



# PeerTECH: a randomized controlled trial of a peer-led mobile health intervention to improve medical and psychiatric self-management for persons with serious mental illness

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**Background:** Certified peer support specialists (CPSs) can empower individuals with serious mental illness (SMI) to engage with mobile health interventions designed to improve medical and psychiatric self-management. This study pilot-tested PeerTECH, a digital, 12-session intervention adapted from Integrated Illness Management and Recovery and delivered by CPSs, to assess its feasibility, acceptability, and preliminary effectiveness in enhancing self-management among individuals with SMI compared to peer support as usual (PSAU).

**Methods:** A two-arm pilot randomized controlled trial was conducted with individuals diagnosed with SMI and at least one medical comorbidity. Participants were randomly assigned to either PeerTECH, a 12-week structured mobile health intervention delivered by CPSs, or PSAU (peer support without mobile technology). Outcome measures related to medical and psychiatric self-management were assessed at baseline and 12 weeks. Data was analysed using linear mixed-effects regression models to compare outcomes between groups. Feasibility and acceptability were evaluated by participant retention rates, intervention adherence, and participant-reported satisfaction.

**Results:** The study demonstrated that the randomized control trial design was feasible and acceptable, with 72.73% of approached patients consenting to participate. PeerTECH delivery was engaging, with 90% of participants initiating the intervention, approximately 80% completing it, and participants engaging in text exchanges on 70% of possible days, averaging 10 text exchanges. The intervention was found to be acceptable, with 100% of participants reporting satisfaction, and safe, with no adverse events. Statistically significant improvements were observed in PeerTECH compared to PSAU in physical health outcomes, as measured by the Patient-Reported Outcomes Measurement Information System (PROMIS) Global-10 Physical Health scores ( $P=0.023$ ). Clinically meaningful improvements in the Integrated Management and Recovery Scale and PROMIS-derived utility scores (EuroQol 5-Dimension Scale, Health Utilities Index) were also observed.

**Conclusions:** The Peer-Led Mobile Health Intervention demonstrated feasibility and effectiveness in enhancing self-management among individuals with SMI and chronic comorbidities.

**Trial Registration:** This trial was registered at ClinicalTrials.gov (NCT04481737).

**Keywords:** Mobile health; serious mental illness (SMI); peer support; psychiatric self-management; digital health intervention

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## Introduction

Adults with serious mental illness (SMI), including people with bipolar disorder, schizophrenia, and persistent major depressive disorder, account for approximately 4% of the population of the United States (1). People with SMI are disproportionately affected by an early mortality health disparity of 10 to 25 years reduced life expectancy compared to the general population (1,2), most commonly attributed to chronic health conditions, i.e., obesity, cardiovascular disease, and diabetes (3-5). Early mortality in individuals with SMI is associated with inadequate self-management of psychiatric and medical conditions (6,7).

Integrated medical and psychiatric self-management interventions demonstrate strong potential in addressing medical and psychiatric symptoms and conditions in persons with SMI (7,8). Integrated self-management interventions offer strategies to help people with both medical and psychiatric conditions manage symptoms and avoid relapses (9). A growing number of mHealth (mobile health) technologies, which involve the use of mobile devices like smartphones and tablets to deliver health-related services, address medical and psychiatric challenges (10). Many people with SMI can engage with mHealth as they own and use a mobile device, ranging from 65% to 72% (11,12). However, people with SMI commonly disengage with mHealth before intervention effects occur (13-16). Barriers to sustained engagement with mHealth among people with

SMI often include issues like inadequate tech literacy, the severity of psychiatric symptoms, and socioeconomic factors such as limited access to reliable data plans (16,17).

Certified peer support specialists (CPSs) can empower individuals with SMI to engage with mHealth. CPSs are people who have been diagnosed with a mental illness and are hired, trained, and certified to provide Medicaid-reimbursable peer support services in 46 states (18). CPSs comprise one of the fastest-growing sectors of the mental health workforce providing community-based services (18-21). CPSs are known for their ability to promote personal empowerment and engage patients in services like mHealth by specifically addressing barriers such as tech literacy through hands-on training and assistance (18,22). They mitigate the impact of symptom severity by offering emotional and practical support, which can include reminders to use mHealth tools. CPSs can also help navigate socioeconomic challenges by connecting clients to affordable resources and optimizing available technology. Their role incorporates their own lived experience to customize support for individual needs, increasing the likelihood each client can effectively use digital health resources. Under the recovery model of mental health, reciprocal accountability (23,24) (i.e., meaning that CPS and patients mutually help and learn from each other) indicates autonomy, flexible expectations, shared lived experience, and bonding—all of which facilitate personal empowerment and may influence engagement in digital interventions. Promising empirical evidence indicates the combination of CPS and technology-delivered support produces high levels of patient empowerment (25-27) and engagement in mHealth in people with SMI (22). Building on previous work showing that CPSs are most effective when they can deliver interventions flexibly in community settings; rather than from an office using a desktop computer, the PeerTECH technology in this study used a dual app system: a peer-facing app and a patient-facing app (25,26). The shift from a desktop web application to a mobile app was requested by CPSs to allow CPSs to deliver interventions directly in community environments, addressing barriers identified in earlier iterations of the technology.

PeerTECH, a structured mobile health intervention and digital app, is designed to leverage the unique capabilities of CPSs in delivering integrated medical and psychiatric self-management support. This digital app adapts the principles of the Integrated Illness Management and Recovery (I-IMR) program, an in person 12-month program focused on empowering patients through technology-

### Highlight box

#### Key findings

- PeerTECH, a peer-led mobile health intervention, demonstrated feasibility, acceptability, and effectiveness in improving medical and psychiatric self-management for individuals with serious mental illness (SMI) and chronic comorbidities.

#### What is known and what is new?

- Certified Peer Support Specialists empower individuals with SMI, but few mobile health interventions like PeerTECH have been rigorously studied.
- This study supports PeerTECH's role in enhancing self-management, showing physical health improvements and promising psychiatric recovery trends.

#### What is the implication, and what should change now?

- PeerTECH has the potential to reinforce self-management outside clinical settings.
- Future studies should include diverse populations and adaptive strategies to improve digital engagement and outcomes.

mediated education and support. The I-IMR program includes a series of structured modules that cover essential topics such as understanding mental illness, medication management, coping skills for stress, and the development of a personalized recovery plan. Each module is designed to be interactive, involving both education and practical exercises, such as role-playing and problem-solving activities, to help participants apply what they learn to their daily lives. The I-IMR program also integrates cognitive-behavioral techniques to address unhelpful thoughts, as well as encourage the use of social support systems. By adapting these modules into the PeerTECH app, the intervention provides a means for participants to actively engage in their recovery journey with the support of CPSs guiding them through each step and assisting in problems or barriers encountered.

Previous preliminary findings from two single-arm, pre/post pilot studies indicated that PeerTECH could bring significant improvements in self-efficacy to manage chronic disease and personal empowerment (25,28). Additionally, there were observed non-significant improvements in medical self-management skills, feelings of loneliness, hope, and quality of life (QoL). These studies suggested the potential of PeerTECH to provide fidelity-adherent self-management training effectively. The current study aims to further examine the effectiveness of PeerTECH compared to peer support as usual (PSAU) among people with SMI and medical comorbidity (i.e., obesity, cardiovascular disease, smoking, chronic pain, and/or diabetes) aged 18+ years in a two-arm pilot randomized control trial. We present this article in accordance with the CONSORT reporting checklist (available at <https://mhealth.amegroups.com/article/view/10.21037/mhealth-24-64/rc>).

## Methods

### *Study design*

A two-arm pilot study was done in partnership with an urban, New England community mental health center that provides coordination of services, care management, and referrals for adult individuals with SMI (26). Building on findings from two prior pilot trials, this study aimed to address the high prevalence of chronic health conditions and early mortality among individuals with SMI by integrating mobile health technology with peer support to improve engagement and self-management using the PeerTECH intervention. Kate Lorig and colleagues defined

self-management as the process by which individuals with chronic conditions actively manage their health and well-being through a combination of medical management, role management, and emotional management (29).

### **Primary objective**

To assess the preliminary effectiveness of this intervention in enhancing self-management among individuals with SMI compared to PSAU as indicated by the Illness Management and Recovery Scale (IMRS).

### **Secondary objectives**

To assess the feasibility and acceptability of the intervention, along with the efficacy of other measures related to psychosocial outcomes, including empowerment (Empowerment Scale), self-efficacy (Self-Efficacy for Managing Chronic Disease Scale), loneliness (UCLA Loneliness Scale), social support (MOS Social Support Survey), hope (Herth Hope Index), health status (London Handicap Scale), and general health and QoL [Patient-Reported Outcomes Measurement Information System (PROMIS) Global-10 scale].

PeerTECH was provided through peer support specialists wearing masks within a community setting (e.g., outdoors park) or in the participant's home four times per month (across a 12-week period). The PeerTECH intervention includes both the use of the *PeerTECH* app and the structured peer support meetings, which are designed to complement each other. Peer support specialists sent text messages to participants a minimum of three times weekly throughout the study. To ensure comparability, participants in the control arm engaged in peer support sessions of equivalent frequency and duration as those in the PeerTECH arm. These sessions were facilitated in settings consistent with usual care practices without the integration of mobile technology. Study instruments were administered at baseline and 12-week. In-person or over-the-phone research assessments were performed by professionally trained interviewers. Participants in the control arm received traditional peer support with CPSs in accordance with usual and customary treatment, defined as standardized peer support without supplemental digital tools with PSAU, with fidelity to this model monitored through session checklists and supervisor reports. The study was conducted in accordance with the Declaration of Helsinki and its subsequent amendments. The study was approved by the review ethics board of State of Massachusetts (No. STUDY#02000602). Written informed consent was obtained from the subjects. This trial was

registered at ClinicalTrials.gov (NCT04481737), where the full protocol is available for access.

### ***Participants recruitment and eligibility***

The following criteria had to be met in order for a patient to participate in the study: (I) an adult living in the community; (II) 18 years or older; (III) diagnosed with bipolar disorder, schizophrenia, major depressive disorder, or schizoaffective disorder; (IV) at least one medical condition, defined as diabetes, chronic obstructive pulmonary disease, obesity (body mass index of 30 or higher), cardiovascular disease, chronic pain, high cholesterol, current tobacco use, or hypertension, as determined by chart review; (V) ability to speak and read English; (VI) willingness to provide voluntary informed consent; and (VII) eligibility for Medicaid reimbursement. Community-dwelling was defined as living in the community independently. SMI was defined broadly to include major depressive disorder due to its severe impact on social and occupational functioning, which aligns with the substantial disability and self-management challenges often seen in traditionally defined SMI conditions. SMI diagnosis was determined by chart review. Having a personal smart device was not an eligibility requirement and devices were provided if participants did not have their own. Eligibility requirements were conducted with baseline surveys and both baseline and end-of-intervention surveys took 1-hour to complete. Participants were compensated 30\$ via cash or gift card of their choice for their time. Participants were excluded from the study if they met any of the following criteria: (I) a documented diagnosis of dementia or signs of notable cognitive impairment, as reflected by a Mini Mental Status Examination (30) score of less than 24; (II) significant motor or visual impairments, determined by difficulty in turning on a smartphone or an inability to clearly view the screen; (III) current substance use disorder (SUD).

### **Participant compensation**

Participants received \$30 for each research assessment session they completed, including baseline and 12-week end-of-intervention visits. Compensation was provided as cash or gift cards, depending on participant preference.

### ***Peer recruitment and eligibility***

#### **Peer support recruitment**

The supervisor of peer support specialists at the research

site selected individuals to be trained in delivering PeerTECH. The supervisor evaluated employees' interest in the study and provided recommendations to the PI. All peer support specialists who expressed interest underwent PeerTECH training. Prior to this, all peers had completed the Massachusetts CPSs training, a requirement for working as certified peer specialists at the community mental health center. Certification was granted by the state of Massachusetts, following a 10-week training program that included six full-day training sessions and a three-day retreat (28). The participants included nine peer support specialists, ranging in age from 25 to 54 years (mean age: 39 years), with employment durations as peer support specialists spanning 1 to 11 years (mean: 4.25 years). All had access to a work-funded smartphone and data plan. During the PeerTECH study, their workload increased from 30 to 40 hours per week.

#### **Peer support eligibility**

Peer support specialists were recruited from a single community mental health site for both the control and PeerTECH group; eligibility included: (I) trained and accredited CPSs in the state of Massachusetts; (II) aged 18+ years; (III) ability to speak and read English; (IV) willingness to provide voluntary informed consent; (V) currently in recovery for SMI and chronic health as self-reported by peer support specialist; and (VI) employed at community mental health center research site.

#### **PeerTECH training**

After expressing interest in the study, peer support specialists completed PeerTECH training, which consisted of 16 hours of in-person instruction over two consecutive days. The training included the following components: (I) emphasizing the significance of addressing physical, mental, and social health; (II) incorporating recovery strategies into medical challenges; (III) foundational PeerTECH practices such as psychoeducation, coping skills training, and peer support; (IV) developing meaningful, attainable goals and corresponding action steps with participants; (V) facilitating PeerTECH sessions through smartphone use; (VI) organizing weekly sessions and managing text-based interactions between peers and participants; (VII) instructing participants on how to navigate and use technology; (VIII) approaches to sustain engagement; and (IX) purposefully applying lived experience to aid in self-management; and (X) hands-on training with the smartphone app and peer care management dashboard. All peers also

completed the Digital Peer Support Certification (25) throughout the course of the study. The Digital Peer Support Certification is a 12-week training program led by the PI, featuring two education and simulation training sessions, along with ongoing synchronous and asynchronous support, audit, and feedback. The training covers digital communication skills, technology literacy, and proficiency in using the PeerTECH system, including tasks such as downloading apps, sending SMS text messages, entering goals, saving information, adjusting smartphone volume, watching videos in the library, and providing digital peer support services. Additional topics include available digital peer support technologies, organizational policies and compliance, maintaining boundaries between work and personal life, digital crisis intervention, and ensuring privacy and confidentiality.

### **Peer supervision**

Peer support specialists met individually with a peer supervisor, who was also a CPSs and trained supervisor, either in person or by phone for one hour each week. These meetings focused on challenges related to working with participants in PeerTECH and issues with the PeerTECH technology. Supervision sessions helped identify whether peers required additional technical support for PeerTECH or if participants needed extra services or assistance with the PeerTECH smartphone application.

### ***PeerTECH intervention description and implementation***

PeerTECH is offered on iOS and Android and can be accessed on a smartphone or a tablet. The app has both a client-facing portion and a CPS-facing portion. The client-facing portion allows participants to access educational content, track their goals, receive reminders, and communicate with their CPS through text messages. The CPS-facing portion includes tools for guiding the intervention, monitoring progress, and maintaining fidelity to the protocol. PeerTECH includes weekly one-on-one in-person meetings. In the intervention, CPSs are responsible for facilitating the sessions, providing guidance, and using their lived experiences to support the clients. Clients are expected to engage with the app to track their progress and apply the self-management skills discussed during meetings. Participants in the PeerTECH intervention engaged with CPS providers for a total of 12 hours over the 12-week period, through weekly 1-hour in-person sessions and text messages between in-person meetings (*Table 1*). If a

participant missed a week, the material was covered during subsequent sessions to ensure all modules were completed. Progress on the app was tracked through weekly CPS reports. Additionally, participants could independently access app resources at any time. Each meeting includes the following (I) scripted content to guide the CPS in fidelity-adherent delivery of medical and psychiatric self-management skill development on the CPS-facing app; (II) peer-led videos to watch together to facilitate experiential self-management instruction tasks; and (III) prompts to share lived experience.

### **Texting patients between PeerTECH meetings (12-week during intervention)**

Texting occurs in between in-person meetings. Based on CPS recommendations from two previous studies similarly piloting the integration of technology and peer support, CPSs are encouraged to send at least 3 text messages weekly (25,26). Texting strategies include: peer support, appointment reminders, reinforcement (e.g., goals), and self-management techniques (e.g., selected YouTube videos on self-management techniques).

### **Comparison condition—PSAU**

Peer support, as usual, is the standard Medicaid-reimbursable peer support training. Medicaid-reimbursable peer support is often viewed as listening, sharing one's lived experiences with mental health and chronic health conditions, and role modeling. Real-world CPS delivery is on an "as requested" basis by a patient and does not conform to standardized weekly meetings. As such, to simulate real-world conditions and equipoise in CPS contact hours, CPSs met with a patient for one hour for a minimum of six meetings over the course of 12 weeks in a community-based setting. Aligned with Medicaid reimbursable peer support, this arm will include the following: (I) goal selection; (II) identifying activities to achieve goals; (III) discussion of progress towards goals; (IV) CPSs sharing lived experience of similar challenges and how they overcame them; and (V) referral.

### ***Fidelity assessment***

The principal investigator monitored intervention fidelity through (I) daily monitoring of the peer care management dashboard, which displayed the text messages exchanged between peer support specialists and recipients; (II) a self-reported fidelity form uploaded securely every week; and (III) weekly discussions between the principal investigator

**Table 1** 12-week PeerTECH weekly one-on-one in-person meeting

Meeting	PeerTECH
1. Orientation to PeerTECH	<p>Scripted PeerTECH library content: CPSs meet with patients in-person to develop rapport. CPSs conduct an app task proficiency test through experiential learning and feedback. CPSs explain PeerTECH monitoring for safety and emergencies procedures</p> <p>PeerTECH lived experience prompts: CPSs are prompted to discuss their experience learning to use technology to establish credibility, trust, and model technology use</p>
2. Discovery/reinforcement of PeerTECH app features	<p>Scripted PeerTECH library content: experiential learning using the PeerTECH app features and feedback. PeerTECH app training can be accomplished in 1–2 meetings</p> <p>PeerTECH prompts: CPSs are prompted to discuss their experience learning how to use technology and model confidence in technology use</p>
3. Identify recovery and wellness goals	<p>Scripted PeerTECH library content: dyadic discussion of recovery and personalized goals associated with medical and mental health</p> <p>PeerTECH prompts: CPSs are prompted to share their recovery and wellness story, if deemed an appropriate time to share their journey</p>
4. Psychoeducation on SMI and chronic health conditions	<p>Scripted PeerTECH library content: dyadic discussion of information about SMI and health conditions (e.g., cardiovascular disease, obesity, diabetes) that patient is experiencing</p> <p>PeerTECH prompts: CPSs are prompted to discuss their experience of medical and psychiatric conditions and self-management</p>
5. Stress vulnerability and illness	<p>Scripted PeerTECH library content: dyadic discussion of the causes of SMI (trauma, biological, etc.) and protective factors (self-management) that can offset challenges</p> <p>PeerTECH prompts: CPSs are prompted to discuss their lived experience of medical and psychiatric conditions and discuss self-management techniques</p>
6. Psychiatric and medical relapse prevention	<p>Scripted PeerTECH library content: dyadic discussion on identifying warning signs of a psychiatric/medical relapse and developing a relapse prevention plan. Patients are encouraged to add their plan and their daily self-management task list to the app</p> <p>PeerTECH prompts: CPSs are prompted to discuss their lived experience of the warning signs when medical and psychiatric conditions worsen and self-management techniques</p>
7. Medication adherence	<p>Scripted PeerTECH library content: dyadic discussion on using medications effectively. Activities include behavioral tailoring for medication adherence. Optional: patients are encouraged to add their medication schedule to the app to be sent reminders to take medications</p> <p>PeerTECH prompts: if a CPSs chooses to take medications, discussions focus on their experience taking medications. If they don't take medications, CPS focuses on scripted content</p>
8. Coping w/stress and psychiatric symptoms	<p>Scripted PeerTECH library content: dyadic discussion of the coping skills training and identifying stressors that exacerbate medical symptoms and strategies to cope with stress</p> <p>PeerTECH prompts: CPSs are prompted to discuss lived experience of stress-reduction</p>
9. Coping w/stress, and medical symptoms	<p>Scripted PeerTECH library content: dyadic discussion of coping skills (e.g., deep breathing) and identifying stressors that exacerbate medical symptoms and strategies to cope with stress</p> <p>PeerTECH prompts: CPSs are prompted to discuss their lived experience of stress-reduction</p>
10. Building social supports	<p>Scripted PeerTECH library content: dyadic discussion on social skills training (e.g., experiential-instruction starting conversations with people)</p> <p>PeerTECH prompts: CPSs are prompted to discuss their lived experience of social support</p>

**Table 1** (continued)

Table 1 (continued)

Meeting	PeerTECH
11. Navigating the mental health and medical system	Scripted PeerTECH library content: dyadic discussion of self-advocacy within the mental health and medical healthcare system (e.g., experiential-instruction)  PeerTECH prompts: CPSs are prompted to discuss their lived experience of accessing services, advocating for themselves, and making informed decisions about healthcare
12. Graduation celebration	Scripted PeerTECH library content: dyadic discussion of their experience with PeerTECH, summarize goals, progress, and discuss how to incorporate gains moving forward  PeerTECH prompts: CPSs are prompted to discuss their experiences over the past 12 weeks

CPSs, certified peer support specialists; SMI, serious mental illness; w/stress, with stress.

and peer supervisor. The principal investigator completed the non-interventionist PeerTECH fidelity instrument for each PeerTECH class over the 12-week intervention and provided an ongoing evaluation of their work to peer support specialists and the peer supervisor.

### Primary measure

Study instruments were administered at baseline and 12 weeks by a trained rater (study staff). Research interview data were entered into REDCap. Instruments were chosen to reflect peer support intervention targets described in the research literature (i.e., social support, empowerment, hope (19,31,32) and mechanisms to promote engagement in psychiatric and medical self-management behaviors [i.e., self-efficacy (33) and loneliness (34)].

The client-rated IMRS was the primary outcome of this study, used to assess psychiatric self-management skill development (35). The IMRS is a valid, reliable 15-item instrument that focuses on the patient's knowledge and skills directly related to managing serious psychiatric conditions (36). An example item reads, "*how much do you know about symptoms, treatment, coping strategies (coping methods), and medication*". Response options include the following, "*not very much*", "*a little*", "*some*", "*quite a bit*" and "*a great deal*". Response options are scored on a 5-point Likert scale ranging from 1 ('Not very much') to 5 ('A great deal'). Total scores are summed and range from 15–75, with higher scores indicating higher levels of psychiatric self-management skills. The Cronbach's alpha for this scale was 0.832.

### Secondary measures

Empowerment was measured using the Empowerment

Scale (37), which is a widely used valid, reliable 28-item instrument that measures personal empowerment (35,38). Sample questions include "*I can pretty much determine what will happen in my life*" and "*people are only limited by what they think is possible.*" Response options are scored on a 4-point Likert scale ranging from 1 ('Strongly disagree') to 4 ('Strongly agree'). Consistent with scoring, scores were aggregated and averaged, in which *lower* scores indicated lower levels of empowerment, with total scores ranging from one to four. The internal consistency (Cronbach's alpha) of the Empowerment Scale in this study was 0.833.

The ability to perform health behavioral skills was assessed using the Self-Rated Abilities for Health Practices Scale (SRAHPS) (33). The SRAHPS is a 28-item scale designed to assess individuals' confidence in performing general health-related behaviors and has shown both reliability and validity among adults with disabilities (33). It is divided into four subscales, each containing seven items, which address a wide range of daily functioning beyond mental health management: (I) exercise; (II) nutrition; (III) responsible health behaviors; and (IV) psychological well-being. Trained raters ask participants to indicate how well they are able to carry out health-related tasks within each domain. Responses are recorded using a 4-point Likert scale ranging from 0 ("Not at all") to 3 ("Completely"). One sample item is, "*I am able to get help from others when I need it.*" Subscale scores are calculated by summing item responses, which are then combined to generate a total overall score. SRAHPS scores are summed and range between 0 and 112 points, with higher scores indicating higher levels of self-management skills. A Cronbach's alpha value of 0.925 was observed, suggesting strong reliability.

Self-efficacy was measured using the Self-Efficacy for Managing Chronic Disease Scale (SEMCD) (39). SEMCD has established reliability and validity in people with chronic

physical health conditions (39). Participants answer each item from a trained rater on a 1–10 point scale (i.e., one = not confident at all to 10 totally confident), and the final SEMCD score is the average of the six items. Higher scores indicating higher self-efficacy. An example item is, “*How confident do you feel that you can keep the fatigue caused by your disease from interfering with the things you want to do?*”. This instrument yielded a Cronbach’s alpha of 0.940, supporting its internal consistency.

The 12-item Herth Hope Index (40), which has shown reliability and validity in medically complex nursing home patients (41) and individuals with cognitive impairments (42) was used to measure hope for the future. Sample questions include the following, “*I feel all alone*” and “*I have short and/or long-range goals*”. Response options include the following from a 5-point Likert scale, “strongly disagree”, “disagree”, “agree”, and “strongly agree”, with higher scores indicate a higher self-reported level of hope. Scores on the Herth Hope Index are summed and range from 12–60. The internal consistency of the scale was confirmed with a Cronbach’s alpha of 0.885.

Loneliness was measured using the 3-item UCLA Loneliness Scale (34). Each of the three items was self-rated on a three-point scale, with higher values indicating greater feelings of loneliness (i.e., 1= hardly ever; 2= some of the time; 3= often). The three items are “*How often do you feel that you lack companionship?*”, “*How often do you feel left out?*” and “*How often do you feel isolated from others?*”. The numbers for each item are summed, giving a total score ranging from 3 to 9 (34,43). The 3-item UCLA Loneliness Scale has demonstrated good validity and reliability in measuring loneliness, with a high correlation ( $r=0.82$ ) with the original 20-item UCLA Loneliness Scale that it is based off (44). The scale achieved a Cronbach’s alpha of 0.751 in this study.

The Medical Outcomes Study (MOS) Social Support Survey is a 19-item validated and reliable instrument used to assess multiple domains of social support, including emotional/informational, tangible, affectionate, and social interaction support (45). Each item is scored on a 5-point Likert scale ranging from 1 (‘None of the time’) to 5 (‘All of the time’), with total scores ranging from 19 to 95. Participants were asked by trained raters how often each type of social support was available to them. Response options include the following, “*none of the time*”, “*a little of the time*”, “*some of the time*”, “*most of the time*”, and “*all of the time*”. Each domain’s score was averaged across and aggregated. Scores range from 19–95. Higher scores indicate higher levels of social support. The Cronbach’s

alpha for this scale was 0.906, indicating a high level of internal consistency.

Health status was assessed using the London Handicap Scale. London Handicap Scale is a six-item scale and has established reliability and validity in people with chronic health conditions (Cronbach’s alpha =0.83) (46). Each dimension has six levels (i.e., one = with no disadvantage and six = most severe disadvantage). Scores range from zero to one, with zero indicating zero disadvantage and six indicating most severe disadvantage. An example item reads, “*You can go where you want to go but it’s not easy*”. The Cronbach’s alpha of the scale was 0.631.

General health and QoL were assessed using the PROMIS Global-10 scale. The PROMIS Global Scale is a valid and reliable (Cronbach’s alpha >0.70) (47) 10-item instrument representing two domains, physical health and mental health. Questions include, over the past seven days, “*how would you rate your pain on average?*” and “*how would you rate your fatigue on average?*”. Each item is scored on a 5-point Likert scale ranging from 1 (‘Poor’) to 5 (‘Excellent’) or 1 (‘Never’) to 5 (‘Always’), depending on the item. Domain scores are calculated as T-scores, with a mean of 50 and a standard deviation of 10. Scale items relevant to either domain are summed, with higher scores reflecting better functioning. The internal reliability of the PROMIS Global-10 was reflected in a Cronbach’s alpha of 0.824. Given the PROMIS Global-10’s strong predictive ability for utility measures such as the EuroQol 5-Dimension Scale (EQ-5D) ( $R^2=0.65$ ) (48) and Health Utilities Index (HUI) ( $R^2=0.48$ ) (49), these estimates were also calculated from the PROMIS Global-10 data, providing additional insights into the QoL impacts of the intervention.

### *Feasibility and acceptability*

#### **Feasibility assessment**

- ❖ Recruitment: recruitment feasibility was assessed by calculating the proportion of eligible participants who consented to participate out of the total approached. Recruitment feasibility was also evaluated for certified peer support (CPS) providers, using similar methods.
- ❖ Retention and adherence: retention was evaluated by calculating the percentage of participants who completed the study through the 12-week end-of-intervention. Adherence was assessed by tracking the percentage of participants who initiated the intervention and completed the structured 12-week program. Adherence metrics also included the

frequency of text message exchanges between peer support specialists and participants. In addition, adherence to scheduled CPS visits was monitored.

### Acceptability assessment

- ❖ Participant satisfaction: participant satisfaction was measured using a brief, anonymous survey administered post-intervention. Participants rated their overall satisfaction with the intervention and its components (e.g., app usability, peer support) on a 5-point Likert scale ranging from “very dissatisfied” to “very satisfied”.
- ❖ Safety monitoring: safety was assessed by monitoring and documenting any adverse events during the intervention. Peer support specialists completed weekly check-ins with the principal investigator to report potential safety concerns or adverse events.

### Analytical plan

#### Randomization

A trained research assistant randomly assigned patient participants to either the PeerTECH or PSAU arm using a permuted block design using a computerized program to ensure 1:1 allocation using random block sizes of 2, 4, and 6. Participants were stratified by their primary diagnosis, grouping them into psychotic disorders (schizophrenia spectrum disorders) and affective disorders (bipolar disorder and major depressive disorder). A statistician with no clinical involvement prepared the block randomization in the trial. Because of the study's nature, the principal investigator, research assistant, participants, CPS supervisors, and CPS interventionists were not blinded.

#### Utility score derivation

Utility scores were derived from the PROMIS Global-10 data using established algorithms to estimate the EQ-5D and HUI. These measures were identified as key priorities by patient partners who were in collaboration in building PeerTECH. Raw PROMIS Global-10 scores were transformed into utility scores, which are standardized measures of health-related QoL that can be used in cost-effectiveness and policy evaluations. The EQ-5D estimates reflect dimensions such as mobility, self-care, and usual activities, while the HUI captures attributes like cognition, vision, and pain. Utility scores range from 0 (representing death) to 1 (perfect health). These derived scores were analyzed to compare changes between the PeerTECH and

PSAU groups.

### Statistical analyses

Means and percentages were used to describe the study sample. We assessed differential attrition by examining characteristics of the sample at baseline and 12-week end-of-intervention. Covariance pattern models (pre-post analysis with fully estimated variance-covariance parameters) were used to assess differences within individuals over time (baseline and 12 weeks) on primary and secondary outcome variables. To evaluate the preliminary effectiveness of the intervention, condition x time interactions were examined using linear mixed-effects regression models. These models accounted for both fixed effects (e.g., condition, time, and their interaction) and random effects (e.g., individual variability), allowing comparison of outcome variables between the PeerTECH and PSAU groups over time (from baseline to 12 weeks). Between-group effect sizes at endpoint were computed with Cohen's *d* by using the thresholds defined by Cohen for small (0.20), moderate (0.50), and large (0.80) effect sizes (50). Statistical analysis was conducted using STATA Version 15 (51) and R Version 4.4.1 (52).

### Results

A total of 17 participants were randomly assigned to participate in the PeerTECH program while 18 other participants were assigned to a control Peer Support group during the recruitment month of March 2019 (*Figure 1*).

Participants were matched on demographics, as shown in *Table 2*, including gender, race, ethnicity, current housing, the highest level of education, primary mental health diagnosis, and physical health diagnosis. The *t*-test (for mean difference) and chi-square test (for categories) results indicate that there were no statistically significant differences between the two groups.

Baseline and 3-month data demonstrated the randomized control trial study design was feasible and acceptable. Recruitment and randomization was feasible [n=55 patients were approached and 40 patients consented (72.73%)]. Recruitment and retention of CPSs were 100%, demonstrating the feasibility of engaging CPS providers. Further, PeerTECH intervention delivery is feasible and engaging (90% of participants initiated the intervention, approximately 80% completed the intervention, texting on 70% of possible days, averaging 10 text exchanges),

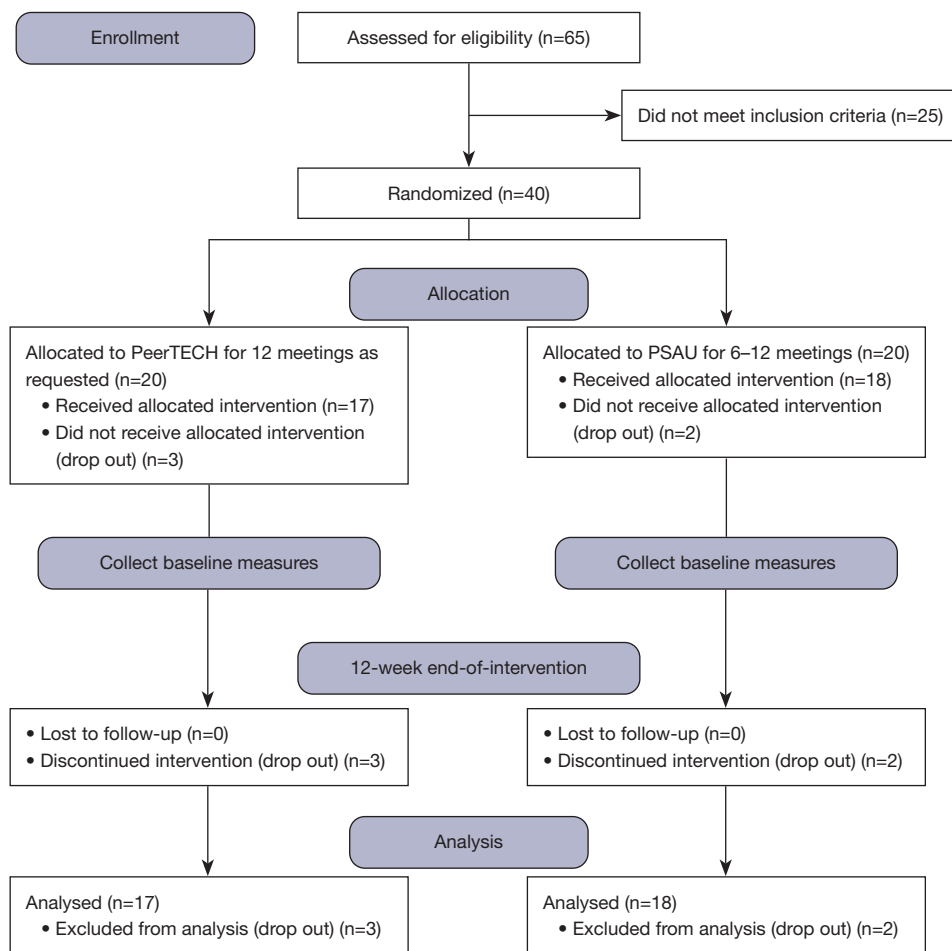


Figure 1 Consort diagram. PSAU, peer support as usual.

acceptable (100% reported satisfaction), and safe (no adverse events). Adherence to CPS visits was also 100%, with all scheduled visits either met or appropriately accounted for.

Mixed-effects regression analyses were conducted to assess pre-post treatment differences between the two intervention groups across nine instruments, as shown in Table 3. Among the instruments evaluated, the PROMIS-10 Physical Health instrument demonstrated statistically significant improvements in the PeerTECH group compared to the PSAU group (P=0.02), with a medium to large effect size (mean difference: 1.750 vs. 0.001, Cohen’s d: 0.856). Both PeerTECH and PSAU groups showed improvements in the IMRS (mean difference: 2.723 vs. 1.000, Cohen’s d: 0.161), with the PeerTECH group showing larger improvements, although these differences were not statistically significant (P=0.65).

Utility score derivation

Utility scores were derived from the PROMIS Global-10 data to estimate the EQ-5D and HUI. Analysis showed that PeerTECH led to an increase in predicted HUI scores, compared to a slight decrease in the PSAU group (mean difference: 0.750 vs. -0.062, Cohen’s d =0.415, P=0.37). Similarly, predicted EQ-5D scores showed greater improvement in the PeerTECH group compared to the PSAU group (mean difference: 1.375 vs. 0.375, Cohen’s d =0.361, P=0.41).

Discussion

The purpose of this study was to examine the feasibility, acceptability, and preliminary effectiveness of PeerTECH compared to PSAU among people with SMI and medical comorbidity (i.e., obesity, cardiovascular disease, smoking,

**Table 2** Sociodemographic of the samples assigned to PeerTECH and PSAU

Variable	PeerTECH (n=17)	PSAU (n=18)	P value	Total (n=35)
Age, years, mean (SD)	46.2 (11.9)	50.1 (10.5)	0.31	48.2 (11.2)
Gender, n (%)			0.33	
Male	10 (58.8)	8 (44.4)		18 (51.4)
Female	6 (35.3)	10 (55.6)		16 (45.7)
Transgender	1 (5.9)	0 (0.0)		1 (2.9)
Race, n (%)			0.59	
White	10 (58.8)	12 (66.7)		22 (62.9)
Black/African American	1 (5.9)	3 (16.7)		4 (11.4)
American Indian/Alaska Native	1 (5.9)	0 (0.0)		1 (2.9)
More than one race	4 (23.5)	2 (11.1)		6 (17.1)
Did not report	1 (5.9)	1 (5.6)		2 (5.7)
Ethnicity, n (%)			0.18	
Non-Hispanic/Latino	12 (70.6)	16 (88.9)		28 (80.0)
Hispanic/Latino	5 (29.4)	2 (11.1)		7 (20.0)
Highest level of education, n (%)			0.43	
Some elementary school	1 (5.9)	0 (0.0)		1 (2.86)
Some high school	2 (11.8)	0 (0.0)		2 (5.7)
High school	2 (11.8)	7 (38.9)		9 (25.7)
Some college	7 (43.8)	6 (33.3)		13 (37.1)
Associates degree	1 (5.9)	0 (0.0)		1 (2.9)
Bachelor's degree	1 (5.9)	1 (5.6)		2 (5.7)
Some graduate school	1 (5.9)	1 (5.6)		2 (5.7)
Did not report	2 (11.8)	3 (16.7)		5 (14.3)
Current housing, n (%)			0.22	
Supervised facility	1 (5.88)	0 (0.0)		1 (2.9)
Assisted/supportive housing	2 (11.8)	2 (11.1)		4 (11.4)
Supported living at home	0 (0.0)	4 (22.2)		4 (11.4)
Independent	13 (76.5)	10 (55.6)		23 (65.7)
Did not report	1 (5.9)	2 (11.1)		3 (8.6)
Primary mental health diagnosis, n (%)			0.26	
Schizophrenia	2 (11.8)	0 (0.0)		2 (5.7)
Schizoaffective disorder	8 (47.1)	6 (33.3)		14 (40.0)
Major depressive disorder	5 (29.4)	10 (55.6)		15 (42.9)
Other	2 (11.8)	1 (5.6)		3 (8.6)
Did not report	0 (0.0)	1 (5.6)		1 (2.9)

**Table 2** (continued)

Table 2 (continued)

Variable	PeerTECH (n=17)	PSAU (n=18)	P value	Total (n=35)
Physical health diagnoses, n (%)				
Arthritis	4 (23.5)	6 (33.3)	0.52	10 (28.57)
Diabetes	8 (47.1)	4 (22.2)	0.12	12 (34.3)
Heart disease	0 (0.0)	2 (11.1)	0.16	2 (5.7)
Obesity	9 (52.9)	8 (44.4)	0.62	17 (48.6)
High blood pressure	3 (17.7)	7 (38.9)	0.16	10 (28.6)
High cholesterol	7 (41.2)	6 (33.3)	0.63	13 (37.1)
Osteoporosis	1 (5.9)	2 (11.1)	0.58	3 (8.6)
Fibromyalgia	0 (0.0)	2 (11.1)	0.16	2 (5.7)
GERD	4 (23.5)	3 (16.7)	0.61	7 (20.0)
Osteoarthritis	0 (0.0)	2 (11.1)	0.16	2 (5.7)
COPD	0 (0.0)	3 (16.7)	0.08	3 (8.6)
Other	2 (11.8)	4 (22.2)	0.41	6 (17.1)

COPD, chronic obstructive pulmonary disease; GERD, gastroesophageal reflux disease; PSAU, peer support as usual; SD, standard deviation.

chronic pain, and/or diabetes) aged 18+ years. Baseline and three-month data demonstrated that the randomized controlled trial design was both feasible and acceptable, as evidenced by the successful randomization and retention rates. Recruitment and randomization were effective, with 55 patients approached and 40 consenting to participate (72.73%). These findings suggest that the PeerTECH study design is robust and can be expanded into a fully-powered study, offering a promising strategy to reinforce self-management training for patients with SMI outside of a clinical setting.

PeerTECH demonstrated promising preliminary results for improving the primary outcome, the IMRS. Participants in the PeerTECH group showed greater improvements in IMRS scores compared to those in the PSAU group (mean difference: 2.723 *vs.* 1.000, Cohen's *d*: 0.161). PeerTECH is based on the I-IMR program, a structured psychosocial intervention aimed at promoting illness self-management among individuals with SMI. The first randomized controlled trial assessing the efficacy of the original, non-peer support version of the I-IMR program was conducted by Roosenschoon *et al.*, finding that participants who received I-IMR along with care as usual (CAU) demonstrated statistically significant improvements in psychiatric illness self-management, as measured by the IMRS,

compared to those only receiving CAU ( $P=0.048$ ) (53). The trial study involved 187 participants and included 12 months of IMR treatment followed by six months of follow-up. Similarly, a more recent 2014 randomized controlled trial by Bartels *et al.*, evaluated an I-IMR program specifically for older adults aged 50 years or older with SMI (54). The study found that the I-IMR group showed statistically significant improvements in IMRS scores (Cohen's  $d=0.29$ ,  $P=0.04$ ) compared to the usual care group after the 8-month program, with a 14-month follow-up. As our pilot study had a short 12-week duration of treatment, a longer treatment duration is likely necessary to achieve significant improvements in illness self-management through I-IMR and PeerTECH. Nonetheless, the modest effect size of this study may still be clinically meaningful, as even small increases in IMRS correlate with better downstream self-management outcomes including progress towards employment ( $r=0.37$ ), housing goals ( $r=0.22$ ), and education goals ( $r=0.32$ ) (55).

The results from this pilot trial also indicate that PeerTECH can significantly improve physical health outcomes as measured by the PROMIS 10 Physical Health instrument, with a medium to large effect size (Cohen's  $d=0.856$ ). The PROMIS Global-10 prompts respondents to assess their overall physical, mental, and social well-being,

**Table 3** Changes in outcomes from baseline to post-treatment for PeerTECH and PSAU

Outcome measure	Baseline, mean (SD)	Post-treatment, mean (SD)	Change in Raw score	P value (of change)
IMRS				0.65
PeerTECH	3.226 (0.656)	3.407 (0.481)	0.182	
Peer support	3.363 (0.492)	3.429 (0.692)	0.066	
SRAHP				0.66
PeerTECH	78.500 (18.872)	76.889 (19.712)	-1.611	
Peer support	80.188 (21.967)	81.000 (18.536)	0.813	
Herth Hope Index				0.69
PeerTECH	33.867 (5.854)	34.588 (5.136)	0.721	
Peer support	33.615 (5.075)	34.500 (4.587)	0.885	
SEMCD				0.47
PeerTECH	6.519 (2.853)	6.185 (2.330)	-0.333	
Peer support	5.690 (2.345)	5.823 (2.317)	0.133	
MOS Social Support				0.15
PeerTECH	3.599 (0.820)	3.304 (0.876)	-0.295	
Peer support	3.441 (0.656)	3.556 (0.985)	0.115	
UCLA Social Support (3-item)				0.65
PeerTECH	6.647 (1.801)	6.471 (2.183)	-0.176	
Peer support	6.500 (1.789)	6.063 (1.948)	-0.438	
Empowerment Scale				0.70
PeerTECH	2.126 (0.390)	2.060 (0.381)	-0.067	
Peer support	2.207 (0.299)	2.179 (0.344)	-0.028	
PROMIS-10 Physical Health				0.02
PeerTECH	11.063 (2.265)	12.813 (1.905)	1.750	
Peer support	12.063 (2.407)	12.064 (2.323)	0.001	
PROMIS-10 Mental Health				0.96
PeerTECH	12.529 (4.679)	12.278 (4.638)	-0.251	
Peer support	12.688 (3.219)	12.750 (3.357)	-0.063	
London Handicap Scale				0.56
PeerTECH	0.7176 (0.140)	0.6694 (0.205)	-0.048	
Peer support	0.6476 (0.195)	0.6436 (0.220)	-0.004	

IMRS, Illness Management and Recovery Scale; MOS, Medical Outcomes Study; PROMIS, Patient-Reported Outcomes Measurement Information System; PSAU, peer support as usual; SEMCD, Self-Efficacy for Managing Chronic Disease; SD, standard deviation; SRAHP, Self-Rated Abilities for Health Practices; UCLA, University of California, Los Angeles.

as well as their general QoL. Notably, the items on this scale are designed to allow individuals to report a high QoL even if their life circumstances do not align with traditional

or normative expectations (e.g., an individual who has few social connections by choice could still report a high level of satisfaction with their social relationships). This flexibility

makes the PROMIS Global-10 especially relevant in diverse populations. Additionally, the scale's brevity—comprising only 10 items—makes it efficient to administer while still capturing sufficiently comprehensive information. PROMIS Global-10 scores have been shown to be predictive of healthcare utilization and mortality in both general and SMI populations (56). A previous randomized controlled trial conducted by Kelly *et al.*, demonstrated that participants in a peer support group, where peer supporters provided healthcare navigation guidance, experienced fewer pain and health symptoms (57). Healthcare utilization within the peer support group also shifted towards using primary care providers instead of relying on emergency services. Thus, peer support interventions like PeerTECH may be improving physical health outcomes through greater engagement of participants, whether that may be from empowering individuals to take control of their health, increasing interaction with more efficacious healthcare services, or fostering better self-management of chronic conditions.

Previous studies have used PROMIS Global-10 items to estimate utility scores such as the EQ-5D and HUI, for assessing quality-adjusted life years (QALYs) and conducting cost-benefit and budget analyses (58,59). Both scales have been shown to be predictive of hospitalization and mortality in patients with psychotic and mood disorders and elderly patients (60-62). When using the PROMIS Global-10 items to predict these two scales in this study, moderate improvements were found for the EQ-5D (Cohen's  $d = 0.415$ ) and HUI (Cohen's  $d = 0.361$ ) respectively. These findings further suggest that the PeerTECH intervention may have a positive impact on QoL, with utility scores providing a standardized measure that can be used in cost-effectiveness analyses and broader health policy decisions.

PSAU and PeerTECH are both active interventions and produce different results. Many peer support services do not follow standardized training protocols and often lack clearly defined competencies, roles, and responsibilities (63). According to a national survey of peer support specialists ( $N=291$ ), "peer support" emerged as the most common type of service delivered (63). While traditional peer support has been associated with increases in hope, personal agency, and the capacity to make constructive life changes, along with reductions in psychiatric symptoms (26), it generally does not follow evidence-based approaches for managing psychiatric and physical health conditions and lacks structured protocols for ensuring fidelity or tracking outcomes systematically. The findings of this pilot

trial show promising evidence PeerTECH, a systematic intervention with real-time guidance in fidelity adherent delivery, can overcome these fundamental limitations of routine peer support and provide effective evidence-based self-management training. A full-powered RCT should be conducted to rigorously evaluate the long-term effectiveness and generalizability of PeerTECH in improving self-management outcomes for individuals with SMI.

### Limitations

A few limitations should be noted. First, the 12-week intervention consisted of a small sample size, which makes potential effectiveness difficult to assess due to the limited power of the study. Additionally, the relatively short-term intervention duration may have limited our ability to detect significant changes, as some effects may require a longer time period to become evident. Second, the sample was racially and ethnically homogenous, limiting generalizability to more diverse populations. This is particularly important given the disparities in the diagnosis and treatment of SMI in racial and ethnic minority groups, who are at higher risk of reduced access, reduced utilization, and higher rate of dropouts from mental health services (64). Future fully-powered studies will verify these diagnoses through a structured clinical interview. Additionally, differences in the prevalence of major depression between groups could have favourably impacted outcomes for the PeerTECH intervention. Future studies should explore whether such differences influenced the findings. Due to PeerTECH technology system constraints, engagement measures regarding time spent either on the app, in the library, or outside of audio-recorded PeerTECH classes, as well as data on module completion rates, frequency of app usage, and time spent engaging with specific app features were not captured, limiting our understanding of engagement patterns. While participant satisfaction was reported, satisfaction among CPS providers was not formally assessed, which limits our understanding of how CPS providers perceived the intervention and its implementation process. Finally, it is also unclear to what extent improvements in self-management within the PeerTECH group were attributable to the app itself versus the additional time spent with CPS. To mimic the real-world conditions of PSAU, we allowed participants in the PSAU to request a meeting with a CPS. Future studies will require equipoise between the number of sessions. Disentangling the relative contributions of the app and the peer interaction will better inform

intervention refinement.

## Conclusions

PeerTECH, a Peer-Led Mobile Health Intervention, was feasible, acceptable, and showed promise for improving recovery and self-management outcomes among patients with SMI with chronic medical comorbidities. Future research should prioritize the inclusion of racially and ethnically diverse participants to better understand the effectiveness of PeerTECH across different demographic groups and to ensure that the intervention is culturally sensitive and equitable. Additionally, future studies should explore adaptive intervention strategies to enhance engagement and outcomes across varying levels of baseline functioning, examining potential barriers to engagement for lower-functioning consumers such as limited digital literacy, language inaccessibility, and disability inaccessibility. It may also be valuable to compare the efficacy of PeerTECH with traditional I-IMR to identify the most effective components and optimal implementation strategies, providing insight on how a digital adaptation may enhance engagement outcomes.

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## Footnote

*Reporting Checklist:* The authors have completed the CONSORT reporting checklist. Available at <https://mhealth.amegroups.com/article/view/10.21037/mhealth-24-64/rc>

*Trial Protocol:* Available at <https://mhealth.amegroups.com/article/view/10.21037/mhealth-24-64/tp>

*Data Sharing Statement:* Available at <https://mhealth.amegroups.com/article/view/10.21037/mhealth-24-64/dss>

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*Conflicts of Interest:* All authors have completed the ICMJE

uniform disclosure form (available at <https://mhealth.amegroups.com/article/view/10.21037/mhealth-24-64/coif>). K.L.F. offers consulting through Social Wellness and partners with Emissary Health, Inc. The other authors have no conflicts of interest to declare.

*Ethical Statement:* The authors are accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved. The study was conducted in accordance with the Declaration of Helsinki and its subsequent amendments. The study was approved by the institutional review ethics board of the State of Massachusetts (No. STUDY#02000602) and informed consent was obtained from all individual participants.

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