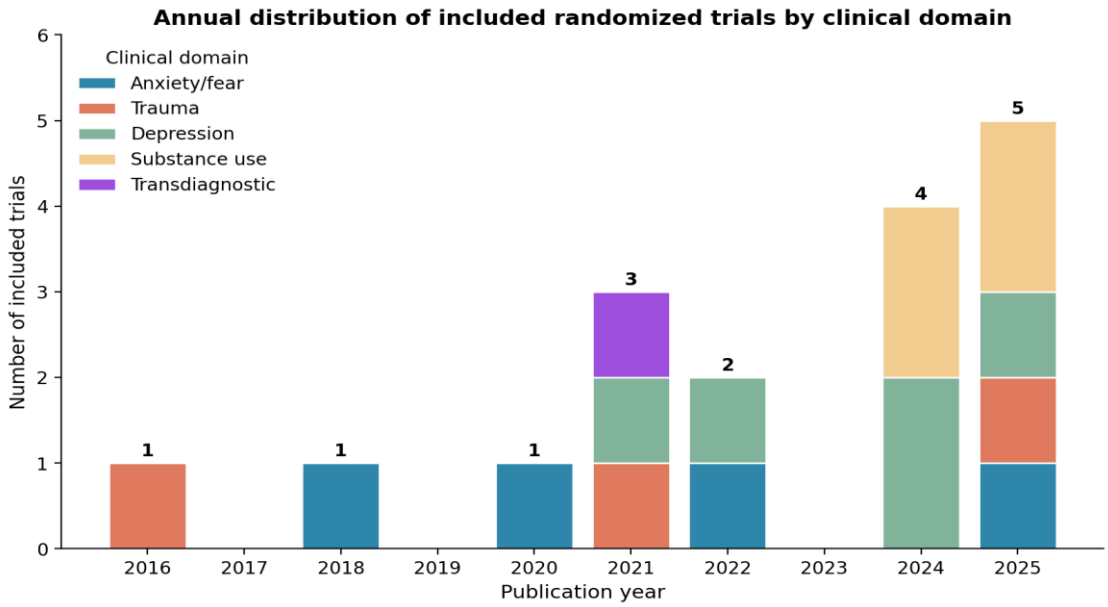

Figure 2. Annual distribution of the included randomized trials by clinical domain

The trials were conducted in eight countries (Figure 3): the United States (n = 5); the United Kingdom, the Netherlands, Germany, Iran, and South Korea (n = 2 each); and Denmark and Poland (n = 1 each). The 13 publishing journals included *The Lancet Psychiatry*, *JMIR Mental Health*, *Journal of Clinical Medicine*, and *Brain and Behavior*, each with two trials.

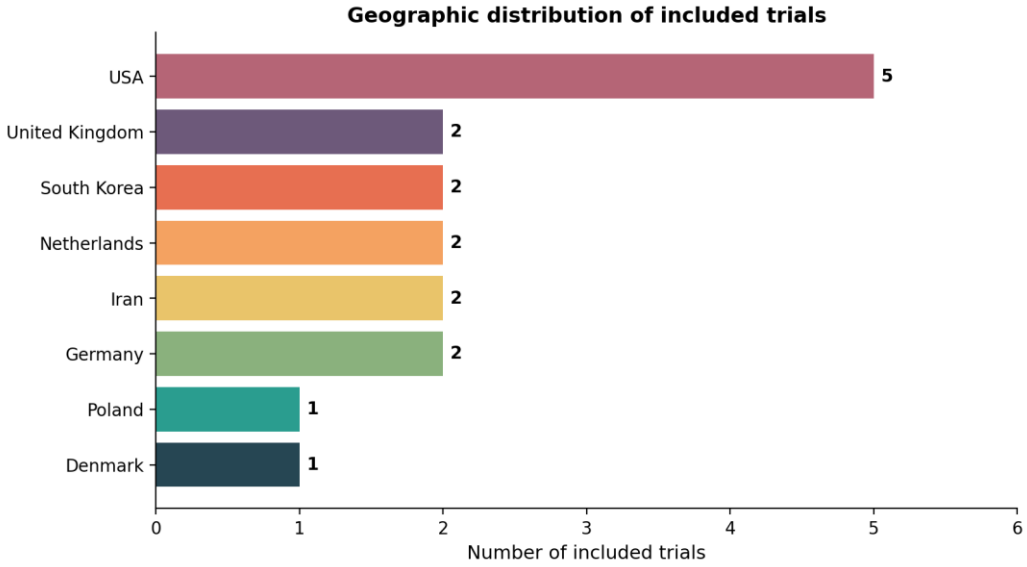

Figure 3. Geographic distribution of the included trials by country

The keyword network comprised 23 terms in four clusters (Figure 4). The therapeutic approaches cluster was anchored by psychotherapy and VR exposure therapy (10 trials each) and cognitive behavioral therapy (6). Depression (9) and anxiety (7) dominated the clinical conditions cluster, treatment outcome (7) and clinical effectiveness (5) led the outcomes cluster, and feasibility (5) and mobile app delivery (3) anchored the technology and design cluster. Comparative effectiveness appeared in only two trials.

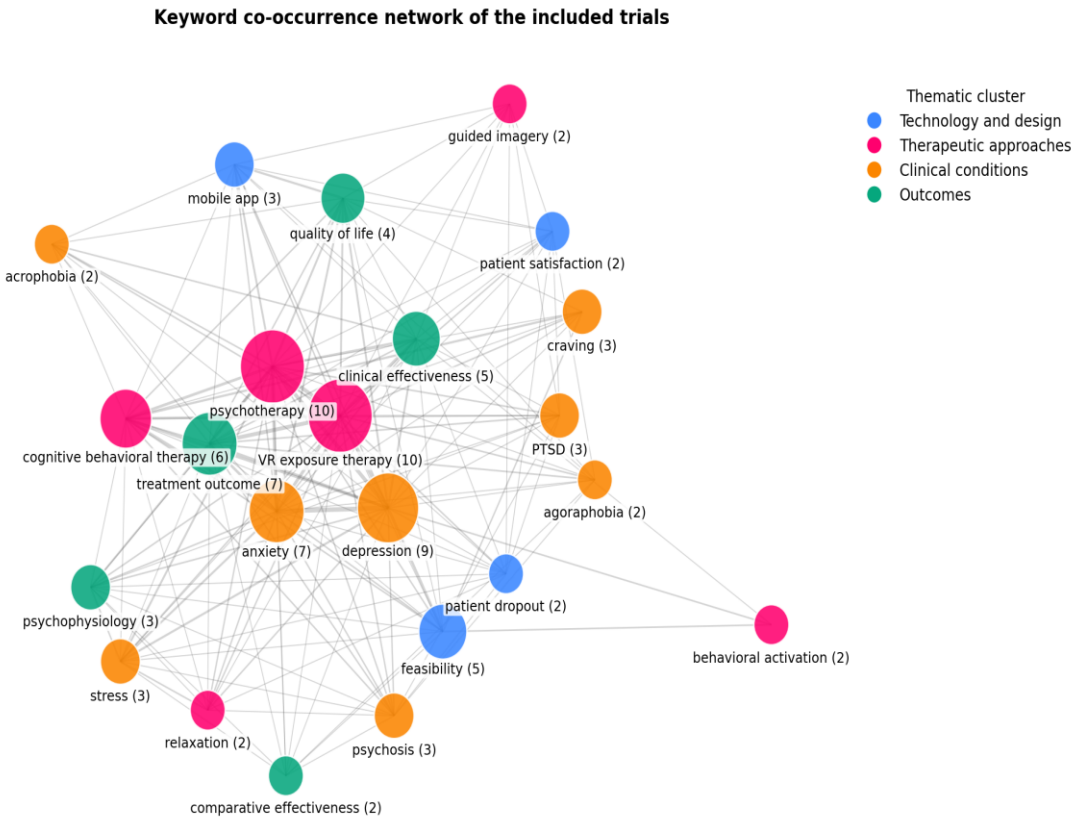

Figure 4. Keyword co-occurrence network of the included trials (node size indicates frequency; colors indicate thematic clusters)

Risk of Bias Assessment

Table 5 presents the RoB 2 judgments. One trial had low overall risk (Kroczek et al., 2025), ten raised some concerns, and six were at high risk. Concerns arose almost universally for deviations from intended interventions because VR delivery could not be blinded, and many outcomes were self-reported. High risk ratings reflected very small samples, single sessions, limited reporting, or non-engagement (Donker et al., 2020; Lotfinia et al., 2024; Paul et al., 2022; Sadeghi et al., 2025; Szczepańska-Gieracha et al., 2021; Thaysen-Petersen et al., 2024).

Table 5. Risk of bias assessment of the included trials using RoB 2

No	Author(s), Year	D1	D2	D3	D4	D5	Overall
1	Reger et al., 2016	L	SC	SC	L	L	SC
2	Freeman et al., 2018	L	SC	L	SC	L	SC
3	Donker et al., 2020	L	SC	H	SC	SC	H
4	Gramlich et al., 2021	L	SC	SC	L	SC	SC
5	Veling et al., 2021	SC	SC	L	SC	L	SC
6	Szczepańska-Gieracha et al., 2021	SC	SC	L	SC	SC	H
7	Freeman et al., 2022	L	SC	L	SC	L	SC
8	Paul et al., 2022	SC	SC	SC	SC	SC	H

No	Author(s), Year	D1	D2	D3	D4	D5	Overall
9	Paul et al., 2024	L	SC	L	SC	L	SC
10	Tacca et al., 2024	SC	SC	L	SC	L	SC
11	Thaysen-Petersen et al., 2024	SC	SC	L	SC	SC	H
12	Lotfinia et al., 2024	SC	SC	L	SC	SC	H
13	Dai et al., 2025	SC	SC	SC	L	L	SC
14	Schultz et al., 2025	L	SC	SC	SC	L	SC
15	M. Lee et al., 2025	L	SC	L	L	L	SC
16	Kroczek et al., 2025	L	L	L	L	L	L
17	Sadeghi et al., 2025	SC	SC	SC	SC	SC	H

Note. D1 = randomization process; D2 = deviations from intended interventions; D3 = missing outcome data; D4 = measurement of the outcome; D5 = selection of the reported result; L = low risk; SC = some concerns; H = high risk.

Thematic Synthesis

Findings for RQ1: Counseling and Psychotherapeutic Applications of Virtual Reality

Depression was the largest domain, addressed by five trials that embedded VR within established models rather than creating new ones. Behavioral activation was enhanced with pleasant or mastery activities completed in VR as homework (Paul et al., 2022, 2024), a VR program based on cognitive behavioral therapy targeted depression and suicidality (M. Lee et al., 2025), solution-focused counseling was delivered in an electroencephalography-enhanced virtual environment (Tacca et al., 2024), and a virtual therapeutic garden supported older women with insufficient response to multimodal therapy (Szczepańska-Gieracha et al., 2021). VR thus made abstract counseling tasks experiential.

In the anxiety and fear domain, VR was the exposure medium itself. Automated cognitive therapy with a virtual coach targeted fear of heights (Freeman et al., 2018) and agoraphobic avoidance in psychosis (Freeman et al., 2022), while self-guided apps delivered graded exposure for acrophobia and panic disorder with little or no therapist input (Donker et al., 2020; Schultz et al., 2025). In the trauma domain, two reports involving active-duty soldiers contrasted VR exposure with imaginal prolonged exposure (Gramlich et al., 2021; Reger et al., 2016), whereas a recent trial used VR to deliver stabilization imagery for pandemic-related post-traumatic stress symptoms (Dai et al., 2025), signaling a shift toward preparatory trauma work.

Four trials addressed substance use. VR simulated high-risk settings to elicit craving for cognitive restructuring in alcohol use disorder (Thaysen-Petersen et al., 2024), provided cue exposure added to group therapy for smoking cessation (Kroczek et al., 2025), combined aversive conditioning with restructuring during methadone maintenance (Sadeghi et al., 2025), and offered 360° nature scenes for stress reduction during detoxification (Lotfinia et al., 2024). A transdiagnostic trial tested self-managed VR relaxation for outpatients with various psychiatric disorders (Veling et al., 2021). Across domains, VR was delivered by therapists, automated virtual coaches, or self-guided devices, thereby augmenting, partly substituting, or extending counseling.

Findings for RQ2: Therapeutic Effectiveness Compared with Conventional and Control Conditions

Effectiveness depended strongly on the comparator (Figure 5). Against usual care or no VR, results were consistently favorable. Automated VR therapy produced a very large, sustained

reduction in fear of heights (Freeman et al., 2018), and self-guided VR exposure yielded moderate improvements in anxiety, panic, and depression in panic disorder (Schultz et al., 2025). In psychosis, gameChange produced small but significant reductions in agoraphobic avoidance and distress, largest among severely avoidant patients (Freeman et al., 2022). Similar advantages emerged in two small high-risk trials (Lotfinia et al., 2024; Szczepańska-Gieracha et al., 2021).

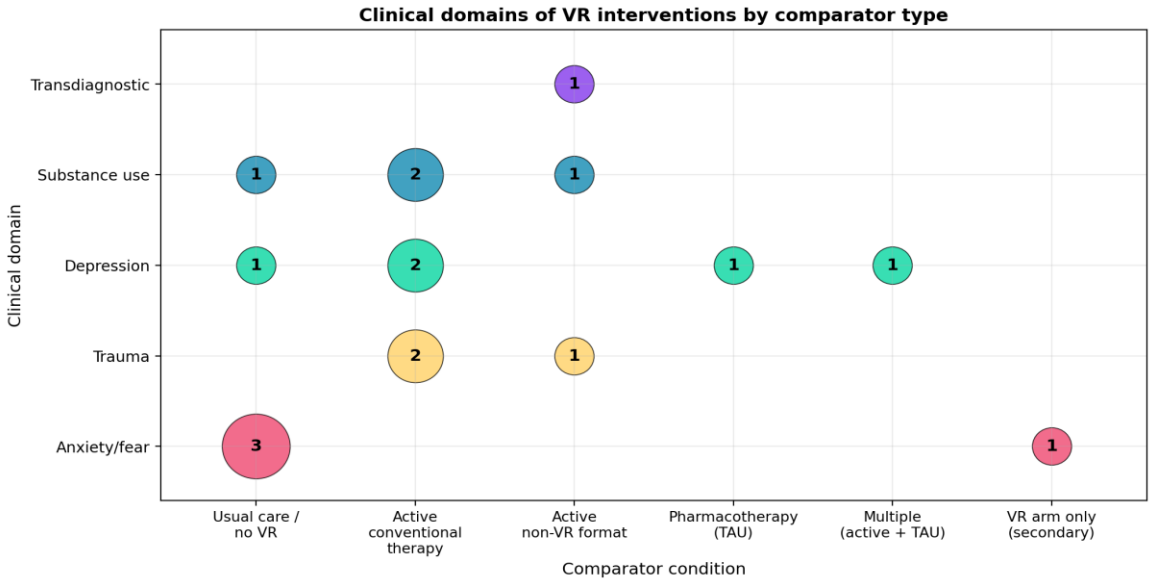

Figure 5. Distribution of clinical domains of VR interventions by comparator type (bubble size and numbers indicate the number of trials)

Comparisons with active treatments were more nuanced. Extended reality-enhanced behavioral activation was non-inferior to traditional behavioral activation (Paul et al., 2024), VR-based cognitive behavioral therapy matched pharmacotherapy for depression while uniquely reducing suicidality (M. Lee et al., 2025), and VR-EEG counseling equaled videoconference counseling in session quality while feeling more restorative (Tacca et al., 2024). In the largest comparative trial, VR cue exposure did not improve six-month smoking abstinence relative to relaxation (Kroczek et al., 2025), and VR exposure was not superior to prolonged exposure after treatment and was inferior at follow-up (Reger et al., 2016). Conversely, smaller trials favored VR over conventional CBT for alcohol use (Thaysen-Petersen et al., 2024), counseling for opioid use (Sadeghi et al., 2025), an audio app with identical scripts (Dai et al., 2025), and standard relaxation for momentary negative affect (Veling et al., 2021).

Benefits in psychosis were mediated by reduced threat cognitions and defensive behaviors (Freeman et al., 2022). Imaginal exposure generated higher heart rate arousal than VR exposure, and skin conductance habituation predicted improvement mainly in the imaginal condition (Gramlich et al., 2021), suggesting weaker engagement with trauma memories in VR. Usage data revealed an optimal exposure dose (Donker et al., 2020), and high baseline craving predicted poorer abstinence only with VR, implying insufficient cue exposure (Kroczek et al., 2025). No adverse events were reported in several trials (Freeman et al., 2018; M. Lee et al., 2025; Paul et al., 2022, 2024), and simulator sickness was mild (Thaysen-Petersen et al., 2024).

Comparative and Critical Analysis

The evidence base is dominated by parallel-group designs (14 of 17 trials), with one crossover trial and two secondary analyses, but rigor varied. Only three trials randomized more than 150 participants (Freeman et al., 2022; Kroczek et al., 2025; Reger et al., 2016), five enrolled 30

or fewer, and four were explicitly pilot or feasibility studies. Several small trials interpreted non-significant differences as equivalence despite limited power. Most follow-up periods ended at post-treatment or within three months, and only those three larger trials assessed outcomes at six months.

The design logic also evolved. Early work compared therapist-delivered VR exposure with a gold standard (Reger et al., 2016), later trials tested automated or self-guided programs against usual care (Freeman et al., 2018, 2022; Schultz et al., 2025), and the most recent trials integrated VR into existing protocols such as behavioral activation, group therapy, or methadone treatment (Kroczek et al., 2025; Paul et al., 2024; Sadeghi et al., 2025). Hardware moved toward consumer and hybrid devices (Donker et al., 2020; Tacca et al., 2024). Powered non-inferiority trials, dismantling studies isolating immersion, and trials in school, university, or community counseling services remain underused.

Interpretation of Findings

The central finding is that VR-based interventions reliably outperform inactive conditions but rarely outperform established treatments. This mirrors earlier conclusions that VR treatment exceeds treatment as usual and is broadly comparable to conventional therapy (Valmaggia et al., 2016), suggesting that the therapeutic engine lies mainly in the underlying model, such as exposure or behavioral activation, rather than in the technology (Ma et al., 2021). VR adds value by making these mechanisms accessible and vivid (Wrzus et al., 2024). Advantages observed in small trials against audio-based or conventional formats (Dai et al., 2025; Sadeghi et al., 2025) are consistent with evidence that immersion can intensify and then regulate stress responses (Kosonogov et al., 2023), but they require replication.

Theoretical Implications

The findings suggest that therapeutic change in VR depends on the quality of emotional engagement rather than realism alone. Lower physiological arousal during VR than imaginal exposure (Gramlich et al., 2021), together with evidence that presence predicts symptom reduction (Augustin et al., 2024), indicates that presence and personal relevance may moderate change. Mediation by threat cognitions (Freeman et al., 2022) supports the view that VR operates through established cognitive mechanisms rather than a novel pathway. Embodied perspective-taking may also act as an active ingredient (Slater et al., 2019; Yamashita & Yamamoto, 2024). Counseling theory should thus treat VR as a relational context in which alliance, presence, and emotion interact (Kang et al., 2024; Schaarschmidt & Koehler, 2021).

Practical Implications

The evidence supports VR as a credible option for phobic and agoraphobic avoidance, for enhancing behavioral activation, and for stress regulation, particularly for clients who struggle to access real-world exposure or leave home (Freeman et al., 2022; Paul et al., 2024). Clients often prefer VR to in vivo exposure (Levy et al., 2023) and accept coach-guided home therapy (Gomez Bergin et al., 2024). Services and training programs should address barriers such as limited knowledge and training, cost, and concerns about the therapeutic relationship (Felnhofer et al., 2025; Kim et al., 2025). Practitioners should screen for cybersickness susceptibility (Garrido et al., 2022), and policymakers should establish data protection and ethical standards for automated and remote VR counseling (Orzeł & Strzałek, 2025).

Comparison with Prior Reviews

These findings converge with, and refine, prior syntheses. Earlier reviews found VR comparable to conventional treatment (Valmaggia et al., 2016) and ranked VR coach-delivered psychotherapy highest for acrophobia (Chou et al., 2021), consistent with the large automated VR

effect observed here (Freeman et al., 2018). A review of addictive disorders reported heterogeneous results for exclusive VR cue exposure (Segawa et al., 2020), which the null abstinence finding of the largest smoking trial reinforces (Kroczek et al., 2025). A pandemic-focused review relied mainly on uncontrolled studies (S.-A. Lee et al., 2023). Stratifying randomized evidence by comparator shows that conclusions are strongest against inactive controls and weakest against gold-standard treatments.

Contradictions in the Literature

VR exposure was inferior to prolonged exposure at follow-up for combat-related posttraumatic stress disorder (Reger et al., 2016), whereas VR stabilization outperformed an app with identical scripts (Dai et al., 2025). Generic scenes may dilute personalized memory retrieval, which motion-assisted frameworks try to address (van Gelderen et al., 2018), whereas stabilization benefits from calming immersion. Likewise, VR augmented treatment for alcohol and opioid use in small trials (Sadeghi et al., 2025; Thaysen-Petersen et al., 2024) but not for smoking cessation in a large trial (Kroczek et al., 2025). Small samples, weaker comparators, and insufficient exposure dose may explain this (Segawa et al., 2020).

Research Gaps

First, no trial was conducted in educational or community counseling services, although VR is already used for student and metaverse counseling (Kang et al., 2024; Kristiansen & Lauridsen, 2025). Second, the cultural transferability of VR counseling to low- and middle-income regions, including Southeast Asia, remains untested (Zale et al., 2021). Third, avatar-based self-counseling is supported mainly by experiments with non-clinical participants (Slater et al., 2019; Yamashita & Yamamoto, 2024). Fourth, counselor role, working alliance, and client emotional experience were rarely measured, despite evidence that mediated formats alter emotional communication (Schaarschmidt & Koehler, 2021). Fifth, cost-effectiveness and long-term outcomes remain largely unexamined (Ma et al., 2021).

Limitations of This Review

This review has limitations. First, searching only Scopus and restricting to open-access, English-language, final-stage articles may have omitted relevant trials and introduced selection and language bias. Second, heterogeneity precluded meta-analysis. Third, six trials were at high risk of bias, and most relied on unblinded self-report outcomes that may inflate effects. Fourth, one secondary analysis appears to share its sample with another included trial. Fifth, publication bias could not be formally assessed, and small positive trials may be overrepresented (Wrzus et al., 2024).

Future Research Agenda

Future research should conduct adequately powered, preregistered non-inferiority trials against gold-standard therapies with clinician-rated outcomes and follow-up of at least six months (Reger et al., 2016; Valmaggia et al., 2016). Dismantling designs should isolate the contribution of immersion by comparing VR with non-immersive formats delivering identical content (Dai et al., 2025). Implementation trials should test VR counseling in schools, universities, and community services, including counselor training (Felnhofer et al., 2025; Kim et al., 2025). Presence, cybersickness, and alliance should be tested as moderators (Augustin et al., 2024; Garrido et al., 2022), and culturally adapted content should be evaluated economically in underrepresented regions (Orzeł & Strzałek, 2025).

Answers to the Research Questions

For RQ1, randomized trials applied VR across five domains: depression, anxiety and fear, trauma, substance use, and transdiagnostic stress. The dominant applications were VR exposure

therapy, VR-enhanced cognitive behavioral therapy and behavioral activation, cue exposure and aversion-based interventions, guided imagery stabilization, and relaxation. For RQ2, VR consistently improved outcomes relative to usual care or no-VR conditions, with effects ranging from small in psychosis to very large in acrophobia. Against active conventional treatments, VR was mostly equivalent or non-inferior, occasionally superior in small high-risk trials, and inferior at long-term follow-up in the trauma trial.

CONCLUSIONS

Randomized evidence on VR-based counseling and psychotherapy spans depression, anxiety and fear, trauma, substance use, and transdiagnostic stress, with exposure therapy, enhanced behavioral and cognitive interventions, guided imagery, and relaxation as the main applications. VR consistently outperformed usual care or no-VR conditions and was generally comparable to active conventional treatments, though rarely superior to them. The core contribution of this review is a comparator-sensitive synthesis showing that VR functions best as a medium that strengthens established therapeutic mechanisms rather than as a replacement for them. Practitioners can consider VR for clients who face barriers to real-world exposure or conventional services. These conclusions are tempered by the reliance on a single database, small pilot samples, unblinded self-report outcomes, and short follow-up. Larger comparative, long-term, and implementation-focused trials in diverse counseling settings are needed.

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