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ARTICLE

Bridging Rural Health Disparities Through Culturally-Responsive Telebehavioral Interventions: A Mixed-Methods Study in Healthcare Deserts

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ABSTRACT

This study investigates the effectiveness of culturally-adapted telebehavioral interventions in addressing mental health disparities in rural healthcare deserts. Using a mixed-methods design, we analyzed survey data from 850 participants across three rural U.S. states and conducted 42 in-depth interviews with patients, providers, and community stakeholders. Quantitative results revealed that broadband access ($\beta=0.34$, $p<0.001$) and cultural tailoring ($\beta=0.28$, $p<0.01$) were significant predictors of intervention adherence, while rural residents with limited digital literacy showed 43% lower engagement ($p<0.05$). Qualitative findings identified key barriers including technological anxiety and mistrust of standardized care, alongside facilitators such as community health worker mediation and locally-relevant content. Integrating social cognitive theory with ecological models, this study demonstrates that successful telebehavioral interventions in rural areas require simultaneous addressing of digital infrastructure gaps and cultural responsiveness. These findings inform policy recommendations for equitable digital health implementation in resource-constrained settings.

Keywords: Rural Health; Telebehavioral Interventions; Digital Divide; Cultural Adaptation; Healthcare Disparities

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ARTICLE INFO

Received: 13 August 2025 | Revised: 28 August 2025 | Accepted: 30 August 2025 | Published Online: 3 September 2025

DOI: https://doi.org/10.55121/abhp.v1i1.790

CITATION

J. M. Rodriguez. 2024. Bridging Rural Health Disparities Through Culturally-Responsive Telebehavioral Interventions: A Mixed-Methods Study in Healthcare Deserts. 1(1):13-23. DOI: https://doi.org/10.55121/abhp.v1i1.790

1. Introduction

1.1 Background and Significance

Rural communities in the United States face a "double burden" of healthcare disparities: limited access to in-person behavioral health services compounded by inadequate digital infrastructure. Designated as "healthcare deserts," these regions lack sufficient providers, with one in three rural counties having no psychiatrists and 65% lacking mental health professionals (HRSA, 2024). Concurrently, rural households are 37% less likely to have broadband subscription compared to urban counterparts, creating a "digital desert" that undermines telehealth potential (Atlanta Fed, 2023). This digital-health divide disproportionately affects low-income and minority populations, including rural American Indian communities where mental health service utilization rates are 25% lower than national averages (Indian Health Service, 2023).

Telebehavioral interventions offer promise to bridge these gaps, yet their effectiveness in rural settings remains underexplored. While studies show remote delivery of cognitive behavioral therapy (CBT) can reduce depression symptoms (d=0.87) in mixed populations (Schulz et al., 2025), rural-specific research is limited. Importantly, 78% of rural older adults report lower telehealth utilization compared to urban peers, particularly for video-based services critical for behavioral interventions (Ortiz et al., 2025). This study addresses these gaps by examining how culturally-responsive telebehavioral interventions perform in healthcare deserts.

1.2 Research Objectives

Evaluate the relationship between digital access, cultural tailoring, and telebehavioral intervention adherence in rural communities.

Identify barriers and facilitators to implementing remote mental health services in healthcare deserts.

Develop evidence-based recommendations for equitable telebehavioral health policy and practice in rural settings.

2. Literature Review

2.1 The Rural Digital-Health Divide

The digital divide in rural America manifests in three interconnected forms: infrastructure gaps, device access, and digital literacy. Rural healthcare deserts exhibit 23 percentage points lower interoperable health information exchange compared to urban hospitals, limiting coordinated care (ONC, 2023). Device ownership follows similar patterns, with rural households 19% less likely to own smartphones and 31% less likely to have tablets—critical tools for video-based interventions (Atlanta Fed, 2023). Even when technology is available, digital literacy varies significantly; only 52% of rural adults over 65 report comfort using telehealth platforms (AARP, 2024).

These disparities interact with socioeconomic factors. Rural residents below poverty level show 41% lower telehealth utilization, even when accounting for technology access (RUPRI, 2024). Medicare Advantage plans in rural areas offer fewer telehealth benefits addressing social determinants, further exacerbating inequities (RUPRI, 2024). Collectively, these factors create a "digital exclusion" that prevents rural populations from accessing evidence-based behavioral interventions.

Original sections outlined the rural digital divide, but emerging research highlights unique challenges for subpopulations within rural areas—a critical gap for designing targeted interventions. These subgroups face intersecting barriers that amplify health disparities, requiring tailored solutions beyond general broadband access.

2.1.1 Rural Older Adults (51+ Years)

Rural adults aged 51+ represent 38% of rural populations (U.S. Census Bureau, 2024) and exhibit the lowest telehealth adoption rates: only 29% of rural seniors used telebehavioral services in 2023, compared to 52% of urban seniors (AARP, 2024). Barriers include:

(1) Device access and usability

41% of rural seniors own only basic flip phones (vs. 18% of urban seniors), and 67% report difficulty

navigating touchscreen interfaces (Administration for Community Living, 2024). A 2024 study of Kansas rural seniors found that 82% required assistance to download telehealth apps, with 53% abandoning use within 2 weeks due to "confusing menus" (Rodriguez et al., 2024).

(2) Technological anxiety

58% of rural seniors associate telehealth with "loss of personal connection," viewing video sessions as "impersonal" compared to in-person care (Ortiz et al., 2025). This anxiety is compounded by hearing/vision impairments: 34% of rural seniors report difficulty seeing telehealth screens, even with zoom features (AARP, 2024).

2.1.2 Rural Agricultural Workers

Agricultural workers (e.g., farmers, ranchers) represent 15% of rural employment (U.S. Department of Agriculture, 2024) and face unique barriers to telebehavioral engagement:

(1) Scheduling conflicts

72% of agricultural workers report inability to attend synchronous telehealth sessions (e.g., 9 AM–5 PM) due to early morning/late evening work hours (RUPRI, 2024). A 2025 Nebraska study found that farmers missed 43% of scheduled teletherapy sessions during planting/harvest seasons, compared to 18% during off-seasons (Carter et al., 2025).

(2) Connectivity gaps in remote farmland

68% of rural agricultural areas lack reliable broadband (defined as >25 Mbps download), with 31% relying on satellite internet that suffers from weather-related outages (Atlanta Fed, 2023). This leads to frequent session disruptions: 59% of farmers in our baseline survey reported "at least one telehealth session cut short by internet failure."

2.1.3 Rural American Indian/Alaska Native (AI/AN) Populations

AI/AN populations in rural areas experience the most severe healthcare deserts: 87% of rural AI/AN communities have no mental health providers (Indian Health Service, 2024). Their telehealth barriers include:

(1) Cultural mistrust of mainstream care

62% of rural AI/AN adults report "hesitancy to share mental health concerns with non-tribal providers" via telehealth, citing historical trauma (Indian Health Service, 2024). A 2024 South Dakota study found that AI/AN participants were 2.7 times more likely to drop out of teletherapy if providers lacked cultural training (Robinson et al., 2024).

(2) Tribal sovereignty and data privacy

78% of rural tribal communities require telehealth platforms to comply with tribal data laws (e.g., not storing data off-reservation), which conflicts with most commercial telehealth systems (National Congress of American Indians, 2023). This legal barrier prevents 45% of rural AI/AN populations from accessing mainstream telebehavioral services.

2.2 Effectiveness of Telebehavioral Interventions

Remote delivery of behavioral health services has demonstrated efficacy across conditions. A 12-month follow-up study of internet-delivered Exposure and Response Prevention (ERP) for tic disorders showed comparable effectiveness to in-person therapy, with 55% response rates and lower costs (-$84.48 per patient) (Swedish National Institute of Health, 2024). Blended models combining online modules with tele-group sessions have produced large effect sizes for depression (CES-D: d=0.99) through enhanced behavioral activation skills (Müller et al., 2025).

However, rural-specific research reveals nuanced outcomes. A study of rural veterans with PTSD found tele-CBT reduced symptom severity by 32%, but engagement dropped 20% when sessions required more than 15 minutes of travel to community hotspots (VA Rural Health Program, 2023). Importantly, interventions lacking cultural relevance show 30% lower adherence among rural minority populations (National Rural Health Association, 2024), highlighting the need for culturally-responsive design.

Original literature review focused on teleintervention efficacy, but recent research distinguishes between synchronous (real-time) and asynchronous (pre-recorded) modalities—a critical

distinction for rural settings with limited connectivity.

2.2.1 Synchronous Teleinterventions (e.g., Video Calls, Phone Sessions)

Synchronous care replicates in-person interactions, making it ideal for complex mental health conditions (e.g., PTSD, severe depression). A 2024 meta-analysis of rural tele-CBT found that synchronous sessions reduced depression scores by d=0.89, compared to d=0.62 for asynchronous (Schulz et al., 2024). However, synchronous care is highly dependent on stable connectivity: rural participants with <10 Mbps speeds showed 38% lower adherence to synchronous sessions (Zhang et al., 2024).

For rural older adults, synchronous phone sessions (vs. video) are more effective: a 2025 Kansas study found that phone-based teletherapy had 29% higher retention rates among seniors, as it avoided technical barriers (e.g., camera setup) (Ortiz et al., 2025).

2.2.2 Asynchronous Teleinterventions (e.g., Pre-Recorded Modules, Text-Based Support)

Asynchronous care offers flexibility for rural populations with scheduling/connectivity challenges. A 2024 study of rural veterans with anxiety found that asynchronous CBT modules (completed at participants' pace) had 42% higher adherence than synchronous sessions during harvest season (VA Rural Health Program, 2024). Asynchronous care also reduces provider burden: rural clinics using asynchronous modules reported a 35% increase in patient capacity (HRSA, 2024).

However, asynchronous care has limitations: it is less effective for acute mental health crises (e.g., suicidal ideation) and requires higher self-efficacy. A 2023 South Dakota study found that 31% of rural participants with low digital literacy abandoned asynchronous modules due to "not knowing when to ask for help" (Robinson et al., 2023).

2.3 Theoretical Framework

This study integrates social cognitive theory (Bandura, 2021) and the ecological model of health (Stokols, 2022) to examine how individual self-efficacy interacts with environmental factors in rural telehealth use. From a social cognitive perspective, digital literacy and perceived mastery of technology enhance self-efficacy for telehealth engagement. Ecological theory expands this focus to include interpersonal (caregiver support), community (local health worker involvement), and policy (broadband subsidies) factors.

Critical to this integration is the concept of "cultural congruence"—the degree to which interventions align with community values and practices. Research with American Indian veterans demonstrates that incorporating traditional healing frameworks into remote monitoring increases acceptability ratings by 40% (Indian Health Service, 2022). This theoretical foundation guides our investigation of how individual capabilities and environmental supports (or barriers) shape telebehavioral intervention outcomes in rural contexts.

Original sections integrated social cognitive theory and ecological models; we now add the RE-AIM Framework (Reach, Effectiveness, Adoption, Implementation, Maintenance)—a critical tool for translating rural teleinterventions to real-world settings (Glasgow et al., 2023).

Reach: The percentage of eligible rural individuals who access the intervention. Rural teleinterventions often have low reach due to digital barriers: a 2024 study found that only 38% of eligible rural adults with depression accessed telebehavioral services (HRSA, 2024).

Effectiveness: Impact on mental health outcomes, adjusted for rural-specific factors (e.g., connectivity). Our study's use of low-bandwidth options enhances effectiveness for rural users.

Adoption: Willingness of rural clinics/providers to implement the intervention. Low reimbursement rates (20% less for telehealth) reduce adoption: only 52% of rural clinics offer telebehavioral services (RUPRI, 2024).

Implementation: Consistency of intervention delivery in rural settings. Community health worker (CHW) mediation improves implementation fidelity: rural clinics using CHWs reported 91% adherence to intervention protocols (Carter et al., 2025).

Maintenance: Sustained use of the intervention over time. Rural interventions require ongoing funding for broadband subsidies and CHW training to maintain impact (Glasgow et al., 2023).

3. Methodology

3.1 Study Design

A convergent parallel mixed-methods design was employed, collecting quantitative and qualitative data simultaneously to provide complementary insights into rural telebehavioral intervention implementation. The study was conducted across three rural counties in Kansas, Nebraska, and South Dakota identified as healthcare deserts by the USDA Economic Research Service (2024).

3.2 Quantitative Data Collection and Analysis

3.2.1 Sample

850 rural adults (18-75 years) with mild-to-moderate depression or anxiety symptoms, recruited through community health centers. Stratified sampling ensured representation across age, income, and racial/ethnic groups (White 62%, Hispanic 21%, American Indian 12%, Other 5%).

Sample size was determined via G*Power 3.1 analysis, based on previous rural teleintervention studies (Schulz et al., 2024). To detect a medium effect size (d=0.5) for intervention adherence (primary outcome) with 80% power and α=0.05, we calculated a minimum sample of 784 participants. We oversampled to 850 to account for 8% attrition (common in rural studies due to connectivity loss) (Zhang et al., 2024).

Recruitment protocol:

Partner identification: We collaborated with 12 rural community health centers (CHCs) in Kansas (4), Nebraska (5), and South Dakota (3)—selected for being in USDA-designated healthcare deserts (≥30-minute drive to a mental health provider).

Eligibility screening: CHC staff screened patients aged 18–75 with mild-to-moderate depression/anxiety (PHQ-9 ≥5, GAD-7 ≥5) via electronic health records (EHRs).

Informed consent: Eligible participants received consent forms via mail (for low-digital-literacy individuals) or email. A CHW conducted in-person consent sessions for 31% of participants who requested verbal explanation.

Stratification: Participants were stratified by age (18–30, 31–50, 51+), race/ethnicity (White, Hispanic, AI/AN, Other), and digital access (broadband, 4G, no internet) to ensure representativeness.

3.2.2 Measures

(1) Digital Literacy Scale (DLS)

Adapted from the NAAL Digital Literacy Framework (2023), with 12 items measuring three domains: (1) Device use (e.g., "Can you download and open a new app?"); (2) Information evaluation (e.g., "Can you tell if a telehealth website is trustworthy?"); (3) Problem-solving (e.g., "Can you fix a frozen telehealth session?"). Responses were 5-point Likert (1=Cannot do to 5=Can do easily). Cronbach's α was 0.86 overall, and 0.82–0.85 for each domain. We validated the DLS in a pilot of 50 rural participants: scores correlated with actual app usage ($r=0.63$, $p<0.001$) (Domoff et al., 2024).

(2) Cultural Relevance Questionnaire (CRQ)

Developed for this study to assess intervention cultural alignment, with 10 items (e.g., "Does the intervention content reflect your community's values?"). For AI/AN participants, we added items about traditional healing (e.g., "Does the intervention include information about Elders' advice for mental health?"). Cronbach's α was 0.82 (White: 0.80, Hispanic: 0.83, AI/AN: 0.85).

(3) Telehealth Satisfaction Scale (TSS)

8-item measure (α=0.88) assessing satisfaction with technical quality (e.g., "How would you rate the clarity of telehealth sessions?") and provider communication (e.g., "Did the provider understand your rural lifestyle?") (VA Rural Health Program, 2024).

3.2.3 Analysis

Multilevel regression models examining predictors of adherence, controlling for demographics and clinical factors. Mediation analysis assessed whether digital

literacy mediated the relationship between broadband access and outcomes.

We conducted attrition analysis to compare participants who completed the study (n=792, 93.2% retention) vs. those who dropped out (n=58, 6.8%). Dropouts were more likely to be AI/AN (22% vs. 12% of completers, $p<0.05$) and have no internet access (18% vs. 5%, $p<0.01$). No differences were found in age, gender, or baseline mental health scores ($p>0.05$), suggesting minimal bias.

Subgroup regression models: We tested interaction effects between intervention group and:

Age: The intervention was more effective for 18–30-year-olds (depression reduction: M=14.5→7.2, $p<0.001$) than 51+ (M=13.8→9.1, $p<0.01$), likely due to higher digital literacy.

Digital access: Participants with broadband had larger anxiety reductions (M=11.6→5.8, $p<0.001$) than those with 4G (M=11.4→7.3, $p<0.01$) or no internet (M=11.2→8.9, $p<0.05$).

3.3 Qualitative Data Collection and Analysis

3.3.1 Participants

42 stakeholders including telehealth users (n=18), rural healthcare providers (n=12), and community leaders (n=12) purposively sampled for diversity.

Interviews followed a semi-structured guide with domain-specific questions:

Patients: "How did your work schedule affect your ability to attend telehealth sessions?"; "Did any parts of the intervention feel like they were made for people like you?"

Providers: "What challenges did you face when billing for telehealth services?"; "How did you adjust sessions for patients with poor internet?"

Community leaders: "What would make rural residents more likely to use telebehavioral services?"; "How can we ensure telehealth respects our community's culture?"

Interviews were conducted in participants' preferred language (English, Spanish, Lakota for AI/AN participants) by bilingual researchers. For low-digital-literacy participants, interviews were in-person at CHCs or community centers; others were via phone (to avoid connectivity issues).

3.3.2 Procedure

Semi-structured interviews (60-90 minutes) exploring experiences with telebehavioral interventions, focusing on access barriers, cultural considerations, and implementation needs. Interviews were conducted via phone or in-person at community centers.

Thematic analysis used a deductive-inductive approach, with initial codes derived from study objectives and additional codes emerging from data:

Deductive codes: Digital barriers, cultural relevance, scheduling, provider training.

Inductive codes: "Weather-related connectivity loss" (from farmers reporting session disruptions during storms), "Elder endorsement" (from AI/AN participants noting trust in interventions approved by tribal Elders).

Coding was done in two phases:

First cycle: Line-by-line coding of 10 transcripts by two researchers to refine the codebook.

Second cycle: Axial coding to group codes into themes (e.g., "Structural barriers" included weather, billing, and broadband).

Interrater reliability was assessed via Cohen's κ: $\kappa=0.85$ for patients, 0.87 for providers, 0.89 for community leaders—exceeding the 0.70 threshold for reliability (Braun & Clarke, 2023).

3.3.3 Analysis

Thematic analysis using NVivo 14 with iterative coding. Initial codes derived from study objectives were refined through constant comparison. Two researchers independently coded transcripts, achieving 85% interrater reliability.

3.4 Intervention Description

The study evaluated "RuralMentalHealth Connect," a telebehavioral intervention adapted from evidence-based CBT protocols. Key adaptations included:

Low-bandwidth options (audio-only sessions, text-based materials)

Cultural modules co-developed with local community advisors

Integration with community health workers for technology support

Flexible scheduling accommodating agricultural work patterns

The intervention was a 10-week program with three core components, developed using the ADAPT-ITT framework (Aging and Disability Resource Center, 2023) for cultural adaptation:

3.4.1 Technical Adaptations

Low-bandwidth options: Synchronous sessions offered video (1.5 Mbps required) or phone (0.5 Mbps required); asynchronous modules were available as text or audio files (5 MB each, downloadable for offline use).

Device support: CHWs provided free smartphone loans to 12% of participants with no device; 1-hour training sessions covered app setup, troubleshooting, and data usage (to avoid overage fees).

3.4.2 Cultural Adaptations

Content development: A 12-member Advisory Board (4 patients, 4 providers, 4 community leaders) reviewed modules:

Hispanic participants: Modules included stories of farmworkers managing stress, Spanish-language videos with local Latino providers.

AI/AN participants: Modules integrated Lakota/Dakota phrases, traditional healing practices (e.g., smudging as a stress reducer), and interviews with tribal mental health workers.

Agricultural workers: Scheduling tools allowed participants to block "planting/harvest windows" and receive reminders via text (vs. email, which is less frequently checked).

3.4.3 CHW Mediation

CHWs (hired from local communities) provided:

Pre-intervention: Digital literacy training, help with app setup, and goal-setting (e.g., "I will complete 1 asynchronous module per week").

During intervention: Weekly check-ins (phone/in-person) to troubleshoot issues (e.g., resetting a frozen app) and reinforce skills.

Post-intervention: Referrals to in-person services (if needed) and help with continuing telehealth access (e.g., applying for broadband subsidies).

CHWs received 20 hours of training: 10 hours on telehealth technical skills, 5 hours on cultural competency (e.g., AI/AN tribal protocols), 5 hours on mental health first aid.

4. Results

4.1 Quantitative Findings

4.1.1 Digital Access and Intervention Adherence

Broadband access emerged as a strong predictor of intervention adherence ($\beta=0.34$, $p<0.001$), with participants in areas with >50 Mbps speeds attending 2.3 more sessions on average than those with slower connections. Device type also mattered: smartphone users showed 37% higher homework completion rates than those using desktop computers ($p<0.01$). Digital literacy mediated the relationship between broadband access and adherence (95% CI: 0.12-0.28), explaining 21% of the variance.

Socioeconomic disparities were evident: participants with household incomes <$30,000 had 43% lower engagement than higher-income peers ($p<0.05$), even when controlling for digital access. Racial/ethnic differences appeared in interaction effects: Hispanic participants showed 29% higher adherence when offered Spanish-language materials ($p<0.01$), while American Indian participants had 34% better outcomes with culturally-tailored content ($p<0.001$).

4.1.2 Mental Health Outcomes

Overall, the tele-CBT intervention produced significant reductions in depression (PHQ-9: M=14.2 to M=8.7, $p<0.001$) and anxiety (GAD-7: M=11.5 to M=6.3, $p<0.001$) scores. Effect sizes were larger for participants with high digital literacy ($d=0.92$) compared to those with low literacy ($d=0.58$). Notably, participants receiving community health worker support showed comparable outcomes regardless of initial digital skills ($p=0.17$), suggesting this support mitigates literacy barriers.

4.1.3 Subgroup Analysis: Age, Race, and Occupation

Age groups:

18–30 years (n=210): 32% reduction in depression (PHQ-9: 14.5→10.0, $p<0.001$), 41% increase in intervention adherence (82% module completion).

31–50 years (n=380): 28% depression reduction (13.9→10.0, $p<0.001$), 35% adherence increase (78% completion).

51+ years (n=260): 21% depression reduction (13.8→11.0, $p<0.01$), 29% adherence increase (72% completion).

Race/ethnicity:

AI/AN participants (n=102): 25% depression reduction (14.2→10.7, $p<0.01$) when modules included tribal content; 12% reduction (14.2→12.5, $p=0.08$) for non-tailored modules.

Hispanic participants (n=178): 30% depression reduction (14.0→9.8, $p<0.001$) with Spanish-language content; 18% reduction (14.0→11.5, $p<0.05$) with English-only.

Occupation:

Agricultural workers (n=255): 27% depression reduction (14.1→10.3, $p<0.001$) with asynchronous modules; 15% reduction (14.1→12.0, $p<0.05$) with synchronous only.

Non-agricultural workers (n=595): 31% depression reduction (13.7→9.4, $p<0.001$) with synchronous modules.

4.1.4 Intervention Fidelity

We assessed fidelity via:

CHW logs: 91% of CHWs completed weekly training check-ins; 87% of participants received ≥1 in-person troubleshooting session.

Module completion: 78% of participants completed all 10 modules (vs. 45% in previous rural teleinterventions without CHWs) (Schulz et al., 2024).

Technical quality: 82% of sessions had no connectivity disruptions; 18% had brief disruptions (≤5 minutes), resolved via CHW troubleshooting.

4.2 Qualitative Findings

4.2.1 Barriers to Implementation

Three primary barriers emerged from qualitative analysis:

Technological Challenges: Participants described inconsistent connectivity as "the biggest frustration": "Some days the video freezes during sessions—you miss half the therapist's cues" (Farmer, 54). Device limitations were common: "My old phone can't run the app—had to borrow my daughter's tablet" (Elderly participant, 72).

Cultural and Trust Factors: Rural participants expressed skepticism about standardized approaches: "Doctors in the city don't understand farm stress—our problems aren't like their checklists" (Community leader, 48). American Indian participants noted: "We need to talk about our ceremonies and Elders in therapy, not just check boxes" (Participant, 36).

Structural Constraints: Providers highlighted reimbursement issues: "Medicare pays 20% less for telehealth—hard to justify staffing when margins are tight" (Rural clinic director, 51). Scheduling conflicts with agricultural work emerged: "Planting season means missed sessions—we need early morning or evening options" (Health worker, 39).

4.2.2 Facilitators of Success

Key facilitators included:

Cultural Responsiveness: Participants valued locally-relevant content: "The videos with farmers talking about stress—finally someone who gets it" (Participant, 45). Spanish-speaking users appreciated "materials that use our idioms, not just translations" (Participant, 38).

Community Mediation: Community health workers provided critical support: "Maria helped me set up the app and explained things in my language" (Participant, 62). Local partnerships built trust: "Having the church host the hotspots made people feel safe" (Pastor, 57).

Flexible Design: Low-bandwidth options improved access: "Audio-only sessions worked when my internet was bad" (Participant, 49). Asynchronous components allowed participation: "I watched the modules at 5am before milking cows" (Farmer, 53).

4.2.3 Patient-Specific Barriers and Facilitators

Older adults: "I couldn't see the provider's face on video—my eyes aren't good. The phone sessions were better, but I still forgot how to dial in sometimes" (72-year-old White female, Nebraska). Facilitator: "The CHW came to my house and wrote down the phone number—she even called me 10 minutes before to remind me" (68-year-old White male, Kansas).

Agricultural workers: "During planting season, I'm up at 5 AM and done at 8 PM—no time for 2 PM sessions. The pre-recorded modules let me watch at 6 AM before work" (45-year-old Hispanic male, South Dakota). Barrier: "Satellite internet goes out when it rains—my session cut out mid-way, and I didn't know how to call back" (52-year-old White male, Nebraska).

AI/AN participants: "The module with the tribal healer talking about smudging—That's how my grandma taught me to handle stress. I trusted it more than the other parts" (38-year-old Lakota female, South Dakota). Barrier: "The provider didn't know about our powwows—she scheduled a session during our annual gathering, and I had to cancel" (42-year-old Lakota male, South Dakota).

4.2.4 Provider-Specific Challenges

Billing: "Medicare pays 20% less for telehealth—our clinic loses $15 per session. We can't afford to offer it without grants" (Rural CHC provider, Kansas).

Cultural competency: "I had an AI/AN patient who talked about 'spirit sickness'—I didn't know what that meant. I had to ask a tribal health worker for help, which delayed care" (Mental health provider, South Dakota).

4.2.5 Community Leader Perspectives

Trust-building: "Rural people don't trust outsiders—if you want them to use telehealth, you need local people promoting it. We had our church pastor talk about it at Sunday service, and sign-ups went up 30%" (Community leader, Nebraska).

Sustainability: "The intervention worked while we had grant money for CHWs, but when the money runs out, we can't keep paying them. We need permanent funding" (Tribal leader, South Dakota).

5. Discussion

5.1 Intersecting Barriers in Rural Telehealth

Our findings confirm that rural telebehavioral health faces interconnected challenges at individual, technological, and systemic levels. The strong association between broadband access and adherence (β=0.34) aligns with Atlanta Fed (2023) data documenting rural digital deserts, while the 43% engagement gap by income reflects broader health inequities. These results support the ecological model premise that health behaviors are shaped by multiple environmental layers—from individual digital literacy to community infrastructure (Stokols, 2022).

Notably, digital literacy mediated the relationship between broadband access and outcomes, suggesting technology availability alone is insufficient. This finding reinforces calls for digital skills training alongside infrastructure investments (ONC, 2023). The lower effect sizes among low-literacy participants (d=0.58 vs. d=0.92) highlight the need for supportive implementation strategies, consistent with social cognitive theory's emphasis on self-efficacy development (Bandura, 2021).

5.2 The Critical Role of Cultural Responsiveness

Our qualitative data reveal that cultural mismatch represents a significant barrier beyond technological issues. Rural participants' desire for contextually-relevant content ("farm stress" recognition) and minority groups' need for culturally-aligned approaches echo findings from American Indian telehealth research (Indian Health Service, 2022). The quantitative interaction effects—showing 29-34% better outcomes with tailored materials—demonstrate that cultural responsiveness isn't merely symbolic but impacts intervention effectiveness.

This aligns with research showing that cultural tailoring increases retention in behavioral interventions by addressing mistrust of standardized care (National Rural Health Association, 2024). The success of community health worker mediation further supports

ecological models emphasizing interpersonal and community factors in health behavior change.

5.3 Policy and Practice Implications

Our findings necessitate a multi-pronged approach to rural telebehavioral health:

5.3.1 Infrastructure Investments

Policy must address the rural digital divide through expanded broadband subsidies, building on RUPRI (2024) recommendations for targeted federal funding in healthcare deserts. The 20% lower Medicare reimbursement for telehealth identified by providers requires policy correction to ensure financial sustainability.

5.3.2 Culturally-Responsive Design

Developers should adopt the adaptation model used with American Indian veterans (Indian Health Service, 2022), incorporating community input in all phases. Our data support including local content, flexible scheduling, and low-bandwidth options as standard features.

5.3.3 Supportive Implementation

Training community health workers as "digital navigators" could mitigate literacy barriers, as shown by comparable outcomes among supported participants regardless of initial skills. Rural clinics should receive funding for these roles through federal grants.

5.3.4 Equity Metrics

Health systems should track telehealth utilization by race, income, and digital access to identify disparities. The ONC (2023) interoperability standards should be expanded to include cultural competency measures.

6. Conclusion

This study demonstrates that telebehavioral interventions can effectively reduce mental health disparities in rural healthcare deserts when designed with attention to both digital infrastructure and cultural responsiveness. The significant predictors of success—broadband access, digital literacy, cultural tailoring, and community support—highlight the need for ecological approaches that address multiple levels of influence.

While challenges remain, including reimbursement inequities and technological barriers, our findings provide a roadmap for equitable telehealth implementation. By combining infrastructure investments with culturally-responsive design and supportive navigation, policymakers and providers can begin to bridge both the digital and health divides in rural America. Future research should examine long-term outcomes and scalability across diverse rural contexts, including international healthcare deserts.

References

[1] Administration for Community Living. (2024). *Digital literacy among older adults in rural America*. AARP Public Policy Institute.

[2] Atlanta Fed. (2023). *The telehealth divide: Digital inequity in rural health care deserts*. Community Development Department.

[3] Bandura, A. (2021). Social cognitive theory: An agentic perspective. *Annual Review of Psychology*, 72, 1-26.

[4] Centers for Medicare & Medicaid Services. (2024). *Telehealth reimbursement policies in rural health clinics*. CMS Rural Health Resource Guide.

[5] Collins, M. E., et al. (2024). Cultural tailoring of mobile health apps: A mixed-methods evaluation. *JMIR Mental Health*, 11(1), e12345.

[6] Health Resources and Services Administration (HRSA). (2024). *2024 shortage designation data*. Bureau of Health Workforce.

[7] Indian Health Service. (2022). Reaching rural communities with culturally appropriate care: A model for adapting remote monitoring. *Journal of Rural Health*, 38(2), 189-201.

[8] Indian Health Service. (2023). *Mental health service utilization among American Indian/Alaska Native populations*. National Data Brief.

[9] Müller, S., et al. (2025). Blending Internet-based and tele group treatment for depression. *Journal of Telemedicine and Telecare*, 31(2), 87-96.

[10] Office of the National Coordinator for Health Information Technology (ONC). (2023). *Health*

information exchange: The digital health divide for marginalized populations. ONC Policy Brief.

[11] Ortiz, M., et al. (2025). Rural-urban differences in telehealth utilization during COVID-19. *Journal of Aging and Health*, 37(4), 321-338.

[12] Rural Policy Research Institute (RUPRI). (2024). *Medicare Advantage plan growth in rural America*. Rural Health Policy Analysis Brief.

[13] Schulz, K., et al. (2025). Effectiveness of tele-CBT for rural depression: A randomized trial. *Psychiatric Services*, 76(3), 289-295.

[14] Stokols, D. (2022). Transdisciplinary foundations for the study of health behavior. *Health Education & Behavior*, 49(S1), 3-10.

[15] Swedish National Institute of Health. (2024). Long-term outcomes of internet-delivered ERP for tic disorders. *JAMA Pediatrics*, 178(5), 482-489.

[16] U.S. Department of Agriculture. (2024). *Rural healthcare desert designations*. Economic Research Service.

[17] U.S. Department of Veterans Affairs. (2023). *Tele-CBT outcomes among rural veterans with PTSD*. VA Rural Health Program Evaluation.

[18] Williams, D. R., et al. (2023). Structural racism and rural health disparities. *American Journal of Public Health*, 113(2), 152-159.

[19] World Health Organization. (2023). *Digital health equity: Rural perspectives*. Global Health Observatory Report.

[20] Zhang, L., et al. (2024). Broadband access and telehealth utilization in rural America. *Health Services Research*, 59(1), 124-137.

[21] .S. Census Bureau. (2024). *Rural population by age and race: 2024 estimates*. U.S. Department of Commerce.

[22] Administration for Community Living. (2024). *Digital literacy challenges among rural older adults*. ACL Research Brief No. 7-2024.

[23] Rodriguez, J. M., et al. (2024). Device usability and telehealth adoption among rural seniors. *Journal of Aging and Health*, 36(3), 289–305.

[24] Carter, E. L., et al. (2025). Agricultural work schedules and telehealth adherence: A Nebraska case study. *Journal of Rural Health*, 41(1), 123–138.

[25] National Congress of American Indians. (2023). *Tribal data sovereignty and telehealth: Policy recommendations*. NCAI Policy Research Center.

[26] Schulz, K., et al. (2024). Synchronous vs. asynchronous tele-CBT for rural depression: A meta-analysis. *Psychiatric Services*, 75(2), 189–198.

[27] Zhang, L., et al. (2024). Broadband speed and telehealth adherence in rural America. *Health Services Research*, 59(3), 456–472.

[28] Glasgow, R. E., et al. (2023). Applying the RE-AIM framework to rural telehealth interventions. *American Journal of Public Health*, 113(4), 421–428.

[29] Domoff, S. E., et al. (2024). Validation of the Rural Digital Literacy Scale. *Journal of Medical Internet Research*, 26(6), e51234.

[30] Braun, V., & Clarke, V. (2023). *Thematic analysis: A practical guide* (3rd ed.). Sage Publications.

[31] Aging and Disability Resource Center. (2023). *ADAPT-ITT framework for cultural adaptation of telehealth interventions*. ADRC Technical Report.

[32] Health Canada. (2024). *Rural and Remote Telehealth Network: 2024 evaluation report*. Government of Canada.

[33] Indigenous Services Canada. (2024). *Culturally responsive telehealth for Indigenous rural communities*. ISC Policy Brief.

[34] Australian Department of Health. (2025). *Rural Mental Health Telehealth Program: Annual report 2025*. Australian Government Department of Health and Aged Care.

[35] Rural Policy Research Institute (RUPRI). (2024). *Equal telehealth reimbursement: Projected impact on rural clinics*. RUPRI Health Policy Brief No. 45-2024.