Original Article

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Dance, Music, and Social Conversation Program Participation Positively Affects Physical and Mental Health in Community-Dwelling Older Adults: A Randomized Controlled Trial

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Abstract

Introduction: As the world population ages, practitioners use community-engaged interventions to help older adults stay healthy. Engaging in arts programs (e.g., dance or music) reportedly improves physical and mental health, but little research exists examining these effects in community-dwelling older adults. Our purposes were to examine how taking part in 10-week, twice per week community arts programs (dance and music) and control (social conversation) affected physical and mental health in community-dwelling older adults and their perceptions after program participation.

Methods: In this randomized controlled trial, 64 older adults over 65 years of age (71.3 ± 4.6 years, 166.9 ± 8.3 cm, 78.1 ± 18.1 kg) took part in community-engaged arts programs: ballroom dance (n = 23), music (ukulele-playing, n = 17), or control (social conversation n = 24), two times per week for 10 weeks. Participants' physical health using the Short Physical Performance Battery (SPPB; score 0 = worst to 12 = best) and mental health using the Montreal Cognitive Assessment (MoCA; score = 0 to 30, where less than 26 = normal) were tested three times: 1. before (pre), 2. at the end of 10 weeks (post-1), and 3. 1 month after intervention (post-2). Separate 3 (group) x 3 (time) ANOVAs and adjusted Bonferroni pairwise comparisons as appropriate examined changes across groups and time. Focus group interviews and surveys were audio recorded, transcribed, and analyzed using inductive thematic analyses to examine participants' perceptions.

Results: Across all groups, participants had an 87.8% attendance and an 87.5% retention rate. Participants' SPPB performance improved over time (pre = 10.5 ± 1.4, post-1 = 10.7 ± 1.3, post-2 = 11.3 ± 1.0; $p < 0.001$), but similarly across groups ($p = 0.40$). Post-hoc analyses revealed that performance improved from pre to post-1 ($p = 0.002$) and pre to post-2 ($p < 0.001$). Participants' cognition improved over time (pre = 26.3 ± 2.8, post-1 = 27.3 ± 2.6, post-2 = 27.5 ± 2.5, $p < 0.001$), and similarly across groups ($p = 0.60$). Post-hoc analyses revealed that cognition improved from pre- to post-1 ($p = 0.002$), and pre- to post-2 ($p = 0.001$). Participants consistently mentioned increased social engagement as the major reason for participation.

Conclusions: Overall, taking part in community-engaged arts (dance and music) and social conversation programs positively influenced physical and mental health in older adults. Still, as all groups improved equally, the results may partly be due to participants having normal physical and mental function pre-participation and due to them learning the test over time. These study findings imply that providing fun and free community-engaged programs that empower participants to be more engaged can positively influence physical and mental health and promote successful aging in older adults.

Key Points

- Arts and other community-engaged programs that are participant-empowering, fun, and free for participants can positively affect physical and cognitive health in older adults.
- Older adults perceive increased social engagement after regular participation in group activities.
- Providing participant focused programming and incentives can attract and retain older adults in community programs.

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Introduction

The 2020 Profile of Older Americans Report by the U.S. Department of Health and Human Services Administration on Aging indicated that 18% of the population, or 55 million Americans, were aged 60 or older.[1] This trend is global, and so as the world population ages, it is important to meet this population's health care needs

and help them age successfully.[2-4] For adherence to the programs, participants need to enjoy them.[5,6] Arts engagement is generally considered enjoyable, and practitioners are using arts programs (e.g., dance and music) as interventions to improve multiple components of health and well-being.[7,8] Likewise, physical activity[9] has positive effects on physical and mental cognitive functioning and can help assist with normal and pathological aging.[10]

Dancing can successfully engage participants, increase adherence and satisfaction, and promote independent lifestyles in older adults.[11,12] In a systematic review and meta analyses, Mattle et al.[11] reported that dance-based mind-motor activities reduced (37%) the risk of falling (risk ratio, 0.63; 95% CI: 0.49-0.80; eight trials, 1,579 participants) and reduced (31%) the rate of falls (incidence rate ratio, 0.69; 95% CI: 0.53-0.89; seven trials, 2,012 participants), and reduced falls risk. In another systematic review of the effects of dancing on cognition in healthy older adults, Predovan et al.[12] reported that dance interventions either helped maintain or improve cognitive performance including attention, visuospatial recall, and attentional performance. For example, tango dancing improved health-related quality of life in adults with Parkinson's disease,[13] and older adult women who danced or engaged in dance movement therapy five times per week reported decreased stress, enhanced social engagement, and personal well-being.[14] Additionally, participation in folkloric dance provided physical benefits, including improved physical performance, balance, and quality of life in community-dwelling older women.[15]

Music participation can improve verbal memory, spatial skills, attention, and executive functioning in older adults.[16,17] Participation in music, imagery, and movement interventions has been noted to improve social engagement in older adults.[18] Music engagement also decreases anxiety, tension, and pain and increases immune system functioning.[19] Receiving piano and jazz instruction improves older adults' cognitive abilities and balance.[20,21] Thus, participating in music activities can improve physical and mental health in in older adults.

Generally, previous research has suggested that arts engagement (e.g., dance and music) improve functioning in older adults and promotes successful aging,[4] with some researchers[18] providing a combination of multiple arts to their participants. Also it is unclear how the participants self-perceive possible changes in their function and overall health after program participation, especially in community-dwelling older adults. Finally, relatively little research exists on how social engagement program participation affects older adults' physical and mental health. Thus, our purposes were to examine how taking part in 10-week, twice per week community arts programs (dance or music) and control (social conversation) affected physical and mental health in community-dwelling older adults and their perceptions after program participation.

Methods

Registration and Institutional Review Board (IRB)

This randomized controlled trial (RCT) was registered on ClinicalTrials.gov. The local institutional review board approved all procedures. All participants provided signed informed consent prior to participation.

Study Design and Sample Size

This RCT used a pre-post three-group intervention design with 1-month follow-up with mixed methods (quantitative and qualitative) to analyze study results. An a priori power analyses using G*Power version 3.1.9.4 (Heinrich Heine Universität Düsseldorf, Germany) with an effect size = 0.40, alpha level = 0.05, and 1-beta = 0.80 helped determine the need for 22 participants per group for the primary outcome measure, the Short Physical Performance Battery (SPPB).[22]

Study Setting

The project was conducted at a large community-based performing arts center in a suburban region. The facility is administered via a tripartite agreement among the local city government, the county government, and the university.

Participant Recruitment

Participants were recruited through flyers and in-person information sessions provided at local active living centers, social media advertisements, e-mails, and newsletters to local community partners, including the county and town Area Agency on Aging and local older adult active living communities. A web page was used to promote recruitment and provided registration links. A single investigator used the inclusion and exclusion criteria provided below to determine participant eligibility. For the current study, community-dwelling was operationalized as participants who were not in medical settings (e.g., inpatients or hospital-dwelling) and were able to come to the study site (performing arts center) without need for the study investigators to provide transportation.

Inclusion and Exclusion Criteria

Participants were included in the study if they were healthy, community-dwelling, and older than 65 years. Participants were excluded if there was the presence of a comorbid mental health diagnosis (e.g., actively receiving psychiatric care) or other issues (e.g., current vision problems) that the study staff assessed as rendering the participant unable to participate. Participants also were excluded if they were currently taking musical instrument learning or dance classes or had previously received formal instruction in ballroom dance or playing the ukulele.

Participants and Randomization

Ninety-five individuals initially showed interest in taking part in the study. Of these interested individuals, 64 participants met the eligibility criteria and were included in the study. Then the investigator who performed inclusion and exclusion checks created unique participant identification codes. A separate investigator then input these codes in an Excel random generator to randomize participants into the three groups. After initial randomization, four participants were reassigned due to logistics or timing issues. See CONSORT flowchart (Fig. 1) for details. See Table 1 for participant and group baseline demographics.

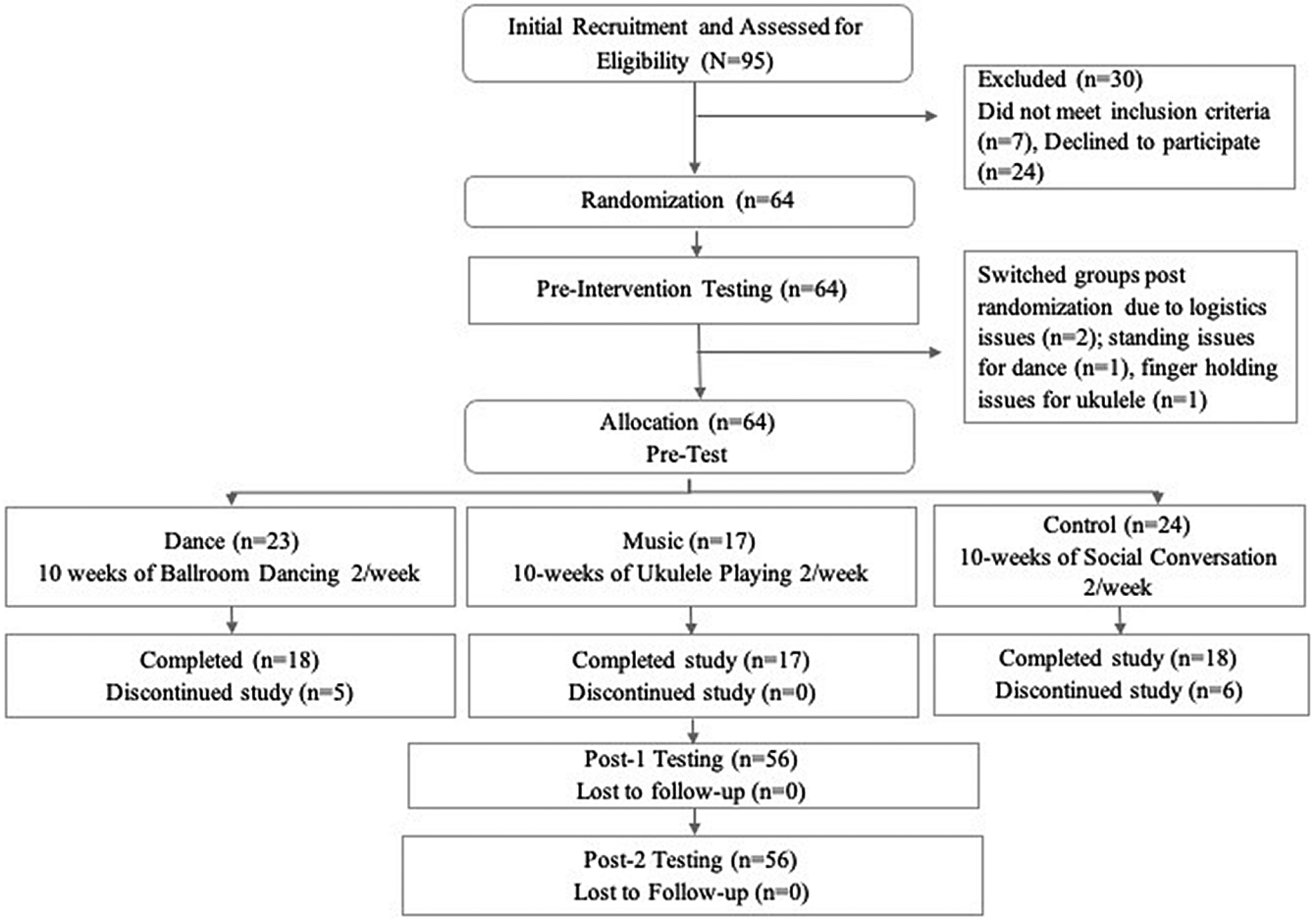

Figure 1 CONSORT flowchart.

Table 1 Baseline Participant Demographics (Mean ± SD) and Attendance of Older Adults Taking Part in 10-Week Arts Engagement (Dance or Music), or Control (No Arts-Social Conversation) Programs

Group	Sex	N	Age (years)	Attendance (%)	Height (cm)	Weight (kg)
Dance	Female	14			163 ± 5.7	63.2 ± 8.1
	Male	9			177 ± 6.4	97.3 ± 22.2
	Combined	23		87.5	168 ± 9.0	75.1 ± 21.7
Music	Female	11			163 ± 6.9	75.4 ± 14.2
	Male	6			175 ± 2.9	91.8 ± 14.2
	Combined	17		85.3	167 ± 8.3	81.2 ± 15.9
Control	Female	13			161 ± 4.7	72.4 ± 14.9
	Male	11			171 ± 7.4	86.3 ± 14.3
	Combined	24	71.3 ± 4.6	90.6	166 ± 7.7	78.7 ± 16.0

Interventions

Time, Length, and Group Sizes

The study was performed in the fall season. The study investigators recruited and performed intakes and pre-testing in August. The interventions took place from September to November. The post-1 testing was in November and post-2 testing was in December. The research team completed the interventions before the start of the winter season, which would have made it difficult for participants to come to the center, and the center would be booked for holiday performances. The interventions were for 10 weeks. This intervention length was chosen as it was in the mid-range of other programs ranging

from 8 to 15 weeks.[13,20,23] All programs were 1-hour long and conducted during the same time frame.

Dance

Participants took ballroom dance lessons twice per week for 1 hour per session for 10 weeks. The investigators chose ballroom dancing as this form was a set of partner dances enjoyed both socially and competitively.[24] The study team chose these dance styles based on the investigators and instructors' prior successful experiences using these styles to adjust the complexity and timing of dance moves based on participants' skill levels. Further, dance cadences and step sequence complexity were adapted based on participants' motor skill levels. Thus, adults with a wide range of motor skills could dance successfully. Two dance instructors, one male and one female, who each had 5 to 6 years of experience teaching the bachata, rumba, and waltz led the dance sessions. The instructors used recorded bachata, rumba, and waltz music played via a sound system in that specific order to offer participants a variety of dances and account for differences in personal preferences. In these "Dance for Health"[25] sessions and in the music sessions, the instructors engaged participants as individuals who wanted to dance or learn how to play a musical instrument rather than patients (thus participants were treated differently from those who undergoing dance movement therapy or music therapy).

In the beginning, the instructors used a "complete command" style as per Mosston's teaching styles,[26] where the participants received specific instructions about the dance steps they should perform. In the last 2 weeks of the program, the instructors asked participants to bring personal music and song choices if they desired. Based on their teaching expertise, the instructors listened to the music that some participants brought and chose the ones that they believed were appropriate to perform the bachata, rumba, and waltz. Thus, the instructors shifted toward a more participant-empowering "learner designed" teaching style by still serving as the expert but using participant-provided music. Also, the music cadence was slower at the start of the program and became faster over the course of the program.

Music

Participants took ukulele lessons twice per week for 1 hour per session for 10 weeks. The study team chose ukulele playing as the intervention as this activity is relatively low-tech and does not require excessive physical activity. Members of the research team also had multiple years of experience in programs teaching ukulele to older adults as part of their regular community outreach programming via the performing arts center. A single ukulele instructor with over 35 years of teaching experience led the sessions. All participants used concert ukuleles and playbooks. The instructor used a Layered Learning Approach to allow participants to learn based on their preferred learning styles. Specifically, the instructor first taught basic concepts (chords and positions), then added in basic tunes, and finally added more complex tunes and songs to meet participant learning needs.

Control

Participants met twice per week for 1 hour per session for 10 weeks in a routine social interaction and conversational group. Members engaged in weekly discussions on the broad topic of "living well in our changing world" that the participants generated themselves. Members self-elected to work in three subgroups focusing on technology needs and interests for older adults (n = 9), active retirement (n = 7), and lifetime wellness (n = 9). Subgroup members internally generated weekly topics. Two social workers and graduate students facilitated these sessions. The facilitators provided resources to spark conversations or provide information requested by subgroups. These facilitators met with study team members weekly to ensure that the session content and delivery was consistent over the study period and across the subgroups.

The groups also hosted guest speakers on age-related topics. Speakers included a representative from the American Association of Retired People, a nutritionist from the local Area Agency on Aging, and a local public speaker who provided lectures on how to improve life happiness. Each subgroup also worked toward various goals self-determined by members. The technology subgroup members compiled a document to address accessing technology in their community. The active retirement subgroup members organized tips for staying active in their local communities. The wellness subgroup organized discussions on a variety of physical and mental health topics related to aging. The subgroups reconvened at the end of every session as a whole group with a short wrap-up and discussed what took place during that session.

Measures

Retention and Adherence

The investigators operationally defined "retention" as the percentage of the participants for whom the researchers were able to collect post-intervention data. The investigators operationally defined "adherence" as the percentage of attended sessions. To promote retention and adherence, all participants were provided two sets of two free tickets each for selected performances at Hylton Performing Arts Center. Specifically, participants received one set of two tickets halfway into the program (at the end of week 5) and the second set of two tickets after the post-2 testing.

Physical Health

The participants physical performance was examined using the SPPB.[22] The SPPB is a standardized and clinically relevant assessment of balance, lower extremity strength, and functional performance in older adults. The SPPB only takes a few minutes to complete and uses simple equipment.[27] Prior authors have reported that SPPB results are reproducible and sensitive to changes in function through time.[28] The equipment required for the test was a stopwatch, a measuring tape to mark distance on the floor, and a standard height armless chair.

The first component of the test was examining participants' balance. Participants were asked to stand unassisted without the use of cane or walker in three positions for 10 seconds each.

The three positions were keeping: 1. their feet side-by-side, 2. their feet in semi-tandem stance (i.e., with side of the heel of one foot touching the big toe of the other foot), and 3. the heel of one foot in front of and touching the toes of the other foot. If any position was held for less than 3 seconds, the score was recorded as a 0, if any position was held for 3 to less than 9.9 secs, the score was recorded as a 1 and if the position was held for 10 seconds, then the score was recorded as 2.

The second component of the test was examining participants' gait speed. Participants were asked to walk as quickly as possible from a starting line to the ending line that was 4 meters away. As per the test instructions, they were allowed to use a cane or walker if they needed; however, none of the participants needed to use a cane or walker. Participants were asked to not slow down when they reached the ending line but follow through so that their speed was not slowed down at the end. The investigator recorded the score using a stopwatch to the last 100th of a second. Participants walked this distance two times. The faster of these two times was used for scoring. The scoring was as follows: 1 point if time was more than 8.70 seconds, 2 points if was 6.21 to 8.70 seconds, 3 points if it was 4.82 to 6.20 seconds, and 4 points if it was less than 4.82 seconds.

The third component of the test was a chair stand test. Participants were asked to fold their arms across their chest and sit so that their feet were on the floor. Then they were asked to stand up keeping their arms folded across their chest. If they were able to do this, then they were asked to stand up straight as quickly as they could five times without stopping in between. After standing up each time, they were instructed to sit down and then stand up again while keeping their arms always folded across their chest. The investigator recorded the score using a stopwatch to the last 100th of a second. The participant scored 0 points if they were unable to complete 5 complete chair stands in less than 60 seconds, 1 point if the time was 16.70 seconds or more, 2 points if the time was 13.70 to 16.69 seconds, 3 points if the time was 11.20 to 13.69 seconds, and 4 points if the time was 11.19 seconds or less. As per test instructions, the scores of the three components were combined to form a single score that ranged from 0 (worst performance) to 12 (best performance).

Mental Health

The researchers used the Montreal Cognitive Assessment (MoCA) to examine participants' mental health.[29] The MoCA is a rapid screening instrument for mild cognitive dysfunction. It assesses different cognitive domains: attention and concentration, executive functions, memory, language, visuoconstructional skills, conceptual thinking, calculations, and orientation. The MoCA tasks include Alternating Trail Making (drawing a trail), Visuoconstructional Skills (drawing a three-dimensional cube), Visuoconstructional Skills (drawing numbers on a clock), Naming (animal), Memory (immediate recall), Attention (forward digit span, backward digit span, vigilance, and serial sevens), Sentence Repetition, Verbal Fluency, Abstraction, and Memory (delayed recall). The time to administer the MoCA is approximately 10 minutes. The total possible score is 30 points; a score of 26 or above is considered normal. The MoCA[30,31] meets the criteria for screening tests to detect mild cognitive impairments among patients over 60 years of age[31] with high sensitivity and specificity.[29]

Focus Group Interviews and Arts Surveys

The researchers conducted three focus group interviews (one per group) during post-1 testing. The semi-structured interview questions were based on prior work examining effects of community-based interventions in older adults.[3] These interviews examined participants' self-reported perceptions of physical, mental, and social changes experienced by taking part in the study. A research team member facilitated these interviews. All focus groups were recorded using an audio recorder.

Participants also completed a written arts survey during post-1 and post-2 testing. One study investigator, who is a trained ethnomusicologist and serves on the faculty at the university, custom developed the survey for this study. The survey consisted of 11 ethnographic questions that asked participants about the personal and interpersonal effects after taking part in the study.

Data Analyses

Retention and Adherence

Study staff recorded attendance at the start of each session. If participants could not come, the next time they came to the sessions they were requested, if they felt comfortable, to inform us of reason they did not attend the prior session. Study staff documented retention by recording who came for the post testing.

Physical and Mental Health

Separate 3 (time: pre, post, 1-month post) x 3 (group: dance, music, control) repeated measures ANOVAs compared participants' physical performance and cognition before and after taking part in the programs ($p \leq 0.05$). Adjusted Bonferroni comparisons were used as appropriate to examine any existing pairwise differences. All analyses were conducted using Jamovi version 1.2 (www.jamovi.org).

Focus Group Interviews and Arts Surveys

As described earlier, all focus group interviews were audio recorded. These audio files were uploaded into an online transcription service (Rev.com LLC, San Francisco, California, USA). The service then provided the research team transcribed text files. Two study investigators then reviewed the transcribed data and corrected any typographic or spelling errors. Then, these two investigators independently analyzed all data using inductive analyses.[32] They performed initial line-by-line coding where patterns were characterized by similarity, difference, frequency, sequence, correspondence, and causation according to prior researchers,[33,34] to achieve data familiarity. These codes were checked by a third member of the research team. This third member was the member who facilitated the interviews and surveys. This team then identified and discussed the themes with the larger group of study investigators. Finally, the research team reduced, clustered, and triangulated the data until the investigators obtained data saturation and agreed with the emergence of the major theme.

The Arts Survey responses were analyzed via thematic analysis.[32] First, two study investigators (same as those analyzing qualitative data above) independently identified themes. They then shared these identified themes with a third member (same member as the one analyzing qualitative data above) who independently examined the data and identified and discussed commonalities and differences across coders. Then, like the focus group interviews data analyses, the team identified and discussed the themes and confirmed the arts survey response results with the larger group of study investigators.

Results

Retention and Adherence

See the CONSORT flowchart (Fig. 1) for descriptive numbers of recruitment, randomization, retention, and adherence. Of the 64 participants initially recruited, 56 were included in final analyses (87.5% retention; dance: n = 21; music: n = 17; control: n = 18). Overall attendance across all groups was 87.8 ± 2.7%. The reasons for missing attendance included, but were not limited to, health issues (e.g., doctor visits), caregiving to family and or friends, holidays or vacations, transportation or weather-related issues, and others.

Physical Health

No interactions existed across time or groups. Participants' SPPB performance improved over time [$F(2, 106) = 12.4$, $p < 0.001$], with all groups improving similarly [$F(2, 53) = 0.5$, $p = 0.40$]. Bonferroni pairwise comparisons revealed that SPPB scores improved from pre (10.5 ± 1.4) to post-1 (10.7 ± 1.3; $p = 0.002$) and pre to post-2 (11.3 ± 1.0; $p < 0.001$; Table 2).

Mental Health

No interactions existed across time or groups. Participants' cognition improved [$F(2, 106) = 9.4$, $p < 0.001$] over time, with all groups improving similarly [$F(2,53) = 0.9$, $p = 0.60$]. Bonferroni pairwise comparisons revealed that cognition improved pre (26.3 ± 2.8) to post-1 (27.3 ± 2.5, $p = 0.002$), and pre-to-post-2 (27.5 ± 2.5, $p = 0.001$; Table 3).

Focus Group Interviews and Arts Surveys

The major theme that emerged consistently across all groups was "increased social engagement" because of participation. Participants indicated that they felt positivity being surrounded by people around their own ages, made new friendships, and connected doing a common activity (Table 4).

Discussion

Primary Findings

Older adults' physical and mental health improved over time after taking part in arts engagement and social conversation programs similarly across all groups. Across all groups, participants consistently mentioned increased social engagement as the major reason for participation.

Retention and Adherence

The near 90% retention and adherence rates in the current study are higher than previously reported 67% to 83% retention rates.[35-37] The current interventions lasted for 2.5 months, while these other program durations ranged from 4 to 8 months.[35-37] Interestingly, most of the missed attendance was due to factors outside the intervention (e.g., medical issues or personal issues). The research team was proactive in reaching out and addressing any issues that were under their control and employed pedagogical changes to promote accessible program participation.

The study team provided accommodations to all groups to assist with adherence and retention. Accommodations for the dance group included providing microphones to the dance instructors so that participants could hear the instructors better.

Table 2 Physical Health (Short Physical Performance Battery, SPPB, scores; Mean ± SD; 95% Confidence Intervals) in Older Adults Taking Part in 10-Week Arts Engagement (Dance, Music), or Control Programs

	Pre	Post-1	Post-2	Overall
Dance	10.6 ± 1.1 (9.9, 11.2)	10.4 ± 1.4 (9.8, 11.0)	11.1 ± 1.2 (10.7, 11.6)	10.9 ± 1.3 (10.2, 11.5)
Music	10.8 ± 1.2 (10.1, 11.5)	10.9 ± 1.3 (10.2, 11.6)	11.4 ± 0.7 (10.9, 11.9)	11.2 ± 0.9 (10.7, 11.6)
Control	10.1 ± 1.9 (9.4, 10.7)	10.9 ± 1.3 (10.2, 11.5)	11.4 ± 1.2 (10.9, 11.9)	10.7 ± 1.0 (10.3, 11.1)
Overall	10.5 ± 1.4 (9.4, 10.7)	10.7 ± 1.3 (10.2, 11.5)	11.3 ± 1.0 (10.9, 11.9)	10.9 ± 1.1 (10.6, 11.2)

Pre = pre-test, Post-1 = after 10 weeks of intervention, Post-2 = 1 month after post-1.

Table 3 Mental Health (Montreal Cognitive Assessment, MoCA, Scores; Mean ± SD; 95% Confidence Intervals) in Older Adults Taking Part in a 10-Week Arts Engagement (Dance, Music), or Control Programs

	Pre	Post-1	Post-2	Overall
Dance	25.8 ± 2.5 (24.6, 26.9)	27.3 ± 1.9 (26.2, 28.4)	27.3 ± 2.0 (26.2, 28.4)	26.7 ± 3.5 (25.0, 28.4)
Music	27.1 ± 2.4 (25.8, 28.5)	28.0 ± 1.7 (26.7, 29.2)	27.9 ± 1.8 (26.7, 29.2)	27.8 ± 1.6 (26.9, 28.6)
Control	26.2 ± 3.3 (24.9, 27.5)	26.7 ± 3.7 (25.5, 27.9)	27.3 ± 3.6 (26.1, 28.6)	26.4 ± 2.8 (25.2, 27.6)
Overall	26.3 ± 2.8 (24.9,27.5)	27.3 ± 2.6 (25.5, 27.9)	27.5 ± 2.5 (26.1, 28.6)	26.9 ± 2.8 (26.1, 27.7)

Pre = pre-test, Post-1 = after 10 weeks of intervention, Post-2 = 1 month after post-1.

Table 4 Collection of Quotes from Focus Group and Arts Survey Demonstrating Older Adults' Perception of the Theme "Increased Social Engagement" After Taking Part in a 10-Week Arts Engagement (Dance or Music), or Control Programs

Quote	Source of Quote	Group
Being around people my age was so positive.	Arts Survey	Dance
Met wonderful new friends and had the privilege to dance with them.	Arts Survey	Dance
It's been really nice because recently, my son and his five children, my grandchildren, moved to Pennsylvania. So, my life came to a halt because I helped to take care of them. So, when my friend told me about this group, I was like, "Oh yes." Sign me up. And it's been wonderful. Everybody in the group and the teachers and everybody connected. It's so, so nice. I really hate to see it end. If there was a way to sign a petition to keep it going.	Focus Group	Dance
Our group really bonded in the short term. Actually doing something in interacting accelerated this. Helped each other.	Arts Survey	Music
Meet new people that I did not know—developed in friendship with me and went to see Cats at the Kennedy Center.	Arts Survey	Music
Well, that's what living is. Learning new things, enjoying the people you're with, enjoying what you're doing, wanting to continue it. That's living, that's life and as you say, those are very positive things. I'm not ready to quit living, that's for sure.	Focus Group	Music
Particularly after retirement, it was like, "Okay, now I have time," and so you have options for that. You can travel, you can volunteer a lot or find groups like this. But when you can find a group of people who really connect, doing a common thing that really makes.... That's the ultimate I think because you make a lot of new friends.	Focus Group	Music
Yes, enjoyed meeting new people, joined senior center and took Tai Chi.	Arts Survey	Control
And I also noticed that just after the first few meetings, I attended a town hall and the way the town hall worked, and I'd never done this before, everyone was split into small groups. And the facilitators went from group to group. So we stayed in our small groups and worked on different questions. And I was really enjoying this, whereas before, I don't think I would have sat there and been too afraid to say anything.	Focus Group	Control

For the music group, the study team arranged for seating in a semicircular design so that participants could hear the instructors better. For the control group, the format evolved from a primarily facilitator led conversation group to a participant empowered pedagogical approach to decrease the initial resistance and disappointment that some participants felt who were more interested in an arts class. In this way, across all groups, the instructors started with a "complete command" teaching style as per Mosston's teaching styles,[26] and shifted toward a more participant empowering "learner designed" teaching style near the end of the program, where the instructor decided the area of focus (e.g., dance skill) and participants developed within this area by drawing on the instructor's or facilitator's expertise.

The provision of free tickets was another unique feature that may have helped adherence and retention. While the current study investigators do not have any formal data to support this notion, the authors speculate that providing these incentives at multiple times (midpoint of the program and endpoint of the program) helped retain participants. Interestingly, the authors could not find any specific information in prior literature regarding any specific incentives to increase adherence and retention in similar programs in older adults. Still, several participants informally informed the research team that they were enthusiastic about the free tickets they received for selected performances during and after successful participation in this project. Overall, the current authors believe that the additional incentives of tickets may be a good way for future program administrators to motivate participants and create long-term adherence in community-based programs, especially if the researchers do not have the funding or logistics to provide the intervention to control group participants in a waitlist control research study design format.

Physical Health

The comparisons of SPPB performance revealed that while there were no differences across the three groups, the participants' performance improved with time. Interestingly, some authors have reported that a small meaningful change in the SPPB score was 0.5 points and substantial change was 1.0 points.[38] In the current study, the point change from pre to post-2 across all groups was 0.8. Thus, the participants may have meaningful improvements in physical performance. Still, as all groups improved similarly, part of the improvement may be due to a learning effect. The "learning effect" is when participants'

performance on a test improves because they "learn" to take the test and, thus, score better on repeated testing rather than actual improvements due to the intervention. In the current study, participants had 10-week (pre to post-1) and 14-week (pre to post-2) intervals. Thus, while they did not have many attempts close to each other in time, there may have been some carry over from participants remembering the test content from previous attempts.

A partial explanation of the lack of differences in SPPB performance across groups may also be due to the ceiling effect. A "ceiling" effect is when participants in a study obtain close to maximum scores on the observed variable. In such cases, as participants reach the maximum score on the testing instrument, any further improvements in performance cannot be measured by the instrument. Support for this explanation may lie in the SPPB scores of the current participants. Specifically, the participants' SPPB scores (around 10 to 11) were close to maximum test scores (maximum = 12). In support, prior authors examining older adults lower extremity function have reported that the SPPB may have a ceiling effect in higher functioning adults.[39] Combining all these observations with the current findings, it appears that while the SPPB can examine function in older adults with pathology,[40] it may be less sensitive in delineating performance differences in higher functioning community dwelling adults.

Mental Health

The current participants' cognition improved with time and similarly across all groups, consistent to observations in the SPPB. Montreal Cognitive Assessment scores less than 26 are noted to indicate mild cognitive impairments.[30] The current participants were not cognitively impaired (pre-intervention testing means across all groups around 26 to 27; see Table 3). Also, the minimally clinically important differences for the MoCA are between 1.2 (anchor based) to 2.2 (distribution based) points,[41] which are lesser than the differences in the current participants (pre: 26.3 to post-2: 27.5). Thus, although the MoCA scores did statistically improve across time, the changes may not be clinically meaningful. Rather, again it appears that participants had a learning effect. In support, Cooley et al.[42] examined MoCA scores in older adults aged 51 to 85 across three time points (baseline, 12 months, and 48 months) and found that the MoCA may be susceptible to practice effects. Those researchers noted that only those scoring less than 26 at baseline demonstrated a significant increase in MoCA scores from baseline to 12 months.[42] So, in the current study, the learning effect may have played a larger role in improved cognition scores of the current participants. Prior authors note that physical exercise positively impacts cognitive functioning and helps counteract normal and pathological aging.[9,10] Thus, additional work is needed to elucidate how the interventions or the test sensitivity and specificity or both contribute to cognitive scores improving over time.

Focus Group Interviews and Arts Surveys

Participants across all groups mentioned that just attending their group twice a week was a positive experience. Taking part allowed participants to meet new people and increase their social engagement. All programs used in the current study were "active" engagement programs. Specifically, in the dance and the music groups, participants actively learned and performed arts rather than passively watching dance performances or watching others give a musical performance or just listening to music. Prior researchers have found that active arts activities have higher levels of engagement than passive arts activities.[43] Similarly, in the control group, participants actively formed their own subgroups and discussed topics that were interesting to them, and thus this kept the participants motivated. Taken as a whole, the act of proactively coming to the program twice a week and actively taking part in a program likely allowed all participants in all groups to experience an improvement in self-reported health.

Strengths, Limitations, and Future Recommendations

One of the major strengths of this study is the use of assessments that included: 1. physical (SPPB) and mental (MoCA) measures, and 2. quantitative (SPPB and MoCA) and qualitative measures (focus group interviews). The high adherence and retention rates also provide evidence of high levels of program engagement and is a strength of the current study.

However, the study does have some limitations. It is likely not possible to overgeneralize the results and to other populations. All participants in the present study were community dwelling and generally high functioning, so how these results may extrapolate into other settings and across other measures needs added study. While the study investigators followed up with participants only 1 month after the interventions due to timeline and financial limitations in this funded project, future investigators should examine longer time periods for follow-up (e.g., 18 to 24 months post-intervention) in agreement with prior[44] suggestions. Also, another form of RCT study design is the "waitlist control group design," where the participants assigned to the control group are offered the intervention after the study's completion. While that study design was not feasible in the current study due to logistical funding and timeline issues, future researchers can use this study design if they are able to obtain the long-term financial and logistical support to implement the program.

Another study limitation was the different levels of creative content across groups. Supporting autonomy and providing choice in learning has an impact on physical and cognitive performance outcome.[45] While all groups had participant engagement, the amount of creative engagement differed across the groups. In the control group, the facilitators allowed participants to self-generate ideas to discuss during their sessions. While ultimately this technique did foster creativity and participant empowerment in the initial weeks, the lack of specific guidance was unsettling for some participants but provided a sense of autonomy, allowing participants to feel involved in guiding group discussions, even if it was a control group. The intervention in the music group was yoked as participants had to play the ukulele (no choice of instrument), but the experienced teacher implemented a variety of teaching approaches dependent on individual learning styles. This element of individualization

and choice in learning style likely impacted the music group's physical and cognitive results. Participants in the dance group had the most "command" style of instruction at the start of the program by design, as their dance genre (ballroom) and styles (e.g., bachata) were already determined. Near the end of the program, the dance group did have some autonomy in choice of music, but again the instructors guided the participants in their dance steps. The exact differential effects of these differing autonomy levels across groups on participant perceptions of engagement needs additional study.

Finally, while in this study, the researchers used one dance (ballroom) and music (ukulele) form, multiple other arts forms exist, including but not limited to other dance genres, playing other instruments, creative arts participation, and watching or creating visual arts. How longer interventions would affect participants' functioning needs additional study. Overall, practitioners can use the current findings to design tailored arts and social engagement programs to diverse populations.

Implications

One of the major implications of this study for all those who work with the performing arts is evidence that regularly attending community engaged programs that are participant empowering and fun and free for the participants can improve physical and mental health in older adults. Taken as a whole, practitioners can use these study results to attract and retain older adults in community programs and promote successful aging.

Conclusions

Overall, taking part in community engaged dance, music, and social conversation programs positively influenced the physical and mental health of older adults. Still, as all groups improved equally, the results may partly be due to participants having normal physical and mental function pre-participation and due to them learning the test over time. The study findings indicate that providing community engaged programs (e.g., dance and music) that empower participants so that they feel more engaged and are fun and free for participants can positively influence physical and mental health in older adults.

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