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Effects of a Therapeutic Dance Program on Balance and Quality of Life in Community Dwelling Older Adults

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EFFECTS OF A THERAPEUTIC DANCE PROGRAM ON BALANCE AND QUALITY OF LIFE IN COMMUNITY DWELLING OLDER ADULTS

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ABSTRACT

Background and Purpose

Falls are common in older adults and linked to decreased balance and increased morbidity. Regular exercise can improve balance and decrease falls risk. Recent research suggests that participation in cultural-based activities, such as dance, may be associated with decreased falls risk and improved health. The purpose of this study was to examine effects of a dance-based exercise program called "The Dancing Heart Program" on balance and quality of life in community-dwelling older adults. This is an interactive program facilitated by professional instructors from Kairos Dance Theatre in the Twin Cities. It includes activities challenging balance while providing social engagement.

Methods

Ten subjects over age 60 were recruited from an assisted living facility and seven subjects completed the study. Demographic information was collected at the beginning of the study. Participants attended 60-minute sessions once a week for 13 sessions. Outcome measures included the Berg Balance Scale (BBS) and the 36-item Short Form Health Survey (SF-36). Participants were assessed 1 month prior to the program, at program initiation, and 12 weeks into the program.

Results

Three people who agreed to participate but did not attend Dancing Heart sessions were classified as non-participants; the four that attended were classified as participants. All subjects demonstrated significant improvement on the BBS over time ($p=.01$). There were no between group differences for balance or interaction effects. Scores on the SF-36 physical component were significantly lower for participants compared to non-participants ($p=.01$). There were no significant changes over time or interaction effects for the SF-36 physical component. No significant differences were found for the SF-36 mental component across time or based on participation status.

Conclusions

Results of this study suggest that the Dancing Heart Program had no significant effect on balance or quality of life. Significant differences between groups on the SF-36 physical component suggest there may be important differences between those who choose to participate in programs such as Dancing Heart and those who do not. In addition, the intensity of the Dancing Heart Program may be too low to effect changes. Primary limitations of this study include small sample size and low power.

RESEARCH ADVISOR FINAL APPROVAL FORM

The undersigned certify that they have read, and recommended approval of the research project entitled…

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in partial fulfillment of the requirements for the Doctor of Physical Therapy Program

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Chapter I: INTRODUCTION

Physical activity has numerous benefits including improved strength, flexibility, endurance and balance as well as being associated with a decreased risk for a number of diseases. Despite the countless benefits, many people do not get the recommended amount of exercise. According to the Centers for Disease Control and Prevention, only 10.4% of adults over the age of 65 get the recommended amount of both aerobic and strengthening exercise.[1] The natural aging process results in changes to all body systems that may lead to increased fall risk and a greater chance for injury with falls. Falls are a common occurrence in the older adult population and are linked to decreased balance as well as increased morbidity.[2, 3] Nearly one third of adults over the age of 65 fall annually[4, 5] accounting for an estimated $20 billion of annual medical expenditures in the United States. Furthermore, fall related expenditures are expected to increase to $54.9 billion by 2020.[6] These numbers reflect the need for activities that decrease risk of falls in the older adult population in the United States.

Barriers to older adults participating in an exercise program may include a fear of falling, fear of injury while exercising, a lack of enjoyment during exercising, and a lack of social support or motivation to exercise.[7, 8] Regular exercise may improve balance and therefore lead to decreased fall risk, but it is important for a person to find activities that he or she feels safe doing and enjoys enough to start or continue participating in on a consistent basis in order to see results.

Current research shows there is a link between the impact of cultural-based activity participation and physical and mental health. A study conducted by Cohen et al[9]

examined the effect of participation in a cultural-based program including artistic activities on physical health, mental health and social functioning of older adults. The researchers found that as an individual experiences mastery in a new area they are more likely to feel confident and motivated to seek out participation in organizations/groups.[9] Once adults reach an age where they can partially or fully retire, they have more freedom to explore activities that they never had time to do while they were working. [10] The results of the prospective study by Cohen et al[9] also showed that participants involved in artistic activities in comparison to a control group experienced improved health, a decreased number of falls, and a decreased number of doctor visits.[9-10] These findings suggest the benefits of participating in cultural-based interventions with artistic activities are multifaceted.

Dance based intervention is one form of artistic activity that older adults can participate in to achieve the positive results of exercise. The benefits of dance as an alternative to more traditional exercise programs, such as walking, biking and resistance training, are being researched among older adults. Benefits beyond the physical improvements include providing a social environment that encourages interaction which can serve to increase participation rates, improve adherence, and improve emotional health by creating feelings of confidence and well-being. This literature review includes a review of research regarding dance-based interventions and their effect on improving balance and quality of life in older adults.

Chapter II: REVIEW OF THE LITERATURE

Barriers such as fear of falling may prevent older adults from participating in traditional exercise programs.[7, 8] Because of these factors some older adults are turning to dance, Tai chi, and other non-traditional exercise programs in an attempt to improve their balance and decrease their fear of falling. Studies involving the use of Tai chi pose a unique challenge in that there are several different styles. Common characteristics of these styles are the use of slow, controlled movements with time spent in bipedal, unipedal and tandem stance, taking large steps forward, backward, laterally, and using both bilateral and unilateral upper extremity movements. [2, 11-13] A 10-week study compared Tai chi and Combined Balance and Step Training (CBST) in a group of participants aged 65 and older who were in congregate housing (35%) and community-dwelling (65%). CBST is a type of exercise training involving practicing stepping forward, backward, laterally, and adding either cognitive or postural components to these tasks. The participants in the CBST group improved an average of 9% more on dynamic balance measures over the Tai chi participants.[2]

One study exploring Sun-style Tai chi as an intervention over a 12-week period in older adults living in residential care showed improvement in 6 minute-walk time, unipedal stance with visual feedback, and a self-reported increase in confidence in avoiding falling for the experimental group.[11] Similarly, in a large (N=684) 16-week randomized controlled trial of young-old community dwelling adults (mean age =69) using Tai chi as an intervention, subjects in the experimental group improved their scores on five out of six balance measures.[13] Subjects participated in once weekly Tai chi

classes for one hour, and the balance measures used were sway on floor, sway on foam mat, lateral stability, coordinated stability, choice stepping reaction time, and the maximal leaning balance range test. After the researchers adjusted for age, sex, falls history at baseline and physical activity at baseline the intervention group (N=347) performed significantly better on all measures except for the maximal leaning balance range test.[13]

In a larger study (N=132) examining the effects of Western Exercise (WE), (n= 39) compared to Tai chi (TC), (n=37) on physical and cognitive functioning in healthy community-dwelling older adults, the single leg stance, functional reach, and the chair-stand tests were used to assess balance and lower body strength, respectively. There was also an attention-control group (n=56) that was only involved in the first 6 months portion of the study. In addition to the aforementioned outcome measures, all participants completed the Community Health Activities Model Program for Seniors (CHAMPS) physical activity questionnaire at baseline and 6 months, and the WE and TC groups completed this questionnaire again at 12 months. The CHAMPS records class attendance, time spent exercising, and changes in activity level in response to an intervention. This randomized controlled trial had two phases. The first 6 months were called "an adoption phase" in which WE, TC, and the attention-control groups were compared. During the next 6 month phase, called the maintenance phase, only WE and TC were continued and compared. All participants were age 60 and over, sedentary (no regular exercise for more than 60 minutes/week), and ambulating without an assistive device. During the adoption phase the WE and the TC interventions included a social-cognitive teaching approach

with personalized and in-class feedback 2 times per week, plus home activity 3 times per week at 60 minutes each of moderate intensity. Also included in the WE and TC group interventions were individual goal-setting and education about the benefits of physical activity. During this phase, the attention-control group attended weekly 90-minute healthy aging classes on topics such as healthy eating, elder law, elder care, and appropriate foot and eye care. During the maintenance phase the WE and TC groups continued by participating in one class-based and three home-based exercise sessions per week of 60 minutes at moderate intensity. Results significant to our review purposes include statistically significant improvements on the balance subscale of single-leg stance ($p = .002$) for the Tai chi group at maintenance-phase (12 months), lower extremity strength as measured by chair-stands in 30 seconds ($p<.001$) for the Tai chi group at 12 months, and the Western Exercise group ($p<.001$) at 12 months. These results indicate that the Tai chi group improved in their static balance over time whereas the WE group did not, and that both groups improved in their lower body strength overall. While there were not any major differences in improvements between the two groups in terms of lower body strength, this provides some evidence that Tai chi may be related to improvement in static balance among this population.[12] The slow and controlled movement required in Tai chi may be considered analogous to movements found in some styles of dance.

Every form of dance has a unique set of steps, rhythms and skills. As a result, different dance forms could potentially have a different effect on function. Eyigor et al.[14] utilized Turkish folklore dance to see if it improved gait speed, endurance, balance and

quality of life. Nineteen subjects were included in the experimental group and 18 subjects served as the control group. The experimental group participated in Turkish dance, taught by an expert three times per week for an hour each session for eight weeks, while the control group did not participate in any form of exercise. The authors chose to assess function using the 20 meter walk, 6 minute walk, Berg Balance Scale (BBS), SF-36, chair rise test, and the stair climb test. The experimental group showed statistically significant improvements in the 6 minute walk, chair rise, stair climbing, BBS, and the SF-36 sub-scales of physical functioning, general health, and mental health ($p<.05$). The control group showed no statistically significant improvement. When compared to each other, significant improvements for the intervention group were found for performance in the 6-min walk test, chair rise test, and stair climbing as well as on the physical function, general health, and mental health portions of the SF-36 compared to the control group.

An additional study conducted by Sofianidis et al[15] examined the effect a 10 week traditional Greek dance program on static and dynamic balance in healthy older adults. Twenty six participants were randomly divided into an intervention group who took supervised Greek traditional dance classes one hour a day, two sessions a week for 10 weeks (n=14) or a control group who only underwent pre and post intervention testing (n=12). The pre and post intervention testing included an assessment of balance through recording the center of pressure (COP) variations and trunk kinematics during performance of the Sharpened Romberg test, one legged stance, and dynamic weight shifting. It was found that there was a decrease in center of pressure displacement and trunk sway in one legged stance for the dance group. The results noted can be correlated

to the challenge that the Greek dance intervention provided: the postural control system was constantly challenged to maintain equilibrium, while at the same time, the center of gravity was being shifted outside the normal limits of stability, further pushing the participants to test their balance.[15]

Additional studies have looked at the effect of Jazz dance programs on balance in older adults. A study conducted by Wallmann and colleagues[5] assessed the effects of a 15 week jazz dance class on improving static balance in 14 healthy community-dwelling women over the age of 50 (mean age = 68). This study used the Sensory Organization Test (SOT) as their outcome measure administered on a NeuroCom Smart Balance Master System with collection of data taken at week 1, week 7, and week 15. The SOT is a protocol that challenges and tests the three primary sensory inputs to the body: visual, vestibular, and somatosensory by introducing conditions such as eyes open, eyes closed, fixed support, sway-referenced support, and sway-referenced visual conditions using the NeuroCom system. Results for increased balance in all 6 conditions were analyzed and significant improvements were found in SOT 3 - SOT 6 in different combinations across the three time frames and a significant composite score was found. Significant results indicate that balance improved throughout the duration of the Jazz dance class, that participants learned to utilize all three components of the sensory system to help improve their static balance, and that vision became an important component of improved balance during the second half of the class. The authors proposed that the significant results suggest that using a dance program that challenges all three components of the sensory system helps improve static balance.

A similar study conducted by Alpert and colleagues[16] looked at the effect of a 15 week jazz dance class on balance, cognition and mood in 13 community-dwelling older women (mean age = 69). The outcome measures used in this study included the Mini Mental Status Examination (MMSE), Geriatric Depression Scale (GDS) and the sensory organization test (SOT) for balance measurements using a NeruoCom Smart Balance Master. Data for these three outcome measures were collected at *time 1*: between week 1 and week 2 of the jazz dance class, *time 2*: between week 8 and week 9, and *time 3:* after week 15 of the jazz class. For our review purposes the significant results of the SOT will be discussed. Data analysis using analysis of variance with repeated measures showed balance measures improved throughout the duration of the study ($p<.001$). Additionally, post hoc analyses were performed using paired t-tests with Bonferroni corrections, which showed significant increases in balance occurred from time 1 to time 2 ($t = -3.86$, $p = .003$) and time 2 to time 3 ($t = -6.818$, $p<.001$). These significant results suggest that participating in a 15 week jazz dance class can improve balance not just in the early weeks of the class but also throughout the entire program.

To further investigate the effect of dancing on balance in older adults, a summary of tango dance as the focus of dance-based interventions will be discussed next. According to a study by McKinley and colleagues[17] participation in a tango dance program, specifically, is beneficial as this dance style incorporates movements such as standing on one leg, forward and backward stepping as well as longer step lengths which all focus on specific aspects of balance. In the study by McKinley and colleagues[17] researchers investigated the effect of a 10 week tango dance program versus a simple

walking program on balance, strength, walking speed and fear of falling in 25 seniors, ages 62-91. The seniors were randomly assigned to either the walking group (N = 11) or the dance based group (N = 14) and participated in 4 hours of either walking or dancing per week. The authors collected data on participants in both groups 1 week before intervention began, 1 week after the last class, and 1 month after the dance program finished using the outcome measures of sit-to-stand (STS), normal and fast walking speed, and the Activities Specific Balance Confidence (ABC) scale. Significant improvements in STS, ABC and normal walk speed were noted which decreased the fall risk category for many participants from high risk to low or moderate risk. Although both groups showed improvement, improvements in STS, ABC, and normal walk speed were greater for the dance group than the walk group. Additionally, this study found that improvements were sustained at the one month follow-up after completion of the dance program. Through this study, McKinley and colleagues showed that dance-based interventions are effective in improving balance in the older adult by providing evidence that improvement in balance can lead to a decreased fear of falling and that improvements seen during dance-based interventions are sustained post intervention.

Evidence has also been collected on dance-based interventions that do not follow a specific type of dance style such as jazz or tango, but instead have a more general framework. These general dance-based activities try to incorporate specific movements that work to improve a certain type of impairment, or provide exercise classes that are dance focused. A study conducted by Valentine-Garzon et al.[18] looked at the effect of a range of motion dance program on functional ROM and activities of daily living

participation. Seventeen frail elderly women were recruited from an adult day care center. Nine women were placed in the experimental group and participated in a thirty minute dance-based exercise program two times per week for four weeks. The remaining 8 women served as controls, continuing with their usual activities. The study found no statistical significance between the experimental and control groups when comparing post program scores or one month follow-up scores. The authors attributed this to the short time period and the small number of subjects. Further research on this topic with larger numbers of participants is warranted in order to explore this area in greater detail. Federici et al.[19] looked at how a combination of dance types improved balance in older adults. The study included 40 individuals who were divided into a control group that participated solely in social activities and no exercise, and an experimental group that met two times each week for 60 minutes to learn basic steps of Salsa, Merengue, and Bachata dance styles. Balance was assessed using the Tinetti, Romberg, Improved Romberg, and the Sit-Up-and-Go. The experimental group demonstrated a significant improvement in all four outcome measures ($p<.001$), while the control group showed a small but insignificant decline in the outcome measures. The authors noted that the improvement was similar to that of interventions such as Tai chi, and the improvement was more significant than what is seen with home-based exercise programs.

Shigematsu et al [20] also conducted a study examining the effect of a dance-based aerobic exercise intervention on the indices of falls in older women. Thirty eight independent and healthy women aged 72-87 were included in the study. The intervention group (n=20) received dance based exercise classes 60 minutes a day, three times a week

for 12 weeks that were designed to increase balance, strength, locomotion/agility and motor processing. The control group (n=18) did not participate in exercise classes and were asked to resume their normal activities.[20] The outcome measures in this study that assessed balance included single leg balance with both eyes open and eyes closed conditions and functional reach. Hand grip strength and maintaining a half squat position assessed strength; walking time around two cones and 3 minute walking distances assessed locomotion/agility; and hand reaction time and foot tapping assessed motor processing. Following the 12 week time period, researchers found that there were significant increases in single leg balance with eyes closed ($p=0.03$) and functional reach ($p=0.01$). In addition, there was a significant decrease in the amount of time it took the dance group to walk around two cones ($p=0.03$).The results helped the researchers conclude that the positive increases in the outcome measures can be attributed to the increase in lower body muscle strength, power and agility. As a result of the increase in lower extremity strength, power and agility, it has been asserted that these three things are sufficient to lead to a decrease in the amount of falls.[20]

Traditional exercise programs are not readily adopted by older individuals due to fear of falling, health problems, and motivation.[8,21] Therefore, another approach to exercise that includes choreographing dance steps that incorporate movements from activities of specific interest to the participants may encourage participation. For example, in a study conducted by Krampe and colleagues[4], a new dance step entitled the Shoe Shine was incorporated into the dance routine as one of the participants had been a shoeshine his entire life. In this study, Krampe and colleagues[4] conducted a pilot study

looking at the effects of a dance based intervention on balance and gait outcomes in community-based frail seniors. The authors of the study looked at the effect of a Lebed Method dance intervention three times a week for six weeks on 11 participants in a Program of All-inclusive Care for the Elderly (PACE) on balance and gait. The Lebed Method combines low-impact dance with upbeat participant specific movement where a certified instructor choreographs a dance routine with specific balance and mobility outcomes. The outcome measures used in the study included the Functional Reach (FR) for balance and Timed Get Up and Go (TGUG) for gait with data collection at baseline, 6 weeks after start of the dance intervention, and 6 weeks post intervention. Due to the small sample size of this study, the authors used it as a descriptive study to show the need for further research on dance-based interventions. As this review is focusing on balance outcomes, the results for the FR will be discussed. Comparisons of pre- and post-FR graph data showed positive trends in functional status with the majority of patients improving an average of 4 inches on their FR tests. When FR results were combined with TGUG data, a global improvement of about 50% from baseline functional status was seen in the participants. These results indicate that further research into dance as a means of improving balance in the elderly is warranted.

As Krampe and colleagues[4] worked to incorporate parts of the participants lives into their dances, Lin et al[22], looked to take this a step further and sought to find a relationship between dance based exercise and physical and emotional functioning by combining exercise and story-telling. Fifteen subjects from an adult day care program were recruited for this study. The eight subjects who were placed in the intervention

group participated in the Dancing Heart Program for ten weeks. The program lasted ninety minutes one time per week, with sixty minutes devoted to dancing and movement and thirty minutes devoted to storytelling. The seven control subjects did not participate in the Dancing Heart Program. Lin et al. used the Functional Fitness Assessment, which has components of flexibility, strength, balance and endurance, to assess physical function. The Life Satisfaction Scale was used to assess the subject's perceived satisfaction with life. In this study no statistically significant differences were found between the intervention and control groups. However, the interviews following the conclusion of the study found that 75% of those in the intervention group reported feeling happier following the dancing sessions. The authors concluded that lack of significance was due to the small number of subjects. They stated that future studies with the Dancing Heart Program should "examine the impact of specific dance movements matched to specific skill...with a larger sample increasing the power of the results to generalize to the larger target population."[22]

In conclusion, the research presented in this review supports dance as an effective intervention to improve balance and decrease fall risk in the older adult population. Studies show that dance-based programs can lead to improvements in static balance, dynamic balance, 6 minute walk, chair rise, stair climbing, BBS, and the SF-36 quality of life sub-scales of physical functioning, general health, and mental health. The studies varied greatly in intensity and frequency of interventions, from as little as 30 minute sessions 2 times per week for 4 weeks to 60 minute sessions 3 times per week for 12

months. Interventions with higher intensity and frequency appear to have greater impact on balance and quality of life.

The majority of studies that have been conducted in the area of dance based intervention have been relatively small with the number of participants ranging from 11 to 68. Larger studies include Taylor-Piliae et al. and Voukelatos et al. with 347 and 132 participants respectively.[12, 13] Studies involving smaller sample sizes are meaningful despite their size in that they point us in a direction for further research. However, a limitation of smaller studies is that it is harder to show statistical significance. Results of the larger studies demonstrate statistically significant changes in static balance measures for the experimental groups over the control groups.

The current available literature on dance based intervention is focused on healthy community-dwelling independent older adults. The types of movement and dance-based interventions utilized in the studies reviewed included Tai chi, Turkish folk dance, Greek, jazz, Latin dances, and aerobic dance. Many of the interventions required participants to perform dynamic standing balance and demanded a high level of coordination, speed, and accuracy.

Due to the lower physical demands, dance interventions or programs where participants can make up their own steps or go at their own pace may be more appropriate to use with older adults who have concerns about balance or self-efficacy with physical activity. For example, the Dancing Heart Program allows for participation by individuals with a wide range of abilities and includes activities that challenge both static and dynamic balance through interactive dance and storytelling activities.[23] One study has

examined the impact of this program for individuals attending an adult day care center and found a positive trend in improving mood for program participants but no statistically significant positive changes in quality of life or balance measures.[22] Given the limited research in this area, the purpose of this study was to examine the impact of "The Dancing Heart Program" on balance and quality of life in older adults in an assisted living setting.

Chapter III: METHOD

Setting and Participants

A total of 10 seniors over the age of 60 years old, living independently in the community or in an assisted living facility and attending day programs through Augustana Homes participated in this study. The participants voluntarily indicated whether or not they would be interested in participating as a research subject for this study upon registering for the Dancing Heart program, offered to this facility through the Kairos Dance Theatre, a community partner. Researchers contacted these participants, either by phone or in person, with information about the research study including the testing dates, time commitment, incentives, and purpose of the study. Participants who indicated they understood the requirements of the study and gave their informed consent, in addition to meeting the inclusion criteria, became participants in the study prior to beginning the Dancing Heart program so baseline balance and quality of life data could be collected. Participants were excluded if their cognitive level or level of mastery of the English language prevented them from giving consent indicated by the necessity of a guardian or conservator, MMSE score below 9 (cognitive) and ELL level 4 or below (language). This language cut off was also indicated as participants needed to be able to read and understand the assessments.

Study Design and Procedures

This study used a prospective, multiple case within subjects design (A-B-A). Data was collected on participants at three different time periods throughout the duration of the study in order to assess changes over time in balance and quality of life. One

month prior to the start of the Dancing Heart Program, demographic information including the individual's age, sex, race and number of years of education were obtained through participant interview with a researcher. In addition to the demographic information, individuals performed the Berg Balance Scale (BBS) and completed the mental and physical components of the Short Form Health Survey (SF-36) at this time in order to obtain a baseline score for each participant. The BBS and SF-36 were chosen for use in this project as they took into account the quantitative impact of participating in the Dancing Heart Program on overall quality of life and physical health. The participants were again assessed on the BBS and SF-36 at the initiation of the Dancing Heart program and at 12-14 weeks post initiation of the program to compare changes and progress throughout the duration of the program. Data was collected by a single researcher either with the participant in their individual apartment or in one of the community areas of Augustana Homes. When answering the SF-36 questionnaire, participants had the option of reading the test themselves or having the questions read aloud by the researcher for time purposes.

The Dancing Heart Program was carried out in Augustana Homes from September 2011 to August 2012. The Kairos Dancing Heart Program uses modern dance, movement improvisations, and folk dance and oral history traditions from all over the world to establish a sense of community and well-being among participants of all ages and abilities. The interplay of interactive dance and story-telling allows participants to exercise their minds and bodies in a way that improves their physical, psychological, emotional and social health.[23] Participants attended the Dancing Heart Program one time

per week over 14 weeks for a total of 13 sessions. Each session lasted 60 minutes. Following is a brief overview of a Kairos Dancing Heart session. During a session participants begin with a warm-up activity that allows them to start to move different body parts and engages them in the session. After the warm-up, a name sharing and dance activity is started to enhance social connections and continue with movement patterns dictated by the song chosen by the Teaching Artists of the dance company. An example of this would be singing names together while performing the movement patterns of working the earth. Participants are then instructed in a body/brain activity that focuses on eight developmental movement patterns including breath, tactile, core-distal, head-tail, upper-lower, body-side, cross- lateral, and vestibular in order to emphasize opposites. These movements are again intertwined with specific music selections. The second to last activity participants engage in is entitled "Language of Dance" and involves focusing on rhythm and balance. Rhythm activities incorporate rhythm of the feet, hands, elbow and shoulders, rhythm of words and rhythmic movement patterns to the beating of a drum. Examples of balance activities include creating balance shapes with partners, balance at high, middle, and low levels, and mirror balancing with a partner. Lastly, under the direction of a Teaching Artist, participants choreograph specific dance movements for a song chosen by the Teaching Artist that fits the theme of the session, incorporating movement patterns learned throughout the session. During the dancing session, participants could chose to either stand and perform the activities or participate in the session from a chair. Kairos dance staff assisted researchers by

collecting participant attendance during the 13 Dancing Heart sessions for analysis purposes.

Outcome Measures

The primary areas of focus in this research study were on balance and quality of life in the Dancing Heart participants. Balance was assessed using the Berg Balance Scale (BBS) and quality of life was determined using the Short Form Health Survey (SF-36). The Berg Balance Scale is a 14 item clinical tool used to assess an individual's static and dynamic balance abilities. Each of the 14 items is scored on a scale of 0-4 (ranging from unable to perform to independent with task) with a total possible score of 56 points. The Berg Balance Scale has been shown to be both reliable and valid, with values of 0.96 and 0.85, respectively.[24] The SF-36 is a 36 question survey that assesses overall functional health and well-being of an individual. The 36 questions are compiled into eight scaled scores which are weighted sums of the questions in each section. Each scale is transformed into a 0-100 scale based on the assumption that each scale holds equal weight in a person's quality of life. The SF-36 has been shown to be both reliable and valid in the general population, with values ranging from 0.60-0.81 for reliability and ranging from 0.73-0.96 for validity.[25]

Data Analysis

The results were analyzed using the Statistical Package for Social Sciences (SPSS) Version 19 software for Windows. To evaluate the socio-demographic characteristics, descriptive statistics, such as frequency, mean, range, and percent, were used. For comparisons between groups and with-in subjects, a mixed, 2 factor with-in

subjects ANOVA followed by pairwise comparisons with a Bonferonni adjustment for any significant F-values was used. The two factors analyzed included time and participation type where subjects were considered either participants or non-participants in the Kairos program based on attendance totals from the 13 possible sessions. Levels of $p < 0.05$ were considered statistically significant.

Chapter IV: RESULTS

At baseline, a total of 10 subjects participated in testing for the SF-36 and BBS measurements. Seven subjects completed the full study. One subject declined participation at the second testing session citing family commitments and scheduling conflicts as reasons for discontinuing the study. A second subject also declined participation at the second testing session as they were unwilling to fill out paperwork required for the study. An additional participant was unable to be contacted for follow-up testing at the third testing session, despite multiple attempts by researchers, leading to the exclusion of their data in the analysis. At the 12-week post-initiation testing period, 7 subjects remained in the study and were included in the data analysis. The demographic information for these seven subjects can be found in Table 1.

Table 1. Demographic Information

	Frequency (n=7)	Percent
Gender		
Male	1	14.3
Female	6	85.7
Marital Status		
Single	2	28.6
Married	1	14.3
Other (divorced, widowed, etc.)	4	57.1
Education		
Some high school	1	14.3
High school	2	28.6
Some college	3	42.9
Master's degree	1	14.3
Race/Ethnicity		
African American or	4	57.1
Black	2	28.6
White	1	14.3
Hispanic/Latino		
Living Situation		
Independent	1	14.3
Assisted Living	4	57.1
Unknown	2	28.6

Three of the seven subjects did not participate in any of the Kairos Dancing Heart sessions and are classified as non-participants for data analysis. Four participants attended at least 40% of the sessions and are classified as participants for data analysis. The means and standard deviations for the BBS and the SF-36 physical and mental scores at time 1, time 2, and time 3 are presented in Table 2.

Table 2. Mean Values for With-In and Between Subject Comparisons for the BBS and SF-36 Physical and Mental Components.

Test	Time 1 M ± SD	Time 2 M ± SD	Time 3 M ± SD	N
BBS				
Nonparticipant	49.33 ± 3.51	45.0 ± 5.29	48.67 ± 4.51	3
Participant	23.33 ± 15.95	20.67 ± 15.28	30.0 ± 20.66	3
SF-36: Physical				
Nonparticipant	50.23 ± 1.81	46.97 ± 5.61	48.07 ± 10.23	3
Participant	32.83 ± 7.94	34.35 ± 5.07	34.03 ± 6.51	4
SF-36: Mental				
Nonparticipant	55.07 ± 5.64	53.93 ± 11.14	55.80 ± 1.30	3
Participant	63.25 ± 12.24	60.83 ± 16.91	56.88 ± 16.08	4

NOTES: M = Mean; SD = Standard Deviation

The data for the Berg Balance Scale (BBS) was analyzed for 6 subjects, as one subject was wheelchair bound. The time periods analyzed included time 1 to time 2, time 2 to time 3, and time 1 to time 3, with time 1 denoted as the time when baseline measures were taken, time 2 as measures taken at initiation of the program, and time 3 as 12 weeks post-program initiation. Significant results were found for the with-in subject comparison over time for all subjects in BBS scores ($F_{2,17}$=8.759, p=0.010, effect size (ES)=0.686, power 0.874). No significant interaction effects were found for the participation group in comparison to the non-participation group over time ($F_{2,17}$ = 3.057, p = 0.103, ES=0.433, power 0.432). A post hoc analysis was run for the main effect found for with-in subjects over time and a significant difference was identified between time 1 and time 3 for balance scores (p=0.017), with the scores at time 3 being significantly higher. There were also no significant differences between the two groups on the BBS overall ($F_{1,17}$ = 5.031, p=0.088, ES=0.557, power 0.403).

Perceived quality of life on both the physical and mental components of the SF-36 were compared for with-in subject changes over time, for participation versus non-

participation group interactions over time, and for significant differences in SF-36 scores between groups. With-in subject comparisons over time for all participants did not suggest any significant changes in SF-36 physical component scores ($F_{2,20} = 0.40$, $p = 0.961$, ES=0.008, power 0.055). There were also no significant interactions in SF-36 physical component scores over time when compared between participation versus non-participation groups ($F_{2,20} = 0.319$, $p = 0.734$, ES=0.060, power 0.088). Although the groups did not indicate significant changes with-in subjects when analyzed for time and participation factors, the data did suggest a significant difference for SF-36 physical component scores between groups ($F_{1,20} = 15.901$, $p = 0.010$, ES=0.761, power 0.885). The non-participant group had significantly higher scores on the physical component than the participant group. SF-36 mental component scores were not significant for the with-in subject time ($F_{2,20} = 0.312$, $p = 0.739$, ES=0.059, power 0.087) or interaction of groups ($F_{2,20} = 0.549$, $p = 0.594$, ES=0.099, power 0.117) factors, or between group comparisons ($F_{1,20} = 0.382$, $p = 0.564$, ES=0.071, power 0.080).

Chapter V: DISCUSSION and CONCLUSION

The purpose of the present study was to assess the effects of a dance-based program combining skill-specific movements and storytelling on balance and quality of life in community-dwelling older adults over the age of 60 years old. Overall, contrary to our hypotheses, the results suggest that this program did not have a significant effect on either the balance or quality of life measures analyzed. For example, no significant changes in SF-36 mental or physical component scores were observed after 12 weeks of program participation. In the case of balance, a significant increase in Berg Balance Scores over the course of the study was noted but this improvement occurred in both the participant and non-participant groups.

As mentioned in the methods section, the original design of this research study was to follow all participants as one group over time. However, due to attendance rates, participants self-selected into participant and non-participant groups. Therefore, in addition to analyzing with-in subject results overtime, between group comparisons were also made between those that attended the Dancing Heart session and those that did not. While performing the analyses it was found that those who did not participate in the Dancing Heart program were actually significantly higher on all measures for the SF-36 physical component and had higher scores on the Berg Balance scale than those who did participate in the program. Despite the significant between group differences in the physical component of the SF-36, the mental component scores were very similar between all of the participants, suggesting that the self-reported mental health of participants and non-participants was comparable.

It is important to note that although the Berg Balance Scale between group scores were higher at all three time points and trending toward significance, the results were not significant. Had there been a larger number of participants in this study, giving the data more power, a significant difference in BBS scores between the participant and non-participant groups might have been identified. The fact that the non-participants scored higher at all three time points on both the SF-36 physical component and the Berg Balance Scale may have important implications for future research and intervention options in this population.

These implications pertain to who may or may not be appropriate participants in interventions such as the Dancing Heart program. It was found that the higher functioning group, or the non-participants, may not be appropriate for dance interventions similar to the Kairos sessions as they did not prioritize participation in the Dancing Heart program. This may have been due to the fact that they were more mobile and therefore able to leave their homes more easily, making them too busy to participate. Also, due to their increased mobility, the non-participants may have perceived the Dancing Heart program as too easy.

In contrast, the lower functioning group, or the participant group in this study, may be better suited for dance-based interventions such as the Dancing Heart program as their decreased ability for community participation, secondary to decreased mobility, may have caused this program to be more important to them and therefore a higher priority. This greater importance of the program could have been due to the fact that it provided social interactions and exercise which otherwise may not have been available to this

group of subjects throughout their week, increasing their motivation to participate. Additionally, the program took place in the community room of the building where the participants lived, making it easily accessible to them, and therefore supported their attendance. However, due to the design of this study, there may be other underlying reasons explaining why the participants chose to participate or not that researchers were unable to control for and identify as the groups were not randomized.

The lack of significant results in association with program participation for either balance or quality of life suggests that a program that meets one time per week for 13, 60 minute sessions may have too low of an intensity to provide positive changes in subjects on these measures. According to the literature, in order to see a significant change in balance scores, subjects need to participate in at least 50 hours of balance training, which this program did not provide.[26] However, even simply doubling the amount of time participants spent in dancing interventions in this study may have produced significant improvements in balance as Wallmann and colleagues[5] showed balance improvements in their subjects with 23 total hours of dance interventions. Overall, the literature suggests that the more time spent in dancing interventions through multiple sessions per week and study durations lasting 10 weeks or greater, the more significant improvements are seen in balance measures.[5, 12, 14, 17, 19-20]

In addition, the level of challenge participants experienced during the dancing sessions may have been too low as subjects could chose to participate while seated in their chair, while standing, or using a combination of the two positions. An example of increased challenge discussed in the literature review includes the use of the Tango by

McKinley and colleagues[17] as a dance medium to improve balance in older adults. In order to dance the Tango, participants were required to stand on one leg, walk forward and backward, vary their speed, length and direction of stepping, and perform quick pivot turns. This increased complexity of dance moves may have been one of the main factors for the significant improvements in balance seen in their participants. Therefore, considerations for future research and program development in this area could include increasing time spent in the dancing sessions by offering longer sessions or number of days per week the program is available and increasing the challenge of the dancing activities.

Comparison of this present study and that by Lin et al.[22] can also provide specific insight into future research when working with the Dancing Heart Program to improve balance and quality of life in older adults. As mentioned earlier, the Lin study appointed subjects to an intervention and a control group. This differed from the present study as the original intention was to follow one group over time, yet, due to attendance rates, the subjects self-selected into participant and non-participant groups. Intentional separation of participants in the Lin study may have identified variables that were not able to be controlled for in this study. For quality of life, Lin and colleagues did not find a significant difference between groups; however, they did find a positive trend in improving mood in their subjects. This same positive trend in mood improvement was not identified in the current study, suggesting that the additional 30 minutes of separate storytelling time provided to participants in the study by Lin and colleagues[22] may have been a factor in the mood improvement. For balance, both this study and the one by Lin

and colleagues failed to find a significant between group difference on balance after the Dancing Heart intervention. This may indicate that factors such as the amount of time spent in dancing and storytelling activities and the challenge of dancing activities, as discussed previously, should be reviewed and modified for future research.

An additional implication for future research resulting from this study includes considerations that should be made when working with community partners. One of these includes different priorities of the participants versus the researchers. In an attempt to increase the number of participants for this study an additional facility was considered for gathering participant data. However, researchers found that when the weather was nice, subjects in this facility did not want to participate in data collection but preferred to be outside enjoying the weather instead. Consequently, due to scheduling conflicts and lack of data collection times these participants were unable to be included in this study. Therefore, considering the time of year when data is projected to be collected and also the number of other activities being offered to groups of potential participants is an important consideration when working with this population as this could lead to participant drop-out. Another recommendation then, is to emphasize and be clear with participants about time commitments and expectations during the initial stages and recruiting process of the research study so as to avoid scheduling conflicts during the data collection period of the research process.

There were several limitations that were found after the completion of this study. As was previously stated, this study had a small number of participants, which resulted in low statistical power and small effect sizes for all interactions analyzed. Additionally, the

subjects included in our study were not randomized into participant and non-participant groups by the researchers, thus limiting the ability of this study to account for differences between participants at baseline. This may have affected the results because there may have been other differences between participants and non-participants that were not controlled for based on this study design.

Conclusion

Participation in the Dancing Heart program had no statistically significant impact on balance or quality of life for subjects included in the present study. Working with a community partner was a good experience however; it limited the number of individuals that decided to participate, resulting in a small number of participants and subsequent low power making it difficult to acquire significant results. Despite these barriers, one benefit of this study was the ability to discover important implications for future research and program design when looking at the impact of dance-based interventions on balance and quality of life in community-dwelling older adults.

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