

METHODOLOGICAL STUDY

The Effects of a Combination of Live and Videotaped Exercise Sessions on Functional Mobility and Falls Prevention Among Community-Dwelling Elders

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ABSTRACT

Study Design: Longitudinal study. **Objectives:** The purpose of this program was to measure the effects of a combination of both live and videotaped exercise sessions on functional mobility and falls prevention among community-dwelling elders. **Background:** African American female subjects (mean age 78) who attend a local senior center participated in one 45-minute exercise class per week for ten weeks over two consecutive years. The program was based on ACSM guidelines for older adults and included 45 minutes of a combination of seated conditioning and strengthening exercises. **Methods and Measures:** The exercise program was designed with various levels of challenges, enabling participants to choose based on their comfort level and physical ability. The group of elders was videotaped both at the beginning and at the mid-points of the program as they gradually progressed. This videotape, which featured the program participants, was edited and copied for use at home as a supplement to the live classes. **Results:** To measure the effectiveness of this program, a pretest-posttest approach was used for the assessment of functional mobility using the timed up and go test (TUG) and the performance oriented mobility assessment (POMA). Data was analyzed using the paired, dependent t-test in three stages. After the first program, the POMA scores increased significantly from pretest to posttest, but TUG scores showed no significant change; however, there was a trend towards decreased performance time among participants. POMA and TUG scores measured prior to the start of the second program showed no significant differences when compared with the same measures taken at the conclusion of the first program. This suggests that participants were maintaining gains made following participation in the first session. However, the results from the third stage revealed significant differences with POMA and TUG. **Conclusions:** The group dynamics proved to be a strong motivator for participants to exercise, and the use of a video as a supplement to live group sessions was found to be beneficial in the short term. Perhaps the provision of ongoing support via telephone would have enabled the video to continue to serve as an adjunct to a live group-based program thereby serving as a falls prevention strategy. Future research is needed to assess the effectiveness of the telephone support.

Background

Falls are the 6th leading cause of death in individuals over 65,¹ and account for approximately half of all geriatric trauma.² In 2002, 22.1% of Medicare beneficiaries

representing 6.86 million people over the age of 65 suffered a fall.³ Ten percent of these 3.1 million people have reported a reoccurrence of falls.³ Fall-related injuries on average account for 40% of hospital admissions with an average length of stay of 11.6 days.³ Falls or fear of falling have

resulted in an increase in inactivity, decreased compliance with exercise, decreased strength and balance impairments. Altogether, this can lead to a decline in functional independence, with regards to activities of daily living.^{3,4} Common risk factors for falls include gender (women more often than men), lower socioeconomic status, living alone, poor cognition, visual deficits, and multiple co-morbidities.^{3,5,6} A study by Biderman et al. identified five specific risk factors that increase the risk of falling.⁷ These included poor self-rated health, poor cognitive status, difficulty performing activities of daily living (ADLs), two or more clinic visits in the past month, and slow walking speed.⁷ These risk factors not only correlated with a higher risk of falls, but also correlated highly with depression.⁷

Participation in exercise tends to decrease with age, and the prevalence of inactivity is highest among adults aged 65 and older. This inactivity can lead to a decrease in balance, strength, and agility.² Only 25% of seniors aged 65-74 and 15% of those over 75 engage in some form of regular physical activity.⁸ One of the reasons activity levels decrease with age, specifically with older adults, is the belief that it is too late for them to change their behavior.^{2,9} Programs that foster the development of participant self-efficacy, the belief that one has in one's ability to perform a particular task, by providing them with encouragement and motivation have been shown to be effective when compared with programs that do not address this important issue.^{2,7} Other barriers as identified by Schutzer et al. include location, health status, socioeconomic status, and knowledge about exercising.²

A physically active lifestyle is an important component in the prevention and management of chronic diseases.⁸ The

benefits of exercise, specifically for the geriatric population, include increased respiratory function, increased muscle mass and strength, increased bone mass, and an increase in overall balance and mobility.^{1,2,8,10,11} One study implemented by Morgan et al. found that low-intensity exercise programs appeared to reduce the risk for falls among elderly men and women recovering from recent hospitalizations, bed rest, and those with low levels of physical functioning.¹² Participation in a weekly exercise program supplemented by a home exercise program can decrease the risk of falls by improving balance, muscle strength, and physical functioning.¹⁰ Exercise programs that include balance and coordination activities, strengthening activities, and aerobic training have been shown to be most effective in improving functional mobility and reducing risk of falls.¹⁰ In fact, weekly exercise programs that are group-based can provide participants with peer encouragement and a fun environment for exercising.² These qualities of a group-based program have been perceived positively by the geriatric population⁸ and have led to a higher adherence rate as compared with home exercise programs alone.² There are certain barriers that can hinder an individual's ability to attend group exercise class weekly. As a result, it is also important to design a home exercise program that is easy and fun to perform which, if performed regularly, can also produce measurable gains.

Several outcome measures can be used to assess the effectiveness of a specific exercise program. This study used the timed up and go test (TUG) and the performance oriented mobility assessment (POMA).

TUG is a quick and simple test that has proven to be valid in measuring functional mobility and risk for falls in community-

dwelling elders.¹³ The POMA is another test that has been shown to be effective in measuring risk for falls in frail community-dwelling older adults.¹⁴ When compared to other outcome measures such as functional reach (FR) and one-leg stand (OLS), TUG and POMA were shown to be the most suitable outcome measures for evaluating balance and risk of falls in community-dwelling frail elders.¹⁵ The interclass correlation co-efficient for inter and intra-rater reliability for TUG and POMA ranged between 0.93 and 0.99.¹⁵

Most importantly, all the participants in this particular study were able to complete the TUG and POMA as opposed to the FR and OLS.¹⁵ In fact, the refusal rate for the FR and OLS was 1.5-2 times that of TUG and POMA.¹⁵ Overall, TUG and POMA correlated moderately to strongly with each other and were better predictors of falls than the FR and OLS.¹⁵ The purpose of this study was to measure the effects of a combination of both live and videotaped exercise sessions on functional mobility and falls prevention among community-dwelling elders.

Methods

Subject Profile

The Institutional Review Board at the University of the Sciences in Philadelphia approved the study. Ten community-dwelling African American females who attend a local senior center participated in this ten-week exercise program over two consecutive years. Eighty percent of the participants were between the ages of 81-90 and the other 20% between 71-80. In order to participate, the subjects needed to obtain medical clearance from their primary care physician. Informed consent was also required and obtained. Medical clearance was of utmost importance since all participants confirmed that they were using

more than four prescription medications to manage their medical conditions, which were kept confidential. In addition to the age and past medical history, physical inactivity or low active life and architectural barriers specifically stairs contributed to an increased risk for falls specifically for those eight participants who already had a previous history of falls. Major risk factors for falls for these participants are summarized in Table 1.

Table 1. Characteristics of participants.

Risk Factors	Participants
<u>Age Range</u>	
71-80 years	2
81-90 years	8
<u>Gender</u>	
Female	10
Male	0
<u>History of falls</u>	
Yes	8
No	2
<u>Prescription Medication Use</u>	
>4 medications	10
<u>Architectural Barriers</u>	
Stairs	9
No Stairs	1

Functional Measures

A pretest-posttest approach was used for the assessment of functional mobility using the timed up and go test (TUG) and the performance oriented mobility assessment (POMA). The purpose of the TUG is to predict the risk of falling and to assess their functional mobility, while the POMA assesses an individual's risk for falling by looking at balance and gait. A study performed by Lin et al. researched the reliability and validity of the TUG and the POMA. It was concluded that the most suitable measure for evaluating balance in community-dwelling adults aged 65 and older was the POMA followed by the TUG.^{1,10} For the TUG test, subjects were timed from the moment they rose from a chair, walked a distance of 3 meters, turned, walked back and sat in the chair.^{1,10} The

stopwatch was started as soon as the subject rose from the chair and stopped once the subject reached and sat back in the chair.^{1,10}

For the balance component of the POMA, subjects performed 13 tasks. These tasks were graded with a high score recorded at 16 points.^{1,10} For the gait component, subjects were also graded with a high score recorded at 12 points. The gait component observes the subject's walking pattern and abnormalities that could affect their balance and increase their risk of fall.^{1,10} Subjects who score lower than 19 points are deemed to be at a high risk for falls while those who score in the 19-24 range are at a moderate risk for falls.^{1,10} These tests were conducted at the beginning and end of the program, and to ensure reliability, each tester consistently conducted the same test.

Execution of the Task

Two physical therapy students under the supervision of a licensed physical therapist led the exercise program. It was designed to decrease the risk of falling and to improve functional mobility. It was conducted once a week for ten consecutive weeks in two consecutive years. It was based on American College of Sports Medicine (ACSM) guidelines for older adults and included 45 minutes of seated conditioning and strengthening exercises. Exercises were graded to meet the capabilities of each participant. Cuff weights and dumbbells were also available for those participants who chose to use them for exercise.

Exacerbation of arthritis or decreased overall strength were reasons given by those who declined the weights. The exercise routine for the upper and lower extremities targeted each joint and consisted of exercises outlined in Table 2. To make the exercise sessions challenging, upper and lower extremity exercises at times were

simultaneously performed. For example, upper extremity punching was combined with lower extremity marching. While the sessions specifically focused on strengthening exercises, combining upper and lower extremity movements also added an aerobic component.

Table 2. Exercise routine followed by the participants.

Upper Extremity: 3 sets x 10 reps bilaterally	Lower Extremity: 3 sets x 10 reps bilaterally
Shoulder: <ul style="list-style-type: none"> • Flexion • Abduction • Horizontal Abduction • Protraction/retraction 	Hip: <ul style="list-style-type: none"> • Flexion • Abduction • Adduction
Elbow: <ul style="list-style-type: none"> • Flexion • Extension 	Knee: <ul style="list-style-type: none"> • Flexion • Extension
Wrist: <ul style="list-style-type: none"> • Flexion • Extension 	Ankle: <ul style="list-style-type: none"> • Dorsiflexion • Plantarflexion
**warm up and cool down period consisting of stretching and rhythmic breathing was included at the beginning and end of each session.	

To help foster self-efficacy, the group was videotaped at the beginning and at the midpoints of the first year of the program. The videotaped sessions featured an exercise class suited for beginners, while the videotaped session from the midpoint incorporated exercises for the intermediate level participants. All participants received a copy of the video for use at home to supplement the live classes. They were then able to select the level of difficulty that best suited their abilities. Participants agreed to perform the exercise program at home at least one time per week during the course of this two-year study.

Results

Data Analysis

SAS for Windows and Microsoft Excel were used for all data analysis. Data was analyzed using the paired, dependent t-test with a significance level of $p < 0.05$. After participation in the first 10-week session in

2006, POMA scores increased significantly from pretest to posttest, while TUG scores showed no significant change as shown in Table 3. However, there was a trend towards decreased performance time among participants. After participation in the second 10-week program in 2007, the results revealed significant differences with POMA and TUG as shown in Table 4.

Table 3. Pretest to posttest TUG and POMA results from 2006.

2006	Mean	Standard Deviation	p value
TUG			
Pretest	15.72	3.25	$p=0.25^*$
Posttest	14.76	2.73	
POMA			
Pretest	21.09	3.59	$p=0.03^*$
Posttest	23.0	3.43	

*Note: Significance level of $p<0.05$, two-tailed

Table 4. Pretest to posttest TUG and POMA results from 2007.

2007	Mean	Standard Deviation	p value
TUG			
Pretest	15.43	4.41	$p=0.008^*$
Posttest	12.92	3.55	
POMA			
Pretest	23.6	3.10	$p=5.5741E-05^*$
Posttest	26.6	2.22	

*Note: Significance level of $p<0.05$, two-tailed

POMA and TUG scores had no significant difference from the end of the first program in 2006 to the start of the second in 2007. Follow-up questionnaires at six months post participation revealed that participants were continuing to exercise on average two to three times per week. Participants also reported improved mood, energy, and sleep. No falls were reported despite 30% admitting to having a fear of falling. However, when the POMA and TUG scores were compared from the end of the second program in 2007 to the start of the third in 2008, the scores showed statistically significant differences as shown in Table 5. A follow-up questionnaire completed by the participants revealed that 40% were not

exercising on a regular basis citing personal obligations, misplacement of DVD, and malfunctioning DVD players as some of the reasons for discontinued adherence.

Table 5. Comparing post TUG and POMA results from 2007 to initial TUG and POMA results from 2008.

	Mean	Standard Deviation	p value
TUG			
End of the program in 2007:	13.11	3.71	$p=0.034^*$
Start of the program in 2008:	15.30	4.32	
POMA			
End of the program in 2007:	26.44	2.30	$p=0.008^*$
Start of the program in 2008:	24.22	2.33	

*Note: Significance level of $p<0.05$, two-tailed

Discussion

Participation in a weekly exercise class that is supplemented by a home exercise program has proven to be effective in decreasing risk for falls and increasing functional mobility in elders.¹⁰ By designing a home exercise program that provided participants with a video of their live group, compliance was promoted over the short term. The results from this study supported the benefit of this video for the first six months following the live exercise classes. Unfortunately, exercise compliance deteriorated the next year after the second cycle was completed. Moreover, the participants demonstrated an overall decrease in their functional performance as measured by the POMA and TUG.

Due to multiple risk factors, trends in exercise decrease as we age.^{2,9} Low perceived self-efficacy in older women seems to be one of the primary deterrents to increased activity levels.⁷ These elders not only believe themselves unable to participate in exercise, but they tend to believe that exercise will not be beneficial to reversing age-related changes.⁹

Studies have shown that falls or the fear of falling result in a decrease in activity and a decreased compliance with exercise.³ In the case of this program, however, despite 30% of the participants reporting fear of falling, positive changes were noted after the live group sessions and the first year's home program.

Since seniors benefit from group support to stay motivated, this group-exercise program was successful in providing encouragement for the participants.⁸ Group-based exercise classes for older adults have a higher adherence rate as compared with home exercise programs alone.⁸ In this program, the researchers endeavored to bridge the gap between the empowering nature of peer support provided by live sessions and solitary exercise at home. By providing the opportunity to exercise while watching themselves on video, it was hoped there would be a carryover of the increase in perceived self-efficacy that resulted from the support and motivation derived from the live sessions.

It is postulated by these researchers that compliance at home during the first year may be attributed to the novel concept of the peer-supported exercise group followed by the use of a video of the live classes. The decreased compliance at home during the second year may have been due in part to the video no longer being a novelty. While participants reported a variety of factors, specifically, the loss of the DVD, malfunctioning DVD player, changes in health status, and family issues for lack of compliance, the overriding reason may actually have been the lack of socialization. Compliance may have been enhanced through the use of regular telephone contact to provide support and motivation to continue exercising.

Conclusions

In this study, group exercise classes provided participants with peer encouragement and opportunities to participate in enjoyable activities. Through socialization, participants were provided with opportunities to encourage and support each other while improving their overall function. The group dynamics proved to be a strong motivator for participants to exercise and the results supported the effectiveness of the group sessions.

The use of a video as a supplement to live group sessions was found to be beneficial in the short term. Studies have shown that exercise is an important component in maintaining physical functioning and preventing falls in adults aged 65 and older.^{4,15,16} Perhaps the provision of ongoing support via telephone would have enabled the video to continue to serve as an adjunct to a live group-based program thereby serving as a falls prevention strategy. Future research is needed to assess the effectiveness of the telephone support.

Limitations

The first limitation of this study relates to both the convenience sampling technique used, as well as the small sample size of only ten participants. However, these limitations were minimized by the longitudinal nature of the study that allowed this same cohort of participants to be followed over a two-year period allowing the researchers to observe differences in performance over time. Another limitation of this study was the fact that the participants were only able to attend the exercise class one day per week. Because of this, researchers had to rely on the participants' use of the supplemental

exercise video. It was determined that use of the video was inconsistent at times due to a variety of reasons, in particular, a general lack of compliance. By examining variables such as cognition, depression and motivation at the start of the study, researchers would have had information about the participant's ability to independently follow through with the exercise video at home. With this knowledge, the researchers would then be able to provide reminders and support to encourage participants to comply with the home video program.

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