

Feasibility, Acceptability, and Preliminary Effectiveness of a Peer-Delivered and Technology Supported Self-Management Intervention for Older Adults with Serious Mental Illness

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Abstract To assess the feasibility, acceptability, and preliminary effectiveness of a peer-delivered and technology supported integrated medical and psychiatric self-management intervention for older adults with serious mental illness. Ten older adults with serious mental illness (i.e., schizophrenia, schizoaffective disorder, bipolar disorder, or major depressive disorder) and medical comorbidity (i.e., cardiovascular disease, obesity, diabetes, chronic obstructive pulmonary disease, hypertension, and/or high cholesterol) aged 60 years and older received the PeerTECH intervention in their homes. Three certified peer specialists were trained to deliver PeerTECH. Data were collected at baseline, one-month, and three-month. The pilot study demonstrated that a three-month, peer-delivered and technology-supported integrated medical and psychiatric self-management intervention (“PeerTECH”) was experienced by peer specialists and participants as feasible and

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acceptable. PeerTECH was associated with statistically significant improvements in psychiatric self-management. In addition, pre/post, non-statistically significant improvements were observed in self-efficacy for managing chronic health conditions, hope, quality of life, medical self-management skills, and empowerment. This pre/post pilot study demonstrated it is possible to train peers to use technology to deliver an integrated psychiatric and medical self-management intervention in a home-based setting to older adults with serious mental illness with fidelity. These findings provide preliminary evidence that a peer-delivered and technology-supported intervention designed to improve medical and psychiatric self-management is feasible, acceptable, and is potentially associated with improvements in psychiatric self-management, self-efficacy for managing chronic health conditions, hope, quality of life, medical self-management skills, and empowerment with older adults with serious mental illness and chronic health conditions.

Keywords Serious mental illness · mHealth · Peers

Many older adults with serious mental illness (SMI) experience challenges that impact his or her ability to remain living independently in the community compared to adults without SMI, including limited independent living skills and poor medical and psychiatric self-management skills [1]. Compared to younger adults with SMI, these challenges place older adults with SMI at increased risk of multimorbidity, hospitalizations, early placement in nursing homes, and mortality [2–5]. Integrated medical and psychiatric self-management interventions for older adults with SMI are associated with increased community tenure, independent living skills, and reduced hospitalizations [6–9]. A recent systematic review found nine effective integrated medical and psychiatric self-management interventions [10]. However, the reach of these interventions has been limited likely due to the resources required for implementation including staff time to train and deliver an intervention, intervention length, and related costs [10]. Peer specialists have been identified as a potential solution to expand the reach of these interventions [10].

Certified peer specialists (CPS) are people who have been diagnosed with a mental illness and are certified to provide Medicaid reimbursable services [11, 12]. Involving peers in service delivery has been associated with improvement in consumer engagement, social functioning, well-being, and confidence and skills to manage their own health [13]. Despite the benefits of peer-delivered services and dissemination opportunities, there are difficulties in providing peer-delivered interventions, including inconsistency in training related to requirements for certification [14], and lack of defined job functions [13]. Employing technology in service delivery offers a potentially viable tool to address these challenges by standardizing and guiding intervention delivery. To our knowledge, it is not known how peer-delivered services can be advanced through technology.

PeerTECH Program

Integrated Illness Management and Recovery (I-IMR) was identified in our systematic review [10] as having evidence of effectiveness with older adults with SMI and the potential to be delivered by peers. I-IMR is an evidence-based intervention that teaches adults aged 50 years and older with co-morbid SMI and chronic medical conditions how to self-manage medical

and psychiatric conditions [6, 15]. A clinician with a master’s degree and a nurse deliver I-IMR over 10 to 12-months [6].

“PeerTECH” is an adaptation of I-IMR. PeerTECH is delivered by a CPS augmented with a smartphone application [16, 17]. By simplifying the concepts and supporting real-time reinforcement of skills using a smartphone application, PeerTECH reduces intervention delivery time from the original 10-month program to a three-month program. PeerTECH includes in-person eModules and a smartphone application.

PeerTECH eModules PeerTECH educational eModules are designed to be reviewed together by a CPS and consumer on a tablet during one-hour, weekly, in-person sessions (see Table 1). Each eModule includes peer-led videos and text on psychoeducation and coping skills training.

Smartphone Application The smartphone application is designed to reinforce skills learned from in-person sessions. The “App” includes: (a) access to personalized self-management support; (b) intervention components that correspond to a consumers’ needs and goals; (c) medication reminders; and (d) a HIPAA-compliant chat feature. The App was developed on commercially available products from Wellframe, which allows professionals to use technology platforms to design intervention protocols.

Methods

A pre/post pilot feasibility study was conducted in collaboration with [blinded for review] and [blinded for review]. CPSs provided PeerTECH within the participant’s home four times per month (over a three-month period) and text messaged participant’s an average of three times per week. Study measures were administered at baseline, one-month, and three-month time intervals. All assessments were conducted by a trained rater at the participant’s home. This study was approved by [blinded for review] Institutional Review Board.

Table 1 PeerTECH eModule sessions

Session #1: Identifying Your Personal Recovery and Wellness Goals and Plan: Setting recovery and health goals and strategies to achieve goals to maximize functioning and orientation to the smartphone application.
Session #2: Psychoeducation: Psychoeducation on SMI and medical illness.
Session#3: Stress Vulnerability and Illness: Causes of mental illness and factors that impact its course.
Session #4: Building Social Supports and Recovery and Wellness: How to build social supports to improve well-being and sustain wellness.
Session #5: Medication Adherence Strategies: Behavioral tailoring and motivational techniques for psychiatric and medical medication adherence.
Session #6: Psychiatric and Medical Relapse Prevention: Identify warning signs and develop a relapse prevention plan for psychiatric symptoms.
Session #7: Coping with Psychiatric Symptoms and Health-related Stress and Solving Problems: Establish a step-by-step method managing psychiatric symptoms and problem solving.
Session #8: Coping with Stress, Chronic Pain and Medical Symptoms, and Solving Problems: Identifying stressors that exacerbate symptoms and strategies to cope with stress.
Session #9: Substance Abuse and Medication Misuse: Overcoming substance abuse and the effects on symptoms and functioning.
Session #10: A Guide to Navigating the Mental Health and Medical Healthcare System: Accessing mental health and medical health services and insurance benefits, making informed decisions.

Participants

The pilot study included $N = 10$ adults aged 60 years and older with SMI and medical comorbidity (see Table 2). Eligibility for participation included: (1) community-dwelling adult, (2) aged 60+, (3) diagnosis of schizophrenia, schizoaffective disorder, bipolar disorder, or major depressive disorder, and (4) at least one medical condition defined as cardiovascular disease, obesity, diabetes, chronic obstructive pulmonary disease, chronic pain, hypertension, or high cholesterol. Participants were excluded if they had a chart diagnosis of dementia, or evidence of significant cognitive impairment as indicated by a Mini Mental Status Examination [18] score of less than 24.

Measures

Measures were selected to reflect key goals described in the literature on peer support including engendering hope, facilitating empowerment, and providing social support [19–21]. To measure hope, we administered the 12-item Herth Hope Index [22] that has

Table 2 Sociodemographic characteristics of study participants ($N = 8$)

Characteristic	n (%) or mean (SD)
Age, years	
Mean (SD)	68.8 (4.9)
Range	62–77
Sex, n (%)	
Female	7 (87.5)
Male	1 (12.5)
Marital status, n (%)	
Ever married	6 (75.0)
Never married	2 (25.0)
Education, n (%)	
High school or GED	6 (75.0)
Associate's	1 (12.5)
Bachelor's	1 (12.5)
Housing status, n (%)	
Assisted/supported	4 (50.0)
Independent	4 (50.0)
Smartphone owner, n (%)	
Yes	5 (62.5)
No	3 (37.5)
Mental health disorder, n (%)	
Major depressive disorder	5 (62.5)
Schizophrenia	2 (25.0)
Bipolar disorder	1 (12.5)
Physical comorbidity, n (%)	
Obesity	6 (75.0)
Hypertension	6 (75.0)
Osteoarthritis	6 (75.0)
Diabetes	5 (62.5)
High cholesterol	4 (50.0)
Heart disease	2 (25.0)
Fibromyalgia	1 (12.5)
Chronic obstructive pulmonary disorder	1 (12.5)
Two or more chronic health conditions, n (%)	8 (100.0)

shown reliability and validity in nursing home patients [23] and people with cognitive impairments [24]. Scores range from 12 to 48 with higher the scores indicating a higher level of hope. To measure empowerment we used the Empowerment Scale [25], which was developed with consumers with SMI and is a valid, reliable 28-item scale that measures empowerment [26, 27]. Scores were totaled and averaged with a potential score of one through four, in which lower scores indicated higher levels of empowerment. The Medical Outcomes Study Social Support Survey instrument [28] was used to measure social support. Scores range from 0 to 100 possible with higher scores indicating higher levels of social support. This instrument has been used to measure social support in people with chronic health conditions and has demonstrated reliability and validity [29].

Psychiatric self-management skills were assessed with the Illness Management and Recovery Scale (IMRS) [30]. The IMRS is a valid, reliable 15-item scale that assesses domains of illness management [31, 32]. Participants score between zero to five possible points. Higher scores indicated higher levels of psychiatric self-management skills.

Medical self-management was measured with the Self-Rated Abilities for Health Practices Scale (SRAHPS) [33]. SRAHPS is a 28-item scale that assesses confidence to execute health practices that has demonstrated reliability and validity with adults with disabilities [33]. Participants score between 0 and 112 possible points. Higher scores indicated higher levels of medical self-management skills.

Quality of life was measured using the Quality of Life Enjoyment and Satisfaction Questionnaire – Short Form (Q-LES-Q-SF) [34]. The Q-LES-Q-SF has demonstrated reliability and validity with adults with mental illnesses [34]. Scores range between 14 and 70 raw points and the final score was adjusted for the non-zero minimum score and normalized to a 100 point scale. Higher scores indicated higher levels of enjoyment and satisfaction with life.

Self efficacy was measured using the Self-Efficacy for Managing Chronic Disease Scale (SEMCD) [35]. SEMCD is a six-item scale that assesses domains of self-efficacy. SEMCD has demonstrated reliability and validity in people with chronic health conditions [35, 36]. Participants respond to each item on a 1–10 point scale (1 = not confident at all to 10 totally confident) and the final SEMCD score is the mean of the six items. Scores can range from six to 60. Higher scores indicated higher self-efficacy.

Fidelity Assessment

The principal investigator and peer supervisor monitored intervention fidelity through (1) consumer engagement with the smartphone application and (2) weekly discussions between the principal investigator and peer supervisor. The principal investigator also observed a minimum of one in-person eModule session over the three-month intervention with each CPS and provided an evaluation of their work to peer interventionists and the peer supervisor.

Procedures

Peer Recruitment The Peer Liaison for the state of [blinded for review] identified peer specialists to be trained as PeerTECH interventionists. All peers completed the [blinded for review] certified peer specialists training [37] and the certified older adult peer specialist training. Peers were all aged 55 years or older, 75% were female, and 75% identified as White and 25% identified as African-American.

Training Once peers were hired, they completed the 16-h PeerTECH training. Training included: (1) background information about the importance of addressing both physical and mental health; (2) therapeutic techniques (i.e., psychoeducation, skills training, behavioral tailoring, motivational interviewing); (3) delivering eModule sessions using the tablet; and (4) using role-play to teach concepts in PeerTECH.

Peer Supervision CPSs met in-person or over the telephone with a peer supervisor once a week for one hour. Discussions centered on concerns working with participants and problems with PeerTECH technology. Peer supervision revealed if the peer needed additional support or technical assistance with the eModules or if a participant needed extra services or technical assistance with the App.

Consumer Recruitment The principal investigator met with the clinical team leader at [blinded for review] to discuss the purpose of the study and the recruitment process. The clinical team leader reviewed current consumer caseloads with case managers. Together, they identified potential participants that met inclusion criteria, telephoned the individual, and spoke with them about the study. The clinical team leader read a one-page summary of the study over the telephone to the potential participant. If they were interested in the study, they verbally agreed to meet with a trained rater and a CPS in their home.

Informed Consent During the scheduled meeting, the participant was provided a description of the study, shown the App, and informed their information was confidential and that the study was voluntary. Participants were evaluated for study criteria. If the participant met the criteria and provided informed consent to participate in the study, the trained rater completed baseline assessments. Thereafter, the CPS independently completed their first in-person PeerTECH eModule. CPSs scheduled subsequent meetings with the participant. Each participant was provided with an iPhone 4 and three-month data plan (at no cost to participant).

Statistical Analyses

Descriptive statistics were conducted to describe demographic characteristics of the study sample. A paired-sample t-test was conducted to assess the difference between baseline and three-month scores for statistical significance. Descriptive statistics and analyses were computed using STATA version 13.1.

Results

Demographic Characteristics of the Study Sample

Table 2 presents the sociodemographic characteristics of the sample at baseline. The sample of older adults had a mean age of 68.8 years ($SD = 4.9$) and was predominantly female (87.5%), White (100%), and married (75%). More than half of the sample was diagnosed with major depressive disorder (62.5%), one-quarter with schizophrenia spectrum disorders (25%), and the remainder had bipolar disorder (12.5%).

Two participants dropped out of the study. One decided after hearing about the study and completing the informed consent that he/she did not have time to participate in the study; the other met with a peer three times and decided he/she did not want to work with a CPS. The remaining eight participants completed the PeerTECH intervention and returned the smartphone without any damage at the end of the study.

Eight people (80%) participated in 10 or more in-person sessions, consistent the original I-IMR study definition of adequate exposure [6] and indicating an acceptable rate of engagement in PeerTECH. On average, 74% to 88% of participants engaged weekly with the App and 33% to 47% engaged daily. On average, participants completed 42% of all self-management tasks over the course of the intervention. Of the eight participants, four reported on the App that they took their medication daily.

The results of the baseline, one-month, and three-month post-treatment assessments for the eight participants who were exposed to the PeerTECH intervention are shown in Table 3. All of the participants demonstrated an increase in psychiatric self-management skills on the IMRS scale, with a statistically significant change from an average score of 2.38 at baseline to an average of 3.69 at post treatment (see Table 4). The post-intervention increase in psychiatric self-management remained statistically significant after correction for multiple-testing using the Bonferroni method. Five of the participants had an increase in medical self-management skills as indicated by the SRAHPS scale, while two participants reported a modest decrease in medical self-management skills, and one participant reported a decrease. Six out of eight participants reported increased levels of self-efficacy for management of chronic health conditions on the SEMCD scale while two participants reported a modest decrease in self-efficacy. On the Q-LES-Q-SF scale, five out of eight participants demonstrated modest improvement in quality of life over the course of PeerTECH, with the remaining three participants showing a decrease in quality of life.

Regarding measures of peer support (1) six out of eight participants reported increased levels of hope while two participants reported a decrease in hope; (2) five out of eight participants reported increased levels of social support while one participants reported a modest decrease in social support and two participants reported a larger decrease in social support; and (3) six out of eight participants reported increased levels of empowerment while one participants reported a modest decrease in empowerment.

Fidelity Assessment

Ongoing monitoring of PeerTECH in-person sessions and consumer engagement with the App revealed several findings with respect to adherence to the intervention. First, two of the consumers experienced initial difficulty using the App and required additional technical assistance. Second, CPSs did not provide detailed medical education to participants, but rather peers shared their personal experiences managing their own medical and mental health issues.

Discussion

The pilot study demonstrated that a three-month, peer-delivered and technology-supported integrated medical and psychiatric self-management intervention (“PeerTECH”) is feasible and acceptable for both peer specialists and participants. The pilot study demonstrated it is possible to train peers to deliver PeerTECH and integrate psychiatric and medical self-

Table 3 Results of baseline, one-month, and three-month post-treatment assessments for study participants

Measure	Subject no.	Subject no.								Average
		1	2	3	4	5	6	7	8	
SRAHP										
Nutrition	Baseline	14	10	19	24	28	22	16	26	18.75
	Month 1	12	22	24	21	25	20	–	–	20.67
	Post-treatment	19	28	16	20	25	20	28	21	22.13
Well-being	Baseline	11	0	10	18	13	10	14	14	11.25
	Month 1	14	28	15	18	19	12	–	–	17.67
	Post-treatment	18	21	90	18	26	10	20	16	17.25
Exercise	Baseline	10	8	20	15	10	0	1	7	8.88
	Month 1	15	28	12	10	17	7	–	–	14.83
	Post-treatment	20	24	7	13	25	14	12	0	14.38
Health	Baseline	22	23	26	27	28	22	17	25	23.75
	Month 1	21	26	27	23	28	20	–	–	24.17
	Post-treatment	24	27	19	21	28	24	14	26	22.88
Total	Baseline	57	32	75	84	79	54	48	72	62.63
	Month 1	62	104	78	72	89	59	–	–	77.33
	Post-treatment	81	100	51	72	104	68	74	63	76.63
I-IMR	Baseline	2.0	1.7	2.1	2.7	2.7	1.9	2.9	2.9	2.38
	Month 1	2.7	2.1	2.8	3.7	2.7	2.7	–	–	2.80
	Post-treatment	3.5	3.6	3.7	4.0	4.2	3.5	3.7	3.4	3.69
Q-LES-Q-SF	Baseline	35	38	42	54	29	37	31	41	38.39
	Month 1	58	75	52	–	67	31	–	–	56.57
	Post-treatment	50	58	48	48	58	35	40	21	44.71
Herth Hope Index	Baseline	31	33	36	33	30	33	34	34	33.00
	Month 1	34	35	36	38	32	31	–	–	34.33
	Post-treatment	34	43	38	38	34	30	31	37	35.63
SEMCD	Baseline	2.7	1.0	4.7	4.0	6.7	6.5	7.0	4.7	4.65
	Month 1	4.0	–	7.7	6.3	7.0	3.2	–	–	5.63
	Post-treatment	3.2	6.7	7.0	6.2	9.0	3.7	6.7	6.0	6.04
MOS Social Support	Baseline	42	59	66	61	48	9	29	54	46.13
	Month 1	52	50	57	66	71	52	–	–	57.96
	Post-treatment	68	86	31	59	55	45	13	70	53.53
Empowerment	Baseline	2.6	2.9	2.3	2.6	2.5	2.3	1.3	2.4	2.36
	Month 1	2.5	–	2.4	2.4	2.3	2.5	–	–	2.40
	Post-treatment	2.5	2.0	2.4	2.3	2.4	2.0	1.8	2.1	2.18

MOS Social Support The Medical Outcomes Study Social Support Survey, *IMRS* Illness Management and Recovery Scale, *SRAHPS* Self-Rated Abilities for Health Practices Scale, *Q-LES-Q-SF* Quality of Life Enjoyment and Satisfaction Questionnaire – Short Form, *SEMCD* Self-Efficacy for Managing Chronic Disease Scale

management in a home-based setting with older adults with SMI using technology with fidelity. PeerTECH was associated with statistically significant improvements in psychiatric self-management. In addition, improvements were found (though not statistically significant) in self-efficacy for managing chronic health conditions, hope, quality of life, medical self-management skills, and empowerment.

Feasibility and acceptability by peers was demonstrated through their capacity to use the eModules to deliver evidence-based components of integrated self-management on the tablet with fidelity. The PeerTECH system enabled peers to link consumer needs and preferences to standardized evidence-base intervention components. While emerging evidence exists on the potential of a national CPS workforce [14], this study highlights promising findings that technology-based interventions may ease standardization of peer delivery of evidence-based practices.

Table 4 Changes in outcomes from baseline to post-treatment (three-months) for study participants

Measure	Baseline	Post-treatment	Change (95% CI)	<i>P</i> value ^a
SRAHP	62.63	76.63	14.00 (−10.3, 38.3)	.216
IMRS	2.38	3.69	1.31 (0.93, 1.69)	<.001
Q-LES-Q-SF	34.12	44.71	10.59 (−8.4, 29.6)	.229
Herth Hope Index	33.00	35.63	2.63 (−0.9, 6.2)	.123
SEMCD	4.65	6.04	1.39 (−0.7, 3.5)	.152
MOS Social Support	39.49	53.53	14.04 (−15.5, 43.6)	.298
Empowerment	2.36	2.18	−0.19 (−0.5, 0.2)	.232

MOS Social Support The Medical Outcomes Study Social Support Survey, *IMRS* Illness Management and Recovery Scale, *SRAHPS* Self-Rated Abilities for Health Practices Scale, *Q-LES-Q-SF* Quality of Life Enjoyment and Satisfaction Questionnaire – Short Form, *SEMCD* Self-Efficacy for Managing Chronic Disease Scale

^a Two-tailed, paired t-test used to assess statistical significance

The feasibility and acceptability of PeerTECH was established through consumers' capacity to use the smartphone App, adherence to self-management task completion on the App, and in-person attendance. Specifically, participants met with a peer a total of 12 times, messaged with a peer an average of 2.6 times per day, and on average completed 42% self-management tasks over the course of the intervention. These findings suggest that peer-delivered interventions augmented by a smartphone App represents a promising strategy to reinforce self-management training for older adults with SMI outside of a clinical setting.

PeerTECH was found to be potentially effective in improving multiple domains that contribute to functioning and community tenure. To meet the complex medical and psychiatric needs of older adults with SMI, age-appropriate interventions that provide integrated illness self-management interventions may offset premature nursing home placement, hospitalization, and mortality and promote community tenure. While many people are aging with SMI and in need of both medical and psychiatric services [38], aging services for older adults with SMI are limited [38]. Partnerships between aging services and mental health services may facilitate delivery of such interventions.

Self-management skill development reported in this study is comparable to outcomes observed in other in I-IMR intervention studies [6, 15], yet PeerTECH required seven to nine months less to deliver. We attribute the potential to deliver self-management training and support as a briefer intervention due to two factors—peers and technology. First, peers are particularly effective at engaging consumers in interventions [13]. Bonding, shared lived-experience, and accountability with another person promotes engagement in technology-based interventions and health behavior change [38]. As older adults with SMI have limited health and technology literacy [39], peers may be of particular importance in technology-based interventions as they can also provide technical assistance. Second, by sharing the experience of having a mental illness, peers can quickly develop an alliance with consumers as they are viewed as having more credibility than traditional providers [11]. Therefore, peers are well positioned to motivate other individuals with mental health issues to engage in technology-based self-management activities and health behavior change [16]. Finally, technology enabled us to increase the dose of the intervention without in-person sessions. Daily self-management tasks and peer text messaging reinforced intervention components and allowed participants to use the smartphone at any time, in any location.

This study has several important limitations. First, this is a pilot study with a small sample size consistent with our primary goal of assessing feasibility. Hence, the study was not powered to detect pre/post differences. In addition, there was no control group. Therefore,

we cannot determine if the improvements were related to use of the PeerTECH system or other unaccounted for factors. Second, given that PeerTECH includes self-management training in-person and on the App, it is not possible to identify the comparative effect of either peers or the App to produce improvements. A fully-powered study could examine the relative impact of intervention components. Third, we recruited CPSs from one state. As peer certification training varies by state, we do not know if these findings generalize beyond the state of [blinded for review]. Future studies with a larger sample will allow us to control for variation in delivery by interventionist (peer). Fourth, the sample size was small and included heterogeneous grouping of psychotic disorders and mood disorders. We do not expect that diagnostic heterogeneity interfered with our results because a prior study comparing skills training and usual care among older adults (≥ 50 years old) from varying SMI groups found no differences by diagnosis with respect to self-efficacy and functional outcomes [6, 9]. Further, the sample was racially and ethnically homogenous, potentially limiting generalizability to non diverse groups. Fifth, participants' comfort level with technology was not known at the beginning of the study; however, five participants had used smartphones prior to enrolling in the study. Sixth, we modified the standard smartphone application orientation procedure, which was recommended by the technology platform company (Wellframe), which perhaps impacted participants' ability to use the App.

Conclusion

The pilot study demonstrated that it is possible to train peers to use technology to deliver PeerTECH and provide psychiatric and medical self-management in a home-based setting for older adults with SMI. These findings provide preliminary evidence that a peer-delivered and technology-supported intervention designed to improve medical and psychiatric self-management is feasible, acceptable, and provides promising preliminary evidence towards increasing self-efficacy and psychiatric self-management skills with older adults with SMI and chronic health conditions.

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Compliance with Ethical Standards

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Conflict of Interest All authors declare that he/she has no conflict of interest.

Ethical Approval All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards.

Informed Consent Informed consent was obtained from all individual participants included in the study.

References

1. Druss BG, Bradford DW, Rosenheck RA, et al. Mental disorders and use of cardiovascular procedures after myocardial infarction. *JAMA*. 2000;283(4):506–611.
2. Walker ER, McGee RE, Druss BG. Mortality in mental disorders and global disease burden implications: a systematic review and meta-analysis. *JAMA Psychiatr*. 2015;72(4):334–41.
3. Druss BG, Zhao L, Von Esenwein S, et al. Understanding excess mortality in persons with mental illness: 17-year follow up of a nationally representative US survey. *Med Care*. 2011;49(6):599–604.
4. Colton CW, Manderscheid RW. Congruencies in increased mortality rates, years of potential life lost, and causes of death among public mental health clients in eight states. *Prev Chronic Dis*. 2006;3(2):1–14.
5. Mortensen PB, Juel K. Mortality and causes of death in first admitted schizophrenic patients. *Br J Psychiatry*. 1993;163(2):183–9.
6. Bartels SJ, Pratt SI, Mueser KT, et al. Integrated IMR for psychiatric and general medical illness for adults aged 50 or older with serious mental illness. *Psychiatr Serv*. 2014;65(3):330–7.
7. Pratt SI, Bartels SJ, Mueser KT, et al. Helping older people experience success: an integrated model of psychosocial rehabilitation and health care management for older adults with serious mental illness. *Am J Psychiatr Rehabil*. 2008;11(1):41–60.
8. Pratt SI, Bartels SJ, Mueser KT, et al. Feasibility and effectiveness of an automated telehealth intervention to improve illness self-management in people with serious psychiatric and medical disorders. *Psychiatr Rehabil J*. 2013;36(4):297–305.
9. Bartels SJ, Pratt SI, Mueser KT, et al. Long-term outcomes of a randomized trial of integrated skills training and preventive healthcare for older adults with serious mental illness. *Am J Geriatr Psychiatry*. 2014;22(11):1251–61.
10. Whiteman KL, Naslund JA, DiNapoli EA, et al. Systematic review of integrated general medical and psychiatric self-management interventions for adults with serious mental illness. *Psychiatr Serv*. 2016;67(11):1213–55.
11. Solomon P. Peer support/peer provided services underlying processes, benefits, and critical ingredients. *Psychiatr Rehabil J*. 2004;27(4):392–401.
12. State Medicaid Directors Letter 07–11. Baltimore, Centers for Medicare and Medicaid Services, 2007. http://downloads.cms.gov/cmsgov/archived-downloads/SMDL/+_downloads/SMD081507A.pdf.
13. Chinman M, George P, Dougherty RH, et al. Peer support services for individuals with serious mental illnesses: assessing the evidence. *Psychiatr Serv*. 2014;65(4):429–41.
14. Salzer MS, Schwenk E, Brusilovskiy E. Certified peer specialists roles and activities: results from a national survey. *Psychiatr Serv*. 2010;61(5):520–3.
15. Mueser KT, Meyer PS, Penn DL, et al. The Illness Management and Recovery program: Rationale, development, and preliminary findings. *Schizophr Bul*. 2006;32(Suppl 1):S32–43.
16. Whiteman KL, Lohman MC, Gill L, et al. Adapting a psychosocial intervention for smartphone delivery to middle-aged and older adults with serious mental illness. *Am J Geriatr Psychiatry*. 2017;5:S1064–7481(16).
17. Whiteman KL, Lohman MC, Bartels SJ. Peer and technology supported integrated medical and psychiatric self-management intervention for older adults with serious mental illness. *Psychiatr Serv*. 2017;68(4):420.
18. Folstein MF, Folstein SE, McHugh PR. Mini-mental status: a practical method for grading the cognitive state of patients for the clinician. *J Psychiatr Res*. 1975;12(3):189–98.
19. Jacobson N, Greenley D. What is recovery? A conceptual model and explication. *Psychiatr Serv*. 2001;52(4):482–6.
20. Corrigan PW, Salzer M, Ralph RO, et al. Examining the factor structure of the recovery assessment scale. *Schizophr Bull*. 2004;30(4):1035–41.
21. Resnick SG, Fontana A, Lehman AF, et al. An empirical conceptualization of the recovery orientation. *Schizophr Res*. 2005;75(1):119–28.
22. Herth K. Abbreviated instrument to measure hope: Development and psychometric evaluation. *J Adv Nurs*. 1992;17:1251–9.
23. Haugan G, Utvaer BK, Moksnes UK. The Herth Hope Index – a psychometric study among cognitively intact nursing home patients. *J Nurs Meas*. 2013;21(3):378–400.
24. Hunsaker A, Terhorst L, Gentry A, et al. Measuring hope among families impacted by cognitive impairment. *Dementia*. 2016;15(4):596–608.
25. Rogers E, Ralph RO, Salzer MS. Validating the empowerment scale with a multisite sample of consumers of mental health services. *Psychiatr Serv*. 2010;61(9):933–6.
26. Wowra S, McCarter R. Validation of the empowerment scale with an outpatient mental health population. *Psychiatr Serv*. 1999;50(7):959–61.
27. Morris SB, Huang J, Zhao L, et al. Measurement equivalence of the empowerment scale for white and black persons with severe mental illness. *Psychiatr Rehabil J*. 2014;37(4):277–83.

28. Sherbourne CD, Stewart AL. The MOS social support survey. *Soc Sci Med*. 1991;32(6):705–14.
29. Sherbourne CS. A the MOS social support survey. Santa Monica, CA: RAND Corporation, 1993. Available at: [https:// http://www.rand.org/pubs/reprints/RP218.html](https://http://www.rand.org/pubs/reprints/RP218.html).
30. Sklar M, Sarkin A, Gilmer T, et al. The psychometric properties of the illness management and recovery scale in a large American public mental health system. *Psychiatry Res*. 2012;199(3):220–7.
31. Hasson-Ohayon I, Roe D, Kravetz S. The psychometric properties of the illness management and recovery scale: client and clinician versions. *Psychiatry Res*. 2008;160(2):228–35.
32. Salyers MP, Godfrey JL, Mueser KT, et al. Measuring illness management outcomes: a psychometric study of clinician and consumer rating scales for illness self management and recovery. *Community Ment Health J*. 2007;43:459–80.
33. Becker H, Stuifbergen A, Oh H, et al. Self-rated abilities for health practices: a health self-efficacy measure. *Health Values*. 1993;17(5):42–50.
34. Stevanovic D. Quality of life enjoyment and satisfaction questionnaire-short form for quality of life assessments in clinical practice: a psychometric study. *J Psychiatr Ment Health Nurs*. 2011;18(8):744–50.
35. Lorig KR, Sobel DS, Ritter PL, et al. Effect of a self-management program on patients with chronic disease. *Eff Clin Pract*. 2001;4(6):256–62.
36. Riehm KE, Kwakkenbos L, Carrier ME, et al. Validation of the self-efficacy for managing chronic disease scale: a scleroderma patient-centered intervention network cohort study. *Arthritis Care Res*. 2016;68(8):1195–2000.
37. Kaufman L, Kuhn W, Stevens Manser S. Peer specialist training and certification programs: a national overview. Texas Institute for Excellence in Mental Health, School of Social Work, University of Texas at Austin 2016.
38. DE Hert M, Correll CU, Bobes J, et al. Physical illness in patients with severe mental disorders. I. Prevalence, impact of medications and disparities in health care. *World Psychiatry*. 2011;10(1):52–77.
39. Mohr DC, Cuijpers P, Lehman K. Supportive accountability: a model for providing human support to enhance adherence to eHealth interventions. *J Med Internet Res*. 2011;13(e30).

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