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The Efficacy and Utilization of an Online Mindfulness Intervention on Lonely Older Adults

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ABSTRACT

Background: To support successful aging within a rapidly increasing population of older adults, a holistic approach with accessible interventions has become essential. Research shows mindfulness meditation can reduce negative health outcomes, including loneliness and psychological distress. Common barriers to attending in-person interventions include frequency of sessions, inflexibility of scheduling, lack of transportation, and COVID-19 restrictions.

Alternatively, online interventions can be ideal, as they are more accessible and flexible.

Purpose: The purpose of this study is to test the feasibility of an online mindfulness intervention among lonely and non-lonely older adults and determine if an online mindfulness program could decrease loneliness and improve other psychosocial measures.

Methods: A total of 510 older adults (248 lonely; 262 non-lonely) participated in an eight-week online mindfulness intervention in 2018-2019. Pre- and post-surveys were administered before starting and at the completion of the intervention.

Results: Analytic results conducted in 2020 showed significant differences between lonely and non-lonely individuals who participated in this study. Matched paired t-tests showed significant improvement for lonely participants in purpose, loneliness, and mindfulness awareness. For non- lonely participants, improvement was observed in purpose, mindful awareness, perceived stress, and well-being. Greater impact was shown in measures for those who participated in the intervention.

Conclusions: This online mindfulness-based intervention decreased loneliness and improved other psychosocial measures among older adults. Participants who attended sessions experienced greater improvement than those who did not. However, the ability to improve retention rates in this format remains uncertain. Future research regarding larger scalability of this intervention would be beneficial.

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Introduction

Estimates predict that by 2035, the number of older adults in the U.S. will outnumber children, and by 2030, the entire Baby Boomer generation will be over age 65 [1]. Trends to support continued successful aging and greater emphasis on addressing a comprehensive, holistic approach to health and well-being has become a priority, indicating its impact on older adults' chronic conditions and mortality [2]. Recent studies demonstrate a relationship between factors related to psychological well-being, such as optimism, resilience, and purpose, as protective for negative health outcomes [3-6]. These outcomes include higher quality of life, better mental health, reduced depression and stress, and longevity [7-9]. Conversely, loneliness has a negatively influence on both physical and mental well-being [10-13]. Loneliness impacts a significant proportion of older adults, with up to nearly 60% of those age 65+ reporting moderate or severe loneliness [14,15]. This number has likely increased in recent months due to "stay-at- home" orders of COVID-19 meant to keep vulnerable populations safe during the pandemic. According to data gathered in mid-2020, 7.4 million adults suffered from "Lockdown Loneliness", loneliness resulting from social disconnect during the pandemic [16].

Resilience is the process of adapting well through adversity, trauma, or stress, and is associated with positive outcomes among older adults [17]. Purpose in life is defined as having goals, direction, and meaning in life, and has been found to be strongly associated with improved well-being among older adults [18,19]. Optimism is the extent to which people hold

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favorable expectations about the future and has also been associated with successful aging [20,21].

Meanwhile, social relationships and connectedness play an integral role in positive health outcomes later in life. Social relationships, the connection between at least two individuals, impacts health through behavior, psychosocial, and physiological pathways; conversely, social isolation is considered an objective view of the absence of those relationships measured by the count of relationships [22,23]. Loneliness is a subjective view of inconsistency between one's desired and actual social relationships [24]. While these constructs are unique, feelings of loneliness tend to be common among those who are also socially isolated [2].

Research indicates that older adults who report loneliness or social isolation tend to have higher rates of depression, more chronic health conditions, greater mortality risk, and other suboptimal health outcomes [25,22]. For instance, loneliness is associated with many other chronic and psychosocial conditions that can contribute to poor overall health outcomes later in life, including decreased physical functionality, psychosocial well-being, and reduced longevity [26-28].

Mindfulness

Mindfulness is the process of openly attending, with awareness, to one's preset moment experience [29], and is considered a type of mental training used to reduce cognitive vulnerability to reactive modes of mind to decrease feelings of distress [30]. Meditation is a method of training to practice and benefit from mindfulness. The primary purpose of mindfulness meditation is to learn and practice moment-to-moment awareness without judgment and acknowledge mental processes that may contribute to negative feelings and behaviors [30]. Recent research findings suggest the benefits of mindfulness meditation for older adults include improvement in anxiety, depression, stress, loneliness, and psychological distress [31-35]. Furthermore, recent studies both before and during the COVID-19 pandemic have examined the impact of mindfulness meditation on other mental health attributes, such as purpose and optimism, finding this approach to have a positive impact on these as well [3-6].

Successful interventions for loneliness using a mindfulness approach typically focus on one of four areas: 1) enhancing social skills, 2) providing social support, 3) increasing opportunities for social interactions, and 4) addressing maladaptive social cognition [36].

Specifically, interventions focused on addressing maladaptive social cognition by methods such as training to reidentify negative thoughts, have been especially effective [25]. However, initiatives integrating mindfulness meditation have traditionally been designed predominantly as in-person events, requiring older adults to leave their homes to attend. This has created barriers to the success of in-person mindfulness meditation interventions and continues to remain challenging during the current COVID-19 pandemic. Thus, alternative options must be considered.

Technology and online interventions

In the past decade, older adults have become more digitally connected, and report more positive attitudes towards technology use [36]. 2017 AARP survey found nine out of ten older adults reported owning a computer or laptop [37]. Additionally, a review of technology use among older adults found increasing opportunities to utilize technological options to support successful aging [38]. Meanwhile, technology-based and online intervention approaches for older adults have emerged, in some cases proving success in managing pain and reducing depression, anxiety, and stress [39-41]. However, there is limited research to support online mindfulness meditation interventions to improve loneliness for older adults.

Statement of purpose

Our research team worked to expand the previous test and learn [41] and launched multiple phases with more participants to test the feasibility of an online mindfulness meditation intervention. Our purpose was to assess the efficacy and utilization of an online mindfulness intervention and the extent to which both lonely and non-lonely older adults would use the online program over eight weeks. A secondary purpose was to determine if this program could decrease loneliness and improve other psychosocial measures.

Methods

Recruitment and study population

Participants were recruited from a seven-question interactive voice recognition survey (7QIVR) that included a question to screen for loneliness. The 7QIVR survey is part of a larger research investigation within the UnitedHealthcare (UHC) organization to improve customer experience and better understand the health-related issues of older adults. In order to avoid the need for additional time and surveys, the 7QIVR was used as the eligibility identifier for this intervention, with the understanding that participants may score differently during the baseline survey than they did on the one-item loneliness question in the 7QIVR. In 2016, approximately 5 million Medicare beneficiaries were covered by an AARP® Medicare Supplement Plan insured by UnitedHealthcare Insurance Company or an affiliate (collectively "UnitedHealthcare"). These plans are offered in all 50 states, Washington DC, and various US territories. Eligibility criteria for this study included individuals covered by these plans, who were age 65+ and screened for loneliness. Exclusion criteria included those already participating in UHC clinical support, younger than 65, on the "do not call" list, and without a valid phone number or internet access.

Eligible participants received a pre-mailer informing them of this study. All other components of the study were conducted online. A total of 7,071 individuals were contacted to participate in the study, of which 624 (9%) started the intervention in 2018 and 2019. This recruitment rate was expected, as qualitative data collected with other similar studies at UHC found many individuals expressing concerns in participating in research with a health insurance company, impacting the ability to recruit participants more effectively [42].

Compensation was provided for participation or completion of surveys, with earlier phases of the intervention providing $25 for program completion, the last phase providing $25 for completing the baseline survey, and $75 for completing the second survey. Before agreeing to participate, individuals

received an information sheet explaining participation was completely voluntary and participating as well as data and feedback from participating would not affect their insurance plan or coverage. This study was approved by the New England Institutional Review Board (NEIRB #120170358).

Intervention

The eight-week program was based on Internet Mindfulness Meditation Intervention (IMMI) and Mindfulness-Based Stress Reduction (MBSR) intervention approaches, focusing on self-compassion and education in an online setting. The first session provided an overview of what to expect during the intervention, as well as an opportunity to allow for questions and resolve potential technological difficulties that could arise during the online format. The next seven session topics included: 1) Mindfulness and Healthy Aging, 2) Anchoring with the Breath, 3) Resiliency, Social Connectedness, and Well-being, 4) Mindful Body Awareness, 5) Working with Thoughts; Challenging Emotions, 6) Challenging Body Sensations, and 7) Compassion, Kindness, and Action Planning. Each session was tailored specifically for topics and context related to experiences and challenges among older adults. The first session was scheduled for 90 minutes, with the next seven sessions scheduled for 60 minutes each.

Participants had a choice of participating in two group sessions once a week, offered at two pre-scheduled times. Each session was led by a trained mindfulness facilitator and was held via WebEx's online platform. The WebEx session offered the opportunity for participants to engage with both the facilitator and other attendees using a chat function.

Participants who could not attend one of the live session times offered had the opportunity to watch a previously recorded session, which included the same content as the live sessions without the interaction features available during the live session.

Demographics and socioeconomic status

Demographic information for all participants including age, gender, and marital status was collected during the initial survey. Socioeconomic status included income, education, and health resource information such as Primary Care Provider (PCP) rates and Mental Health Provider (MHP) rates geocoded from zip codes. Hierarchal Condition Category (HCC) risk scores were used to assess clinical health status (McCall & Cromwell, 2011). HCC scores are derived from the Centers for Medicare & Medicaid Services (CMS) guidelines and based on medical claims.

Survey measures

Quality of Life

Quality of life was assessed with the 12-item Veteran's Rand (VR-12) survey. This measure asks participants about their quality of life in the previous four weeks [43] and is divided into two subscales: Physical Component Score (PCS) and Mental Component Score (MCS). The validated algorithm is scored on a scale of 0 to 100, with higher scores indicating better physical and mental quality of life. Cronbach's α for the VR-12 was 0.87 at baseline and 0.91 at T2.

Loneliness

Loneliness was measured using the 10-item short version of the UCLA Loneliness Scale (UCLA-10) [44]. Responses ranged from 1 (never) to 4 (often) and were summed to create a score ranging from 10 to 40. Higher scores indicate higher levels of loneliness. A score of 24+ is considered lonely. Cronbach's α for loneliness was 0.91 at baseline and 0.90 at T2.

Psychological well-being

Resilience was measured with the six-item Brief Resilience Scale (BRS) [45]. Participants were asked about their ability to bounce back from life experiences in the previous month on a five-point scale from 1 (strongly disagree) to 5 (strongly agree). Responses are averaged so that total scores range from 1 to 5, with higher scores indicating higher levels of resilience. Cronbach's α for resilience was 0.91 at both T1 and T2.

Purpose in life

Purpose in life was measured with seven items adapted from the National Institutes of Health (NIH) Tuberculosis Meaning and Purpose Scale Age 18+ [46]. Responses, ranging from 1 (strongly disagree) to 5 (strongly agree), were averaged with totals from 1 to Higher scores.

Indicate higher levels of purpose in life. Cronbach's α for purpose was 0.93 at baseline and 0.92 at T2.

Optimism

Optimism was measured using the six-item Life Orientation Test-Revised (LOT-R) [47]. Responses ranged from 0 (disagree a lot) to 4 (agree a lot) and were summed to create a total score ranging from 0 to 20 with higher scores indicating greater optimism. Cronbach's α for optimism was 0.85 at baseline and 0.84 at T2.

Perceived stress

Perceived stress measures the degree to which situations in one's life are considered stressful [48]. Responses for each question range from 0 to 4 and were summed to give an overall perceived stress score ranging from 0-40. Higher scores indicate a greater perception of stress. Cronbach's α for perceived stress was 0.89 at baseline and 0.88 at T2.

Anxiety

Anxiety was measured using the seven-item Generalized Anxiety Disorder Test (GAD) [49]. It asks participants, on a four-point scale, about their anxiety-related thoughts in the previous two weeks. Responses range from 0 (not at all) to 3 (every day) and were summed to create a single score ranging from 0 to 21. Higher scores indicate greater levels of anxiety. Cronbach's *α* for anxiety was 0.90 at baseline and 0.87 at T2.

Depression

Depression was identified using the validated two-item Patient Health Questionnaire-2 (PHQ-2) [50]. It consists of two questions asking respondents how often they experienced depressed mood and loss of interest over the previous two weeks. Responses for each question ranged from 0 to 3 and were summed to give an overall score ranging from 0 to 6. Depression is defined as a score of three or higher. Cronbach's α for depression was 0.85 at baseline and 0.82 at T2.

Mindfulness

Mindfulness was measured using the 15-item Mindfulness Attention Awareness Scale (MAAS) [51]. MAAS assesses differences in the receptive mindfulness state between a person, and one's tendency towards mindfulness or mindlessness. Responses for each question ranged from 1-6 (almost always to almost never) on a Likert scale. Responses were summed to give an overall score, and the mean was then calculated. A higher score indicated higher levels of mindfulness. Cronbach's α for MAAS was 0.91 at baseline and 0.90 at T2.

Intervention data

Engagement

The intervention engagement variable was created by summing online attendance, listening to recorded sessions, and engaging in check-in calls (post online attendance) together to create a range of 0 (no engagement) to 21 (all forms of engagement throughout the eight weeks).

Statistical testing

All data was imported into SAS Enterprise Guide Version 7.1 (SAS Institute Inc., Cary, NC, USA) in 2020. Matched paired t-tests were conducted for respondents who completed T1 and T2 by lonely and non-lonely respondents. Linear and logistic regressions were used to detect impact of engagement in the intervention on the psychosocial measures.

Response bias

Response bias analysis was conducted using demographics, socioeconomic data, and claims data for those who were reached but did not participate (n = 7.071) versus those who participated (n = 624). Analysis demonstrated differences between participants and non-participants in baseline characteristics. Therefore, a propensity weight was generated based on baseline characteristics and then applied to adjust the differences between the two groups. After propensity weighting, there was no difference in baseline characteristics between participants and non-participants. Therefore, the weight was used for all subsequent analyses to adjust for response bias. The weighted sample (n = 510) was then divided into lonely (n=248) vs. non lonely (n = 262) groups.

Results

Demographics of the study participants for T1 (n = 510) are shown in Table 1. At baseline, participants were primarily female and younger. On average, lonely participants were younger, less likely to be married, more likely to reside in areas with lower median household incomes, have fewer healthcare resources, and less likely to have a college education than non- lonely participants. At baseline, lonely participants had lower resilience, purpose, and mindfulness awareness than non-lonely, and higher scores of stress and anxiety (Table 2). Lonely participants also attended fewer sessions overall. Matched paired t-tests were conducted for participants who completed both surveys. There was significant improvement from T1 to T2 among all participants in many of the study variables (Table 3). Among lonely participants, purpose in life ($p=<.05$), loneliness ($p<0.01$), and mindful awareness ($p=<.05$) improved significantly. As expected, loneliness did not change significantly among non-lonely participants. However, there was improvement in purpose in life ($p \leq 0.01$), mindful awareness ($p \leq 0.05$), perceived stress ($p \leq 0.01$), and mental well-being ($p \leq 0.01$).

Attendance effect

After combining all potential engagement options (Table 4), both lonely and non-lonely participants were more likely to continue with the intervention after the seventh point of participation. Lonely participants were slightly more likely to continue than non-lonely participants. Linear regressions were conducted to investigate attendance effect on psychosocial measures (Table 5). Lonely individuals who engaged in the intervention saw significant changes in loneliness, mindfulness, and mental well-being. Non-lonely individuals saw significant changes in mental well-being, optimism, and purpose.

Discussion

Our results indicate that when given multiple options, participants showed willingness to engage in the different components of the online intervention. Once participants began, they were more likely to complete the program. Importantly, the more frequent the engagement, the better psychosocial outcomes were observed, regardless of lonely or non-lonely status. For those who scored as lonely at the start of the intervention, reported loneliness significantly decreased from T1 to T2. Notably, there was no significant change in loneliness scores for non-lonely participants. It is important to remember the significant differences found between lonely and non-lonely participants: lonely participants reported more negative psychosocial outcomes at baseline than non-lonely participants. Improvements observed in loneliness, purpose, mindfulness awareness, and perceived stress within this population are therefore something to note. The current study focused not only on the practice of mindfulness, but also on facilitated live sessions with other older adults, to promote social interactions during sessions with both the facilitator and other participants. Research indicates that interventions to improve loneliness should include increasing social contact, improving social support, enhancing social skills, and addressing maladaptive social cognition [52]. This intervention, which included facilitation topics as well as the ability to chat with both the facilitator and other attendees, may have successfully targeted these outcomes. Decreased loneliness may have also contributed to improvement in other outcomes as well in both the lonely and non-lonely, such as quality of life, stress, and purpose. Meanwhile, greater impact was observed among participants who attended the sessions, although that impact varied among lonely and non-lonely participants. The greater the participation, the greater decrease in loneliness and increase in mindfulness awareness among lonely participants. In evaluating retention, we found that after the seventh point of engagement, both lonely and non-lonely participants were more likely to continue. This finding indicates that once participants began engaging and creating a habit to participate, they were likely to continue to engage, and to receive greater positive impact as a result.

In the current era of COVID-19, with restrictions on outside activities, and social outings, many previously established

Table 1: Unadjusted demographic characteristics among lonely and non-lonely.

	All	Lonely (24+)	Non-Lonely (<24)	*p*
Number of Participants in Study (n)	510	248	262	
Gender				
Female	67.3%	66.5%	67.9%	0.735
Male	32.7%	33.5%	32.1%	
Age Group				
65-74	61.2%	66.5%	56.1%	0.054
75-84	33.3%	28.6%	37.8%	
85 plus	5.5%	4.8%	6.1%	
Average age (years)	74.1	73.3	74.8	0.002
Marital status				
Married	57.5%	49.2%	65.3%	<0.001
ZIP Code based demographics				
Median household income level				
Low	10.4%	12.5%	8.4%	<0.001
Medium	36.9%	44.4%	29.8%	
High	52.7%	43.1%	61.8%	
Minority rate level				
Low	41.0%	45.2%	37.0%	0.175
Medium	41.2%	38.3%	43.9%	
High	17.8%	16.5%	19.1%	
Primary Care Physician rate level				
Low	2.2%	2.8%	1.5%	0.144
Medium	22.7%	25.8%	19.8%	
High	75.1%	71.4%	78.6%	
Mental Health Provider rate level				
Low	0.6%	0.8%	0.4%	<0.001
Medium	39.0%	54.4%	24.4%	
High	60.4%	44.8%	75.2%	
College plus rate level				
Low	4.1%	5.2%	3.1%	0.018
Medium	26.7%	31.5%	22.1%	
High	69.2%	63.3%	74.8%	
State				
AZ	18.2%	27.0%	9.9%	<0.001
CA	58.2%	38.3%	77.1%	
FL	23.5%	34.7%	13.0%	
HCC level				
0.00-0.49	29.5%	27.9%	31.0%	0.181
0.50-1.19	45.1%	42.6%	47.5%	
1.20-2.79	23.2%	27.5%	19.2%	
2.80 plus	2.2%	2.0%	2.3%	
Mean HCC	0.94	0.97	0.90	0.278

Table 2: Baseline survey response variables (adjustment) among lonely and non-lonely.

	Lonely (24+)	Non-Lonely (<24)	*p*
Number of Participants in Study	248	262	
Loneliness score (10-40)	28.51	18.01	<0.001
Caregiver (%)	21.0%	37.4%	<0.001
Purpose in life (8-40)	24.00	29.01	<0.001
Average resilience score (1-5)	3.02	3.56	<0.001
Optimism score (6-30)	19.83	24.02	<0.001
MAAS (1-6)	3.99	4.51	<0.001
GAD score (0-21)	7.13	3.51	<0.001
PSS score (0-40)	19.01	12.63	<0.001
Physical Component Score	40.51	45.64	<0.001
Mental Component Score	41.38	51.15	<0.001

Table 3: Paired t-tests by loneliness status.

Lonely (N=84)				**Non-Lonely (N=108)**		
Means per Survey	T1	T2	*p*	T1	T2	*p*
Purpose in life (8-40)	25.32	26.30	<.05	28.20	29.12	<.01
Average resilience score (1-5)	3.02	3.09	0.18	3.36	3.46	0.06
Loneliness score (10-40)	27.60	25.86	<.01	18.17	18.39	0.61
Optimism score (6-30)	19.81	20.02	0.70	23.83	23.32	0.26
MAAS (1-6)	4.10	4.23	<.05	4.29	4.44	<.05
GAD score (0-21)	6.24	5.52	0.07	3.75	3.24	0.15
PSS score (0-40)	17.91	16.88	0.09	13.27	11.80	<.01
Physical Component Score	43.99	44.38	0.53	46.85	46.83	0.96
Mental Component Score	43.62	45.12	0.12	49.06	51.99	<.01

Table 4: Retention in intervention by overall dosage engagement.

Total Doses	**Lonely**		**Non-Lonely**	
	N	%	N	%
0	118	47.6%	105	40.1%
1	29	11.7%	28	10.7%
2	14	5.6%	11	4.2%
3	6	2.4%	7	2.7%
4	5	2.0%	3	1.1%
5	3	1.2%	11	4.2%
6	6	2.4%	5	1.9%
7	26	10.5%	33	12.6%
8	8	3.2%	17	6.5%
9	4	1.6%	14	5.3%
10	5	2.0%	5	1.9%
11	3	1.2%	3	1.1%
12	4	1.6%	5	1.9%
13	3	1.2%	4	1.5%
14	7	2.8%	8	3.1%
15	2	0.8%	1	0.4%
16	1	0.4%	1	0.4%
17	1	0.4%	0	0.0%
18	0	0.0%	0	0.0%
19	1	0.4%	0	0.0%
20	2	0.8%	0	0.0%
21	0	0.0%	1	0.4%

Table 5: Dosage effect by loneliness status, significant estimates from simple linear regression.

T2 Variables as Dependent	**Independent**	**Lonely (24+)**		**Non-Lonely (<24)**	
		Estimate	*p*	Estimate	*p*
Average resilience score	Total doses*			0.06	0.003
Loneliness score	Total doses*	-0.30	0.012		
MAAS	Total doses*	0.07	0.002		
Mental Component Score	Total doses*	0.53	0.038	0.71	0.017
Optimism score	Total doses*			0.34	0.020
Purpose in life	Total doses*			0.26	0.065

* Total count of sessions attended, sessions watched and check-ins

in-person mindfulness programs may cease to exist, at least for the foreseeable future. This eliminates a potentially vital interaction for older adults, specifically those who are lonely. The success of online mindfulness interventions such as this one indicates a need for the continuation of similar programming during this time, as well as the need to assist and support older adults with access and use of technology.

Limitations and strengths

Strengths include the ease and flexibility of an online intervention for older adults who may have difficulty attending in-person sessions, especially while COVID-19 related restrictions continue. This intervention required less time and intensity each week, yet still demonstrated significant impacts on overall health and well-being. While this intervention showed greater improvement in loneliness for older adults who were lonely, positive impacts on other variables were also observed among not lonely participants. Limitations include lower engagement, possibly due to too many options offered for participation, resulting in choice overload rates and the absence of a control group to test the generalizability of the intervention. Since there was a small retention rate compared

to eligibility for this intervention, there was most likely self-selection bias for those who choose to participate. However, those who engaged clearly did benefit. This study was conducted prior to the COVID pandemic, and the pandemic has likely shifted the need for older adults to utilize online programs to promote psychological health and well-being. Studies such as this provide solutions that should be considered and studied more thoroughly.

Conclusions

In this study, we examined various psychosocial factors that act as important determinants of overall health and well-being among older adults. Our findings support the potential for significant improvement in the specific psychosocial factors considered with this intervention, specifically among those who consistently engaged in the program. Now more than ever, the creation of at-home support and methods to reduce loneliness and increase social connection is imperative. At the same time, flexibility and ease of access to this support is necessary to increase the likelihood of participation. Although additional research is needed, online mindfulness interventions geared specifically toward topics that are relevant to older adults with support from peers have shown potential to improve loneliness.

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Internal Review Board Approvals

This study was approved by the New England Institutional Review Board (NEIRB) Protocol #120170358.

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