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Accessible Virtual Arts Recreation for Wellbeing Promotion in Long-Term Care Residents.

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Abstract

The efficacy of a technology-driven visual arts recreation activity, delivered virtually, was evaluated for its potential to achieve positive impacts, similar to traditional arts-interventions, on wellbeing in long-term care residents. Thirty-one residents (average age 86.8 years; *SD* = 9.4) engaged with the arts-intervention for 30-minutes, twice weekly, for 6 weeks with either a partner or as part of a group. Wellbeing indicators included self-reported psychological and healthrelated wellness, and attention capacity. Binomial tests of postintervention change revealed a significant above-chance probability of improvement in one or more wellbeing indicators ($p < .05$). Postparticipation feedback survey scores were positive ($p < .05$). Cognitive status did not influence outcome; however, other participant characteristics such as younger age, higher openness-to-experience (personality trait), and lower baseline mood were significantly associated with positive response to the intervention ($p < .05$). Findings demonstrate technology may be an effective platform for promoting accessibility to beneficial arts-interventions for older adults.

Keywords

successful aging, technology, wellbeing

Introduction

Research reviews of studies evaluating the impact of participative arts-based interventions demonstrate enhanced wellbeing in older adult participants including those experiencing dementia (Curtis et al., 2018; Fraser et al., 2014; Noice et al., 2014; Zeilig et al., 2014). Commonly reported outcomes include improved mood, interpersonal relationships, quality of life, and even physical health status (Curtis et al., 2018; Noice et al., 2014; Windle et al., 2018).

Participative arts interventions involve active interaction on the part of the participant, such as with art or music making, creative storytelling, or art-inspired discussion; as opposed to passive (watching or listening) activity engagement. Participative arts activities are typically open-ended, allow for self-agency through choice, and provide opportunity to socialize around a subject matter of mutual interest (see Noice et al., 2014). Furthermore, these interventions tend to play to the cognitive strengths of older adults, allowing them to bring their knowledge and life experience to the activity, including experiential cognitive processes that are more resilient to the effects of neurotypical and neuropathological aging, than episodic memory and processing speed for example (Grady, 2012; Salthouse, 2004).

The success of participative arts interventions, such as those involving visual art in particular (e.g., Camic et al., 2014; Rosenberg, 2009) have given a new lens with which to view our art institutions and museums and their role in a healthy society and most specifically in enhancing the health of older adults (Camic & Chatterjee, 2013). Many museums now have arts engagement programming in place aimed at older adults (Todd et al., 2017). Given the positive health outcomes associated with involvement in artsbased activities, creating opportunities to improve access to these interventions is important. In-person access to museum programming requires living in an urban center and may be particularly difficult for older adults residing in long-term care facilities who require additional resources for outings. Outside of museum facilities, visual arts activities often require specialized training on the part of staff as well as access to materials and supplies for activity engagement. Virtual technology offers a potential solution to these barriers.

A web-based digital solution, ArtontheBrain, was created to bring virtual arts engagement with museum artworks to individuals aging in place. The web-based application permits users to select an artwork to learn about, play with (puzzle and storytelling activities), and socialize over by sharing comments and stories online that were inspired by the artwork. It was designed to contain many of the active ingredients found in successful participative arts-based interventions (e.g., self-agency, flexible level of complexity, and opportunity to socialize). It was also designed to be inclusive of all older adults, including those with cognitive decline. The intention was to provide clinicians and care partners with an easy-to-use, evidence-based, and enjoyable, recreation activity that would not necessitate specialized training in the subject matter on the part of users and would leverage technology to improve accessibility.

The current investigation evaluates the feasibility and efficacy of using technology to deliver a participative visual arts intervention in a representative group of older adults residing in long-term care. We assessed the potential for positive health outcomes as well as evaluative response of users. We also examined the flexibility of the application by implementing it in partner play, involving the resident and a care partner/volunteer, and in group play, involving six or more residents and a clinician facilitator. Positive health outcome centered on establishing improved wellbeing with selfreported metrics of psychological and health-related wellness, and an objective metric examining attention capacity. Feedback about the experience with the activity was examined using a brief survey querying self-reported enjoyment and perceived value of the application. The probability of achieving a positive health outcome was analyzed and associations involving potential moderating variables explored. These moderating factors included mood, general cognitive status, and the personality trait of openness-to-experience. Examination of this personality trait was included because it is a good predictor of artistic interest and intellectual engagement generally (McCrae &

Costa 1997), and studies have documented its relevance to arts-based interventions (Corrigall et al., 2013; Thomas et al., 2016).

Based on previously reviewed research showing benefits of visual arts interventions for older adults who are living with dementia and older adults who are cognitively healthy (e.g., Noice et al., 2014; Windle et al., 2018), an assumption that the application being tested was inclusive to "all" older adults irrespective of cognitive status, and a belief that it did indeed capture the active ingredients of a participative arts experience, we hypothesized the following: (a) a positive postintervention change from baseline on wellbeing indices; (b) positive feedback about the intervention experience as measured on brief survey; (c) lower mood at baseline would be associated with greater positive postintervention change; (d) those with higher openness-to-experience would exhibit stronger positive feedback; and (e) general cognitive status would not significantly influence outcome or feedback. We did not have any predictions about the influence of engaging with the application in a group or partner play setting and explored potential associations with this factor in the analyses.

Methods

Participants

A convenience sample of 42 participants residing in a long term care facility for older adults located in the Boston area of Massachusetts, United States, was invited to participate. Recreation therapists on staff, who were familiar with the residents, were consulted to identify participants for inclusion in the study and assign these participants to one of two potential user play scenarios (with a partner [volunteer and participant] or in a group [five to six participants led by a therapeutic recreationist]). Group assignment was based on therapists' judgments using their internal practices. These practices involved both review of the most recent nursing home resident assessment instrument (RAI, see Hawes et al., 1997) including examination of Cognitive Performance Scale component of the instrument to verify there was no severe dementia (e.g., scores < 3; see Morris et al., 1994) and their firsthand knowledge of the resident. The researchers did not interfere with or influence these usual internal practices but did require the therapists adhere to the study exclusion criteria. Specified participant exclusion criteria communicated to the recreation therapists were no significant vision loss (low vision accepted if the display was sufficiently visible to the participants), non-fluent in English, or severe dementia. No other instructions were provided to the recreation therapists to influence their assignment of participants for inclusion in the intervention or type of play scenario. Of the 42 residents approached to participate, one declined, two were unable to provide their proxy's consent for research participation, and seven participants were lost to attrition over the 6-week intervention due to the following; three passed away, two had no proxy consent for research participation, and three did not complete postintervention testing. The final sample size was 31 participants (25 women and six men; with three men and 11 women in the partner play scenario and three men and 14 women in the group play scenario). The characteristics of the participant group are shown in Table 1.

Table 1. Participant Demographics and Baseline Moderator Variables.

Variable	Partner play (*n* = 14)		Group play (*n* = 17)		Overall (*n* = 31)	
	M (*SD*)	Median (IQR)	*M* (*SD*)	Median (IQR)	*M* (*SD*)	Median (IQR)
Age (years)	83.3 (10.3)	85.5 (21.0)	89.8 (7.8)	91.0 (12.0)	86.8 (9.4)	90.0 (14.0)
MoCA	16.7 (5.9)	16.5 (10.5)	11.8 (4.4)	11.0 (6.0)	13.9 (5.6)	13.0 (8.5)
GDS	3.5 (3.9)	2.0 (7.0)	5.2 (5.1)	4.0 (9.0)	4.4 (4.6)	3.0 (7.5)
Openness	7.9 (1.8)	8.0 (4.0)	7.9 (2.2)	9.0 (3.5)	7.9 (2.0)	9.0 (4.0)

Note. IQR = Interquartile range; MoCA = Montreal Cognitive Assessment (maximum score is 30 with scores < 23 considered below normal see Carson et al., 2018); GDS = Geriatric Depression Scale (maximum score is 15 with scores 0 to 4 normal and 5 to 8 mild depression); Openness = Openness-toexperience personality trait (minimum score is 2 and maximum score is 10; higher score indicates greater openness).

Arts-Intervention Activity

An arts recreation activity called ArtontheBrain was accessed in an online virtual environment by users, twice weekly, for a period of 6 weeks, with each session lasting approximately 30 minutes. The duration of the intervention was determined based on previous arts-intervention research with successful health outcomes (reviewed in Curtis et al., 2018; Fraser et al., 2014; Noice et al., 2014). ArtontheBrain was based on work done at Baycrest Health Sciences and further developed by QoC Health Inc., Toronto, Canada. It runs on tablet, laptop, and desktop devices using Chrome and Safari internet browsers. ArtontheBrain engages participants in activities centered on a user-selected visual artwork (such as a photograph, painting, sculpture, and/or textile). In this study, the art content available on the application was drawn from museum partners in Canada (Art Gallery of Ontario), the United States (Boston Museum of Fine Art), and open-source visual artwork material (www.lacma.org) and from the artist Rafael Goldchain.

ArtontheBrain activities include the following: **LEARN**, with options to read (and/or listen to) the curatorial description of the artwork, magnify the artwork for closer viewing, or select to move on to another artwork; **PLAY**, with options to engage in puzzle games (involving three difficulty levels) such as "word search," finding words from the curatorial description on a letter grid, or "shuffle puzzle" restoring a visually scrambled image of the artwork, and a "storytelling" game where participants can type a reminiscence or imagined story the artwork brings to mind (includes leading questions to help the storyteller get started and permits story archiving for posterity and later viewing); and **MINGLE**, with options to share ratings of the artwork (using emojis), post comments, and to view and comment on stories or comments other participants have shared. [The MINGLE section becomes most relevant in individual play, a format not studied here. This is because the application is able to connect people virtually in regard to artwork inspired stories and opinions they wish to share in an online/ virtual environment. In partner play and group play implementation, the application, the discussion, and exchange of ideas took place in-person and in real time in a manner similar to a virtual gallery experience].

The application has a tutorial video to assist users in navigating the activities and features and includes a friendly gallery guide, a labradoodle named Ralph. Ralph provides instructional tutorials specific to the section of the application the user is currently accessing, words of encouragement, and text instructions throughout the experience. Additional information about ArtontheBrain can be accessed at www. ArtontheBrain.org.

Instruction and Support to Facilitators of the Application

The volunteers facilitating partner play and the recreation therapists facilitating group play engagement with the ArtontheBrain application were instructed to watch the tutorial video contained in the application and familiarize themselves with the application prior to introducing it to participants. The tutorial video features an animated version of the labradoodle gallery guide Ralph who explains all of the activities and how to navigate them. The tutorial video explains the application in its entirety and is intended for first-time users. It can be revisited in its entirety or users can access components of the instructional video when they are in a particular play activity that they require guidance in navigating. Facilitators were additionally supplied with a user manual, specific to the assigned partner play or group play scenario. The user manual contained tips for facilitators with respect to how to engage participants with ArtontheBrain. Once familiar with the product, the facilitators and participant users were encouraged to engage with the application according to their own preferences. No further instruction was provided.

In partner play, the technology devices used were iPads (either iPad 6th Generation or iPad Pro 2nd Generation models). Volunteers were trained by research staff in how to access ArtontheBrain virtually with the devices and to enter user specific participant numbers and passwords.

In group play, laptops (Lenovo x270) were connected to a projection screen measuring 150 cm by 200 cm. ArtontheBrain was projected onto the screen and a group of 8 to 9 residents engaged in facilitator-led recreation with the application. Two separate groups participated one at each of the Hebrew Senior Life locations in the Boston

area. The recreation therapist group facilitators were trained by research staff in how to access ArtontheBrain virtually with their devices and to enter the group participant number and password specific to the group they were working with.

All experimental baseline and outcome measures were administered by a trained research assistant (J.R.).

Baseline Measures

In addition to gathering demographic information about participants related to age, education, gender, and their health history, the following baseline measures of cognitive status, mood, and the personality trait openness-to-experience were administered and considered as potential moderating factors on intervention outcome: (a) cognitive status was evaluated with the Montreal Cognitive Assessment (MoCA; Nasreddine et al., 2005), a global measure of cognitive function scored out of a maximum of 30 points that assesses multiple cognitive domains including; visuospatial/executive functions, memory, attention, and language; (b) mood status was evaluated using the 15-item version of the Geriatric Depression Scale (GDS-15; Sheikh & Yesavage, 1986); and (c) openness-to-experience personality trait was measured using the two items corresponding to this trait from the short version of the Big Five Inventory (Rammstedt & John, 2007).

Wellbeing Intervention Outcome Measures

Two subjective and one objective measure of wellbeing administered at baseline and again following the 6-week ArtontheBrain intervention were used. Subjective measures were self-report pencil and paper questionnaires, individually administered by a research assistant to each participant. The measures included the Short Warwick-Edinburg Mental Wellbeing Scale (WEMWBS; Tennant et al., 2007) and a measure of subjectively perceived health-related quality of life known as the EQ-5D-5L (Herdman et al., 2011). The WEMWBS measures subjective mental wellbeing over the previous 2 weeks and includes seven positively phrased statements (e.g., I've been feeling optimistic about the future) that the examinee indicates level of agreement with on 5-point Likert-type scale ranging from 1 (i.e., never) to 5 (i.e., always) with a higher score indicating greater subjective wellbeing (maximum score of 35). The WEMWBS has been adapted for cross-cultural use and has been shown to have good face validity, test–retest reliability, and internal consistency for both the long (14 item) and short (7 item) version (Stewart-Brown et al., 2011). The EQ-5D-5L comprises five dimensions: mobility, self-care, usual activities, pain/discomfort, and anxiety/depression (Herdman et al., 2011). Participants reported on a five-level response scale whether they have no problems (a), slight problems (b), moderate problems (c), severe problems (d), or extreme problems (e). Then, using a visual analog scale (VAS) from 0 to 100, individuals are asked to assess their momentary global health status (100 indicating the best health state and 0 indicating the worst health state they can imagine). The VAS was selected as a study outcome because it considered representative of the patient's perspective of their overall health and sensitive to intervention (Feng et al., 2014; Zanini et al., 2015). The digit span test of attention capacity (reviewed by Lezak et al., 2012) was administered as an objective measure of wellbeing because previous research shows performance on this test may be positively influenced by enhanced wellbeing (Berman et al., 2008; Rowe et al., 2007). Furthermore, the digit span test is known to have negligible practice effects with high test–retest reliability (reviewed in Lezak et al., 2012), making it potentially sensitive indicator of the secondary influence of wellbeing on cognition. The overall score for the digit span test was used as the outcome measure. In this test, a series of digits are orally presented, and participants must repeat the series either in the same order they heard it (passive forward span) or in the reverse order (working memory backward span). Although the cognitive demands of forward and backward spans differ, the overall score is the one that is typically evaluated as an indicator of auditory attention capacity (Lezak et al., 2012). Numbers for the digit span test employed were randomly generated, and the procedure followed after Lezak et al. (2012). Briefly, the overall score was measured as the number of correct trials (with two trials at each length) for both forward (up to 9 digits) and backward (up to 8 digits) spans. The maximum score that could be achieved was 30. An overall score of 9 to 17 is considered in the broad range of normal for older adults 65 years of age and over (Wechsler, 1997).

Participant Feedback About the Arts Intervention

A feedback survey containing five statements about the ArtontheBrain application was individually administered within a week of the final intervention session. The statements were as follows: (a) Using ArtontheBrain was enjoyable, (b) I feel using ArtontheBrain was good for my health, (c) I would like to have access to ArtontheBrain after the research study, (d) If I could, I would use ArtontheBrain at least two times a week or more, (e) I would recommend ArtontheBrain to a friend. Participants indicated their level of agreement with each statement based on a 5-point Likerttype scale ranging from strongly disagree, disagree, neither agree nor disagree, agree, and strongly agree.

Approach to Data Analysis

Because of the small and heterogeneous sample, we carried out nonparametric tests for all reported analyses. Kendall's rank correlation method was used to explore for meaningful associations between participant characteristics, baseline measures, and outcome measures. Evaluation of change on outcomes of wellbeing following the intervention was examined using (a) Wilcoxon signed-ranks tests comparing pretest and posttest performance, (b) Mann–Whitney *U* tests comparing outcomes for partner and group play, and finally by using (c) binomial tests of probability to determine if participants were likely to improve on at least one of the three outcome measures at a rate that was significantly above what might be expected based on chance alone. For the binomial tests, no change or decline at postintervention relative to baseline (preintervention) was coded 0, and an improvement at postintervention on one, two, or all three of the wellbeing outcome measures was coded 1 (Supplementary Materials Table A provides more detail on these calculations). Participant feedback to the technology-driven arts-intervention experience was examined by determining whether responses were significantly more positive than chance using binomial tests whereby "zero" was defined as a negative or neutral response choice on the aforementioned Likert-type scale and "one" was defined as a positive response on the scale. The probability of responding positively by chance on a 5-point Likert-type scale was taken to be 0.4.

Results

Participant Characteristics and Baseline Response Patterns

Kendall's rank correlations examining participant characteristics (from Table 1) and baseline response patterns revealed a sensible pattern of associations in this small heterogeneous cohort. For example, similar to past research (Vogel et al., 2015), higher performance on the MoCA was associated with better baseline performance on the "Cognitive" wellbeing outcome measure of Digit Span, $r\tau(30) = .401$, $p < .003$, and a more positive baseline mood state (i.e., lower score on the GDS-15), $r\tau\ (30) = -.268$, $p = .048$ (as per Blair et al., 2016). As expected, a more positive mood (low score on GDS-15 at baseline) was also associated with higher baseline ratings of psychological wellbeing, $r\tau\ (31) = -.390$, $p = .004$, ("Psychological" wellbeing outcome measure or WEMWBS). Another association observed in this population was a positive correlation between older age and higher self-reported health-related quality of life on the EQ-VAS, $r\tau\ (31) = .281$, $p = .032$, (indicator of "Physical" wellbeing). There were some participant characteristic differences between those who engaged with ArtontheBrain in partner play and those who engaged as part of a group. Compared to group play participants, partner play participants were younger (approaching significance), $U = 168.000$, $p = .053$, $\eta^2 = 0.126$, and had higher MoCA scores, $U = 57.000$, $p = .025$, $\eta^2 = 0.173$., and had higher baseline digit span scores (approaching significance), $U = 71.500$, $p = .059$, $\eta^2 = 0.120$. There were no group differences on baseline measures of mood, openness-to-experience, or on the baseline wellbeing outcome measures of Psychological (WEMWBS), or Physical (EQ-VAS) wellbeing ($p \geq .100$).

The Influence of ArtontheBrain Engagement on Positive Wellbeing Outcomes

Given the small sample size, heterogeneous sample, and because a normal distribution for change in scores at posttest relative to pretest scores could not be assumed (skewness ranged from −0.90 to 1.12, and kurtosis ranged from −0.92 to 2.75 across measures and play conditions), we used Wilcoxon signed-ranks tests to see if participants' T2 scores differed significantly from their T1 scores on the three wellbeing outcome measures. We conducted these analyses for (a) the overall sample, (b) the partner play sample on its own, and (c) the group play sample on its own (for descriptive statistics see Supplementary Materials Table B). We found no evidence for improvement on a specific

outcome measure (two-tailed *p* values > .170). Mann–Whitney *U* tests also found no evidence to suggest that play formats (partner versus group) were linked to improvements on specific outcome measures (two-tailed *p* values > .30). Yet, as Figure 1 shows, the majority of participants demonstrated some level of positive postintervention change with only 4 of the 31 participants showing either decline or no change on any outcome measures. We therefore investigated whether our obtained probability of improving on one or more of the three wellbeing outcome measures was significantly greater than chance using binomial tests. As Table 2 shows, the number of participants showing a positive change on at least one of the three wellbeing indices (27 out of 31) was significantly greater than chance. In fact, participants were likely to improve on two or more tests at a rate that was significantly higher than chance, suggesting more widespread improvements across outcome measures (also see Figure 1).

As we were interested in potential differences in outcome patterns between participants in group play and partner play, binomial tests were also conducted separately for play conditions (see Table 2 and Figure 1). This examination revealed group play was tied to improvement in at least two wellbeing outcomes. Above chance positive outcomes were not evident in partner play (also see Supplementary Materials Tables A and B).

Participant Feedback on Engagement With the Virtual ArtontheBrain Activity

Binomial tests were conducted to examine whether participants' ratings on the feedback questionnaire were significantly more positive than chance. Here, a neutral or negative response (e.g., "neither agree nor disagree," "disagree," or "strongly disagree") were coded as 0 and a positive response (e.g., "agree" or "strongly agree") was coded as 1.

Figure 1. The number of participants showing a positive postintervention change in one or more wellbeing outcomes; overall and separated into partner and group play scenarios.

Table 2. Binomial Tests of Intervention Impact on Wellbeing Outcome Measures.

User play scenarios	*f*	$\hat{p}$	*p*	Sig.
Overall				
Positive outcome on all three tests	3	.097	.037	0.106
Positive outcome on at least two tests	13	.419	.259	0.038*
Positive outcome on at least one test	27	.871	.704	0.026*
N	31			
Group play				
Positive outcome on all three tests	3	.176	.037	0.023*
Positive outcome on at least two tests	9	.529	.259	0.016*
Positive outcome on at least one test	15	.882	.704	0.082
N	17			
Partner play				
Positive outcome on all three tests	0		.037	<0.999
Positive outcome on at least two tests	4	.286	.259	0.510
Positive outcome on at least one test	12	.857	.704	0.168
N	14			

Note. *f* is the cumulative frequency. *p* is the observed probability obtained^by dividing *f* by N. *p* is the expected probability of positive outcomes occurring due to chance (see Supplementary Material in Appendix A for calculations).
*indicates significance at one-tailed $\alpha = 0.05$.

Twenty-seven of the 31 participants in our sample completed the feedback questionnaire, 11 of whom were in partner play, and 16 in group play. One participant declined to provide feedback and three were unavailable. As Figure 2 shows the participants rated their interaction with Arton- theBrain positively suggesting the application was (a) enjoyable, (*n* = 20 of 27, *p* < .001, relative risk, *RR* = 1.852), (b) good for health (*n* = 20 of 27, *p* < .001, *RR* = 1.852), (c) that they wanted continued access to the application (*n* = 20 of 27, *p* < .001, *RR* = 1.852), and (d) would recommend it to a friend (*n* = 19 of 27, *p* = .001, *RR* = 1.759). The results were significantly positive in both partner play and group play. In partner play, participant feedback suggested that they found ArtontheBrain to be (a) enjoyable (*n* = 8 of 11, *p* = .028, *RR* = 1.818), (b) that they wanted continued access (*n* = 8 of 11, *p* = .028, *RR* = 1.818), and (c) would recommend it to a friend (*n* = 8 of 11, *p* = .028, *RR* = 1.818). In group play, participant feedback suggested that they found it (a) enjoyable (*n* = 12 of 16, *p* = .005, *RR* = 1.875), (b) good for health (*n* = 13 of 16, *p* < .001, *RR* = 2.031), (c) that they wanted continued access (*n* = 12 of 16, *p* = .005, *RR* = 1.875), (d) would play it twice weekly (*n* = 11 of 16, *p* = .018, *RR* = 1.719), and (e) would recommend it to a friend (*n* = 11 of 16, *p* = .018, *RR* = 1.719).

Participant Characteristics and Response Patterns Associated With Intervention Engagement

Kendall's Rank correlation analyses were used to explore for meaningful associations between participant characteristics, baseline measures, and outcome measures. As Table 3 shows lower mood at baseline was associated with greater postintervention improvement on an objective index of "cognitive" wellbeing, the digit span test. Possessing greater openness to-experience was associated with stronger agreement that engaging with the application was good for health. There were no associations between general cognitive status, as measured using the MoCA, and postintervention outcomes. Younger members of the cohort had stronger agreement with postintervention feedback that they would like continued access to the application.

Figure 2. Participant responses to the feedback survey demonstrating significant and positive response to the intervention experience.

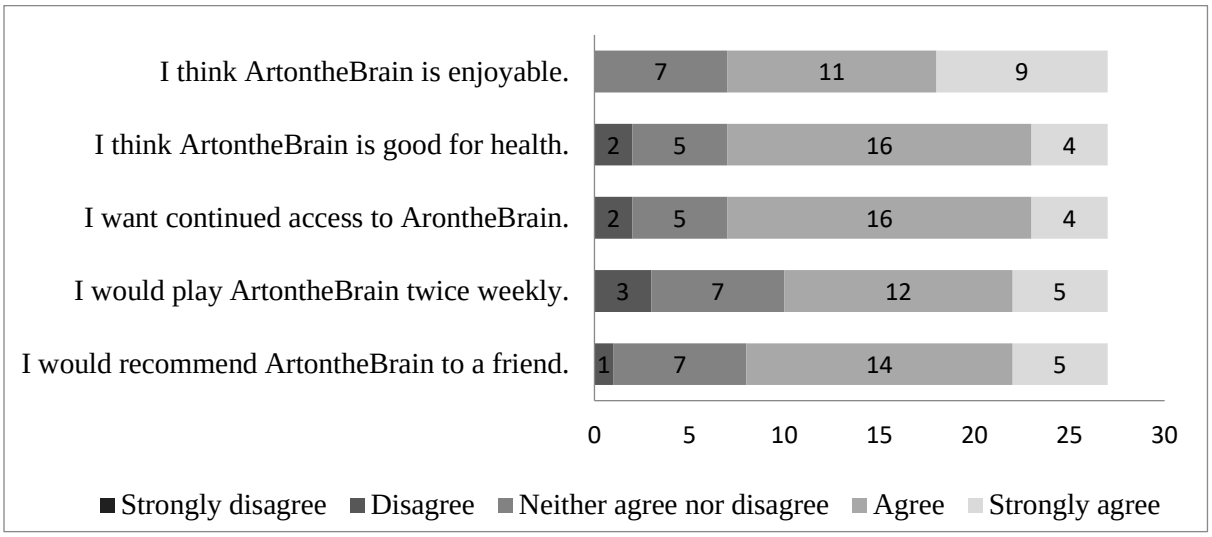

Table 3. Associations Between Participant Characteristics and Response Patterns Associated With Intervention Engagement

	Wellbeing outcomes			Post-intervention feedback (level of agreement)			
Participant characteristic	Psychological	Physical	Cognitive	Enjoyable	Good for my health	Wish continued access	Would play twice weekly
Age	−.034	−.139	−.028	−.196	−.304	**−.374***	−.140
Gender	−145	−.054	.170	−.308	−.228	−.228	−.355
Play Type	.152	.077	−.129	−.117	.057	−.052	.076
MoCA	−.099	.050	.152	.123	.067	−.033	.065
GDS	.159	−.163	**−.313***	−.022	.184	.050	−.004
Openness	.118	−.024	−.178	.092	**.333***	.049	−.011

Note. Wellbeing outcomes refers to change in scores at posttest relative to pretest for self-reported "Psychological" wellbeing measured using the 7-item Warwick–Edinburg Mental Wellbeing Scale; "Physical" wellbeing measured using the visual analog scale of the EQ-5D-5L survey; and "Cognitive" wellbeing indicated by measuring attention capacity with the digit span test. MoCA = Montreal Cognitive Assessment; GDS = Geriatric Depression Scale; Openness = Openness-to-experience personality trait. The variables for "Gender" and "Play Type" were dummy coded (1 = man, 2 = woman; and 1 = Partner play; 2 = Group play, respectively).

*indicates significance at two-tailed $\alpha = 0.05$. Correlations (Kendall's τ) are calculated on the sample of 31 participants who completed our measures of wellbeing, and 27 participants who provided postintervention feedback about their experience with the ArtontheBrain application.

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Discussion

The purpose of the study was to evaluate the feasibility and potential efficacy of delivering a virtual visual arts intervention to a representative group of older adults residing in longterm care. The evaluation was particularly focused on whether the activity may positively influence the wellbeing of participants. Two primary outcomes

established the potential value of the intervention for the population studied. First, postintervention improvement on one or more of the wellbeing metrics was observed at a rate significantly greater than expected by chance. Second, participants' feedback about their engagement with the application indicated positive and significant agreement to feedback survey statements such as, the experience was enjoyable, and they would recommend it to others. The lack of influence of cognitive status on outcome metrics was another factor in support of feasibility and inclusivity of the experience for the older adult users.

Correlational analysis produced sensible associative patterns consistent with expectations. Baseline mood status was positively and highly correlated with wellbeing.

Furthermore, lower mood at baseline was associated with greater postintervention improvement on digit span, possibly indicating a greater sensitivity of this cognitive measure of attention capacity to a potential enhancement in wellbeing as suggested by past research (e.g., Rowe et al., 2007). This interpretation requires further investigation, however, and is constrained by the fact that there was no significant relationship between baseline mood scores and a greater postintervention enhancement of wellbeing. The personality trait of openness-to-experience was positively associated with stronger agreement that the intervention was good for health consistent with past research showing this trait is a predictor of arts-based engagement and interest (McCrae & Costa, 1997). Also consistent with past research (e.g., Blair et al., 2016; Vogel et al., 2015), was the finding that higher scores on the MoCA cognitive screen measure were associated with better baseline mood and attention capacity as measured with the digit span test. These associations were reassuring indicators that the population tested was most likely representative of older adult populations residing in other long-term care communities. Thus, the positive wellbeing outcomes and feedback achieved here should be replicable. This view is further strengthened in consideration of the organic implementation of this intervention. Clinicians determined who would be appropriate for participation in the activity, based on their knowledge of the client, similar to how they would identify individuals for other types of recreational programming they coordinate.

The greater affinity for the arts-based intervention from younger members of the cohort was not predicted, and the reliability of this association requires further research. There was no evidence that the intervention influenced one wellbeing outcome measure more than another nor did play format influence a specific wellbeing metric. Group play participants appeared to respond more positively to the intervention. The binomial probability analysis was not significant for those in the partner play condition analyzed independent of the group play participants, despite the fact that the majority of individuals in the partner play condition did indeed show postintervention improvement in one or more wellbeing outcomes. It was unclear whether the higher likelihood of positive outcomes and feedback in group play as compared to Partner Play was simply an artifact of a smaller partner play sample size and pre-existing differences in participant characteristics between the two conditions, or whether the finding was due to actual differences between the experience of participating in group play and partner play. Future work with larger sample sizes and random assignment to group and partner play conditions will provide meaningful information in this regard.

In keeping with past research showing enhanced communication between staff and residents following arts-intervention (Windle et al., 2018), we received anecdotal report from facilitators of exchange of knowledge between participants and themselves about the artwork. Furthermore, facilitators reported learning something new about their clients as a result of engaging in the activity. Follow-up to this study will qualitatively evaluate the perspectives of both the older adult participants and clinicians implementing ArtontheBrain as part of their recreational programming to better understand the influence of the experience on client and staff relationships and to inform improvements on the product experience for both clinicians and their clients.

Past research investigating museum visit programming geared to older adults has shown positive impacts on selfperceived health, mood, and feelings of loneliness with potential for positive secondary health outcomes related to reduced need for health resource utilization (e.g., Noice et al., 2014; Todd et al., 2017). There are some important study-design limitations in the current paradigm that temper the interpretation of study outcomes and must be

addressed in future research; most notably the lack of a control group, the relatively small sample size, and the potential for bias in participant selection (e.g., therapeutic recreationists may have been predisposed toward selecting participants they thought would enjoy the intervention).

The findings do however, demonstrate the feasibility of leveraging technology to increase accessibility to arts interventions and suggest positive health outcomes influencing wellbeing that are similar to those associated with traditional participative arts programs (e.g., museum programming involving social engagement around the topic of art). Importantly, our findings do not yield an unambiguous estimate for program efficacy and, as others have cautioned (see Leon et al., 2011), the clinical significance of these data require further investigation. The results do support undertaking more rigorous evaluation of the potential benefits of this virtual arts intervention with a larger older adult sample and in other community settings. Future research will undertake randomized control trial evaluation and also more specifically examine accessibility of the application to older adults with low vision.

Authors' Note

Authorship order is alphabetical with the exception of the first five authors and the last listed author. The first four authors listed accept direct responsibility for the manuscript. No HIPPA identifiers are included in the research data set.

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Ethics Statement

The research conducted here was approved by the Baycrest Research Ethics Board (REB) which operates in compliance with the Tri-Council Policy Statement, ICH/GCP Guidelines and Part C, Division 5 of the Food and Drug Regulations of Health Canada. The REB approval number is 17-49. It was also approved at Hebrew Senior Life by the Institutional Review Board at the Marcus Institute for Aging Research (approval # IRB-2017-23). Informed written consent was obtained from all participants or their designated proxy for health care.

Supplemental Material

Supplemental material for this article is available online.

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