



2-28-2013

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DOI: 10.15453/2168-6408.1029

Recommended Citation

Chang, Pei-Fen J. and Kuo, Yong-Fang (2013) "Functional Improvement in Older Adults after a Falls Prevention Pilot Study," *The Open Journal of Occupational Therapy*: Vol. 1: Iss. 2, Article 3.

Available at: <https://doi.org/10.15453/2168-6408.1029>

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Functional Improvement in Older Adults after a Falls Prevention Pilot Study

Abstract

Falls are a costly, disabling, and life-threatening risk in the elderly. Improvements in physical function, balance, lower extremity strength, and health-related quality of life are hypothesized to help mitigate fall risk. In this pilot study, six women and men with an average age of 81 years participated in a 6-week exercise and education program created to reduce risk of falls. Evaluations were made at baseline and at 6 weeks on four tests: the Functional Status Questionnaire, the Berg Balance Scale (BBS), the Six-minute Walk Test, and the World Health Organization Quality of Life–BREF 26-question test. Scores indicated significant improvement in functional physical status (activities of daily living), balance, distance walked in 6 min, and quality of life in the physical health domain. The size of this study limits the generalizability of its findings, but its evidence warrants undertaking a larger trial.

Keywords

activities of daily living, elderly, physical exercise, quality of life, outcomes

Cover Page Footnote

We thank occupational therapy graduate students Julie Zamzow, Winnie Lau, Adrianna Rojas, Juan Torres, Joy LaRonde, Erin Liu, Guiselle Miranda, Kathleen Nguyen, and Marium Raja for assistance with data collection.

Falls and related injuries are leading causes of acute hospitalizations, disabilities, and deaths among community-dwelling Americans age 65 years and older (Bohl et al., 2010; Dellinger & Stevens, 2006; Hartholt, Stevens, Polinder, van der Cammen, & Patka, 2011; Hartholt, van Beeck, et al., 2011; Moylan & Binder, 2007). Nearly one-third of America's elderly fall each year and sustain fractures, tissue trauma, and head injuries. In 2010, injuries sustained in falls cost an estimated \$28.2 billion to treat (Centers for Disease Control and Prevention [CDC], 2011; Roudsari, Ebel, Corso, Molinari, & Koepsell, 2005; Stevens, Corso, Finkelstein, & Miller, 2006). In addition to costs of care in dollars, injury-related losses in functional independence impact the economic, social, and psychological well-being of affected elders, their family members, and caregivers (Stevens et al., 2006).

Because of the significant impact of falls on older adults, researchers have investigated the treatment effectiveness of fall-prevention programs for older adults (Chang et al., 2004). Some have used single-component approaches, such as a home modification program, an educational program, or an exercise program for fall prevention (Cummings et al., 1999; Peel, Steinberg, & Williams, 2000; Rucker et al., 2006; Sattin, Rodriguez, De Vito, & Wingo, 1998; Suzuki, Kim, Yoshida, & Ishizaki, 2004). Others have used multi-component approaches and found that these approaches provide the most beneficial and effective treatment in fall prevention (Campbell et al., 2005; Clemson et al., 2004; Logghe et al., 2009; Lord et al., 2005; Nikolaus & Bach, 2003; Shumway-Cook et al.,

2007). However, results from those studies are mixed. This may be explained, in part, by the wide range of exercises employed, from simple strengthening exercises to Tai Chi, yoga, and other forms of movement. A report from the Cochrane Collaboration (Gillespie et al., 2009) found that factors associated with decreasing falls in the elderly were exercise programs, including balance-, endurance-, flexibility-, and strength-building exercises, and better medication management, such as the monitoring of psychotropic medication, which can cause confusion.

Falls are common in older adults, especially in those age 75 years and older (La Grow, Robertson, Campbell, Clarke, & Kerse, 2006). In a report released by the CDC (2012), adults who are age 75 years and older were four to five times more likely than younger adults to be admitted to a long-term care facility after a fall-related injury; adults in this age group also accounted for approximately 85% of deaths from falls in 2004 (Jones & Rikli, 2002).

In this pilot study, we used exercise programs developed by the National Institute on Aging (NIA) with adults age 75 years and older who resided in the community. We hypothesized that standing balance, lower extremity strength, and health-related quality of life would improve after a 6-week intervention focusing on strength building and home safety education.

Method

Research Design and Participants

This pilot study had a nonrandomized pre and posttest design. The inclusion criteria required participants to be age 75 years or older, have a score

of 24 or higher on the Mini Mental State Exam (MMSE), reside in the community, be able to communicate verbally and understand and sign the informed consent form, and have a self-reported fall history in the past year. The researcher recruited to the study four participants from a senior housing facility and two participants from an adult day center who met the inclusion criteria. The Texas Woman's University IRB approved this pilot study and each participant gave informed consent prior to the baseline assessment.

Measures

All participants took tests on four outcome measures—function, balance, walking endurance, and health-related quality of life—at the baseline and at the end of the 6-week intervention. Trained research assistants completed data collection and weekly attendance. To prevent bias, data input was done by separate research assistants who were blinded to the study details.

Function. Function was measured by the Functional Status Questionnaire (FSQ) (Jette et al., 1986). The FSQ consists of five major categories, including physical function in the activities of daily living (ADLs) and instrumental activities of daily living (IADLs), psychological function, role function, social function, and social interaction. It uses a five-point scale ranging from 0 (indicating an activity that participants usually did not do) to 4 (indicating an activity that participants usually did with no difficulty). The FSQ has shown acceptable internal consistency reliability (range, 0.64–0.82) for the five categories. The FSQ has also demonstrated satisfactory construct validity (range,

0.49–0.72) in physical and psychological function (Jette et al., 1986).

Balance. Balance was assessed by the Berg Balance Scale (BBS). The BBS is a performance-based instrument measuring balance during functional activities. It is a 14-item instrument with each item scoring on a five-point scale (0–4) for a total score of 56 (Tinetti, Speechley, & Ginter, 1988). It has excellent internal consistency (Cronbach α = 0.92–0.98), interrater reliability (intraclass correlation coefficients [ICC] = 0.95–0.98), and test-retest reliability (ICC=0.98) (Tinetti, 2003; Tinetti et al., 1988).

Six-minute walk test. The Six-Minute Walk Test (6MWT) was originally developed to examine exercise tolerance in patients with chronic respiratory disease and heart failure. This test has since been used as a measure of functional exercise capacity in older populations. This test measures the distance an individual can walk on a hard, flat surface in 6 min. A longer distance indicates better function. The test-retest reliability is excellent, with a reported ICC of 0.9 (ATS Committee on Proficiency Standards for Clinical Pulmonary Function Laboratories, 2002; Balke, 1963).

Health-related quality of life. Health-related quality of life (HRQOL) was assessed by the World Health Organization's Quality of Life-BREF (WHOQOL-BREF). The WHOQOL-BREF consists of 26 items in four domains: physical health, psychological health, social relationships, and environment. It uses a five-point scale for each item, ranging from 1 (indicating very poor or very dissatisfied) to 5 (indicating very good or very satisfied). It has been translated into 19 languages.

Research shows that the internal consistency (Cronbach's α) ranges from 0.68 to 0.82 (Skevington, Lotfy, & O'Connell, 2004), discriminant validity is statistically significant in all four domains (Skevington et al., 2004), and domain scores of the WHOQOL-BREF correlate at the 0.92 level with the WHOQOL-100 domain scores (Skevington et al., 2004).

Interventions

The intervention provided was a 6-week program in which participants met once a week in a group for 50 min, with 40 min devoted to exercises and 10 min to educational topics, including tips to prevent falls, environmental risk factors related to falls, medication management, and the use of adaptive devices. The first intervention group was completed between February and April 2011 and the second intervention group was completed between October and December 2011.

The strengthening and balance exercise programs included biceps curls, trunk rotation, hip extension, hip flexion, hip abduction, knee flexion, knee extension, ankle dorsiflexion, and plantar flexion. The clients carried out upper extremity and trunk exercises in a sitting position. They performed lower extremity exercises in a standing position holding on to a chair for support. Based on the NIA exercise guidelines, each exercise requires 15 repetitions. We provided two rest breaks. Weights used in the exercise programs were progressively increased from 1 lbs at week 2 to 4 lbs at week 4, where they remained throughout.

Data analysis

The researcher used the non-parametric Wilcoxon signed-rank test in SPSS (version 15) for data analysis, with significance (α) measured at the 0.05 level in a two-tail test for six participants who completed this pilot study.

Results

There were six individuals (four Asians and two African Americans) in the study. The mean age of the participants (five female and one male) was 80.8 years (SD 5.6), and the mean MMSE score was 27 (SD 1.8). Table 1 reports information on measures at baseline and at the end of the 6-week intervention.

Results from the Wilcoxon signed-rank test follow. In function, measured by the FSQ, only the first category, "Physical Function – Basic activities of daily living" (Figure 1), showed a statistically significant change from baseline to postintervention (baseline, 88.9; posttest, 100; $p = .03$). Participants also showed significant improvement (baseline, 39.0; posttest, 47.0; $p = .03$) in standing balance measured by the BBS (see Figure 2). The third significant improvement was in walking distance measured by the 6MWT. The 6MWT (see Figure 3) changed from 598.6 ft at pretest to 949.8 ft at posttest ($p = .03$). Improvement in health-related quality of life measured by the WHOQOL-BREF (in Figure 4) was marginal and only found to be statistically significant in the physical health domain ($p = .04$).

Table 1

Measures at Baseline and after 6-week Intervention

Outcome Measures	Median (Min-Max)		Median Difference	<i>P</i>
	Baseline	Post-test		
Functional Status Questionnaire				
Physical function				
Basic ADLs	88.9 (66.7-100)	100 (100-100)	11.1	.03
IADLs	44.5 (-33.3-77.8)	47.3 (11.1-100)	2.8	.22
Psychological function	62 (52-68)	60 (52-68)	-2.0	.71
Social activity	72.2 (0-100)	77.8 (44.4-100)	5.6	.50
Quality of interaction	62 (52-100)	70 (52-100)	8.0	1.0
Berg Balance Scale	39 (27-52)	47 (40-54)	8.0	.03
Six-minute Walk Test (feet)	598.6 (492.1-1181.1)	949.8 (705.4-1253.3)	351.2	.03
WHOQOL-BREF				
Physical health	44 (25-63)	59.5 (44-75)	15.5	.04
Psychological health	63 (50-69)	69 (44-88)	6.0	.59
Social relationships	56 (44-94)	68.5 (25-81)	12.5	1.0
Environment	81.5 (69-94)	90.5 (63-100)	9.0	.46

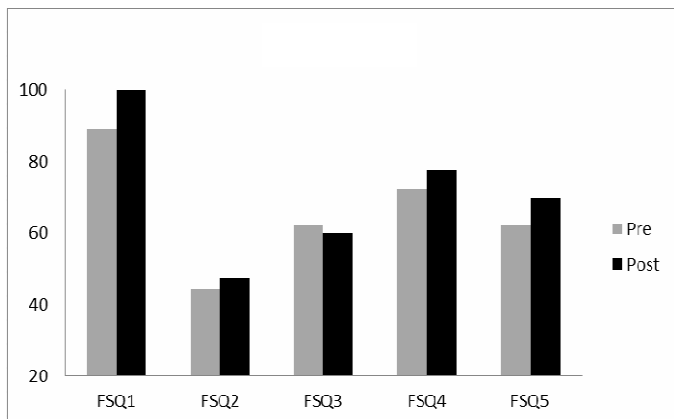


Figure 1. Function.

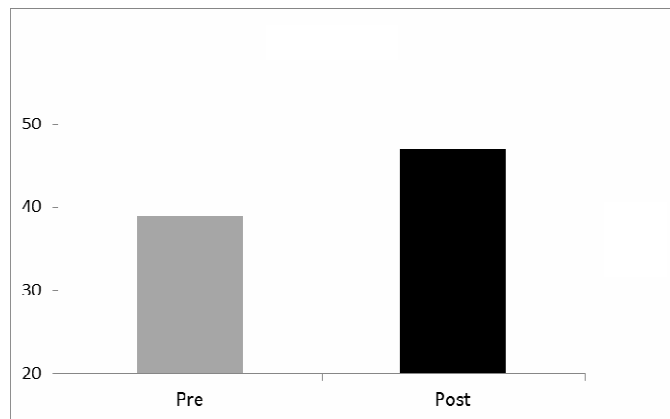


Figure 2. Balance.

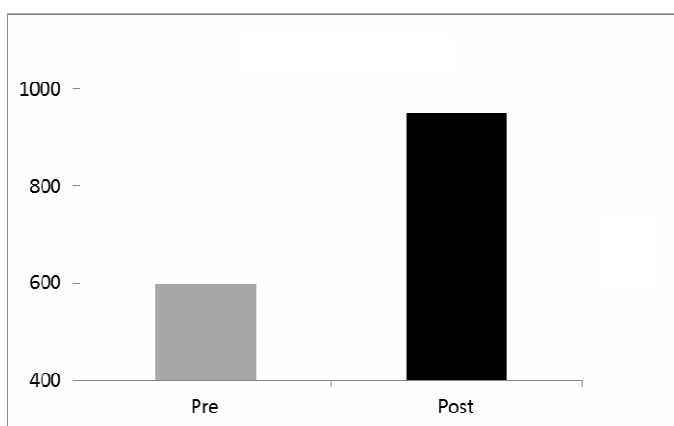


Figure 3. Walking distance.

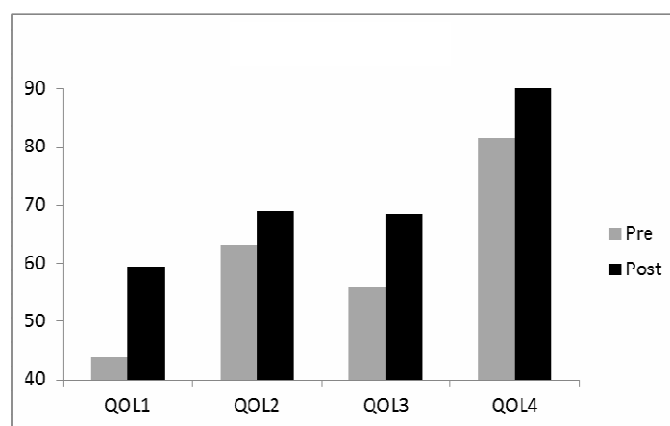


Figure 4. HRQOL.

Discussion

Results from this fall prevention pilot study demonstrate potential improvements following participation in an exercise program focused on strength and home safety education. One of the significant improvements found from this pilot study was increased walking distance. This has implications for occupational therapists who work with older adults in the community. Although balance and strength are important for older adults in preventing falls, they also need endurance for functional mobility when they carry out daily routines. If adults can ambulate only from their bedroom to their bathroom, then they may not have

enough endurance in functional mobility to shop or to visit doctors; therefore, they may need assistance in community activities. From this pilot study, the average improvement of walking distance was 351.2 ft, from which we can extrapolate that these older adults were able to walk an additional distance that is equivalent to six to seven aisles in a supermarket.

Another significant change observed from the pilot study was increased balance. One of the participants reported that she did not need to use a walking cane for daily activities after the intervention. She also reported that participation had made it much easier for her when she moved in

and out of a car because she was able to use both of her legs easily. Another participant reported that she had nearly fallen in a drug store, but strength gained from the intervention made it possible for her to correct herself and prevent the fall.

Improvement, both in physical function from the FSQ and in physical health from the HRQOL, was observed. This result was consistent with improved walking distance and balance. When older adults are able to ambulate farther, they report more satisfaction with physical health.

One outcome that we did not include in the pilot study was pain. Two participants reported that pain decreased significantly in their lower extremities, which allowed them to perform more daily activities, such as cleaning the house and cooking without pain.

Limitations

This pilot study included only six participants, age 75 years and older from two facilities for seniors. Results from this pilot study should be interpreted and applied cautiously because of the small sample size.

Conclusion

Significant functional improvement from this small pilot study warrants undertaking a larger study, particularly in the aging minority population. The cost for this pilot study was less than \$300 for simple wrist weights, and the amount of time required for one person was 6 hr. A significant impact on the ability of these older adults to perform daily activities, however, was observed in this brief time. If larger studies uphold the statistical and anecdotal evidence, providing similar programs in the community for older adults would

be a simple, cost-effective intervention for improving physical function and stamina, reducing falls, and thereby improving public health.

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