



Research Article

Engaging Older Adults through a Virtual Brain Training Program

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Abstract

Background: Along with growth in the older adult population, there will be increases in the numbers of individuals with cognitive deficits. It will be important to delay the decline in cognition through brain stimulating activities. Social interaction may be a contributing factor in improving cognition and reducing the risk for cognitive decline in older adults. It is important to find ways to enhance social interaction and reduce social isolation when considering programming of cognitive programs for older adults during COVID 19. The purpose of this study is to examine the feasibility and evaluate a 6-week virtual (using Zoom) brain training program among community dwelling older adults.

Methods: During each Zoom session, participants were engaged in warm-up activities, provided information about the weekly topic, discussion about the topic, and completed an interactive activity. The 27 participants were all White/Caucasian, female (78%), ranged from 66-86 years of age, and were mostly married and retired. A process, impact, and outcome evaluation was conducted with this virtual program.

Results and conclusion: Results from individual interviews revealed that the majority (50%) of the participants stated the social interaction (which was virtual), followed by learning new things (20%) and the class activities (15%) were their favorite aspects. There was a significant difference in objective measures of cognition scores pre-program to post-program ($p < 0.05$). It may be that by participating in this virtual brain training program, some of the older adults were able to regain the sense of social connections while engaging in cognitively stimulating activities. The online format that allowed participants to become involved when they were unable to attend their local senior center because of COVID 19 restrictions.

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Introduction

Currently, adults over the age of 65 represent 14.5% of the United States (U.S.) population and by 2030, older adults will comprise 20% of the population [1]. In the United States, the “oldest old” population (85 years of age and older) is expected to triple between 2015 and 2050, with the numbers increasing from 126.5 million people to 446.6 million people [2]. While 95% of the older adults’ health care costs stem from chronic diseases such as heart disease, cancer, stroke and diabetes [3], deaths due to Alzheimer’s disease have increased 146% [4]. As longevity continues to rise, the population of older adults will also continue to grow. With this increase in the number of older adults, there are growing numbers of both neurodegenerative dementia and cognitive declines [5].

Cognition is the ability to coordinate thoughts and actions for completing a goal [6]. As individuals age, cognitive decline (trouble remembering, recalling, learning new things, concentrating, or making decisions) becomes more prevalent [7,8] and often begins to worsen between the ages of 50 and 70 years [9]. Due to the projected increase in the older adult population, there is high demand for programs and interventions aimed at decreasing the progression of cognitive decline. While memory can worsen with age, its severity can be offset by interventions [10]. Programs aimed at slowing cognitive decline among older adults have been previously implemented and have included components such as education, socialization and physical activity in a variety of settings [11-14].

Results from several studies suggest that including some type of social interaction and engagement appears to be a cornerstone to improving cognition [15]. It does appear that social interaction may be a contributing factor in improving cognition and reducing the risk for cognitive decline in older adults. It is important to find ways to enhance social interaction and reduce social isolation when considering cognitive programs for older adults. On the other hand, social isolation is a major health-related issue for older adults as it is linked to increased risk of premature death, poor physical and mental health, dementia, depression as well as cognitive deficits [16-18]. Social isolation can be defined as having infrequent social contact or few social relationships [17]. Older adults are particularly vulnerable to social isolation due to transitions in their lives (i.e., retirement, relocations, loss of loved ones) and the COVID-19 virus has often forced older adults into social isolation [19]. Older adults are at risk for COVID-19 due to higher rates of comorbidities such as heart disease, lung disease and diabetes in addition to their depressed immune system [17]. Because of their increased risk of COVID-19, older adults are often self-quarantining and limiting contact from others thus leading to increased social isolation. As Wu (2020) has suggested it is important to utilize technology to bring individuals

together during these times of decreased social interactions [17]. One study reported that during the month of March 2020, that there was minimal use of online platforms to connect with friends or family members with less than 20 percent of the older adult population in the United States reporting its use of this type of technology [20].

Concurrently, during the pandemic, many memory clinics had to stop their programs despite increased need for social support among older adults. This required a shift to virtual platforms such as Zoom or Skype to reduce in person interactions. With this new means of communication, some challenges arose, including access to technology, lack of knowledge on how to use the technology, connectivity issues and ethical concerns regarding privacy [21]. Despite these issues, virtual sessions have the ability to continue memory programs at a cost-effective rate while protecting older adults from being exposed to the virus. The use of these technologies for memory programs has the potential to provide cognitive and leisure related activities, education and support, as well as medical management [22]. It is essential for future virtual programs to ensure that the older adult participants have access to and know how to use technologies such as laptops, smartphones, and tablets to increase participation in programs so they can be cognitively stimulated and maintain social connections [22].

With the continued call for cognitively stimulating activities for older adults during times of COVID 19, more research is needed. Few studies that we have found implemented brain training techniques with independently living older adults in a community setting with no programs being conducted in a virtual format. The purpose of this study is to examine the feasibility and evaluate a 6-week virtual brain training program among community dwelling older adults.

Materials and Methods

Procedures

In summer 2020, this brain training program was implemented virtually via Zoom to members (while in their own homes) of two community senior centers with sessions separately held for each of the senior centers. After the initial implementation, process evaluation feedback informed some minor changes to the curriculum for round two of program implementation that took place in fall 2020. The second round of implementation involved conducting virtual programs to members of two additional senior centers in New Castle County, Delaware. New Castle County (NCC) is located in the northern portion of Delaware.

The brain training program was completed over a seven-week time span including the first orientation session and 6 week program. During the first session, participants were orientated to using Zoom, completed an introductory icebreaker activity, and were presented with an outline for the 6 week program. Each week consisted of a warm up activity/ice breaker, puzzle, a reading and comprehension check, a group discussion, and a group activity which were delivered via Zoom with two instructors present and alternating in leading the class. The topics were determined by review of past successful brain training programs. Each 60-min class examined a different topic each week: (1) languages, (2) history of Delaware, (3) Broadway musicals, (4) travel, (5) poetry and (6) museums. Table 1 outlines each session of the brain training program with the icebreaker, reading and activity. Links to the readings and information were distributed to participants via e-mail 1-2 days prior to their scheduled class (Table 1).

Week	Theme	Description
1	Languages	Icebreaker: If you were to become famous for one thing what would it be? Reading: French, Spanish, German Activities: (1) Language-Country crossword puzzle, (2) reading comprehension questions, (3) map, (4) language matching game
2	History of Delaware	Icebreaker: If you could bring back one fashion trend from any era what would it be? Reading: NCC History, Old New Castle Activities: (1) History of DE word search, (2) reading comprehension questions, (3) Old New Castle word search, (4) Jeopardy, (5) New Castle County Courthouse Museum video
3	Broadway Musicals	Icebreaker: Where is the best place you have traveled? Reading: History of Broadway, Wicked Activities: (1) Famous Broadway show crossword puzzle, (2) reading comprehension questions, (3) Guess the Movie Musical game, (4) Wicked hair, makeup, costume videos
4	Travel	Icebreaker: Picture/souvenir show and tell from previous trips; What is one thing you want to accomplish before the end of this year? Reading: Greece, Seven Wonders, Traveling and the Brain Activities: (1) Around the World word search, (2) reading comprehension questions, (3) Travel trivia game, (4) COVID staycation tips, (5) virtual tours, (6) travel crossword puzzle
5	Poetry	Icebreaker: Write a poem (Haiku) and share/As a child, what did you want to be when you grew up and what did you end up becoming? Reading: Effects of Poetry, Poetry has Power, Effects of Poetry on the Brain Activities: (1) Elements of poetry crossword puzzle, (2) Famous poets word search, (3) Famous poets trivia, (4) Types of poetry
6	Museums	Icebreaker: What is your favorite food to cook, bake, or order and why? Activities: (1) Different museums word search, (2) Museum location trivia, (3) reading comprehension questions, (4) virtual museum tours Reading: Museum Attendance and Dementia, Museums of Mind-Expanding

Table 1: Weekly schedule.

Each weekly session began with an icebreaker activity (i.e., What is the best place to travel?; If you could bring back one fashion trend from any era, what would it be?) that was facilitated by the instructor to initiate engaged discussion on the Zoom platform. This led into the first activity that was usually a crossword puzzle or word search that was completed in the group setting. Following the activity, there were several readings, which were typically read aloud by the participants and instructor and followed by a discussion in the form of quiz questions corresponding to the reading. The quiz was followed by a video or presentation of the topic and the session concluded with some type of interactive game (i.e., Trivia, Jeopardy).

Recruitment

Instructors were recruited from the Department of Behavioral Health and Nutrition, Undergraduate Health Behavior Science Program and Health Promotion Master of Science Program at the University of Delaware. They completed complementary undergraduate coursework relating to aging and human subjects training in

compliance with International Review Board (IRB) standards (University of Delaware, 2020). Program participants were recruited by electronic flyers, postings on social media and through electronic newsletters in conjunction with direct recruitment from the center’s activity director. Program participant inclusion criteria included the following: (1) participants were required to be 50 years of age and older, (2) be community-dwelling residents, (3) be independently living, (4) have no severe cognitive impairment (SLUMS scores less than 21) (5) have no current clinically diagnosed depression, (6) must be able to speak and comprehend English. All human subject procedures were approved by the University of Delaware Institutional Review Board for Research with Human Subjects. Prior to starting the program, baseline assessments of subjective and objective measures of cognition, well-being and demographics. All assessments were conducted virtually over the phone.

Measures

The Patient Reported Outcomes Measurement Information System (PROMIS) and Short Form 8 was used to assess perceived cognitive function [23]. The PROMIS Cognitive Function assesses patient-perceived cognitive deficits in the areas of mental acuity, concentration, verbal and nonverbal memory, and verbal fluency. The short form version has 8 items. The items are tallied and then converted to a z score.

The Saint Louis University Mental Status Exam (SLUMS) exam was used to measure objective cognition [24]. It was first developed as a screening tool for detecting mild cognitive impairment in individuals at the Veterans Administration [24]. It uses small cognition tasks such as recalling simple words, reciting numbers backwards, and answering verbatim questions after a small passage. It is scored out of 30 points on a cognitive scale of 1-19 indicating dementia, 20-26 as mild cognitive impairment and 27+ as normal.

The Satisfaction with Life Scale (SWLS) assessed perceived overall life satisfaction [25]. Participants indicate how much they agree or disagree with each of the 5 items using a 7-point scale that ranges from 7 strongly agree to 1 strongly disagree [25]. These items are tallied and then scored for a total of 5-35, with higher scores indicating a higher quality of life.

Questions regarding demographics included age, sex, marital status, education level, income.

Participants

The participants in this study were independently living members of local senior and community centers who self-selected to be involved in the program. There were 27 total participants, 21 female and 7 male, who completed the virtual brain training program ranging from 62-86 years of age (mean age=74.37+6.96 years). The participants were all White (100%), with the majority of the participants completing some college (90%). The majority of the participants were married (64%) and retired (86%). The annual salary of participants was concentrated between \$35,000-\$75,000 (Table 2).

Process, impact and outcome evaluation

Process evaluation occurred in the following ways: (1) Program attendance was taken weekly by the instructors. (2) An observer

attended class on a weekly basis to monitor participant engagement and topic discussions. (3) Instructors met with the University of Delaware faculty program advisor weekly to discuss feedback from the observer and instructor observations. (4) Open-ended qualitative questions were added post-survey to gather feedback and satisfaction with the program curriculum and to provide input to changes to weekly activities and any discussion topics. Some of these questions included: (1) What was your overall favorite thing about this class? (2) How did you like this class virtually? Based upon the feedback provided by these in-depth interviews, weekly assigned readings were reorganized to better match in-class lecture topics for the next round of implementation.

Variable:	Descriptive Factors:	Percent (N=27)
Age	74.91 +6.47 (66-86 years)	
Gender	Male Female	22% (6) 78% (21)
Race	White African American	100% 0%
Education Status	High School Some college College Grad Post-Graduate	11.5% 23.1% 50.0% 14.8%
Marital Status	Married Widowed Divorced/ Separated Never Married	59.3% 14.8% 14.8% 7.4%

Table 2: Demographics.

Several other post-survey questions were part of an impact evaluation. Example questions included: (1) How do you think this program has changed your forgetfulness or importance in keeping up your current cognitive function (2) What take away(s) from this class will you carry with you in order to enhance your cognitive function?

Outcome evaluation examining pre-post changes in cognition and quality of life and the relationships among the demographic, cognition and quality of life factors was evaluated for both rounds of this program.

Statistical analysis

SPSS Version 24 was used to conduct statistical analysis. Descriptive statistics were conducted to examine participant characteristics. Paired t-tests were run to assess pre-post difference in quality of life and measures of cognition. Pearson’s correlations were conducted to examine the relationships between demographic variables, quality of life, SLUMS and attendance. Thematic analysis of the interviews were conducted and then frequencies of the responses were tallied for the interview questions.

Results and Discussion

Process and impact evaluation

Results from individual interviews revealed that the majority (50%) of the participants stated that their favorite thing was the social interaction (which was virtual), followed by learning new things (20%) and the class activities (15%). In terms of how this program

changed or helped to maintain cognitive function, participants stated that it helped them to better understand cognitive or brain function (45%), being involved in a group setting (15%), challenged them (5%), with few individual stating that it did not impact them (15%). The majority of participants enjoyed the virtual platform (35%), some were indifferent (25%), while only a few (10%) indicated that they did not enjoy the sessions on a virtual platform and 10% stated they had trouble with technology. Most of participants (50%) had used Zoom before, while only a few (5%) reported that they had not utilized zoom previously (Table 3).

How do you think this program has changed or maintained your current cognitive function?	<ul style="list-style-type: none"> • 1/20: Challenging/challenge themselves • 9/20: Understand cognitive/brain function better • 3/20: Has not changed their forgetfulness • 3/20: Group setting/becoming a unit • 3/20: Unsure • 1/20: No response
What take away(s) from this class will you carry with you in order to enhance your cognitive function?	<ul style="list-style-type: none"> • 10/20: Interest in learning more about topics after program completion • 1/20: No takeaways • 8/20: Spurred interest in new activities/experiences • 1/20 unsure
What was your overall favorite thing about this class?	<ul style="list-style-type: none"> • 10/20: Social interaction • 3/20: Class activities • 3/20: No answer • 4/20: Learning new things
Was this your first time with ZOOM?	<ul style="list-style-type: none"> • 9/20: Had used Zoom before • 1/20: Hadn't used Zoom before • 10/20: No response
How did you like this class virtually	<ul style="list-style-type: none"> • 7/20: Enjoyed the virtual platform • 2/20: Didn't enjoy the virtual platform • 5/20: Indifferent • 2/20: Had issues with technology • 3/20: No response

Table 3: Interview frequencies.

Outcome evaluation

There was a significant difference in SLUMS scores pre-program (19.88 + 3.41) to post-program (20.81 + 3.31); $t(8) = 2.05$; $p < 0.05$. There were differences in quality of life scores and PROMIS over the course of the intervention (Table 4). On average, participants completed 75.45% of sessions over the course of the program. Results of Pearson's correlation indicated that there was a significant inverse relationship between age and Slums post-program ($r(27) = 0.520$, $p < 0.005$). There were no other significant relations.

Variable	Pre	Post	t test	P -value
Quality of Life	27.22 (+6.70)	27.48 (+6.22)	0.28	Ns
Slums	19.88 (+ 3.41)	20.81 (+ 3.31)	2.05	0.05
PROMIS	53.55 (6.93)	53.92 (7.38)	0.28	Ns

Table 4: Pre and post -test cognitive and quality of life variables.
 ** PROMIS t- score of 50 is the mean of population

Discussion

As individuals age, there is a greater importance of involvement in brain stimulation programs including social engagement to delay the onset or progression of these cognitive declines [26]. In light of the necessary restriction due to COVID -19, brain stimulating activities had to take on a new platform for implementation as well as new importance in terms of socially engaging older adults. This study examined the feasibility of implementing a brain training program on a virtual platform to a group of independently living older adults. This brain training program used a synchronous class format in which older adults navigated through the use of zoom to connect into the virtual class. Examination of attendance for the overall program demonstrates that participants attended about 75% of the overall sessions. This indicates that the rates were similar to in person classes [27]. This attendance rate of 75% is important when considering the barriers, such as connectivity, access and knowledge of technology, which adults faced when moving to an online platform [21]. Older adults can use technology effectively and can be taught how to navigate the systems [28]. It may be that there is a misperception of how older adults can utilize technology and the numbers may be underestimated in terms of how many utilize technology on a regular basis.

The COVID-19 pandemic has brought to light the increased importance to mitigate social isolation in the aging population. One of the measures to decrease the risk of COVID-19 is social distancing, which in many cases forces individuals to be socially isolated from peers and family members. However, it is known that social isolation can be associated with increased dementia [29]. Social isolation is a concern and both health care professionals and aging agencies are being encouraged to find innovative ways to have older adults connect with their peers and older adults' family members [17,30-32]. One way to do this is through using platforms such as Zoom or Facetime where individuals can interact and actually see people's faces.

Although the focus of this program was cognitive stimulation, the mere act of gathering on a virtual platform seemed to engage people and potentially decrease their sense of loneliness. In fact, when asked about their overall favorite aspect of the brain training class, the vast majority mentioned the social engagement as what they enjoyed the most. They also stated that what they gained from this experience was that the group became more of a social unit and that spurred further discussion and cognitive stimulation. For example:

“The group started to become a unit and we knew each other and we were learning more and remembering some of the things we had forgotten.”

Another participant stated that the favorite aspect of this was:

“...getting to know the other participants and having the social interaction.”

And

“I enjoyed meeting other people and hearing other peoples' experiences.”

“Getting together and being with other people ...it was great because it was something you could do physically and have involvement.”

Many of these older adults participants prior to the COVID 19 pandemic were engaged in senior center activities including art classes, physical activity classes, trips to local and regional

destinations, language classes, educational classes which all involved the common thread of social interaction. This important piece of their daily life was lost when the pandemic related restrictions were put into place. It may be that by participating in this virtual brain training program, some of the older adults were able to regain the sense of social connections while engaging in cognitively stimulating activities, even if it was just for the weeks that the program was held. Some of the participants expressed looking forward to meeting some of these individuals in person once they were able to return to the center.

Additionally, this type of virtual brain stimulation program is replicable and can easily be implemented in various settings. Participants indicated that some had used zoom previously while for others, this was their first time. The facilitators of the classes were patient with participants and assisted them in utilizing their varied technology to access the virtual programs. While there was a wide variety of communication devices used including smartphones, tablets or ipads, laptop and desktop computers and kindles, participants were able to adapt to the technology. Sometimes there was additional one on one instruction to navigate the platform so participants could use the gallery view or view the shared screen.

Some limitations of this program included being aware of the number of people who could actively participate in the program. When there were more than 12 participants on Zoom, it became difficult to interact amongst all participants in addition to making it more difficult to see the participants while also sharing screen. Other limitations included the lack of connectivity or internet instability. At times either facilitators or participants would suffer from instability in their network thus causes freezing or grappled voices. In some cases, the complete lack of technology and internet system would prevent individuals from participating.

In conclusion, this program was an adaptation and refinement of an in person cognitive stimulation program. It was easily adaptable to an online format that allowed participants to become involved when they were unable to attend their local senior center because of COVID 19 restrictions. This format allowed participants to gain back some social interactions that in some cases were completely absent from their life if they were living alone and socially isolating. This type of program can reach those who are physically unable to attend a senior center activity to participate. Future implementation of these programs may extend beyond those members of senior centers to VA groups or even community groups who could benefit from social interaction when being cognitive stimulated and participating in interactive learning modules.

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