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Improving Social Connectedness for Homebound Older Adults: Randomized Controlled Trial of Tele-delivered Behavioral Activation versus Tele-delivered Friendly Visits

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Abstract

Objective: To test the acceptability and effectiveness of a lay-coach-facilitated, videoconferenced, short-term behavioral activation (Tele-BA) intervention for improving social connectedness among homebound older adults.

Methods: We employed a two-site, participant-randomized controlled trial (RCT) with 89 older adults (averaging 74 years old) who were recipients of, and initially screened by, home-delivered meals programs. All participants reported loneliness; many reported being socially isolated and/or dissatisfaction with social support. Participants received five weekly videoconference sessions of either Tele-BA or Tele-FV (friendly visits; active control). Three primary outcomes were social interaction (Duke Social Support Index [DSSI] Social Interaction Subscale), subjective loneliness (PROMIS Social Isolation Scale), and DSSI Satisfaction with Social Support Subscale. Depression severity (PHQ-9) and disability (WHODAS 2.0) were secondary outcomes. Mixed-effects regression models were fit to evaluate outcomes at 6- and 12-weeks follow-up.

Results: Compared to Tele-FV participants, Tele-BA participants had greater increase in social interaction (t [81] = 2.42, p = .018) and satisfaction with social support (t [82] = 2.00, p = .049) and decrease in loneliness (t [81] = −3.08, p = .003), depression (t [82] = −3.46, p = .001), and disability (t [81] = −2.29, p = .025).

Conclusions: A short-term, lay-coach-facilitated Tele-BA is a promising intervention for the growing numbers of homebound older adults lacking social connectedness. The intervention holds promise for scalability in programs that already serve homebound older adults. More research is needed to solidify the clinical evidence base, cost-effectiveness and sustainability of Tele-BA delivered by lay coaches for homebound and other older adults.

INTRODUCTION

A large body of research, reaching back well over a century to the writings of Durkheim, has documented the positive impact of social connectedness in promoting physical, functional, mental, and cognitive health and reducing healthcare expenditures and mortality.[1-10] Whether measured by objective indicators of social isolation or subjective indicators such as loneliness or perceived social support, many US older adults report low social connectedness, making it a significant public health concern.[11,12] These data underscore the importance of identifying feasible and effective strategies to improve social connectedness as a way of enhancing the well-being of older adults in a rapidly aging society.

Given their medical burden and mobility limitations, homebound older adults are at higher risk for social isolation and loneliness than their mobile peers.[13,14] Especially for low-income homebound older adults, lack of financial resources and transportation along with multiple stressors associated with managing chronic illnesses and disability pose significant barriers to maintaining social contacts and activities.[15] This risk is concerning given the growing number of homebound seniors. Between 2011 and 2017, 8.3% of Medicare beneficiaries aged 65+ were chronically homebound (i.e., left the home 1/week in the past month) and 26.2% were at high risk of becoming homebound over the next seven years.[16] Using broader criteria (e.g., needing assistive devices to move around at home or personal assistance outside of one's home), nearly 20% of new enrollees in AARP Medicare Supplement plans in five states were homebound.[17]

A wide range of interventions using different mechanisms (e.g., social facilitation, psychotherapy, befriending/visitation, animal intervention, skill development) have been tested for their impact on social connectedness among older adults. Systematic reviews show a majority of interventions reported some success, although the quality of evidence was generally weak (e.g., few randomized control trials).[18,19]. Most studies have tested in-person group interventions which pose participation barriers for homebound older adults. However, a recent systematic review[19] found individual-based interventions involving technology, such as videoconference and computer/web-based, show promise for improving social connectedness.

In the present study, we report outcomes of a two-site, participant-randomized controlled trial (RCT) that tested the effectiveness of videoconferenced, lay-coach facilitated, short-term behavioral activation (Tele-BA) versus videoconferenced friendly visit (Tele-FV) as

an active control for largely low-income, socially isolated, but not clinically depressed, homebound older adults in both urban and rural areas. We employed tele-delivery as it is less resource intensive than in-person delivery regarding travel times (for both rural and urban areas) and economies of scale (i.e., higher coach-to-client ratio). Older adults in our previous programs have been receptive to in-home tele-delivery given its convenience and privacy.[20] We tested a lay-coach model given current and projected shortages of professional geriatric mental health providers.[21] Evidence confirms lay-people can deliver psychosocial interventions with efficacy and fidelity, especially interventions like BA that are straightforward and highly structured.[22,23]

Our primary hypothesis was that Tele-BA would be more effective than Tele-FV in enhancing social connectedness, specifically testing reductions in social isolation (through increased social interaction) and loneliness, and increased satisfaction with social support. We also explored whether Tele-BA, compared to Tele-FV, reduced mild depressive symptoms and disability. Evidence of effectiveness would be important given the potential scalability of such an intervention in aging services and other agencies that care for one of the most vulnerable groups of older adults.

METHODS

Participants and Setting

Study participants were referred to the investigators by case managers of a home-delivered meals (HDM) program in a large city in Central Texas and a HDM program of the New Hampshire consortium of five aging service agencies that largely serve rural areas. The Older Americans Act requires HDM programs to conduct initial eligibility and annual recertification assessments of each client. Case managers introduced the study to potentially eligible (i.e., cognitively intact, no substance abuse) clients who reported feeling lonely (6 of the possible score range of 3-9 on the 3-item UCLA Loneliness Scale[11]). Case managers obtained oral consent from older adults to be contacted by study personnel to receive a detailed description of the study and complete an eligibility screen.

The inclusion criteria were study confirmation of loneliness (UCLA Loneliness Scale[11] 6), no-to-mild depressive symptoms (Patient Health Questionnaire [PHQ]-9[24]<10), and willingness to participate. The age inclusion was 50+ in TX and 60+ in NH (consistent with each HDM program's eligibility criteria). The exclusion criteria were probable cognitive impairment (the Blessed Orientation, Memory, and Concentration [BOMC][25]>9), any substance abuse, and active suicidal ideation.

Shown in Figure 1, 89 individuals out of 278 referrals were both eligible and consented to participate; of the remainder, 50 could not be contacted, 73 declined participation (either before or after screening), and 66 did not meet eligibility criteria. Written informed consent, approved by the authors' institutional review boards, was obtained after study procedures had been fully explained during an in-home visit. Consented participants were randomized into two arms, each consisting of 5 weekly, one-hour videoconferenced sessions: (1) Tele-BA (n=43) and (2) Tele-FV (n=46).

Participants' Tele-BA or Tele-FV interventionist (i.e., bachelor's-level, lay coach or friendly visitor) conducted an in-home baseline assessment and then demonstrated use of videoconferencing. Videoconferencing equipment (laptop with preloaded HIPAA-compliant videoconferencing platform) was loaned to a majority of participants. Those owning a computer received assistance downloading the videoconferencing platform. Participants without internet access were provided a wireless card (mobile hotspot). For Tele-BA participants, this visit also served as a preparatory session in which they were oriented to Tele-BA session materials (handouts, activity sheets). Tele-FV participants were instructed to think about topics/issues that they would like to discuss during Tele-FV sessions. Follow-up assessments at 6 and 12 weeks were done over telephone by trained assessors. Formal assessments were not conducted during intervention sessions. Given the study's aims, biomarker data were not collected.

Intervention: Tele-BA as Treatment Condition and Tele-FV as Active Control

Tele-BA: BA is a brief, structured behavioral approach that aims to increase and reinforce wellness-promoting behaviors (e.g., engaging in meaningful life activities aligned with personal values) and to decrease depressive behaviors.[26,27] BA may be especially suitable for improving social connectedness among homebound older adults, as they typically have limited opportunities for social engagement. For this study, we tailored the BA manual[27] by modifying the psychoeducation content to focus on social connectedness. Lay coaches worked with participants to identify and schedule values-based, rewarding social engagement and activities and to use strategies to reduce and problem-solve barriers to social connectedness. Participants first reviewed their daily activity patterns, and then chose activity goals, worked on specific implementation plans, and reviewed their successes and areas for improvement. Tele-BA had five sessions, consistent with our previous, highly effective tele-delivered psychotherapy for depressed homebound older adults.[20]

Tele-FV was chosen as an active comparison as Friendly Visiting has long been used by agencies to address loneliness and isolation in their homebound.[28] Friendly visitors engaged participants using supportive techniques such as adding perspective and facilitating self-expression,[29] without direct coaching of specific coping skill development. For consistency with Tele-BA, we delivered five sessions of friendly visiting through teleconferencing, thereby focusing the trial on the intervention and not its mode of delivery.

Tele-BA and Tele-FV interventionists were initially trained by the second author and received ongoing supervision by the second author (in NH) and the first author (in TX). Intervention fidelity was monitored by supervisors' listening to recorded sessions and using a rating scale previously developed and tested by the research team. All Tele-BA and Tele-FV interventionists achieved and maintained satisfactory ratings.

Primary Outcome Measures

For primary outcomes, we assessed three indicators: (1) *Objective Social Isolation* using the 4-item Social Interaction Subscale of the Duke Social Support Index (DSSI-I); (2) *Loneliness* using the 8-item PROMIS (Patient-Reported Outcomes Measurement Information System) Social Isolation Scale (PROMIS-L) and (3) *Subjective Satisfaction*

with Social Support using the 6-item Social Satisfaction Subscale of the Duke Social Support Index (DSSI-S). Each DSSI item is measured on a 1-3 point scale, with lower scores indicating less social interaction (DSSI-I) and less satisfaction with social support (DSSI-S).[30] The PROMIS-L measures perceived isolation and detachment from other people and has been validated for individuals living with chronic conditions.[31] In this study, we used raw PROMIS-L scores (range 8-40), with higher scores indicating greater loneliness. All three scales have evidence of reliability and validity with older adults.[32,33]

Secondary Outcome Measures

Secondary outcomes included depressive symptom severity using the PHQ-9[24] and disability using the 12-item World Health Organization Disability Assessment Schedule (WHODAS 2.0).[34] The PHQ-9 has demonstrated high internal consistency (>.90) in previous projects with homebound older adults.[35] WHODAS 2.0 covers six domains of disability: (a) cognition; (b) mobility; (c) self-care; (d) getting along; and (e) life activities; (f) participation. Scores range from 0 to 48, with higher scores indicating greater disability.

Analysis

Of 89 participants, 81 and 80 completed intervention sessions and 6-week and 12-week follow-up assessments, respectively. Scales had minimal missing data; only nine items were missing across the five outcomes and no respondent was missing more than one item for any given scale. For summed scales scores, missing items were replaced with the mean of the respondents' non-missing items on the scale.

Prior to fitting analytic models, Fisher exact tests and two-sample *t* tests or Welch two sample *t* tests, in the event of unequal variances, were used to assess whether there were differences in Tele-BA and Tele-FV participant characteristics, including the baseline assessments of the outcomes. These characteristics were compared across the Texas and New Hampshire sites. All tests of significance were two-tailed with α set at .05. We did not adjust reported *p* values due to fact that we do not consider the outcomes to be redundant thus comprise a family of tests;[36] nevertheless, we acknowledge that under the α levels used herein, 5% of tests represent a Type I error.

Post-intervention treatment group difference on the DSSI-I, PROMIS-L, DSSI-S, PHQ-9, and WHODAS were analyzed from an intent-to-treat approach by fitting mixed-effects regression models[37] using the lmer function from the lme4[38] and lmerTest[39] packages implemented using RStudio[40] 1.0.143. All models included a random intercept for participants and the 6- and 12-week assessments were treated as the dependent variable. Prior to evaluating treatment effects, we fit the following sequence of models for each outcome to establish an unconditional growth model: (a) an unconditional means (i.e., no independent variables) model, (b) the mean-centered baseline measure of the outcome was added as a covariate, and (c) time was added to assess change between 6- and 12-weeks post-intervention. Each model was compared to the prior model in the sequence using a deviance test; if the models differed, the more complex model was selected; if not, the simpler model was retained. After establishing an unconditional growth model, the treatment effect, using a dummy variable for Tele-BA (i.e., 1 if Tele-BA and 0 if Tele-FV), was added

to the model. Following recommendations from Feingold,[41] effect sizes for the treatment effect were estimated by dividing the difference between the estimated means of treatment groups by the pooled baseline standard deviation. The formula generates an effect size ($d_{GMA\text{-}raw}$) in a growth model context that is equivalent to traditional effect sizes (e.g., Cohen's d).

RESULTS

Participant Characteristics

Participants averaged 74 (SD=9.0) years; 62% were female; 18% were non-Hispanic Black and 15% were Hispanic; 68% lived alone; 83% had household income<$29,000, without any difference between Tele-BA and Tele-FV groups (Table 1). The only site differences were racial/ethnic distribution, ADL/IADL limitations, and travel distance/time. Consistent with the demographics of the two states, TX had a higher proportion of racial/ethnic minorities (55% vs. 14% in NH, p<.001). TX participants had more ADL/IADL limitations than NH participants (4.0 [SD=2.1] vs. 2.4 [SD=2.4] in NH, t [87]=3.19, p=.002). Because the TX site was urban while the NH site was primarily rural, the difference in travel distance (17 [SD=9.2] miles in TX vs. 132 [SD=41.5] miles in NH, *Welch's t* [37]=16.24, p<.001) was also expected.

Outcome Measures at Baseline and Follow-up: Descriptive Findings

At baseline, Tele-BA and Tele-FV groups did not differ on any outcome measure (Table 2). Their scores reflect medium levels of objective social interaction/isolation (DSSI-I), loneliness (PROMIS-L), and satisfaction with support (DSSI-S). Although participants with clinically significant depression were excluded, many reported mild depression (PHQ-9) and disability (WHODAS). At 6-week follow-up, Tele-BA participants reported more social interaction and less loneliness and depression than Tele-FV participants; and at 12-weeks follow-up, depression scores were lower for Tele-BA participants than Tele-FV participants. Almost all Tele-BA and Tele-FV participants provided extremely positive, unsolicited feedback on how much they enjoyed and drew benefits from the program.

Treatment Effects of Tele-BA vs. Tele-FV

In establishing the unconditional growth models, models containing the baseline measure of the outcome as a covariate were significantly different from the unconditional means model for all outcomes and, thus, the covariate was retained in each model. Models containing a time effect did not differ from the prior model in the sequence except for the PHQ-9 model, which had a significant negative effect for time (t [80]=−2.07, p=.042) indicating a decrease in PHQ-9 between the 6-week and 12-week assessments. We present all models as unconditional mean models (i.e., not time effects) for a consistent presentation.[1] Because there are no time parameters in the unconditional means model, the intercept, which is the only fixed effect, estimates a grand mean across all outcome measures; when additional parameters, such as treatment groups, are entered, they test for group differences in the

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[1]We did conduct sensitivity analyses to confirm that the reported treatment effects for PHQ-9 were consistent in models that did include time.

grand mean. Results presented in Table 3 show that Tele-BA participants reported higher levels of social interaction (t[81]=2.42, p=.018) and satisfaction with social support (t[82]=2.00, p=.049) and lower levels of loneliness (t[81]=−3.08, p=.003), depression (t[82]=−3.46, p=.001), and disability (t[81]=−2.29, p=.025). Effect sizes show that Tele-BA had a medium effect on reducing loneliness and small-to-medium effects on the rest of the outcome measures, all in the expected directions.

DISCUSSION

The principal finding of this randomized trial is that among socially isolated, homebound older adults who were HDM recipients in New Hampshire and Texas, a short-term behavioral activation delivered by nonclinicians using videoconferencing (Tele-BA) was associated with significantly greater improvements in all three facets of social connectedness at 12-week follow-up compared to customary friendly visiting similarly delivered via videoconferencing (Tele-FV). Tele-BA participants, compared to those receiving Tele-FV, reported greater increases in social interactions (signifying decreases in social isolation) and satisfaction with social support and greater decrease in loneliness. Compared to Tele-FV, Tele-BA was also associated with greater declines in depressive symptoms and disability. The medium effect sizes for Tele-BA compared to Tele-FV is worth noting given that FV also provided social support for these isolated older adults.

These findings are important given homebound older adults' greater risk for social isolation and loneliness compared to their mobile peers,[13,14] which, in turn, increases their risk for further deterioration of physical and mental health. Homebound older adults, many of whom are low income, have limited opportunities for social engagement due to their mobility impairment and report profound loneliness. As explicated below, the study was designed with these factors in mind.

BA is a client/patient-directed and personalized intervention modality in which the client and coach work collaboratively to accomplish goals that the client identifies. For this study, the coaches focused on educating and coaching their clients on social connectedness. While clients could choose any goals they wanted, all chose goals related to increasing meaningful social contact and reducing loneliness. We compared BA to FV as the latter is a commonly used strategy to increase social contact among homebound older adults. We expected that both BA and FV clients would benefit from the extra social contact, but that only BA clients would learn how to overcome barriers to social connectedness and to use skills for maintaining social connectedness over time. Indeed, although participants in Tele-FV reported enjoying the weekly social interactions, any effect of Tele-FV on outcomes were apparently not sustained beyond the sessions.

As shown by decreased depression (PHQ-9) and disability (WHODAS) scores, using BA to enhance social connectedness with homebound older adults appears to have the added benefit of improving mental health and functioning. The impact on depression is noteworthy as most participants entered the study with mild depressive symptoms. While even mild depressive symptoms contribute to poor functional outcomes,[42] many trials targeting mild depression have had little impact. Often both study arms improve or, as in our own studies

of homebound older adults, mild depression persists over time regardless of interventions that have benefited patients with greater depression severity.[43,44] In this trial where the intervention focused on social connectedness, participants with mild depression saw declines in depression severity.

Given the challenges of providing psychosocial interventions to homebound older adults, the study used strategies for delivering BA that would enhance potential scalability and sustainability. To address the ever-growing geriatric workforce shortages,[21] lay coaches were trained and supervised by mental health professionals to provide BA sessions with fidelity. To reduce costs and burden associated with transportation, we utilized videoconferencing, hence Tele-BA. As lack of broadband access in some rural areas and high internet subscription fees in both urban and rural areas are barriers to implementing tele-delivery, we loaned many participants a laptop and wireless card. Almost all participants, regardless of age, showed high acceptance of tele-sessions for its convenience and functionality. The study had minimal dropouts (9%); most occurred in the beginning of the trial in the few cases when, for logistical reasons, the interventionist was not the same person who conducted the in-home assessment and set up the technology. While anecdotal, this finding suggests the importance of in-person contact prior to initiating tele-sessions.

A fundamental barrier to addressing social connectedness among homebound, socially isolated older adults is having a mechanism for identifying individuals who might need such an intervention and an infrastructure for delivering it. As in our studies of depression, we collaborated with existing service (e.g., HDM, home health) providers for homebound seniors. In both states, investigators had developed meaningful research partnerships with their regional aging service providers. Indeed, this study was prompted by our agency collaborators who recognized the importance of depression, but identified low social connectedness as potentially more prevalent, equally devastating, and a problem more readily acknowledged by their clients.

The study has several important limitations. Of note, while a strength of the study is that it built on routine screening conducted by the HDM agencies, we had little oversight of the recruitment process. Thus, we cannot estimate the extent to which our sample represents HDM clients who might be eligible for the study. A related limitation was the sample size; while sufficiently large to demonstrate significance for moderate-to-large effect sizes, it was not large enough to assess mediating effects. Sample size reflects several important challenges to recruitment and enrollment of older adults for social connectedness interventions, specifically:

First, the relationships among the different facets of social connectedness can be complex, and social isolation does not necessarily indicate loneliness which is the perceived discrepancy between a person's preferred and actual social relations.[45] In some cases, especially in rural New Hampshire, clients reported that isolation was a chosen way of life and saw no need for an intervention. In other cases, despite evidence of loneliness and even social isolation, some clients who lived in geographic proximity to children and grandchildren were not willing to participate – worrying that their involvement might

indicate a failure of relatives to meet their social needs or reinforce their concern of being a burden to family members.

Second, a significant number of referred older adults were not eligible for the study because of moderate-to-severe depressive symptoms. This finding was not surprising given the association between depression and both objective and subjective indicators of social connectedness.[5] A side benefit of screening was providing an opportunity to refer clients for depression treatment. While depression referral is often not successful, either because services are not available and/or older adults deny needing or wanting treatment,[46] our study successfully engaged depressed clients by discussing their symptoms in the context of isolation and loneliness and by directly connecting them with a service provider (i.e., "warm handoff"). This success suggests that approaching depression through the lens of social connectedness may be a useful strategy for improving access to care.

In conclusion, we draw the following research, policy, and clinical implications from the study findings. First, short-term Tele-BA is a promising intervention for the growing number of homebound older adults in the population who experience social isolation, loneliness, or dissatisfaction with social support. More research is needed to solidify the clinical evidence base and to evaluate delivery cost and cost-effectiveness. Second, the potential for scalability is enhanced by successful lay-coach-facilitated Tele-BA for homebound and other older adults. Given the challenges of broadband access and cost, however, policy measures to improve feasibility of tele-delivery for underserved population groups will significantly increase the likelihood of widespread dissemination. Third, given its deleterious health effects, aging-service and healthcare providers should consider routine assessment and interventions to enhance social connectedness especially among homebound older adults. Future research conducted in partnership with community-based aging-service agencies can examine scalability and sustainability.

Acknowledgments

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Highlights

1. What is the primary question addressed by this study?

    • Would lay-coach-facilitated Tele-BA be more effective than Tele-FV in increasing social connectedness among socially isolated and lonely homebound older adults?

2. What is the main finding of this study?

    • Both Tele-BA and Tele FV were highly acceptable to participating older adults.

    • Tele-BA was more effective than Tele-FV in improving social connectedness and decreasing depressive symptoms and disability.

3. What is the meaning of the finding?

    • Short-term Tele-BA by lay providers is a promising intervention for the growing number of homebound older adults.
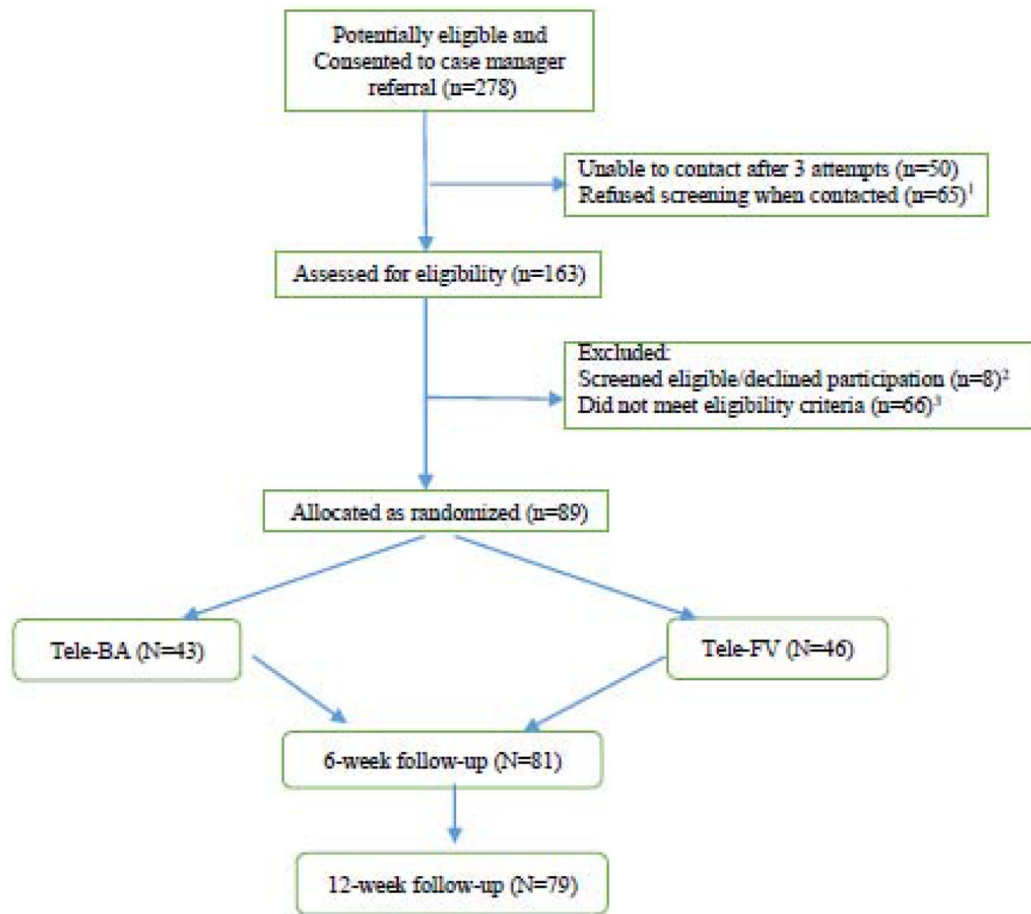
Figure 1. CONSORT Flow chart

[1]Telephone screening refusal reasons: Not interested; not feeling lonely; moving soon; not having time (due to caregiving or medical appointments; not liking videoconference delivery (n=5); already have a counselor

[2]Refusal reasons when eligible: Not perceiving social isloation, too busy, loss of contact; lack of interest; health problems

[3]Ineligibility reasons: UCLA Loneliness scales < 6 (n=10); PHQ-9 >10 (n=47); cognitive impairment (BOMC >9; n=2); other (poor vision, poor hearing, not meeting age cutoff, unable to answer questions; n=7).

Table 1.

Participants' Demographic Characteristics and Baseline Scores

	Total Sample N=89		Tele-BA N=43		Tele-FV N=46		P[a]
	%	n	%	n	%	n	
New Hampshire	40.4	36	44.2	19	37.0	17	.523
Female	61.8	55	67.4	29	56.5	26	.383
Race/ethnicity							.196
White	61.8	55	52.5	22	71.7	33	
Black	18.0	16	25.6	11	10.9	5	
Hispanic	14.6	13	16.3	7	13.0	6	
Other	5.6	5	7.0	3	4.3	2	
Marital status							.170
Married	11.2	10	11.6	5	10.9	5	
Widowed	38.2	34	34.9	15	41.3	19	
Divorced/separated	36.0	32	46.5	20	26.1	12	
Never married	14.6	13	7.0	3	21.7	10	
Living arrangement							.241
Alone	68.2	60	72.1	31	64.4	29	
Spouse	11.4	10	11.6	5	11.1	5	
Adult child	9.1	8	11.6	5	6.7	3	
Other	11.4	10	4.7	2	17.8	8	
Income							.555
<$10,000	19.3	17	16.7	7	21.7	10	
$10,000-$14,999	25.0	22	26.2	11	23.9	11	
$15,000-$19,000	17.0	15	16.7	7	17.4	8	
$20,000-$29,000	21.6	19	16.7	7	26.1	12	
>$29,000	17.0	15	23.8	10	10.8	5	
	Mean	SD	Mean	SD	Mean	SD	
Age	73.9	9.0	74.4	8.2	73.5	9.8	.664
ADL/IADL	3.3	2.4	3.7	2.6	3.0	2.1	.184
Miles from site	63.6	62.6	68.9	68.4	58.5	56.9	.435
Travel time from site	88.5	67.6	93.6	72.6	83.7	63.1	.490

Tele-BA: tele-delivered behavioral activation; Tele-FV: tele-delivered friendly visit; SD: standard deviation; ADL/IADL: activities of daily living/instrumental activities of daily living (range 0-12).

[a] Probability values for differences between Tele-BA and Tele-FV groups were calculated using Fisher exact tests for categorical variables and two-sample *t* tests (df=87) for the age, ADL/IADL, miles from site, and travel time from site variables.

Table 2.

Means (SD) of primary and secondary outcomes at baseline and 6- and 12-week follow-ups

Variable	Baseline	6-week follow-up	12-week follow-up
Social Interaction (DSSI-I)			
Tele-BA	8.2 (SD = 1.6)	8.8 (SD = 1.6)	8.4 (SD = 1.6)
Tele-FV	8.0 (SD = 1.5)	7.8 (SD = 1.6)	7.8 (SD = 1.8)
Loneliness (PROMIS-L)			
Tele-BA	21.0 (SD = 6.2)	17.9 (SD = 6.1)	16.8 (SD = 6.2)
Tele-FV	20.3 (SD = 8.0)	19.6 (SD = 7.9)	20.3 (SD = 8.1)
Satisfaction with Social Support (DSSI-S)			
Tele-BA	13.9 (SD = 3.2)	14.4 (SD = 3.0)	14.9 (SD = 2.9)
Tele-FV	14.1 (SD = 3.1)	14.0 (SD = 3.4)	13.7 (SD = 3.2)
Depression Severity (PHQ-9)			
Tele-BA	7.2 (SD = 4.0)	5.9 (SD = 3.8)	4.7 (SD = 3.0)
Tele-FV	7.7 (SD = 4.5)	8.3 (SD = 4.9)	8.0 (SD = 5.5)
Disability (WHODAS)			
Tele-BA	18.6 (SD = 6.9)	15.6 (SD = 6.5)	15.5 (SD = 7.6)
Tele-FV	16.4 (SD = 8.6)	16.0 (SD = 9.1)	17.1 (SD = 9.1)

DSSI-I: Duke Social Support Index Social Interaction Subscale (range 4-12, higher scores indicate more social interaction and less isolation); PROMIS-L: PROMIS Social Isolation Scale (range 8-40, higher scores indicate greater perceived loneliness); DSSI-S: Duke Social Support Index Satisfaction with Social Support Subscale (range 6-18, high scores indicate greater satisfaction/less dissatisfaction); PHQ-9; Patient Health Questionnaire-9 (range 0-9, based on inclusion criteria; higher scores indicate greater depressive symptom severity); WHODAS: World Health Organization Disability Assessment Schedule 2.0 (range 0-48, higher scores indicate greater disability).

Table 3.

Mixed model parameter for post-intervention differences in primary and secondary outcomes

Outcome	Parameter	estimate	SE	t	df	p	$d_{GMA\text{-}raw}$
Social Interaction (DSSI-I)	Intercept	7.91	0.16	50.98	81	<.001	
	Baseline DSSI-I	0.68	0.07	9.29	81	<.001	
	Tele-BA	0.56	0.23	2.42	81	.018	0.36
Loneliness (PROMIS-L)	Intercept	19.96	0.61	32.79	81	<.001	
	Baseline PROMIS-L	0.71	0.06	11.49	81	<.001	
	Tele-BA	−2.78	0.90	−3.08	81	.003	−0.60
Satisfaction with Social Support (DSSI-S)	Intercept	13.80	0.31	44.19	81	<.001	
	Baseline DSSI-S	0.64	0.07	8.83	81	<.001	
	Tele-BA	0.93	0.46	2.00	82	.049	0.29
Depression Severity	Intercept	8.00	0.50	16.11	82	<.001	
(PHQ-9)	Baseline PHQ-9	0.57	0.09	6.61	81	<.001	
	Tele-BA	−2.55	0.74	−3.46	82	.001	−0.39
Disability (WHODAS)	Intercept	17.54	0.77	22.85	81	<.001	
	Baseline WHODAS	0.74	0.07	9.94	80	<.001	
	Tele-BA	−2.61	1.14	−2.29	81	.025	−0.34

SE: standard error