

# The Effects of Rhythmic Exercise on Reaction Time and Balance in Community Dwelling Older Adults: A Protocol for a Single-Session, Pretest/Posttest Study

Anthony D'Eliseo, SPT ♦ Jacob Klein, SPT ♦ Joseph Levandowski, SPT ♦ Damian Pierontoni, SPT ♦  
Laurie Brogan, PT, DPT, CEEAA, GCS ♦ Kristen Karnish, PT, MPH, DEd, GCS

## INTRODUCTION

- Dancing has been utilized as an exercise modality to improve both functional and metabolic outcomes associated with the aging process, and its concepts have been applied to the older adult population (65+).<sup>1</sup>
- Research has showcased associated benefits that dancing has in connection with general wellness amongst geriatric population and found that it may improve physical factors like balance, strength and flexibility. Improvements in these factors may lower fall risk amongst the elderly population.<sup>2,3</sup>
- Dance-based aerobic exercise programs have demonstrated improved indices of falling in healthy community-dwelling women aged 72-87.<sup>4</sup>
- Meta-analysis data indicates that movements encompassing repetitive motions (quick stepping forward, backward and sideways) are essential in reducing fall risk, specifically noting that stepping interventions were effective in reducing the rate of falls by 52% and the proportion of fallers by 49%.<sup>5</sup>
- Minimal evidence exists for benefits of reactive step training and balance improvement following single-session activities, though one study indicated 50% fall reduction in participants in the year following a single-session reactive step training program.<sup>6</sup>
- More research is needed to determine the immediate effects of a single-session rhythmic exercise program on reaction time and dynamic balance which may promote decreased fall risk factors in community-dwelling in older adults.

## HYPOTHESIS

A single session of a rhythmic exercise routine will improve reaction time and dynamic balance in community-dwelling older adults.



Fig 1. Members of the research team demonstrating rhythmic exercise program

## RESEARCH DESIGN

- Design:** Single-session, pretest/posttest design.
- Setting:** Physical Therapy laboratory spaces at Misericordia University.
- Participants:** Members of the local community aged 65 years or older.
- Inclusion Criteria:** Aged 65 years or older and ambulatory in community without an assistive device.
- Exclusion Criteria:** Current enrollment/participation in formal dance program, cognitive impairments affecting ability to follow directions, or other comorbidities significantly affecting capacity for full participation in intervention.

## OUTCOME MEASURES

- Upper and Lower Extremity Reaction Time:**
- The *American Educational Products Reaction Timer* - This battery-operated digital timer measures reaction time in hundredths of a second. Response switch can be used to measure reactions to light, sound and touch stimuli.
- Upper extremity reaction time: the subject will hold the touch pad in their hand and squeeze when the light appears.
  - Lower extremity reaction time: the subject will place their big toe on the pad and press when the light appears.
  - Both the UE and LE measurements will be repeated five times, an average calculated, and results recorded.



Fig 2. American Educational Products Reaction Timer

## Four Square Step Test:

- Four canes are placed in perpendicular fashion to create 4 individual squares for the subject to step in and out of while being timed.
- Subject begins in bottom left square and moves clockwise, stepping into each square with both feet.
- Subject then performs in reverse direction and with each step remain facing forward throughout.
- The researchers will record the best of the two trials.

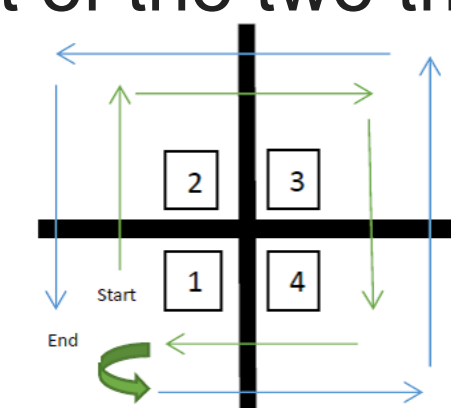


Fig 3. Four Square Step Test Procedure

## INTERVENTION

Following initial testing, subjects will be instructed on the rhythmic exercise program, which will last approximately 25 minutes. Each song will incorporate its own set of functional movement patterns, including marching, side-stepping, mini-squatting, trunk rotation, single-leg standing, kicking, upper extremity swimming motions, and narrow base of support with individualized dance participation and with partners, based upon specific song preference. All movements will occur in synchrony with each song's unique beat as it is playing.

The following songs and functional movement patterns to be performed to the rhythm of these songs.

Song	Movements
"Eye of the Tiger" by Survivor	In-place marching, bilateral shoulder flexion, overhead clapping, lateral stepping
"Burnin' Love" by Elvis Presley	Forward & backward stepping, hip rotation, shoulder flexion, 180° turns, single leg stance (SLS)
"Surfin' U.S.A." by The Beach Boys	In-place marching, alternating overhand swimming motion with both arms, weight-shifting, narrow base of support
"Twist and Shout" by The Beatles	SLS, hip rotation, lateral stepping, shoulder flexion, weight-shifting, mini squats
"Cha Cha Slide" by Mr. C The Slide Man	Forward, backward, & lateral stepping, mini-squats, hopping (if able), trunk rotation, stepping across midline
"Theme from New York, New York" by Frank Sinatra	Gait with waves and looking back and forth, 360° turns, SLS, kicks

Fig 4. Rhythmic exercise song setlist and movement patterns.

## DATA ANALYSIS

The average results of five pre-test and five post-test measurements for self-selected upper extremity and lower extremity and the best effort of two Four Square Step Test times will be collected and analyzed.

Descriptive demographic data will be assessed related to age and gender.

Outcome data will be analyzed via paired sample t-test in order to compare the scores for each participant.

The paired sample t-test will be used to either support or not support the hypothesis. The statistical analysis will be performed using statistical software and a 0.05 significance level.

## DISCUSSION/IMPLICATIONS FOR PT PRACTICE

- Dance programs are fun and engaging and may improve overall health, well-being, and safety of community-dwelling older adults.
- Results will provide insight on whether a single session rhythmic dance exercise program can be reasonably expected to have a positive effect on reaction time and dynamic balance in community dwelling older adults.
- Traditional dance programs have yielded benefits leading to decreased fall risk in older adults, but most require multiple sessions.<sup>1,2</sup>
- If findings of this study support administration of single-session programs, physical rehabilitation clinics may be encouraged to utilize these specific types of programs within their current treatment programs to improve balance and help decrease fall risk in older adults.
- This study's investigative nature would be insufficient to demonstrate clinically significant results about our intervention.
- Further research is required to yield any definitive results about effectiveness or clinical application of single-session rhythmic exercise programs.
- Future studies may investigate effects of single-session rhythmic exercise programs in different populations, including subjects with higher fall risk or other pre-existing conditions.
- Differences in results between single-session programs and multiple-session programs may also be considered in future studies.

## REFERENCES

1. Rodrigues-krause J, Farinha JB, Krause M, Reischak-oliveira Á. Effects of dance interventions on cardiovascular risk with ageing: Systematic review and meta-analysis. *Complement Ther Med.* 2016;29:16-28.
2. Liu X, Shen PL, Tsai YS. Dance intervention effects on physical function in healthy older adults: a systematic review and meta-analysis. *Aging Clin Exp Res.* 2020.
3. Lima M, Vieira A. Ballroom dance as therapy for the elderly in Brazil. *J Dance Med Sci.* 2007;29:129-142.
4. Shigematsu R, Chang M, Yabushita N, Sakai T, Nakagaichi M, Nho H, Tanaka, K. Dance-based aerobic exercise may improve indices of falling risk in older women. *Age Ageing.* 2002;31:261-266.
5. Okubo Y, Schoene D, Lord SR. Step training improves reaction time, gait and balance and reduces falls in older people: a systematic review and meta-analysis. *Br J Sports Med.* 2017;51(7):586-593.
6. Pai YC, Bhatt T, Yang F. Perturbation training can reduce community-dwelling older adults' annual fall risk: a randomized controlled trial. *J Gerontol A Biol Sci Med Sci* 2014; 69:1586-94.