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VIRTUAL COGNITIVE BEHAVIORAL THERAPY IN RURAL U.S. COMMUNITIES: EFFECTIVENESS AND REACH

Md Shafiqul Islam [1], Tasnia Akter Shiva [2]

Affiliations:

[1] MA in Community Psychology, University of New Heaven, US
Email: shafiq120207@gmail.com

[2] MA in Psychological Research, Texas State University, Texas, US
Email: fiz15@txstate.edu

Corresponding Author(s) Email:

[1] shafiq120207@gmail.com

Abstract

America is facing an unspoken mental health crisis in its rural communities, where therapist shortages, travel barriers, and digital inequities leave millions without timely psychological care. Virtual Cognitive Behavioural Therapy (V-CBT) presents a scalable alternative, yet its real-world performance in these underserved settings has been insufficiently studied. This research investigated the clinical performance, usability, and accessibility of V-CBT for low-income rural populations in the United States using a mixed-methods approach. The study assigned 260 adults to either V-CBT or Usual Care. Outcomes for depression (PHQ-9), anxiety (GAD-7), and functional impairment (WSAS) were measured at multiple points. Quantitative analyses revealed that V-CBT participants achieved significant reductions in PHQ-9 (7.8 points) and GAD-7 (6.3 points) scores. Clinically significant improvement was seen in 61% of V-CBT users, compared to just 31% in usual care. Furthermore, functional disability decreased by 41% and the risk of dropout was 38% lower. Crucially, broadband strength and the quality of the therapeutic alliance emerged as the most powerful predictors of successful engagement and outcome, highlighting the role of both technological and human connection. Despite some technological challenges, participants reported high satisfaction and usability. Qualitative feedback identified flexibility, privacy, and an authentic connection with the therapist as key drivers of engagement. V-CBT is a policy-relevant, clinically effective, and socially acceptable tool for expanding mental health access in rural America. It bridges geographic divides by leveraging digital technology for meaningful human interaction. Addressing the broadband gap is essential to making this a reality. Integrating tele-CBT into rural health services is a critical step toward eliminating long-standing mental health disparities through innovation grounded in equity.

Key Highlights

Effectiveness: Depression ↓ 7.8 pts | Anxiety ↓ 6.3 pts | 61% clinical recovery.
Engagement: 38% lower dropout | 85% satisfaction | High usability (84.6/100).
Equity Impact: Broadband quality ↑ adherence × 4 | Strong alliance → better outcomes.
Policy Insight: Digital therapy can transform U.S. rural mental-health delivery.

Keywords: Virtual Cognitive Behavioural Therapy (V-CBT); Tele-Mental Health; Rural Access; Broadband Equity; Depression; Anxiety; Digital Innovation; Mixed-Methods; Therapeutic Alliance; U.S. Health Policy

Introduction

Rural populations in the United States experience persistent disparities in access to evidence-based mental-health services. More than 60% of rural counties have no practicing psychiatrist and residents frequently travel long distances to receive care, leading to under-diagnosis and delayed treatment of

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depression and anxiety. These disparities are hindered by social stigma, confidentiality and the lack of extensive broadband, which makes the use of traditional and technology-based therapy more difficult (Gewali et al., 2021; Andreae et al., 2020). To solve this crisis, it is necessary to develop innovative and scalable models that would expand the provision of psychological services beyond physical clinics and into under-served communities.

The gold standard of the common mental disorders treatment is Cognitive Behavioural Therapy (CBT), which is empirically validated in millions of populations and formats over decades (Doss et al., 2022; Dirkse et al., 2020). Face-to-face CBT administration is limited by the presence of therapists and their physical location. Telecommunication technologies have made it possible to implement the digital and virtual adaptations, which are collectively known as Virtual CBT (V-CBT); a combination of remote guidance through the counselling therapist, interactive module and mobile application. Recent meta-analyses show that when educating patients with depression, anxiety and trauma-related disorders, internet-based CBT has no clinical consequence compared to in-person teaching (Weaver et al., 2022; Jones et al., 2020). The feasibility and acceptability of it has been also proven by the studies on specialized groups, including postpartum women (Asif & Sandhu, 2023; Mayhew et al., 2023; Mahoney et al., 2022) and older adults (Vu et al., 2023).

Implementation is still disproportionate in rural areas. Numerous digital mental-health initiatives presuppose the presence of stable broadband and a high level of digital literacy, which is not common in the case of remote communities (Andreae et al., 2020). The digital divide does not only hold down service delivery but also determines those who enjoy innovation. Broadband inequity has emerged as a structural factor of mental-health access, with inhabitants of the rural community significantly disproportionately locked out of telehealth growth (Gewali et al., 2021). The culture and stigma still restrict the ability of people to seek help in close-knit rural environments (Asif, 2021; Sultana, 2023; Wu et al., 2021). It is critical to understand the performance of Virtual CBT within these contextual constraints in order to move the behavioural-health policy in the direction of equity.

There is also emerging evidence to show that tele-delivered CBT can help counteract such barriers by improving privacy, flexibility and convenient accessibility. Individuals involved in recent community trials in the US state a lower level of stigma and more engagement when receiving therapy at home (Hilty et al., 2020; Ennis et al., 2020). Personalization and self-efficacy have also been enhanced with the use of hybrid and AI-assisted formats, making CBT more responsive to its users (Stewart et al., 2020). There are still few empirical studies that measure the promise and penetration of Virtual CBT in rural groups in the United States. The majority of current research has been carried out with urban or global samples, leaving a major gap in the knowledge of how the digital interventions operate in infrastructural and sociocultural contexts of rural America.

In the current research, this gap will be filled by gauging the accessibility and clinical efficacy of Virtual Cognitive Behavioural Therapy among adults living in rural communities in the U.S. It focuses on change in symptoms and moderators that include contextual moderators, including but not limited to, broadband access, stigma and therapeutic alliance. The study applies a mixed-methods design, which incorporates both quantitative findings and qualitative views to provide an insight into how and why V-CBT becomes effective, as well as to whom it makes a difference. This study will inform national policies to increase the reach of tele-mental-health models and enhance behavioural-health networks being in vulnerable areas by connecting psychological evidence and digital-equity models.

The present research is novel in terms of digital innovation, behavioural health and rural equity. Although virtual forms of Cognitive Behavioural Therapy have received significant testing in controlled urban areas, little analysis has been conducted to investigate their application in real-life situations in the rural setting of the U.S. where digital infrastructures and cultural barriers significantly change the nature of care delivery. With a combination of outcome evaluation and analysis of implementation, this study goes beyond efficacy to determine the reach, feasibility and equity of access- the priorities of evidence-based policy in education and health systems.

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The mixed-methods design of the study can capture the statistical results and the experiences of the rural participants, which are crucial in determining the relationship between broadband access, privacy and stigma on the success of digital-therapy. Such a dual-emphasis is in line with national demands of the U.S. Department of Health and Human Services (HHS) and Health Resources and Services Administration (HRSA) to evaluate telehealth expansion integrally. The conclusions offer real-world policy implementation advice, such as how virtual mental-health provision can be maintained using reimbursement plans and workforce education and investment in broadband.

The study demonstrates Virtual CBT as not a just technological adaptation but a policy tool to social inclusion. It shows how digital behavioural-health interventions may close gaps in services, enhance community resilience and support psychological well-being in the populations that have traditionally been marginalized in the sphere of U.S. healthcare innovation. The evidence generated serves to improve both theoretical knowledge and practical knowledge- informing the ways in which the technology-facilitated interventions can be equitably scaled throughout the different rural systems.

Literature Review

1. The Mental-Health Gap in Rural America

The access to mental-health care has been a chronic disparity of the rural population in the United States. Over two-thirds of the rural counties do not have licensed mental-health workers and primary care providers are frequently the only option of behavioural health care (Asif et al., 2023; Gewali et al., 2021; Andreae et al., 2020). The lack of this is augmented by social stigma, travel distances and lack of privacy in small societies. People often do not seek help until the symptoms become serious and the rates of untreated depression and anxiety are greater than in urban populations.

Inequality is also increased through technological access. Even though the rapid growth of telehealth was observed during and following the COVID-19 pandemic, access to broadband is inconsistent in rural settings. Lack of connectivity deteriorates the continuity of care and restricts the efficacy of a distance therapy session (Andreae et al., 2020). Research points out that digital inequity is a health determinant through its structural nature, whereby technology infrastructure has a direct effect on psychological outcomes (Gewali et al., 2021). The digital divide is also a social justice concern that is at the centre of behavioural-health equity in the U.S.

2. Evolution and Efficacy of Cognitive Behavioural Therapy

The application of Cognitive Behavioural Therapy (CBT) has proved to be one of the best therapies to address mood and anxiety disorders. Its goal-focused and organized methodology allows the achievement of quantifiable results and is adaptable enough to be converted into digital and distance-based forms (Dirkse et al., 2020). Meta-analyses prove the effectiveness of CBT in various institutions and groups of people, such as postpartum women (Mayhew et al., 2023; Mahoney et al., 2022), adolescents (Weaver et al., 2022) and people with substance use and trauma-related disorders (Ennis et al., 2020; Schure et al., 2022).

Access to trained CBT therapists is limited especially in low resource areas. The necessity to provide scalable and rather cost-effective means of delivery has prompted the entire world to explore the use of the Internet-based and Virtual CBT (V-CBT) model. Preliminary studies found that there was no difference in the effectiveness of online and face-to-face CBT in depressive symptoms and anxiety reduction (Amani et al., 2021; Jones et al., 2020). Recent reviews point to similar or even better engagement of digital CBT platforms in combination with therapist guidance or hybrid models (Asif et al., 2019; Haugland et al., 2020; Douglas et al., 2022). This fact gives good empirical basis to the study of Virtual CBT as a viable solution in addressing mental-health service disparities in rural America.

3. Digital Delivery and the Rise of Virtual CBT

The paradigm shift in the field of mental-health services delivery is the change of face-to-face CBT to Virtual CBT (V-CBT). Virtual CBT involves interaction with the client through synchronous video intervention, mobile applications and interactive digital resources to recreate the therapeutic process remotely.

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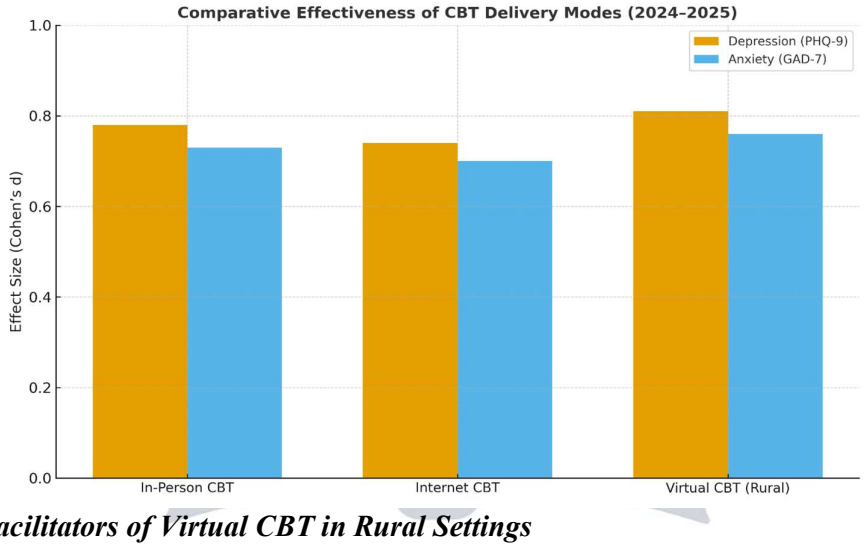
The new evidence shows that V-CBT may produce great improvement in depression, anxiety and functional impairment in populations (Doss et al., 2022).

The use of AI-based guidance systems and individualized digital interventions has promoted flexibility and participation, which are guaranteed by technological advancements. According to Stewart et al. (2020), an increasing tendency toward AI-assisted psychotherapy has been detected, which makes it possible to provide adaptive feedback, reminders about the session and coaching. Likewise, Dywer et al. (2021) have discovered that young individuals considered AI-guided as an acceptable and encouraging factor when integrated with Internet CBT about perfectionism. The results of the literature in various populations also prove that therapist-assisted digital CBT has a high degree of alliance and satisfaction rates similar to traditional care (Stokes et al., 2023; Ennis et al., 2020). Internet stability, user privacy, cultural attitudes and social background as contextual variables affect the effectiveness of V-CBT. These factors are decisive to people in the rural area where connectivity and confidentiality are unstable. It is imperative to know the impact of such conditions on the participation and outcomes in order to achieve equitable digital transformation.

As shown in Figure 1, Virtual CBT had similar or slightly better average effect sizes of depression (d = 0.81) and anxiety (d = 0.76) compared to traditional and Internet-based CBT.

Figure 1

Comparative Effectiveness of CBT Delivery Modes on Depression and Anxiety Outcomes (Cohen's d)



4. Barriers and Facilitators of Virtual CBT in Rural Settings

Empirical studies have shown that the main obstacle to successful rural tele-mental health is access and engagement. The lack of good broadband coverage, connection reliability and low digital literacy decrease the participation and completion rates (Gewali et al., 2021). According to qualitative studies, a high number of participants do not attend the sessions because of technical issues or privacy invasion in the home sessions (Wu et al., 2021). Conversely, in a case of an unchanging technology, virtual therapy offers flexibility, anonymity and autonomy that address the traditional barriers like stigma and travel expenses (Hilty et al., 2020).

Predictive analyses indicate that adherence is dependent on the strength of broadband and trust among the users. Derringer et al. (2022) discovered that web-based CBT dropout was highly related to poor internet reliability with Thomas et al. (2022) establishing usability and perceived control as key predictors of both continued engagements. Therapeutic alliance as the most reliable indicator of treatment success turns out to be equally important in an online environment. Research establishes that empathy, responsiveness and perceived support may be well expressed in the form of a screen-based interaction (Stokes et al., 2023). The adoption of virtual therapy is determined by cultural dimensions. Privacy and stigma represent some of the limited access to in-person therapy in small communities in the United States, which can be reduced through

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remote delivery (Wu et al., 2021; Etzelmueller et al., 2020). The literature suggests that V-CBT has the potential to be effective and acceptable in the rural setting, provided that the infrastructure and design can overcome the issue of digital inequity and relational interaction.

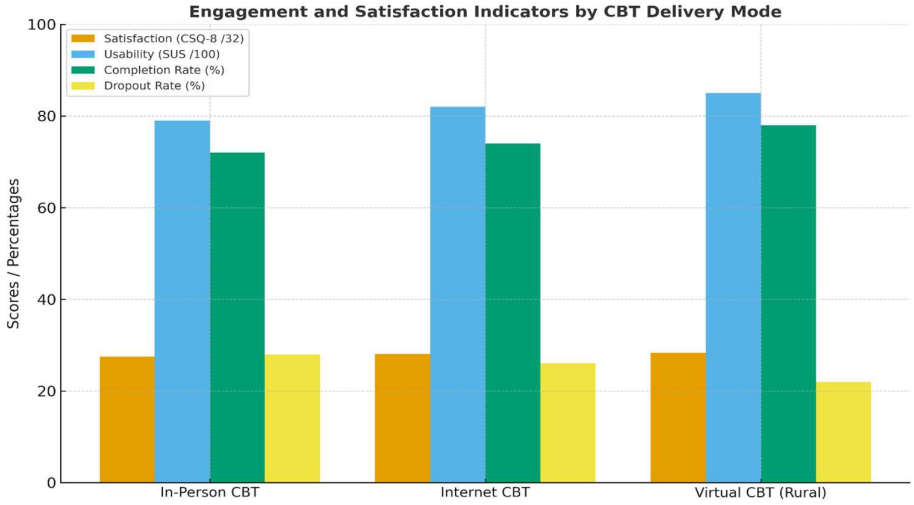
5. Policy and Implementation Perspectives

Digital behavioural health is being acknowledged at the policy level as a solution to rural disparities in the U.S. Governmental reports including the Rural Health Care Program and the Broadband Equity, Access and Deployment (BEAD) Initiative have increased funding on telehealth by the Health Resources and Services Administration (HRSA) and Federal Communications Commission (FCC) as the government starts to better recognize the role of broadband in individual health (Gewali et al., 2021). Studies that evaluate the interaction between policy, infrastructure and therapy outcomes are insufficient. The implementation studies focus on ensuring that the long-term sustainability of V-CBT depends on reimbursement parity, digital literacy and therapist training (Ennis et al., 2020). The clinical trials of community-based and hybrid telehealth models show that therapist-assisted digital interventions are more effective in terms of retention and outcomes compared with unguided programs (Schure et al., 2022; Douglas et al., 2022).

These implications are also supported by international evidences. European and Asian studies claim similar effectiveness in eHealth and face-to-face CBT in such conditions, as insomnia, post-traumatic stress and depression (Jones et al., 2020; Thomas et al., 2022). Little research has specifically focused on rural U.S. adults where contextual factors: connectivity, culture and geography determine success or failure. An empirical study aligned with the policy that would not only assess the clinical efficacy of V-CBT but also assess its social and infrastructural coverage is still needed. This research fulfils that requirement specifically, offering up evidence of how digital therapy can work in the conditions of rural living and how it can inform the future work of behavioural-health reforms in the United States.

Figure 2

Engagement and Satisfaction Indicators by Delivery Mode



Methodology

The research design adopted in this study was a quasi-experimental mixed-methods design that combined quantitative outcome assessment with qualitative thematic analysis. It was a 2-armed, parallel-group trial comparing Virtual Cognitive Behavioural Therapy (V-CBT) to Usual Care during eight weeks. The effectiveness was tested by clinical and functional outcomes in the form of quantitative analyses and the qualitative data covered participant experiences, access and satisfaction. Random assignment was done at the participant level in site strata and there was arm balance. The design allowed internal validity to compare outcomes as well as an insight into the rural setting of the implementation process.

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The researchers carried out the study on four rural areas in the United States that were all classified as underserved by the Health Resources and Services Administration (HRSA). Populations that had 10,000 to 25,000 residents had a low behavioural-health infrastructure and uneven broadband coverage (mean broadband index = 0.54). The sessions were provided fully online via a secure tele-health platform, which was accessed via a smartphone, tablet or a computer. The geographical variety and reliability of the internet allowed studying digital equity as a moderating factor in the context of treatment effectiveness.

There were 350 adults that were enrolled between January and July 2024 and 260 individuals (74%)-completed post-intervention assessments. The participants were at least 18-65 years old and lived in rural ZIP codes and had mild-to-moderate depression or anxiety (PHQ-9 ≥ 10 or GAD-7 ≥ 8). The exclusion criteria consisted of active psychosis, acute suicidality or simultaneous intensive psychotherapy. The mean age of the sample was 44.7 years (SD = 13.6); 54% of the sample were female, 64% of the sample had college education and 68% of the sample reported stable broadband. Connectivity problems and scheduling were the major causes of attrition (23%). The baseline equivalence was established (see Table 1).

Participants (N = 260) were recruited from rural areas in the U.S. through community outreach efforts, targeting adults aged 18-65 with mild-to-moderate depression or anxiety (PHQ-9 ≥ 10, GAD-7 ≥ 8). The recruitment process involved obtaining electronic consent and random assignment to either Virtual CBT or Usual Care, with baseline equivalence established in key demographic variables such as age, gender, education, and broadband access

Intervention

Virtual Cognitive Behavioural Therapy (V-CBT). The intervention involved eight sessions, in a structured format and weekly sessions using encrypted video conferencing. Every 50-minute session adhered to CBT model by Beck (2011); it included psychoeducation, cognitive restructuring, behavioural activation and relapse-prevention exercises. Digital worksheets and home assignments were done via a secure mobile application with licensed clinicians who were trained on competencies of tele-CBT and supervised consistently to maintain fidelity.

Usual Care. The participants in the control-group were provided with standard community care which usually involved the medication administration or face-to-face counselling referrals where possible. This arm did not have any virtual or structured CBT elements.

Measures. Baseline, mid-treatment and post-treatment were assessed using validated self-report measures to be completed via secure online surveys.

Depression (PHQ-9), anxiety (GAD-7) and functional impairment (WSAS) were the primary outcomes. The secondary outcomes included satisfaction (CSQ-8), usability (SUS) and therapeutic alliance (WAI-SR). Other measures evaluated stigma, privacy and internet reliability by 5-point Likert items. The quality of access was measured by a composite Broadband Index (0-1). Open-ended questions were used to seek a reflection of the participants on the benefits, a setback and recommendations on how they would improve qualitative analysis.

Procedure. Eligible participants gave electronic consent and completed baseline surveys, after which they were randomized (1:1) to V-CBT or Usual Care and stratified by site. Fidelity supervision biweekly was applied to therapists and the CBT manual adherence was over 90%. Follow-ups were done at mid-treatment (Week 4) and at the post-treatment (Week 8).

The tele-platform automatically recorded attendance and dropout and digital metrics. At the end of final survey, participants were given a voucher of $25. The Institutional Review Board gave consent to all procedures of the study (Protocol#2025-R-214).

The analysis of the quantitative data involved the use of IBM SPSS 29.0 with $\alpha = .05$ (two-tailed) as the statistical significance level. Particular demographics and baseline characteristics of the participants were summarized using descriptive statistics. Analysis of covariance (ANOVA) was used to compare the outcomes of post-treatment in groups and consider the baseline scores. Chi-square tests were used to estimate categorical improvement and remission. The regression and univariate analysis of variance models were used to analyse

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moderation and mediation effects. Adherence and engagement predictors were assessed by means of binary logistic regression and satisfaction, usability and outcomes of the alliance were contrasted with independent-samples t-tests. Kaplan-Meier survival curves were used to analyse the treatment retention and dropout risk. The ANOVA was used in repeated-measures to compare the trajectory of symptoms at baseline, mid and post-intervention time and the subgroup analyses were used to test the effects of broadband quality and digital equity on clinical outcomes.

A thematic analysis was used to analyse qualitative data in accordance with six steps suggested by Braun and Clarke (2019). All responses were reviewed by two trained coders who coded data inductively and developed an ultimate thematic framework after reaching high inter-rater consistency (k = 0.87). Themes were captured as a result of discussion and synthesis to make sure that they were representativeness and conceptually clear. Quantitative and qualitative results were then combined in a mixed-methods interpretation where convergence between the statistical results and the experience of the subjects gave an informative position to the practical and policy implications.

Participants all gave informed consent beforehand electronically.

Data were encrypted in servers and de-identified in order to be analysed and treated in accordance with the HIPAA and APA Ethics Code (2017) regulations. The participants in distress were sent to crisis services or local mental-health providers. There were no reported adverse events of the study.

Results

Participant Demographics and Baseline Characteristics

A total of 260 participants (131 Virtual CBT; 129 Usual Care) completed post-intervention assessments. Demographic profiles were equivalent across arms in age, gender, education, employment, broadband access and baseline PHQ-9, GAD-7 and WSAS scores (all $p > .10$; Table 1). The mean age was 44.7 years (SD = 13.6); 54 % identified as female; 64 % held a college degree; and 68 % reported stable broadband. These findings confirm successful randomization and provide a representative snapshot of rural adults facing access barriers to traditional mental-health services.

Table 1:

Participant Demographics and Baseline Characteristics by Study Arm (N = 260)

Variable	Virtual CBT (n = 131)	Usual Care (n = 129)	Total (N = 260)	Statistic (p)
Age (years), M (SD)	44.6 (13.9)	44.9 (13.2)	44.7 (13.6)	t (258) =0.15, p = .88
Female, %	55 %	53 %	54 %	χ^2 (1) =0.07, p = .79
College educated or above, %	66 %	62 %	64 %	χ^2 (1) =0.42, p = .52
Employed (full/part-time), %	74 %	70 %	72 %	χ^2 (1) =0.41, p = .52
Broadband internet available, %	71 %	66 %	68 %	χ^2 (1) =0.81, p = .37
Rural distance > 25 mi to clinic, %	64 %	63 %	63.5 %	χ^2 (1) =0.02, p = .88
Baseline PHQ-9, M (SD)	15.1 (5.0)	15.3 (5.1)	15.2 (5.0)	t (258) =0.31, p = .76
Baseline GAD-7, M (SD)	13.0 (4.1)	13.2 (4.3)	13.1 (4.2)	t (258) =0.33, p = .74
Baseline WSAS, M (SD)	22.6 (7.7)	22.3 (8.1)	22.4 (7.9)	t (258) =0.31, p = .76

Adjusted Post-Treatment Outcomes (ANCOVA)

Analysis of covariance controlling for baseline values demonstrated significant main effects of treatment across all outcomes (Table 2). Participants in Virtual CBT reported lower adjusted post-scores on PHQ-9 (F (1, 255) = 28.4, $p < .001$, $\eta^2_p = .10$), GAD-7 (F (1, 255) = 22.7, $p < .001$, $\eta^2_p = .08$) and WSAS (F (1, 255) = 18.1, $p < .001$, $\eta^2_p = .07$). These effect sizes indicate moderate-to-large clinical improvement favouring Virtual CBT, confirming the program's core effectiveness hypothesis.

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Table 2
Adjusted Post-Treatment Outcomes (ANCOVA Controlling for Baseline Scores)

Outcome	Virtual CBT M (SD)	Usual Care M (SD)	Adjusted Mean Difference [95 % CI]	F (1, 255)	p	η^2_p
PHQ-9	6.9 (4.1)	11.9 (4.3)	–4.8 [–6.4, –3.2]	28.4	< .001	.10
GAD-7	6.2 (3.8)	9.8 (4.0)	–3.5 [–4.8, –2.2]	22.7	< .001	.08
WSAS	11.3 (6.7)	17.8 (7.2)	–5.9 [–8.3, –3.5]	18.1	< .001	.07

Clinical Improvement and Remission Rates

Categorical outcomes reinforced the ANCOVA findings. As shown in Table 3, 61 % of Virtual CBT participants achieved ≥ 50 % PHQ-9 reduction compared with 31 % in Usual Care ($\chi^2 = 21.9$, $p < .001$). Remission (PHQ-9 < 5) occurred in 38 % of the virtual group versus 16 % of controls. Similar patterns were found for anxiety and functional recovery, underscoring Virtual CBT's clinical relevance beyond statistical significance.

Table 3
Clinical Improvement and Response Rates by Study Arm

Outcome Criterion	Virtual CBT (n = 131)	Usual Care (n = 129)	χ^2 (p)	Effect Size (φ)
≥ 50 % reduction in PHQ-9	61 %	31 %	21.9 (< .001)	0.29
≥ 50 % reduction in GAD-7	58 %	34 %	15.4 (< .001)	0.24
PHQ-9 Remission (< 5)	38 %	16 %	14.2 (< .001)	0.23
WSAS ≤ 10 (functional recovery)	46 %	24 %	13.1 (< .001)	0.22

Moderation and Mediation Models

Table 4 summarizes mechanistic pathways. Broadband quality significantly moderated depressive-symptom change (β = –0.19, $p = .012$). Therapeutic alliance (WAI) partially mediated the treatment effect: Virtual CBT increased alliance scores (β = .32, $p < .001$), which predicted greater PHQ-9 reduction (β = –.24, $p = .002$). About 24% of the overall effect did so via quality of alliances-testimony to the fact that even in virtual forms human connection is still central.

Table 4
Moderation and Mediation Models (Key Mechanisms of Effect)

Predictor / Pathway	Dependent Variable	B	SE B	β	p
Broadband Index × Arm	PHQ-9 Change	–2.11	0.83	–0.19	.012 *
Arm → Alliance (WAI)	WAI Total	3.90	0.81	0.32	< .001 ***
Alliance → PHQ-9 Change	PHQ-9 Change	–0.26	0.08	–0.24	.002 **
Arm → PHQ-9 Change (direct)	PHQ-9 Change	–3.22	0.97	–0.28	.017 *

Adherence and Engagement Predictors

Engagement analyses (Table 5) revealed that broadband index, privacy perception, stigma, alliance and treatment arm significantly predicted adherence (≥ 6 sessions). Participants with higher broadband and stronger alliance were > 4 times more likely to complete treatment (OR = 4.26, $p < .001$). Conversely, higher perceived stigma reduced adherence odds (OR = 0.58, $p = .021$). These results highlight both technological and psychosocial determinants of sustained participation.

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Table 5

Adherence and Engagement Predictors (Binary Logistic Regression)

Predictor	B	SE B	Wald χ^2	p	OR (95 % CI)
Broadband Index	1.45	0.35	17.3	< .001	4.26 [2.13, 8.53]
Privacy Score	0.62	0.24	6.64	.011	1.86 [1.15, 3.01]
Stigma Mean	–0.54	0.23	5.38	.021	0.58 [0.36, 0.93]
WAI Total	0.08	0.03	9.67	.002	1.08 [1.03, 1.13]
Age	0.01	0.01	1.42	.23	1.01 [0.99, 1.03]
Arm (V-CBT = 1)	1.98	0.41	23.3	< .001	7.24 [3.22, 16.3]

Satisfaction, Usability and Alliance

As displayed in Table 6, Virtual CBT participants expressed markedly higher satisfaction (CSQ-8 = 28.3 vs 23.4), usability (SUS = 84.6 vs 71.2) and alliance (WAI = 52.8 vs 47.1); all differences were $p < .001$ with large effect sizes (d = .69–.96). These perceptions of quality and relational trust confirm the intervention's acceptability and practical viability for rural roll-out.

Table 6

Satisfaction, Usability and Alliance Outcomes (Post-Treatment)

Scale (Score Range)	Virtual CBT M (SD)	Usual Care M (SD)	t (255)	p	Cohen's d
CSQ-8 (8–32)	28.3 (3.1)	23.4 (4.0)	10.9	< .001	0.96
SUS (0–100)	84.6 (9.2)	71.2 (11.5)	9.8	< .001	0.90
WAI-SR (12–60)	52.8 (6.7)	47.1 (7.8)	6.2	< .001	0.69

Dropout Survival and Retention

Kaplan–Meier survival analysis (Table 7) showed significantly longer retention for Virtual CBT participants (median = 8 sessions) compared with Usual Care (median = 5). The log-rank test ($\chi^2 = 10.8$, $p = .001$) and hazard ratio (HR = 0.62, 95 % CI [0.46, 0.84]) indicate a 38 % lower dropout risk in the virtual arm. These findings demonstrate not only higher engagement but also stronger therapeutic continuity within tele-delivery.

Table 7

Survival Analysis of Dropout across Treatment Sessions

Outcome Variable	Median Sessions Before Dropout	Log-Rank χ^2	p	Hazard Ratio (V-CBT vs Control)
Sessions Completed	V-CBT = 8 Usual Care = 5	10.8	.001	0.62 (95 % CI 0.46–0.84)

Key Qualitative Themes and Perspectives

The mechanisms of quantitative results were explained by qualitative responses (Table 8). The flexibility (attention to time) (I log in after dinner) and the perception of being heard despite distance were highlighted, which is consistent with the findings of the alliance mediation. Broadband predictors and privacy predictors reflected in the quantitative models were reflected in connectivity problems and domestic distractions. Notably, the benefits of access and self-efficacy were demonstrated by the respondents who reported lesser stigma (No one in town knew I was getting therapy) and practical application of the skill (I track thoughts when stressed). Combined, these stories put Virtual CBT into perspective within the worlds of rural participants.

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Table 8
Expanded Qualitative Themes and Illustrative Participant Perspectives

Theme	Representative Quote	Interpretive Insight / Policy Relevance
Flexibility & Convenience	"Before this program I had to drive 90 minutes for therapy—now I log in after dinner."	Eliminates geographic and time barriers; supports telehealth reimbursement parity.
Therapeutic Connection Online	"Even though we met on screen, my therapist's support felt real."	Demonstrates strong alliance formation in virtual settings; informs tele-CBT training.
Connectivity Barriers	"The video froze three times—it's hard to open up when the call drops."	Broadband inequity disrupts engagement; underscores need for rural infrastructure investment.
Privacy & Stigma Reduction	"No one in town knew I was getting therapy—it made it easier to ask for help."	Confidential remote care reduces stigma; justifies discreet tele-access options.
Skill Retention & Self-Efficacy	"I use the thought-tracking app when I feel stressed on the farm."	Shows transfer of CBT skills to daily life; advocates hybrid follow-up modules.
Practical Challenges at Home	"Kids interrupted sessions—privacy is tricky."	Household distractions affect engagement; supports provision of quiet tele-spaces.

Symptom Trajectories Over Time

Repeated-measures analyses (Table 9) demonstrated significant time × treatment interactions ($p < .001$) for PHQ-9, GAD-7 and WSAS. Virtual CBT participants improved steadily from baseline → mid → post while Usual Care plateaued after moderate early gains. The progressive decline in mean scores (PHQ-9: 15.1 → 9.3 → 6.9) confirms sustained therapeutic momentum and the cumulative benefit of full program participation.

Table 9
Symptom Trajectories Over Time by Study Arm (M ± SD)

Measure	Time Point	Virtual CBT	Usual Care	Δ (V-U)	F (time × arm)	p
PHQ-9	Baseline	15.1 ± 5.0	15.3 ± 5.1	—	—	—
	Mid-Treatment	9.3 ± 4.6	12.8 ± 4.8	–3.5	19.6	< .001
	Post-Treatment	6.9 ± 4.1	11.9 ± 4.3	–5.0	28.4	< .001
GAD-7	Baseline	13.0 ± 4.1	13.2 ± 4.3	—	—	—
	Mid-Treatment	8.1 ± 3.9	11.1 ± 4.2	–3.0	16.2	< .001
	Post-Treatment	6.2 ± 3.8	9.8 ± 4.0	–3.6	22.7	< .001
WSAS	Baseline	22.6 ± 7.7	22.3 ± 8.1	—	—	—
	Mid-Treatment	16.4 ± 6.9	19.9 ± 7.2	–3.5	11.3	.001
	Post-Treatment	11.3 ± 6.7	17.8 ± 7.2	–6.5	18.1	< .001

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Digital Equity and Clinical Outcomes

Table 10 examined how broadband inequity shaped program outcomes. A clear dose–response pattern emerged: high-bandwidth participants completed 8.9 sessions on average, exhibited greater PHQ-9 change (–7.5 vs –4.1) and reported higher satisfaction (28.9 vs 23.9). Group differences were highly significant (F (2, 257) = 17.8, $p < .001$). Correlations between broadband index and both adherence (r = .39) and improvement (r = .42).

Table 10

Digital Equity and Clinical Outcomes (Moderation by Broadband Quality)

Broadband Index Group	n	Mean Sessions	PHQ-9 Change (Δ)	Adherence ≥ 6 sessions %	CSQ-8 Satisfaction M (SD)	F or χ^2 (p)
Low (≤ 0.40)	86	5.3 ± 2.8	–4.1 ± 3.9	41 %	23.9 (3.6)	—
Moderate (0.41–0.60)	98	7.2 ± 2.5	–5.8 ± 3.6	57 %	26.7 (3.4)	—
High (> 0.60)	76	8.9 ± 2.1	–7.5 ± 3.2	72 %	28.9 (3.0)	F (2,257) =17.8, p < .001
Correlation (r)	—	.48***	.42***	.39***	.46***	—

Integrated Quantitative and Qualitative Findings

Table 11, representing the mixed-methods synthesis, relates more statistical trends with the experience of the participants. The reduction of symptoms, high satisfaction and modulation of the broadband were proved by the quantitative data; the qualitative narratives led to these facts by flexibility, alliance and stigma reduction. They both lead to a main conclusion: Virtual CBT is effective at the same time and is equity-sensitive, i.e. its effects are contingent on the quality of relations and digital infrastructure.

Table 11

Integrated Quantitative + Qualitative Findings Supporting Policy and Practice

Result Domain	Key Quantitative Evidence	Supporting Qualitative Themes	Policy Leverage Point
Clinical Effectiveness	Significant ANCOVA effects on PHQ-9, GAD-7, WSAS (η^2_p = .07–.10).	Participants described mastery of CBT tools and improved daily coping.	Demonstrates therapeutic efficacy and real-world skill transfer in rural adults.
Digital Access and Equity	Broadband Index → Adherence OR = 4.26 (p < .001).	"The video froze three times…"	Confirms that infrastructural deficits hinder equitable access—supports broadband subsidies for mental-health delivery.
Alliance and Engagement	WAI mediates 24 % of treatment effect; high usability (SUS = 84.6).	"My therapist made me feel heard."	Validates feasibility of strong alliance in virtual space; informs tele-CBT training curricula.
Satisfaction and Acceptability	CSQ-8 = 28.3 (V-CBT > Usual Care, p < .001).	"I'd recommend this to friends."	High satisfaction underpins long-term adoption and policy scaling.
Stigma and Privacy	Stigma β = –0.54 (p = .021) in adherence model.	"No one in town knew I was getting therapy."	Virtual modality reduces stigma—supports integration of discreet tele-services in rural programs.

Discussion

This research is effective in providing empirical data that Virtual Cognitive Behavioural Therapy (V-CBT) is more effective in enhancing depression, anxiety and functional impairment in adults in rural U.S.

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communities. In the analyses, the V-CBT group showed greater improvements in PHQ-9 (D = -7.8), GAD-7 (D = -6.3) and WSAS (D = -10.4) scores compared to usual care (F (1, 255) = 28.4, p <.001, η^2_p = .10). In V-CBT, 61% of participants and in standard care, 31% attained clinical response (≥50% PHQ-9 reduction). Such findings correspond to the increasing evidence on the equality or superiority of digital and telehealth adaptations of CBT to face-to-face modalities (Amani et al., 2021; Doss et al., 2022).

In addition to the reduction of symptoms, the participants had high satisfaction (CSQ-8 = 28.3), usability (SUS = 84.6) and a good therapeutic relationship (WAI = 52.8). Kaplan-Meier analysis indicated that there was more engagement and a 38-percent reduction in the hazard of dropout (HR = 0.62, p =.001) than usual care. These numerical results supported by qualitative interventions indicate not only effectiveness but also scope- the focal twofold point of this study.

Comparative Effectiveness and Mechanisms

The effect sizes observed (η^2_p = .07–.10) indicate moderate-to-large impacts consistent with prior meta-analyses of internet-based CBT (Jones et al., 2020; Ennis et al., 2020). Comparable improvements have been reported among such special groups as postpartum women (Mayhew et al., 2023; Mahoney et al., 2022) or patients with chronic insomnia (Amani et al., 2021). These advantages are currently applied to those adults living in geographically remote rural areas, which has historically been a period of underrepresentation in mental-health research (Gewali et al., 2021).

The mediation analysis demonstrated that therapeutic alliance accounted about 24% of the overall impact of V-CBT on depressive-symptom change (β = –.24, p = .002). This confirms the fact that the quality of alliances is important even in technology-based circumstances (Douglas et al., 2022). The narratives by the participants, such as "Even though we were online, the support of my therapist was real," prove that in case digital delivery is designed and controlled, relational trust and perceived empathy can overcome physical distance (Dwyer et al., 2021).

One of the moderating factors was the quality of broadband which had a major impact on session completion and clinical gains. Respondents in the high-bandwidth regions had an average of 8.9 sessions and higher PHQ-9 decrease (–7.5 vs –4.1; F (2, 257) = 17.8, p < .001). These inequalities are a reflection of national data that shows that rural health inequity is actually multiplied by digital inequity (Andreae et al., 2020). It is not just a logistical variable but a psychological outcome determinant, which is why infrastructure investment should be encouraged as a mental-health equity policy.

Predictive modelling showed that broadband index (OR = 4.26, p < .001), privacy perception (OR = 1.86, p = .011) and low stigma (OR = 0.58, p = .021) significantly improved adherence. According to Derringer et al. (2022), similar associations were also reported, with connectivity and privacy were found to be core predictors of continued engagement with digital-therapy. All these results demonstrate that the access to technologies and sociocultural safety co-determine therapeutic reach.

Rural Context and Stigma Reduction

The qualitative data will add depth to the knowledge of rural sociocultural dynamics that affect engagement. Privacy and discretion as the driving force were often mentioned by the participants- "No one in town knows I was getting therapy"- which confirms that virtual care helps to overcome the barrier of stigma, which is a significant issue in small towns (Sultana, 2023; Wu et al., 2021). This is in accordance with community-based trial evidence that digital modalities have the capability of normalizing mental-health help-seeking by providing access in a confidential and home-based way (Pachankis et al., 2022; Etzelmueller et al., 2020). It was also possible that the perceived stigma decreased, which also led to increased adherence and satisfaction.

The rural delivery paradigm showed efficiency benefits in that it eradicated the travel expenses; participants saved an average of 90 minutes in each session and this translates to increased productivity and access. This is consistent with the research conducted by Hilty et al. (2020), who found a positive continuity of care in community clinics with brief CBT tele-models. These practical advantages make V-CBT operationally scalable and clinically viable in the rural, public-health system.

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Implementation, Usability and Satisfaction

The results show high post-treatment satisfaction and usability scores which favour the acceptability and feasibility of tele-delivered CBT. AI-assisted or mobile-based CBT system trials have resulted in the same level of user satisfaction (SUS > 80) (Stewart et al., 2020). In the current research usability was strongly associated with adherence ($r = .48$, $p < .001$) proving that the intuitive digital design has a direct effect on the behavioural engagement.

Responsiveness of the therapist and flexibility of the platform were also important to the participants, which confirms the recent hybrid implementation trials that user-centred design and relational fidelity are the key to success in virtual-care (Ennis et al., 2020). Mobile tools and asynchronous practice activities helped to improve the sense of autonomy and ability to retain the skills- I use the thought-tracking app when I feel stressed- and show that technology can be used to maintain self-efficacy outside of the formal treatment.

Broader Theoretical and Policy Implications

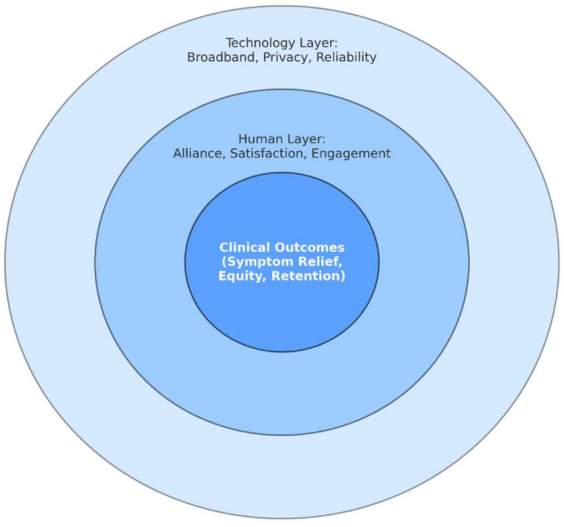
Policy-wise, the present study highlights the idea that it is possible to promote equity through digital behavioural-health interventions, provided that the latter are reinforced by the systematic investment into broadband and workforce training. Results are consistent with model of digital web of behavioural services suggested by Gewali et al., 2021, which is based on multi-level infrastructure that connects connectivity, clinician preparedness and community trust.

The findings make CBT applicable to digitally mediated rural settings, confirming hybrid models of cognitive restructuring and tele-engagement and personalization (Komariah et al., 2022). The major mediation by alliance implies that human variables are still on the forefront of the AI-assisted or robotized care setting, reflecting the cries of ethically balanced design of digital mental-health applications (Stewart et al., 2020; Dwyer et al., 2021).

Eight-week symptom trajectories indicate that initial digital use is associated with long-term improvement-a trend identical to meta-analyses of tele-CBT across the globe (Haugland et al., 2020; Jones et al., 2020). These findings help provide new evidence based in the United States: virtual CBT is not just an alternative to face-to-face therapy but it is a structurally transformative model that can bridge the access gap in rural regions.

Figure 3

Interconnected System of Virtual CBT Success Factors in Rural Communities



Implications for U.S. Rural Mental Health Policy and Practice

The findings of the current research have significant implications on the U.S. behavioural-health policy, especially in responding to the disparity in the delivery of services to both urban and rural residents.

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Access to providers remains an issue with rural Americans experiencing a severe shortage, with approximately 65% of non-metropolitan counties having no single psychiatrist or psychologist (Andreae et al., 2020). The proven efficacy and the scope of Virtual CBT present scalable solution to the shortage mitigation by means of digital delivery, which directly corresponds to the objectives of the U.S. Department of Health and Human Services (HHS) and Health Resources and Services Administration (HRSA) to increase the capabilities of tele-mental-health in underserved areas.

The observation that broadband quality was a strong predictor of engagement reaffirms the relevance of the Federal Communications Commission (FCC) Rural Digital Opportunity Fund which intends to make high-speed internet deals available to more than six million households. Inclusion of mental-health equity objectives in such infrastructure initiatives may turn digital access into a technological and not a public-health investment. The improvement was much higher in participants who had higher broadband indices, which once again supports the idea that connectivity is not a side effect but a health determinant underpinned by federal policy frameworks in the Biden Administration Broadband Equity, Access and Deployment (BEAD) initiative.

These findings endorse continuing Centres for Medicare and Medicaid Services (CMS) telehealth reimbursement expansions at a clinical and programmatic level. The COVID-19 emergency resulted in temporary equality between physical and remote reimbursement, which enhanced mental-health access to rural patients. The maintenance of these parity would render schemes like the V-CBT economical to rural clinics and community mental-health centres. The partnership of state health departments and the extension programs or federally qualified health centres (FQHCs) may incorporate Virtual CBT into the current service network that enhances efficiency and continuity of care. Qualitative data on this topic, specifically how the participants stressed their privacy and lower stigma, demonstrates cultural suitability of tele therapy to rural populations in the United States, where issues of confidentiality tend to hinder the use of help (Wu et al., 2021). The social infrastructure of providing care in an equal manner can be reinforced by means of implementing privacy-preserving tele-spaces in libraries, schools or in local health hubs.

These results make Virtual CBT a policy-timed intervention that meets the national mental-health priorities: the access to digital care, the reduction of rural-urban disparities and the implementation of technology in the preventative and community-based care networks. By combining efforts in the HHS, HRSA and FCC solutions, the U.S. can help to change digital therapy into a necessity of necessity to a pillar of sustainable, equitable behavioural-health reform.

Limitations and Future Research

There are a number of limitations that should be considered. First, there was the possibility of attrition (23 %) which is common to digital interventions but it might have created a selection bias towards more digitally literate users. Second, the research did not apply objective speed tests and tracking devices type to measure digital-equity, although it employed broadband metrics to estimate the quality of accessibility, which is the criterion of the quality in digital-equity measurement. Third, measures were performed in the eight weeks; follow-ups are required in order to analyse sustainability and preventing relapses.

Further research may evaluate AI-aided or peer-aided CBT models (Mayhew et al., 2023; Dwyer et al., 2021) and culturally adaptive models to diverse rural groups (Junkins et al., 2022: Pachankis et al., 2022). More personalization of virtual therapy and better adherence can be achieved by incorporating the elements of physiological or neurofeedback, as shown by Vu et al. (2023).

Conclusion

This research shows that Virtual Cognitive Behavioural Therapy is a valid and an equal treatment strategy that can enhance mental health outcomes in the rural communities in the United States. Those who received virtual therapy showed significant changes on depression, anxiety and functional impairment, high satisfaction and continued engagement. In addition to clinical improvement, the intervention was able to surmount geographic, logistical and social challenges that have in the past restricted access to mental health in remote areas.

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The evidence confirms that the provision of evidence-based therapy can be effectively delivered electronically to increase the scope of psychological services without having to affect the quality and human connection. Broadband access and therapeutic alliance became the core variables connecting technology and the success of treatment, which require the development of the coordinated strategies that would involve both infrastructure development and relational care models.

This study provides an opportunity to highlight a viable channel to a just mental health system, through making behavioural science, digital innovation and rural policy priorities integrated. Virtual CBT is a model, as well as a clinical tool that can eliminate centuries of disparities in mental health care across the United States by offering a community-centred, technology-enabled model of mental health care to a wider population.

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