

Home-Based Telepsychiatry and in-Home CBT for Management of Major Depression in HIV-Positive Adults 50 Years and Older: A Proof-of-Concept Study

Jessica Y Rhee¹,
Eric J Chan²,
Paul M Elizondo III²,
James A Bourgeois²,
Jorien G Breur²,
Joseph K Shemuel¹,
Lisa Dazols¹ and
Malcolm D John¹

Abstract

Background: HIV clinicians are increasingly confronting mild major depression and dysthymic disorder in their older patients. Despite rapid advances in technology-based interventions in the medical field, particularly in psychiatric treatment, the utilization of this resource in mental health services delivery research in the context of HIV disease has been limited. Home-based telemedicine (HBT) – which in this article mainly refers to telepsychiatry – combined with in-home cognitive behavioral therapy (CBT) may serve as a promising clinical strategy through which a broader patient population can be treated.

Objective: The current study aimed to assess: (1) change in psychiatric symptoms, (2) change in perception towards the acceptability of telemedicine, and (3) the viability of using a combined treatment of in-home CBT and HBT.

Methods: Subjects engaged in 6-12 weeks of weekly in-home CBT paired with monthly follow-up home-based telepsychiatry (HBT) sessions for the management of mild to moderate depression in older persons living with HIV (PLWH).

Results: 3 subjects completed the current study. Subjects reported comfortability with receiving services by telemedicine, ability to talk freely, and perceived privacy of the sessions. Clinician feedback further supported the feasibility and acceptability of using this delivery of treatment.

Conclusion: Data gathered from the current study support the findings from the predecessor study. HBT coupled with in-home CBT may serve as a feasible method for the management and treatment of mild to moderate depression in PLWH aged 50+ in an urban setting. Larger clinical trials focused on older PLWH using a similar treatment regimen will help provide more insight into viable healthcare models for this growing population.

Keywords: Older PLWH; Depression; Telepsychiatry; CBT

- 1 Department of Internal Medicine, UC San Francisco, San Francisco, CA, United States
- 2 Department of Psychiatry, UC San Francisco, San Francisco, CA, United States

Corresponding author: James A Bourgeois

✉ James.bourgeois@ucsf.edu

Department of Psychiatry, UC San Francisco, San Francisco, CA, United States.

Tel: 415- 476-9289

Fax: 415- 476-7404

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Introduction

Once a leading cause of death among young adults in the early 1990s in the United States, HIV has evolved into a chronic condition that can be stabilized with strict adherence to medical treatment [1]. As a result, the age demographic of this disease has shifted and the number of adults over 50 with HIV/AIDS has increased significantly. According to the Centers for Disease Control and Prevention, people aged 50 and older accounted for 21% (8,575)

and 27% (7,108) of an estimated 47,352 HIV diagnoses and 26,688 AIDS diagnosis, respectively, in the US in 2013 [2]. In addition, persons living with HIV (PLWH) experience a higher frequency of psychiatric illness, including depression, than their age-matched HIV-negative peers [3]. With an increasing number of older PLWH who must address psychiatric comorbidities as well as limited access to healthcare, new alternatives to treatment must be considered. Home-based telemedicine (HBT) may provide an avenue through which vulnerable and marginalized populations

can gain access to care. This delivery of treatment paired with in-home cognitive behavioral therapy (CBT) may potentially provide an additive net benefit and serve as a viable and effective model of care for this demographic in an urban setting.

Effects of age and depression in older PLWH

As PLWH are increasingly living longer and healthier lives, the “graying” of the HIV epidemic has created new challenges [4]. For patients 50 years and older, the subpopulation that is commonly referred to as “older adults” in HIV literature, healthcare providers must address a group of patients that is faced with greater drug sensitivity, less robust CD4 count responses, greater cognitive decline, and increased likelihood of developing comorbidities than their same-aged HIV-negative peers [5-8].

PLWH experience a greater frequency of psychiatric problems where an estimated 50% of HIV/AIDS patients have been diagnosed with mental health comorbidities, with depressive symptoms among the most common [9]. Some studies report depression rates as high as 52% in people aging with HIV [10]. Among the wide spectrum of psychiatric comorbidities, depression seems to show the strongest association with adverse health outcomes in PLWH, such as non-adherence to antiretroviral therapy, increase of HIV-related morbidity, and greater overall mortality [11-13].

Additionally, depression has been correlated with lower levels of perceived social support, which has been identified as a major concern in older PLWH as it is associated with maintaining positive health habits, better treatment adherence, and fewer sex risk behaviors [14-16]. Whitehead et al. demonstrated an inverse relationship between depressive symptoms and perceived social support, suggesting that depression may negatively impact one's ability to access support resources [17]. Previous studies have shown that depressive symptoms may hinder an individual's ability to engage with their own support network, interfere with the perception of available resources in the environment, and increase the strains in main supportive relationships, the latter of which may jeopardize the effectiveness or continuity of much-needed support [18-22]. Because older PLWH experience greater social isolation and are less likely to seek treatment than their younger counterparts, these findings underscore the importance of addressing depression in and establishing a practical form of intervention for this demographic.

Feasibility of urban telemedicine for older PLWH

Different healthcare solutions must be explored that balance the delicate equilibrium between a growing, marginalized patient population and the finite resources available, such as funding constraints and a shortage of psychiatric services. Telepsychiatry may be a viable option. For the purpose of this paper, telepsychiatry is defined as the provision of psychiatric services via live, interactive videoconferencing technology.

The past decade has demonstrated the validity and efficacy of live interactive videoconferencing as a means of care delivery [23]. Telepsychiatry has been implemented and found effective across various populations, including adult, child, geriatric, and ethnic, and across many settings, including rural areas, schools,

forensic practices, and correctional facilities [24]. Significant advances in technology, which have led to improved security, enhanced image and audio quality, and stability of transmission, have created telemedicine systems that are more consistent, dependable, and acceptable to both patients and providers. Some communities even consider this model of care delivery “the new normal” for rural psychiatric care [25].

Telepsychiatry has also been expanding within correctional settings. The California Department of Corrections and Rehabilitation Division of Correctional Health Care Services implemented a telepsychiatry program that delivered mental healthcare to inmates in 27 correctional systems in the state. The program not only facilitated the delivery of psychiatric care to over 4000 inmates annually, but it also increased public safety, decreased costs incurred during transportation, and increased appropriate access to effective psychiatric care [26]. Additionally, several other states have implemented telepsychiatry programs into their correctional facilities with much success both in regards to increasing inmate access to providers and decreasing costs [27].

Although more commonly affiliated with rural health, telepsychiatry may play a significant role in urban environments in which patients still experience challenges that can prevent timely access to high quality healthcare. Similar to rural settings, those in urban areas also face issues related to insurance, transportation, and uncertainty of service availability [28]. And yet, urban telepsychiatry may have a greater impact when delivering care largely due to the higher density of patients that can be served in urban areas [29]. This may ultimately help to improve the efficiency of and reduce the burden on the healthcare system. Additionally, urban telepsychiatry may accommodate greater flexibility in unique situations compared to rural settings. In an urban setting, providers can leverage the more diverse community resources, such as accessing qualified interpreters during a consultation or making immediate referrals to a nearby facility for another specialty [28]. Both of these scenarios may be more challenging or less effectively managed in a rural telehealth setting. Only about 2% of current publications focus on urban telemedicine health services and limited research addresses the utility of computer-delivered interventions for PLWH to reduce mental health symptomatology [30]; future studies need to assess this dynamic in more detail.

With respect to treatment of depression, the evidence base for telepsychiatry is particularly strong [31]. A number of studies have reported greater symptom improvement when comparing telemental health groups to in-person groups. Hudson et al. found that patients receiving high-intensity, telemedicine-based collaborative care reported significantly fewer antidepressant-related side effects at six and 12 months compared to patients receiving low-intensity, practice-based collaborative care, which may have contributed to improved quality of life [32].

A telehealth intervention may be a promising option for increasing life quality, decreasing healthcare costs, and maintaining more independent living, especially among older adults where there is a rise in chronic disease and other age-related conditions [33,34]. It may also provide a platform through which providers

can carefully monitor patients' overall wellness, which is important in slowing the progression and possibly preventing the deterioration of functionality caused by chronic disease [35]. Regardless, barriers to telepsychiatry continue to persist. These include personal bias, insufficient training, challenging business environment and legislative processes, and technical and administrative complexities, such as licensure and reimbursement [36]. Additionally, older adults have less understanding of or familiarity with new, innovative, and information technology-based concepts and may express more reservations about using this delivery of care [37].

Telepsychiatry has yet to reach successful integration into current models of care delivery [38]; however, this method of treatment delivery may be particularly suitable for PLWH. HIV prevalence is particularly high among minority and disadvantaged populations, who are often difficult to reach and struggle with various forms of stigma and discrimination. Through technology-based solutions, this demographic would be given new opportunities to alleviate psychosocial and structural barriers while accessing healthcare, maintaining continuity in treatment, and promoting adherence to care regimen [39].

Incorporating in-home CBT to treat older PLWH

Chronic physical illness associated with aging may limit the use of antidepressants for individuals who have depressive symptoms, which may make conventional pharmacotherapy less desirable and psychological intervention more impactful [40]. Cognitive behavioral therapy (CBT) – a type of evidence-based psychotherapy model that emphasizes the connection between cognition and emotion and works to increase patients' awareness and mastery of mental processes – is an effective treatment for depressive disorder in adults of all ages [41]. Although psychotherapy treatments are used in only 5% of cases of depression in older people [42,43], reviews suggest that CBT is equally effective in older adults with depression compared to younger adults and superior compared to waitlist, care-as-usual, placebo, and other control groups [40,44,45]. Serfaty et al. found that older people with depression in a primary care setting engage well with psychotherapy treatments, benefit from individual CBT, and respond better to CBT compared to conversing with an empathic therapist [40].

Prior research on the use of CBT for PLWH report conflicting results. Findings generally support the efficacy of psychotherapeutic interventions aimed at decreasing negative affect and increasing positive psychological resources among PLWH [46,47]; however, limitations like stringent inclusion criteria raise questions about the clinical utility or generalizability of such interventions [48]. Safren et al. found that HIV-positive men and women who engaged in a 12-week CBT intervention period for adherence and depression reported reductions in depressive symptoms and greater adherence to electronically monitored anti-retroviral therapy (ART) compared to those who received a single session of intervention [49]. Limitations in the study included small sample size and no control group to help determine whether the components of the study treatment were better than others. In

another study, Carrico et al. examined 15 individually delivered cognitive-behavioral intervention sessions in a diverse sample of PLWH and found no intervention-related changes in psychosocial adjustment across a 25-month investigational period compared to a wait-list control [50]. Further investigation is needed to examine CBT interventions in more detail for this demographic.

Studies have identified the need for evaluations of combined psychiatric and risk reduction interventions, which may potentially offer a cumulative effect to help reduce sexual risk behavior and psychological distress compared to individually targeted interventions [51,52]. A meta-analysis in 2009 determined that combined psychotherapy and pharmacological treatment of depression is more effective compared to psychotherapy treatment alone in the short term, but that the difference is smaller when CBT is used compared to other psychotherapy treatments [53]. This suggests that the additional value of the pharmacological treatment may be limited. Because many patients prefer psychological solutions and are less willing to take antidepressants [54], other variations of combined treatment should be explored.

The current study is an extension of a 2-phase study that assessed the perception of and amenability towards telemedicine by PLWH aged 50+ with mild to moderate major depression in an urban setting, as well as clinician opinion on utilizing the Hamilton Depression Rating Scale (Ham-D) via telemedicine. Specifically, a questionnaire was administered in Phase I of the previous study to assess subjects' initial perception of telemedicine. In Phase II, a home-based telepsychiatry (HBT) session was conducted, after which the clinician and subject's perception towards telemedicine was measured. This final phase consisted of a 6-12 week follow-up period during which subjects engaged in monthly follow-up HBT sessions coupled with weekly in-home CBT (HBT/CBT) for the management of mild to moderate depression in older PLWH. Specific objectives included assessing: (1) change in mental health status, (2) change in perception towards telemedicine, and (3) the viability of using a combined treatment of HBT/CBT.

Methods

This study evaluates provision of HBT/CBT in an urban environment to older PLWH with mild to moderate depression based on assessments established in a previous study. Eligibility included: Ham-D score ≥ 16 , absence of other psychiatric comorbidities, no substance abuse within the past two months, and absence of significant cognitive impairment (MoCA score ≥ 26 ; MMSE score ≥ 24). Subjects who completed Phases I and II of the previous study and fulfilled the eligibility criteria for the current study were offered a chance to continue.

Study procedures during in-home CBT

Subjects who were both eligible for and amenable to the current study engaged in weekly in-home CBT sessions. In-home CBT took place at the subject's home; however, 360: The Positive Care Center at UC San Francisco (360) was offered as an alternate location for those who preferred to hold the sessions elsewhere. Each subject was paired with a psychiatrist from

the study team and worked closely with the same physician at each weekly in-home CBT session throughout the duration of the study. The study psychiatrists used the Community Healthy Activities Model Program for Seniors (CHAMPS) instrument to collect baseline information on physical, social, and recreational activities and the Problem-Solving Therapy for Primary Care (PST-PC), an intervention focused on developing psychosocial skills for problem solving. They worked in a structured fashion with the goal of increasing the subject's attentiveness to his or her inaccurate or negative frame of mind while simultaneously encouraging the participant to adopt coping skills that allowed for a more practical and effective approach to dealing with stressful life situations.

Measures

CHAMPS Activities Questionnaire for Older Adults [55] is a self-report questionnaire that evaluates weekly frequency and duration of various types of physical activities that respondents engage in over the prior four weeks. With the assistance of the study psychiatrist, each subject was able to create a regular physical activity program that was personalized in regards to the type of activities selected and the goals associated for each activity. This questionnaire helped study physicians to establish a baseline level of activity amongst their subjects.

Problem-Solving Treatment for Primary Care (PST-PC) [56] is composed of several components, including understanding the rationale behind problem-solving treatment, evaluating the individual's problems, establishing a productive problem-solving orientation, and guiding the individual to acquiring and using problem-solving skills on their own. Study psychiatrists used this model to introduce problem-solving skills at the beginning and reinforce these new techniques in subsequent sessions.

Study procedures during HBT sessions

In addition to weekly in-home CBT, the subjects engaged in monthly follow-up HBT sessions during which subjects' quality of life, readiness for change, psychiatric history, mental status, and drug and alcohol use were assessed. 360 were offered as an alternate location for those who preferred to hold the sessions elsewhere. During the HBT session, a research member with IT specialty and a social worker set up the telecommunication devices, which included UCSF-provided laptops, WiFi, and Cisco Jabber, (two-way video software). Afterwards they left to maintain privacy between the subject and study physician. Two members went together for personal safety and in case any mental health crisis arose during the interview. The members were prepared to contact the San Francisco mobile crisis team or the police in case of any suicidal ideation, homicidal ideation, or other possible psychiatric crisis. However, the study team was already familiar with the current subjects and experienced no issues.

During the session, the study physician guided the subject through an informed consent form specific to the current study and administered the Quality of Life and the Readiness to Change surveys. Then the study physician conducted the clinical

interview during which the Hamilton Rating Scale for Depression (Ham-D), a clinician-administered depression rating instrument, was performed in order to further assess depression symptoms at that time. The clinical interview also included the Screening, Brief Intervention, and Referral to Treatment (SBIRT) in order to determine whether there were any changes to the subject's substance abuse history. Each subject then completed the Post-HBT Patient Perception Questionnaire (PHPPQ) regarding their perception and satisfaction with the HBT session while the physician completed the Provider Questionnaire to collect their feedback on the session. After the completion of each follow-up HBT visit, subjects received a \$20 food voucher. The number of missed follow-up sessions was recorded in order to monitor adherence.

Measures

Quality of Life Enjoyment and Satisfaction Questionnaire – Short Form or Q-LES-Q-SF [57] was administered by the study psychiatrist during the HBT session. Participants were asked to rate how satisfied they were in various aspects of their life using a 5-point Likert scale ranging from 1 ("Very Poor") to 5 ("Very Good"). Scores can range from 14 to 70, with higher scores indicating better quality of life.

The Readiness to Change survey [58] asked participants to reflect on how they felt about the ways in which they try to stay healthy. Answers were based on a 6-point Likert scale ranging from 1 ("Strongly Disagree") to 6 ("Strongly Agree"). It was conducted by the study psychiatrist during the HBT session and helped to provide insight into how willing each participant was to adopt new practices.

The Hamilton Depression Rating Scale or Ham-D [59] is the most widely used clinician-administered assessment scale that is used to assess the severity of, and change in, depressive symptoms in adults over the past week. Participant responses were based on a Likert scale and scores range from 0 to 53, with higher scores indicating greater severity of depression.

Screening, Brief Intervention, and Referral to Treatment or SBIRT [60] was conducted by the study psychiatrist to gather details about each participant's history of alcohol and substance abuse.

The Post-HBT Patient Perception Questionnaire or PHPPQ was based on The Duke Telemedicine Project Patient Satisfaction Survey and the UC Davis Health System Telemedicine Clinical Consultation Patient Satisfaction Survey as seen in **Table 1**. Permission to modify the surveys for the purposes of the study was collected from the appropriate parties before implementation. Participants were asked about their previous experience with telemedicine, then rated a series of statements regarding their perception on telemedicine on a 5-point Likert scale ranging from 1 ("Strongly Disagree") to 5 ("Strongly Agree"). The PHPPQ aimed to document any changes in perception toward telemedicine after each HBT consultation.

The Provider Questionnaire assessed the perspective of the physician who conducted the telemedicine session during Phase II of the study. Study psychiatrists were asked to rate several

Table 1: Subject responses regarding perception of a telemedicine session after WK4 & WK8 HBT session during phase III.

S.no	Comment	Strongly Agree (5)	Agree	Undecided (3)	Disagree (2)	Strongly Disagree	Yes	No
			-4			-1		
1	Have you heard of telemedicine before getting involved in this study?							
	Phase III (WK 4)	-	-	-	-	-	1	3
	N/Percent	-	-	-	-	-	4/25%	4/75%
	Phase III (WK 8)	-	-	-	-	-	1	2
	N/Percent	-	-	-	-	-	3/33%	3/67%
2	Have you had telemedicine services before today?							
	Phase III (WK 4)	-	-	-	-	-	2	2
	N/Percent	-	-	-	-	-	4/50%	4/50%
	Phase III (WK 8)	-	-	-	-	-	2	1
	N/Percent	-	-	-	-	-	3/67%	3/33%
3	I was comfortable receiving services by telemedicine.							
	Phase III (WK 4)	3	1	0	0	0	-	-
	N/Percent	4/75%	4/25%	4/0%	4/0%	4/0%	-	-
	Phase III (WK 8)	3	0	0	0	0	-	-
	N/Percent	3/100%	3/0%	3/0%	3/0%	3/0%	-	-
4	I was satisfied with the overall quality of care provided through telemedicine.							
	Phase III (WK 4)	3	1	0	0	0	-	-
	N/Percent	4/75%	4/25%	4/0%	4/0%	4/0%	-	-
	Phase III (WK 8)	3	0	0	0	0	-	-
	N/Percent	3/100%	3/0%	3/0%	3/0%	3/0%	-	-
5	I feel my time with the physician was private.							
	Phase III (WK 4)	4	0	0	0	0	-	-
	N/Percent	4/100%	4/0%	4/0%	4/0%	4/0%	-	-
	Phase III (WK 8)	3	0	0	0	0	-	-
	N/Percent	3/100%	3/0%	3/0%	3/0%	3/0%	-	-
6	It was easy for me to talk to a physician via telemedicine equipment.							
	Phase III (WK 4)	3	1	0	0	0	-	-
	N/Percent	4/75%	4/25%	4/0%	4/0%	4/0%	-	-
	Phase III (WK 8)	3	0	0	0	0	-	-
	N/Percent	3/100%	3/0%	3/0%	3/0%	3/0%	-	-
7	The sound quality was good.							
	Phase III (WK 4)	3	1	0	0	0	-	-
	N/Percent	4/75%	4/25%	4/0%	4/0%	4/0%	-	-
	Phase III (WK 8)	3	0	0	0	0	-	-
	N/Percent	3/100%	3/0%	3/0%	3/0%	3/0%	-	-
8	The image quality was good.							
	Phase III (WK 4)	3	1	0	0	0	-	-
	N/Percent	4/75%	4/25%	4/0%	4/0%	4/0%	-	-
	Phase III (WK 8)	3	0	0	0	0	-	-
	N/Percent	3/100%	3/0%	3/0%	3/0%	3/0%	-	-
9	Overall, I was satisfied with the telemedicine visit.							
	Phase III (WK 4)	3	1	0	0	0	-	-
	N/Percent	4/75%	4/25%	4/0%	4/0%	4/0%	-	-
	Phase III (WK 8)	3	0	0	0	0	-	-
	N/Percent	3/100%	3/0%	3/0%	3/0%	3/0%	-	-
10	I would use the telemedicine system again.							

S.no	Comment	Strongly Agree (5)	Agree	Undecided (3)	Disagree (2)	Strongly Disagree	Yes	No
			-4			-1	-1	0
	Phase III (WK 4)	3	1	0	0	0	-	-
	N/Percent	4/75%	4/25%	4/0%	4/0%	4/0%	-	-
	Phase III (WK 8)	3	0	0	0	0	-	-
	N/Percent	3/100%	3/0%	3/0%	3/0%	3/0%	-	-
11	I preferred to use telemedicine instead of going to see a psychiatrist in-person.							
	Phase III (WK 4)	3	0	0	1	0	-	-
	N/Percent	4/75%	4/0%	4/0%	4/25%	4/0%	-	-
	Phase III (WK 8)	1	1	1	0	0	-	-
	N/Percent	3/33%	3/33%	3/33%	3/0%	3/0%	-	-

statements, as outlined in **Table 2**, based on a 5-point Likert scale ranging from 1 (“Disagree”) to 5 (“Agree”). It was completed after each telemedicine session in order to validate the use of the Ham-D via telemedicine.

Results

Participation

Of the 25 subjects that completed Phases I and II of the previous study, only four met the eligibility criteria to continue on to the current study. The subjects were composed of three Caucasian males and one African American female. Three subjects were between the ages of 56-65 and one was between the ages of 50-55. All four subjects were amenable to continuing; however, one subject withdrew after completing three in-home CBT sessions and the first follow-up HBT consultation due to other personal commitments and a belief that he had already maximized his benefits through participation up to that point in the study. The remaining three subjects completed seven in-home CBT sessions and two follow-up HBT sessions over a 2-month period following their completion of the previous 2-phase study.

In-home CBT analyses

Anecdotal evidence gathered during in-home CBT suggested the potential benefits of this model of care for this population subset.

All in-home CBT sessions took place at the subject’s home with the exception of one subject who preferred to hold his sessions in another private location due to issues with his living situation. Regardless of number of sessions completed, all subjects reported a gain in benefits from the CBT therapy. Subject HBT-029 found that the structure offered through the weekly in-home CBT sessions was helpful and the problem solving approach allowed her to “get motivated” to perform tasks and use the skills she learned to tackle challenges that were “holding her down.” By the end of the study, HBT-029 noted that she felt encouraged by the lifestyle changes she made throughout the duration of the study, incorporating more exercise into her daily routine, eating food more regularly, and engaging more socially. She stated feeling a greater level of energy, improvements in mood, and greater stability to cope with stress on her own. Similar sentiment was echoed among the other subjects.

HBT analyses

The first follow-up HBT consultation took place around week 4 after subjects completed 3-4 sessions of in-home CBT. This was

followed by another 3-4 sessions of in-home CBT and the second follow-up HBT consultation, which took place around week 8. Subjects engaged in their follow-up HBT sessions at home with the exception of one individual who preferred to hold the sessions at the 360 clinic, again citing issues regarding personal living situation. This subject still engaged in a telepsychiatric interview using UCSF-issued devices; however, the physician conducted the sessions from a private office outside the clinic to maintain consistency with the delivery of treatment.

Ham-D scores recorded at the first and second HBT sessions in the current study were lower for each subject than the baseline measurement from the previous study, as shown in **Table 3**, indicating improvement in mental health across the board. Notably, subject HBT-029 displayed an 11-point decrease by the second follow-up HBT session compared to baseline. Subject HBT-019 exited the study early, but still exhibited a 9-point decrease in Ham-D score compared to baseline after only three in-home CBT sessions and one follow-up HBT consultation (**Table 3**).

Based on feedback on the PHPPQ after each HBT session, all subjects continued to agree or strongly agree on the following: comfort with receiving services by telemedicine, ability to talk freely, satisfaction with the overall quality of care provided, ease with communication via telemedicine equipment, and perceived privacy of the sessions (**Table 1**). No subjects expressed any dissatisfaction with any of the measures on the questionnaire with the exception of one (**Table 1**). Out of all seven HBT sessions that took place during weeks 4 and 8 among all subjects, only one subject during one HBT session felt that the quality of medical care given through telemedicine was not as good as in person. All other subject responses found that the quality of medical care was the same as or better than in person.

Provider surveys further supported findings from the prior study regarding overall quality of telemedicine for clinical interviews and ability to confidently interpret patients’ physical appearances for completion of the Ham-D. Combined analysis of both the first and second follow-up HBT sessions, as seen in **Table 2**, showed six out of the seven responses reporting provider satisfaction with the telemedicine session and all seven provider responses agreeing that telemedicine is personally and publicly valuable. Six out of the seven provider responses agreed that the quality of medical care given through telemedicine was the same as in person. Additionally, all study providers indicated that the image

Table 2: Cumulative provider questionnaire responses after WK4 & WK8 HBT session during phase III.

S.no	Question	Agree	Moderately Agree	Neutral	Moderately Disagree	Disagree	Better than in Person	Same as in Person	Not as Good as in Person
1	Overall, I was satisfied with the telemedicine visit.								
	Frequency	6	1	0	0	0	-	-	-
	N/Percent	7/85.7%	7/14.3%	7/0.0%	7/0.0%	7/0.0%	-	-	-
2	I would prefer to use telemedicine to treat patients instead of seeing the patient in-person.								
	Frequency	0	0	0	5	2	-	-	-
	N/Percent	7/0.0%	7/0.0%	7/0.0%	7/71.4%	7/28.6%	-	-	-
3	Telemedicine is of value to me and my community.								
	Frequency	7	0	0	0	0	-	-	-
	N/Percent	7/100.0%	7/0.0%	7/0.0%	7/0.0%	7/0.0%	-	-	-
4	I think the quality of medical care given through telemedicine is...								
	Frequency	-	-	-	-	-	0	6	1
	N/Percent	-	-	-	-	-	7/0.0%	7/85.7%	7/14.3%

Table 3: Hamilton depression rating scale (Ham-D) & Patient health questionnaire (PHQ-9): baseline vs. phase III WK4 & WK8.

Time point	Ham-D Score	Mean	Difference
HBT-009			
Baseline	22	19	-2
WK4	15		
WK8	20		
HBT-019			
Baseline	20	15.5	-9
WK4	11		
WK8	NA		
HBT-029			
Baseline	17	11.7	-11
WK4	12		
WK8	6		
HBT-041			
Baseline	19	16.3	-1
WK4	12		
WK8	18		

via telemedicine was not as good as an in-person encounter, but that it did not affect his or her ability to interpret subject behavior for questions 1 (depressed mood), 8 (retardation), 9 (agitation), and 10 (anxiety psychic) on the Ham-D assessment (**Table 2**).

Discussion

Principal results

This proof-of-concept study examined the acceptability of the HBT/CBT treatment model for older PLWH with mild to moderate major depression in an urban setting.

There are many ways to incorporate and maximize the use of technology-based approaches when treating older PLWH. Computer-delivered interventions are promising as a means to promote health and manage disease. Brown et al. offered preliminary data suggesting a favorable approach to promote health-related knowledge to PLWH; however, the findings

also highlight the limited evidence base focused on the use of computer-delivered treatment to address the needs of PLWH [60,61]. With only pilot studies aimed at exploring this approach among HIV-positive populations, larger efficacy trials are needed in the future.

Importantly, certain approaches may not be suitable for all. As demonstrated in the study by Heckman and colleagues, telephone-based delivery of CBT was efficacious in reducing depression in PLWH, but the effects were stronger among heterosexual older PLWH than homosexual PLWH [52]. Notable differences based on gender, including greater vulnerability for mental health difficulties and substance misuse and more unique stress related to childcare for HIV-positive women, would also need to be addressed when tailoring the invention [61]. Careful consideration needs to be implemented when determining the appropriateness of technologies used to deliver treatment for various populations. Additionally, because technology is an

ever-evolving tool, interventions need to maintain flexibility and adaptability in order to accommodate the changes and advances in technology and to avoid obsolescence.

A possible approach for some older PLWH with depressive symptoms may be to use community-based telemedicine. One study by Demiris et al. implemented a telehealth kiosk system in retirement community, which helped to reduce the installation and maintenance costs of individual systems [62]. The authors found that not only were there no privacy concerns among this group, but some even preferred the community setting as it offered more opportunities for social interaction with other individuals. Whether this format would benefit older PLWH needs further exploration.

Limitations

There were limitations of the study that should be noted. First, data gathered from this study were based on individuals who fit within specific eligibility criteria and who were willing to participate in the intervention. There is possibility that this may have introduced a sampling bias, and therefore the generalizability of our findings would not include those who did not qualify or were unwilling to continue. Additionally, the lack of comparison arms makes it difficult to distinguish the effect of only the in-home CBT and the effect of only the HBT sessions when measuring change in mental status or patient feedback. Future studies could consider using this same model along with additional arms in which subjects engage in in-person consultations instead of telemedicine and assessing the effects. Other limitations include small sample size and narrow set of demographics among subjects. Individuals of various ages, backgrounds, or orientations may respond differently to the type of setting or mode of treatment delivery used in this study. Finally, the use of multiple forms of technology, including email, phone, and laptop, may have influenced overall patient satisfaction or perception.

Conclusions

With a high demand for mental health services and a limited supply of providers, the need for new and effective models of

healthcare is urgent. Patient perception towards technology-based medical treatment is an important component to consider when treating different populations. Future research should explore the utility of computer-delivered interventions in PLWH with comorbid psychiatric disorders more broadly while incorporating user needs and attitudes.

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Supplementary Materials

All underlying research materials related to the paper are kept in a locked and secure file in the Department of Psychiatry at UC San Francisco for record keeping. Study documents can be accessed by contacting a member of the author group.

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