

Outcomes of Stay Strong, Stay Healthy in Community Settings

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Abstract

Loss of muscle strength, flexibility, and balance are strong predictors of falls in the elderly. **Objectives:** The goal of this research was to investigate the effectiveness of a 10-week, strength-based exercise program delivered by Extension professionals. **Methods:** Matched pair *t* tests were used to compare differences in five measures of fitness collected from 808 participants (mean age = 65.4 years) at the start and finish of the exercise program. **Results:** Following programming, participants significantly improved strength, flexibility, and balance. **Discussion:** Results indicate that an evidence-based program can be translated into a community Extension program that is able to improve the fitness level of seniors.

Keywords

elderly, falls prevention, exercise, community programs, extension

Introduction

Musculoskeletal (MSK) diseases are now the second greatest cause of disability around the world. More than 1.7 billion people are affected by MSK

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conditions such as joint diseases, back and neck pain, osteoporosis, fragility fractures, soft-tissue rheumatism, sports and workplace injuries, and trauma related to driving accidents (Lim et al., 2013). Among the elderly, an important MSK disease is the development of sarcopenia, (age-related muscle mass loss). The declining muscle mass of sarcopenia occurs at the alarming rate of 4% to 5% per decade (Short, Vittone, Bigelow, Proctor, & Nair, 2004) and results in impaired quality of skeletal muscle and leads to increased muscle weakness (Visser & Schaap, 2011). Such weakness is a strong predictor of falls in the elderly, a significant contributor to decreased quality of life and increased morbidity and mortality in this population (Moreland, Richardson, Goldsmith, & Clase, 2004).

A variety of health-promotion interventions have been shown to be effective in maximizing the health and independence of elderly populations (Fielding et al., 2011; Kang & Russ, 2009; Martin, Kressig, & Röcke, 2011). The most effective of these programs target the important risk of falls prevention and focus on improving muscle strength (MacCulloch, Gardner, & Bonner, 2007). These programs include resistive exercise, that is, strength training, which help attenuate muscle loss and increase strength significantly (M. E. Nelson et al., 1994). Resistive exercise also improves bone density and helps minimize osteoporosis (Klotzbach-Shimomura, 2001; M. E. Nelson et al., 1994). These improvements in muscle and bone help prevent falls and allow older adults to maintain independence and enjoy better quality of life.

Minimal follow-up has been done to assess the outcomes of clinical trials that are implemented in general community practice. This type of evaluation is a final, critical component of what is now known as “translational research” (Collins, 2011). Research conducted under controlled conditions can often have different outcomes when widely disseminated and implemented in community settings. Lack of adherence to program fidelity, heterogeneous participant mix, and differential incentives for completion may result in unexpected or less-than-optimal results.

An example of such an evidence-based program that has been implemented by Extension professionals in community settings is Stay Strong Stay Healthy (SSSH), a strength training program designed for older adults. The SSSH program content was modeled after the Strong Woman program developed at Tufts University (M. E. Nelson et al., 1994). Until now, Extension professionals have had limited exposure to viable exercise programs such as SSSH. In addition, the effectiveness of this community-based and Extension-delivered program has not been evaluated. The goal of this translational research was to investigate the real-life effectiveness of the SSSH program implemented by Extension professionals.

Method

Pre- and post-program strength, flexibility, and balance measures were collected from a sample of participants in the SSSH programs conducted across the state of Missouri over the past 10 years. Each class of approximately 20 participants consisted of group strength training, balance and flexibility 1 to 2 times a week for 10 weeks. For classes meeting once a week ($n = 714$), participants were instructed to perform the movements at home one other time each week. For classes meeting twice a week ($n = 94$), participants were not instructed to perform the movements a third time at home. Each session started with a warm-up, followed by two sets of 10 repetitions on eight exercises (wide leg squat, standing leg curl, side hip raise, knee extension, biceps curl, overhead press, toe stand, and bent forward fly, see Figure 1). Classes ended with stretching and balance movements as participants cooled down.

Programs were delivered by 34 SSSH leaders from the University of Missouri (MU) Extension Nutrition and Health Specialists (NHS) who received small group and individualized training from a MU State Fitness Specialist/Exercise Physiologist and two Tuft's University Certified *Strong Women Stay Young* Ambassadors. SSSH was reviewed and conducted in accordance with University IRB guidelines.

Sample

Participants were recruited via flyers, word of mouth, and advertisement. All participants completed the Physical Activity Readiness Questionnaire (PAR-Q; Public Health Agency of Canada and the Canadian Society for Exercise Physiology, 2002) and provided physician approval to participate. Data were available for a sample of adults ($n = 808$) who participated in the SSSH program and completed at least 60% of the workout sessions. The average age of the sample was 65.4 ($SD = 11.5$, range = 48-96); 72.9% (511) were over 60 years of age and 85.5% (691) were female.

Measures

In addition to demographic data, four fitness outcomes were evaluated pre and post the 10 weeks of strength training using measures from the Senior Fitness Test. Measures included the "chair stand test" that assessed lower body strength and muscular endurance; the "8-foot up-and-go" assessed balance and coordination while moving; the "chair sit and reach" assessed lower body flexibility; the "back scratch" assessed upper body flexibility. Balance



Figure 1. Stay strong stay healthy.

was additionally assessed using a graded balance test (M. Nelson, 2000). These indicators are shown in Table 1.

Descriptive statistics were generated and matched pair *t* tests were used to compare differences in measures of the physical indicators of strength, flexibility, and balance. Two-way analysis of variance (ANOVA) was conducted to examine the gender and age effects on the increments in measures of the physical indicators of strength from pre to post.

Table 1. Data Collected to Assess Physical Strength.

Physical performance test	Purpose	Description
30-s chair stand	Assess lower body strength	Number of full stands that can be completed in 30 s with arms folded across chest
Chair sit-and-reach left and right	Assess lower body flexibility	Distance in centimeters between extended hand and toes when seated at edge of chair with leg extended; Negative number indicates inability to reach toes
Back scratch left and right	Assess upper body flexibility	Distance in centimeters between one hand reaching over shoulder and second hand reaching up the middle of the back
8-foot up-and-go	Assess agility/dynamic balance	Number of seconds required to get up from a seated position, walk 8 feet, return to seated position
Balance tests performed in order of difficulty 1. Mountain pose 2. Tandem stand 3. One-legged stand 4. Tandem stand eyes closed 5. Tandem stand eyes closed head turning 6. One-legged stand eyes closed	Sequentially assess balance	<ol style="list-style-type: none"> 1. Ability to stand for 10 s with feet side by side and touching, without using hands for support 2. Ability to stand for 10 s with heel of one foot touching toe of other foot, one hand touching wall for support 3. Ability to stand for 10 s on one leg 4. Same as mountain pose with eyes closed 5. Same as tandem stand with eyes close with head turning slowly left and right 6. Same as tandem stand except eyes closed

Results

Participants showed statistically significant improvement from pre to post assessment in each of the seven markers used to assess strength and flexibility (Table 2). In addition, in one of the physical measures, sit and reach, results from two-way ANOVA showed that younger participants, that is, those less than 60 years old, had significantly greater improvement than those over 60 years of age (2.08 vs. 1.00; $p = .0116$). There were no differences in improvement by gender.

Discussion

The results of our analysis show that the SSSH program significantly improved lower body strength. This was specifically illustrated by the chair

Table 2. Pre and Post Differences in Group Means for Physical Measures.

Physical measure	Pre M (range; SD)	Post M (range; SD)	Percent change	p
	n	n		
Chair stand	14.30 (3-38; 5.08) 778	16.51 (5-45; 5.64) 778	+15.45%	<.001
Chair sit & reach (right)	0.031 (-13.0-11.0; 3.95) 808	1.18 (-16.0-12.0; 3.8) 808	+3,706.5%	<.001
Chair sit & reach (left)	-0.41 (-13.0-11; 4.13) 592	1.13 (-13-12.5; 4.00) 592	+375.6%	<.001
Back scratch (right)	-3.17 (-53.5-16.0; 5.39) 808	-2.48 (-24.0-21.0; 4.49) 808	+21.77%	<.001
Back scratch (left)	-5.64 (-25.0-21.0; 5.65) 624	-4.61 (-26.0-22.0; 5.61) 624	+18.26%	<.001
8-foot up-and-go	5.80 (0.62-23.90; 2.09) 704	5.20 (-7.5-18.0; 1.83) 704	-10.34%	<.001
Balance test score	3.35 (0-6.0; 1.39) 808	3.70 (0-6.0; 1.44) 808	+10.45%	<.001

stand exercise, in which participants were able to perform 2.1 more stands in 30 s. The lower body strength needed to perform this exercise is critical in helping aging adults perform basic tasks, such as getting up from a seated position, going up or down stairs, and walking short distances. This field test is highly correlated to lower body laboratory measures, and is thus a good indicator of lower body strength (Csuka & McCarty, 1985). It is also sensitive to activity level (Wiacek & Hagner, 2008) and risk of falling (Alexander, Schultz, & Warwick, 1991; Macrae, Lacourse, & Moldavon, 1992). The cut-off criterion referenced standard for independent functioning for our age group is 15 chair stands for women and 17 chair stands for men. Thus, an increase in 2.1 stands post program (14.4 to 16.5) is not only statistically significant but also clinically relevant and meaningful (>14%).

Participants also improved the time to completion of the 8-foot up-and-go exercise, which demonstrates improvement in balance and coordination while moving. Research demonstrates the 8-foot up-and-go exercise is excellent at discriminating different functional categories for older adults (Podsiadlo & Richardson, 1991). In addition, the test is sensitive to changes in physical activity levels (Tinetti, Williams, & Mayewski, 1986) and can help identify those at risk for falling (Rose, Jones, & Lucchese, 2002). It is not surprising that the 0.55 s improvement was statistically significant due to our large sample size. However, it is fairly clear that this is a meaningful improvement (>10%), as the reference standard for independent function for our population is 5.2 s (5.3 s women; 5.1 s men). These data support SSSH

was able to positively impact the functionality, independence, and quality of life of participants while simultaneously reducing the risk of falling.

Participants also significantly improved upper- and lower body flexibility as shown by the change in chair sit and reach and the back scratch exercises. Although flexibility is classified as an important “health-related” component of fitness, it is often neglected and not thought of as being highly associated with good health. Without adequate range of motion, activities of daily living (ADL) become more difficult and adults tend to suffer more back problems and MSK injuries (Jette, Branch, & Berlin, 1990). Lack of range of motion also increases the risk of falls for older adults, making adequate flexibility even more critical for this population (Gehlsen & Whaley, 1990). In addition, walking can become painful and limited if the hip flexors are too short and tight. Driving becomes painful and impaired due to poor neck and shoulder flexibility (Marottoli et al., 1998). All of these things promote a cycle of inactivity. Although SSSH improved the flexibility of our participants, it is important to not imply a direct correlation to improvement in daily tasks, as ability to perform ADLs was not measured. Future research might include ADL measurements.

Poor balance is also strongly associated with an increased risk of falls for older adults (Lord, Ward, Williams, & Anstey, 1994). Even though balance training was not a major part of the SSSH intervention, balance improved as a result of participation. These findings are consistent with other research showing strength training can improve balance in older adults (Orr et al., 2006).

Limitations

Unfortunately, community-based programs such as SSSH do not lend themselves to traditional and ideal research designs. The lack of a control group in the current study limits the level of evidence-based information the study can provide. In addition to the less-than-ideal design, an obvious concern is the differing number of classes attended by participants. Not all SSSH leaders offered the course twice a week. Participants in classes meeting only once a week were instructed to perform the exercises at home using the SSSH take-home poster (Figure 1) one additional time per week. Unfortunately, we do not have information on how many participants complied. Data (unpublished) on a separate but similar cohort of SSSH participants ($N = 2,994$) attending a class offered once per week show that approximately 60% completed the exercises at home one additional time. Although we recognize this as a limitation, it is noteworthy that on average less than two days a week of

strength training can still illicit significant improvements for older adults. The lack of additional information on physical activity beyond SSSH also limits the conclusions of the study.

Conclusions/Implications

Limited data exist for strength-training programs implemented in community practice, especially for older adults. The current translational research was conducted as a vital step in evaluation to help bridge the gap from laboratory to practice. Extension professionals trained in SSSH were successfully and safely able to implement an exercise program to older adults. Significant and meaningful improvements in strength, balance, and coordination while moving, and flexibility were observed. SSSH is a viable option for community professionals, such as Extension professionals, interested in helping older adults maintain independence and quality of life.

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Declaration of Conflicting Interests

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