

# Improved Physical Fitness Among Older Female Participants in a Nationally Disseminated, Community-Based Exercise Program

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## Abstract

**Background.** Strength training (ST) is an important health behavior for aging women; it helps maintain strength and function and reduces risk for chronic diseases. This study assessed change in physical fitness following participation in a ST program implemented and evaluated by community leaders. **Method.** The StrongWomen Program is a nationally disseminated, research-based, community ST program active in 40 states. The Senior Fitness Test is used to assess upper and lower body strength, upper and lower body flexibility, aerobic fitness, and agility; data are collected prior to and following program participation. **Results.** For these analyses, five states provided deidentified data for 367 female participants, mean age 63 ( $\pm 11$ ) years. Attendance in approximately 10 weeks of twice-weekly classes was 69.4%. Paired *t* tests were used to analyze pre–post change. Significant improvements were observed ( $p < .01$ ) in all Senior Fitness Test measures. Data are stratified by age-group and compared with published, age-based norms. **Conclusions.** This study demonstrates that it is feasible for community leaders to conduct pre–post physical fitness evaluations with participants and that participants experienced improvements across several important domains of physical fitness.

## Keywords

aging and health, community-based participatory research, community health promotion, evaluation, health promotion, outcome evaluation, physical activity/exercise, training health professionals, women's health

In 2000, 9.3 million adults in the United States were aged 80 years or older. The Centers for Disease Control and Prevention (CDC) projects an increase to 19.5 million adults 80 years of age or older by 2030 (CDC, 2003b). They further estimate that the proportion of the population 65 years and older will increase from the 12.4% reported in 2000 to 19.6% in 2030 (CDC, 2003b). These demographic shifts, barring significant public health interventions, are expected to result in a rapid increase in age-related chronic conditions, disability, and diminished quality of life and independence among older adults as well as a dramatic increase in related health care costs (CDC, 2003a, 2003b). According to the CDC, approximately 80% of all persons aged 65 years and older have at least one chronic condition, and 50% have two or more (CDC, 2003a, 2003b). One among them is arthritis, which affects 59% of persons older than 65 years (CDC, 2003a, 2003b) and was associated with approximately \$128 billion in related health care costs in 2003 (CDC, 2007a).

Regular exercise—and strength training in particular—is widely recognized and recommended as beneficial to older adults' health (Department of Health and Human Services,

2008). Its effects on reducing risk and/or signs and symptoms of many chronic diseases as well as the importance of exercise for maintaining physical function and activities of daily living is well documented. For example, randomized controlled trials with older adults have demonstrated benefits of strength training on bone health, type 2 diabetes, muscular strength, physical function, arthritis symptoms, depression, sleep, and other age-related chronic conditions (Castaneda et al., 2002; Cress et al., 1999; Hausdorff et al., 2001; Mora et al., 2003; Nelson et al., 1994; Nelson et al., 2004; Rubenstein et al., 2000; Taaffe, Duret, Wheeler, & Robert, 1999).

As such, the 2008 Physical Activity Guidelines for Americans recommend that adults engage in strength-training activities 2 or more days per week, and one of the Healthy

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People 2020 goals is to increase the proportion of adults that meet the physical activity guidelines for aerobic physical activity and strength training (CDC, 2008; Department of Health and Human Services, 2008, 2009). Yet participation in strength training remains low among older adults and even lower in older adult women (CDC, 2007b). Only 18% of adult women aged 45 to 64 years and 11% of women aged 65 to 74 years perform strength-training exercises two or more times a week (CDC, 2007b).

Thus, public health “calls to action” advocate for older adults to participate in physical activity overall, and specifically muscle-strengthening exercises. In addition, the CDC encourages the implementation of evidence-based programs in communities as one viable strategy to answer that call; to date, several programs targeting older adults have been developed and are expanding reach in this audience (Belza et al., 2006; CDC, 2007b; Seguin, Economos, et al., 2008). As such, there is a need to conduct ongoing evaluations of evidence-based research programs in community settings to ensure their effectiveness and to inform adaptation of dissemination efforts. The StrongWomen Program (SWP) is one such opportunity.

## Overview of the StrongWomen Exercise Program

The SWP is a nationally disseminated group exercise program that translates a research-based exercise prescription into detailed curriculum for use in community-based settings (Seguin, Economos, et al., 2008). The SWP targets midlife and older women and was developed by researchers at Tufts University to increase participation in strength training among aging women in particular, although men participate as well. The foundation of the program is more than two decades of research on strength training with midlife and older men and women.

The SWP includes progressive resistance training plus balance training and flexibility exercises. Classes typically have 8 to 12 participants, who are recruited through community posting and flyers at location where older adults commonly gather. Classes last approximately 45 to 60 minutes and include two sets of resistance-training routines, each with 8 to 10 exercises that can be used within the program. Both routines begin with a 5- to 10-minute warm-up that may include walking, marching, or light calisthenics (e.g., toe touches). The resistance-training exercises work all of the major muscles groups, using a combination of dumbbells, adjustable ankle weights, and body weight. Examples of exercises include knee extension, knee curl, biceps curl, overhead press, and bent forward fly. Classes conclude with a 5- to 10-minute cooldown that includes upper and lower body flexibility exercises. Generally, classes meet twice per week for 12-week sessions, with many offering ongoing (back-to-back) sessions, or some taking a 1- to 2-week break between sessions. It is important to note that the SWP curriculum suggests twice weekly, 12-week program sessions, but community leaders run program sessions that range from 6

to 16 weeks. A national dissemination evaluation previously published provides more extensive details related to these topics (Seguin, Economos, et al., 2008).

## Dissemination and Reach

The SWP is disseminated through a strong, nationwide partnership with extension educators in the National Institute of Food and Agriculture agency (formerly Cooperative State Research, Education, and Extension Service), which is part of the executive branch of the U.S. Department of Agriculture. Additional community-based partners include hospitals, departments of public health, and nonprofit community organizations focused on health and aging. Some leaders have experience running community-based programs and/or exercise training experience, whereas others do not. Furthermore, some program participants are later trained to become program leaders, following a classic peer leader–training model. Thus, the training and curriculum are designed to fully support implementation by leaders in both categories.

The leaders are trained by the program directors (RAS and MEN) at Tufts University or by the StrongWomen Ambassadors using a comprehensive written curriculum (The StrongWomen Tool Kit) and through an intensive, daylong, in-person training workshop. The primary components of the training day and curriculum include (a) the research background of the program, with supporting peer-reviewed research articles provided; (b) the logistics of starting a program and participant screening, such as safety, equipment needs, and medical history and clearance; (c) program execution and assessment, which provides in-depth, hands-on skill-building activities to ensure that trained leaders have mastered how to teach each exercise safely as well as how to conduct the participant assessments (e.g., the Senior Fitness Test); (d) basic nutrition information, including topic-focused nutrition handouts for participants; (e) leadership background and training; (f) general physical activity information; and (g) a small-group breakout session that focuses on overcoming barriers to program implementation and maintenance.

StrongWomen Ambassadors are long-term program leaders who have undergone extensive training and mentorship and who possess an exceptional level of proficiency in program principles, the research foundation, and exercise technique and safety. Ambassadors are trained by distance learning, with final “certification” obtained at a daylong observation and assessment at a training workshop. The Ambassador model was created to enable greater dissemination of the program. The program’s 13 ambassadors located are located in eight states (Alaska, Arkansas, Colorado, Missouri, Montana, New York, Pennsylvania, and Wisconsin). Since 2003, approximately 2,330 leaders have been trained throughout the United States and Canada. StrongWomen Ambassadors and Tufts University program directors have collectively held 133 workshops, which range in cost from \$150 to \$300 per attendee. Individuals from

all but two U.S. states (Hawaii and Nevada) have been trained. The structure of the SWP and the community-based nature allow for program accessibility to a wide audience of interested potential leaders and for dissemination in a variety of settings.

## Program Support

The SWP—particularly supporting materials for leaders and participants as well as advancing dissemination strategies—continues to be refined by program directors at Tufts and the StrongWomen Ambassadors. StrongWomen participants demonstrate active engagement through attendance at public SWP events, through e-mail, and through an online social network. They provide feedback related to program impacts and express interest in maximizing improvements and knowledge about health, physical activity, and sound nutrition. In 2008, the program directors introduced a set of supplemental resistance training exercises and recently created a StrongWomen muscle group poster to help leaders learn more about the anatomy of the resistance-training exercises. The StrongWomen Ambassadors have also spearheaded multiple program development projects such as translating program materials in Spanish, creating DVDs of the exercises, and sharing knowledge, materials, and other resources among one another.

In maintaining a public health agenda that supports funding, infrastructure, and other organizational support for evidence-based community programs, the SWP encourages regular participant evaluations be conducted by community leaders. The SWP has previously examined leadership and implementation as well as participant adherence, motivation, and barriers (Seguin, Palombo, Economos, Hyatt, & Nelson, 2008, 2010). The objective of the present study was to evaluate physical fitness measures in participants before and after program participation.

## Method

This study assessed change in six domains of physical fitness following participation in a strength training program implemented and evaluated by community leaders in five states. One component of the SWP training workshop is hands-on training for community leaders detailing how to conduct program evaluations with participants prior to and following program participation (additional workshop components are described under the section “Dissemination and Reach”). There are two evaluation tools that are provided in the curriculum, The StrongWomen Tool Kit (Nelson & Seguin, 2003). The first evaluation tool is an objective set of physical fitness tests (The Senior Fitness Test, discussed below) to be used before and after program participation, and the second tool is a program questionnaire that collects subjective feedback about the program and leader. Leaders are encouraged to

use both tools as part of their evaluations, although it is not a requirement.

The Senior Fitness Test, developed by Roberta Rikli and Jessie Jones (2001), is used with permission in the StrongWomen Tool Kit. The Senior Fitness Test is a reliable and valid tool that also provides performance norms based on actual performance scores of more than 7,000 men and women between 60 and 94 years (Rikli & Jones, 2001). It is a simple, easily administered set of tests that assess six domains of functional fitness of older adults.

During the SWP training workshop, participants are trained in executing the Senior Fitness Test with participants. They are first shown the Senior Fitness Test training video, which has an accompanying manual (Rikli & Jones, 2001). They are then divided into small groups at each of the six test stations, which include the arm curl test and chair stand test (upper and lower body strength), back scratch test and sit-and-reach test (upper and lower body flexibility), 2-minute step test (aerobic fitness), and 8-foot up-and-go test (agility). Scores are based on total count (arm curl, chair stand, 2-minute step), distance/length (back scratch), or time (8-foot up-and-go). The Senior Fitness Test also includes the option to collect height, weight, and age, which are collected by some SWP leaders at baseline. During the training workshop, leaders are equipped with all of the necessary materials plus scoring sheets for practice sessions during training. Each leader has the opportunity to practice being the tester as well as the participant multiple times. The workshop facilitators circulate through each of the stations answering questions and observing each leader in their tester role.

In some of the Senior Fitness Test measures, an increased value signifies an improvement, for example, executing more chair stands over a 30-second period or increasing step count over the 2-minute period. In other tests, a decreased time to perform the test signifies improvement, for example, faster speed to complete the 8-foot up-and-go. Additional details can be found in the Senior Fitness Test Manual (Rikli & Jones, 2001). The exercises tested by the Senior Fitness Test are indicative of an individual’s physical function in everyday activities. For example, poor (slowed) performance on the 8-foot up-and-go test may indicate higher fall risk because of compromised agility, whereas a low score on the chair stand test or the 2-minute step tests may reflect compromised mobility and functional capacity.

Those leaders who then choose to conduct the community-based participant assessments that occur pre-post program participation form networks and travel as teams to neighboring communities and conduct assessments; if more testers are needed, they are encouraged to enlist colleagues and volunteers, using the SFT video and manual as training tools. These easily accessible training tools; and the “team of testers” enables program leaders to efficiently execute the pre-post SFT assessments in their communities.

At the time of these analyses, complete data were available from diverse geographic regions of the United States (16

**Table 1.** Pre–Post Senior Fitness Test Measures and Corresponding *p* Values

Test	N	Pretest (Mean ± SD)	Posttest (Mean ± SD)	Change	<i>p</i> Value
Age <60 years					
Chair stand	104	15.94 ± 4.80	21.52 ± 5.59	5.58	<.01
Arm curl	105	18.50 ± 4.20	24.29 ± 4.70	5.79	<.01
2-Minute step	83	127.22 ± 46.11	160.47 ± 55.70	33.25	<.01
Sit-and-reach	105	1.89 ± 4.05	3.49 ± 3.87	1.60	<.01
Back scratch	104	−0.98 ± 3.20	−0.19 ± 2.97	0.79	<.01
Up-and-go	104	4.44 ± 1.16	4.14 ± 0.97	−0.30	<.01
Age 60–69 years					
Chair stand	144	15.22 ± 4.54	19.44 ± 5.23	4.22	<.01
Arm curl	144	18.17 ± 5.31	23.07 ± 5.31	4.90	<.01
2-Minute step	136	108.04 ± 41.67	132.74 ± 51.87	24.70	<.01
Sit-and-reach	144	1.20 ± 3.40	2.67 ± 3.60	1.47	<.01
Back scratch	144	−1.68 ± 3.33	−0.76 ± 3.10	0.92	<.01
Up-and-go	132	5.16 ± 1.30	4.64 ± 0.98	−0.52	<.01
Age 70–79 years					
Chair stand	81	14.06 ± 4.61	17.04 ± 4.88	2.98	<.01
Arm curl	85	17.78 ± 5.00	21.81 ± 4.52	4.03	<.01
2-Minute step	77	99.62 ± 27.64	126.86 ± 40.71	27.24	<.01
Sit-and-reach	85	1.45 ± 3.50	2.45 ± 3.16	1.00	<.01
Back scratch	82	−2.11 ± 3.62	−1.08 ± 3.46	1.03	<.01
Up-and-go	77	5.94 ± 1.51	5.36 ± 1.23	−0.58	<.01
Age 80+ years					
Chair stand	21	14.76 ± 5.26	18.05 ± 5.37	3.29	<.01
Arm curl	22	18.64 ± 6.31	21.32 ± 5.47	2.68	<.01
2-Minute step	22	97.09 ± 32.13	128.64 ± 57.28	31.55	<.01
Sit-and-reach	22	−0.15 ± 3.43	1.73 ± 2.97	1.88	<.01
Back scratch	20	−2.25 ± 4.84	−0.53 ± 4.61	1.72	<.01
Up-and-go	21	7.01 ± 2.23	6.09 ± 1.49	−0.92	<.01

communities across five states in total). Tufts Institutional Review Board–approved procedures are in place for leaders to submit deidentified pre–post participant data for inclusion in the ongoing dissemination evaluation research that examines SWP effectiveness on a national level.

### Statistical Approach

Pre- and postparticipation evaluation measurements were summarized across subjects using means and standard deviations, stratified by age category. The univariate changes were analyzed using a paired *t*-test matching each subject's pre- and postmeasurements. The significance associated with these changes is shown, where *p* value < .05 is considered significant. To calculate the percentage change between the pre- and postmeasurements, we divided the overall change across subjects by the mean pretest value. The pre- and postintervention means were assigned a percentile based on national norms provided by Rikli and Jones (2001). This analysis was done for each state separately as well as for the full study sample. Given that the overall findings were similar across states and the purpose

of these analyses is not state-by-state comparison, the aggregated data are presented in table and figures, with the addition of stratification by age category.

### Results

Data are presented for 367 female participants, with a mean age of 63 (±11) years. Body mass index data were available for 237 participants; mean body mass index was 27.4 ± 5.2. The class session (program) length ranged from 6 to 12 weeks in this study, with an average of 10 weeks of classes. Overall participant attendance in twice-weekly classes was 69.4%. Aggregated data from the five states, stratified by age-group, are shown in Table 1. Pre–post change in the six domains of physical fitness using paired *t* tests revealed significant improvements (*p* < .01) in all domains in the Senior Fitness Test measures. For the chair stand, arm curl, and back scratch tests, greatest mean change in terms of actual scores (not percentile rank) were among participants younger than 60 years; yet for the 2-minute step, sit-and-reach, and 8-foot up-and-go tests, the participants 80 years and older saw greatest improvement.

Figures 1 and 2 illustrate mean pre–post percentile rank norms for each test overall and by age category, respectively. In Figure 1, the chair stand shows greatest pre–post improvement comparatively, with similar percentile rank improvements across the other five tests. This ranking accounts for all ages being grouped together, though similar improvement in the chair stand test is also shown in Figure 2. The older age categories in that figure also show notable improvement in percentile ranking. Reaching or exceeding the > 95 percentile rank for age was achieved for chair stand, arm curl, and 2-minute step tests in the overall and age-stratified groupings.

## Discussion

There are several important findings and lessons from this research. First, results from this evaluation of Senior Fitness Test data show consistent improvement in six domains of physical fitness across program sites and age-groups, demonstrating the efficacy of the SWP and its community-based implementation model. The improved performance in each of the tests indicates increased mobility and strength as well as decreased risk for falls, which are viable indicators for maintaining independence and improved quality of life in aging women. These improvements may also enable participants to walk a few extra blocks to a social engagement, to take care of household chores on their own, to help with child care for grandchildren, or to simply to stand up from a chair or bathe unassisted. Thus, it is understandable how such abilities would be empowering, both physically and psychologically. In addition, sharing regular feedback and recognizing accomplishments of participants, such as high attendance or improvement in Senior Fitness Test measures, are important vehicles to support motivation and adherence (Seguin et al., 2010).

A limited number of additional community-based programs have published similar contributions related to older adult physical activity program evaluations. One example is EnhanceFitness, which is a community-based exercise program to increase function in older adults that has undergone evaluation of its translation into community settings. The EnhanceFitness classes include moderate-intensity exercise, strength-training, flexibility, and balance exercises (Belza et al., 2006). Their locations are similar to the SWP and include community centers, churches, senior centers, public housing, and hospitals. Classes meet three times per week for about an hour (Belza et al., 2006). Data published in 2006, which included assessments of EnhanceFitness participants at baseline, 4 months, and 8 months, demonstrated significant improvements in measures similar to those in the Senior Fitness Test at both time points (Belza et al., 2006).

Another important element of the present study is that it contributes to the growing body of research demonstrating the great capacity of community-based leaders as well as some important considerations for using this type of training

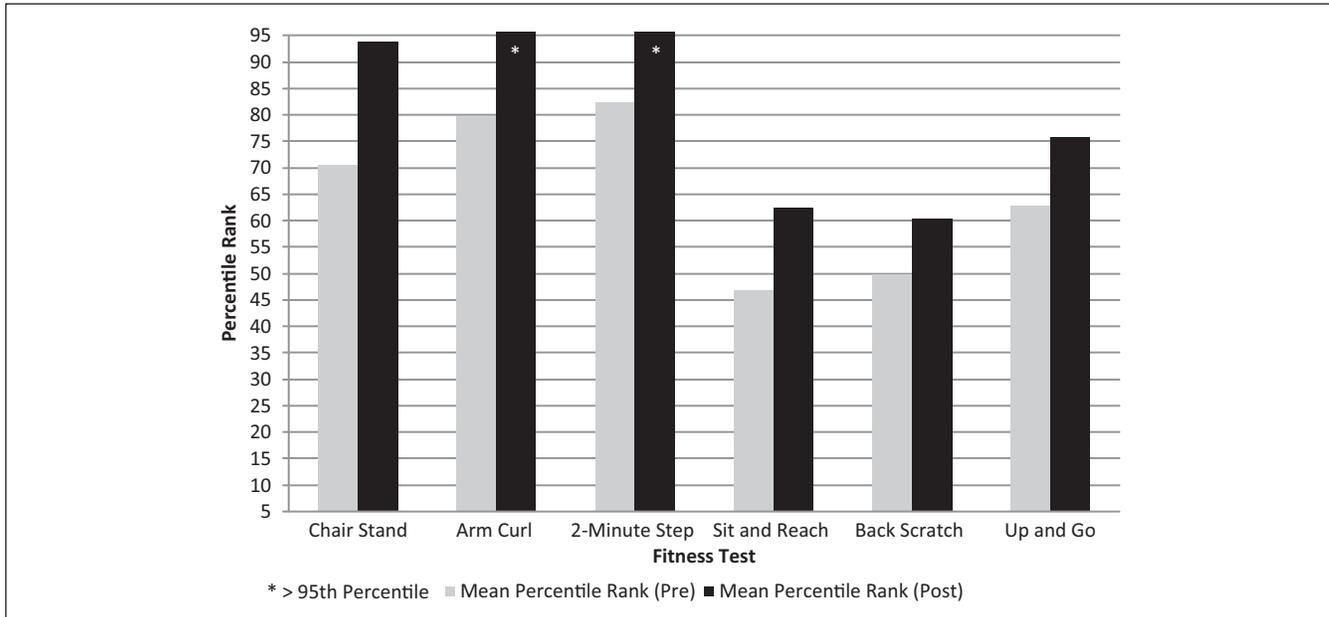
and implementation model. The majority of leaders teaching the SWP classes and conducting the Senior Fitness Test evaluations had limited prior training in exercise prescription or exercise program evaluation prior to their training with the SWP, although many were allied health professionals with some relevant training (e.g., nurse, physical therapist). In addition, many leaders have community-based program implementation experience; for others, SWP may be the first community-based program they are involved with. It is important to note that in some cases, program participants also eventually become trained peer leaders, who are then supervised by an experienced SWP leader.

Regardless of prior experience, all individuals undergo the same daylong training workshop, which is limited to approximately 10 to 15 people, thus allowing for ample personal attention and training feedback on both exercise techniques as well as on conducting the Senior Fitness Test. With this rigorous training and supplemental tools, including the Senior Fitness Test video augmented by the StrongWomen Tool Kit, they have demonstrated full competency to safely teach the exercise classes and to conduct the evaluation assessments during their training observations and subsequent site visits (Seguin, Palombo, et al., 2008).

Training nonexercise professionals to teach community-based exercise classes increases the reach of the SWP and other similar programs—particularly in rural and underserved areas. However, program administrations are encouraged to recruit and train community leaders who possess an exercise certification and/or degree whenever possible, with the goal of promoting the highest levels of program adherence, safety, and efficacy. Furthermore, program leaders without exercise certification/degree should be provided resources and materials for advanced, exercise-specific training. For example, the SWP Tool Kit provides a list of certifying organizations and training options most relevant to working with the program's target population of midlife and older women. Where individuals with less exercise-specific training are leading community classes, organizations should aim to identify highly qualified, supervising leaders who can be enlisted to provide ongoing support, instruction, modifications, and feedback within a team of local community leaders and should regularly conduct observations within existing classes.

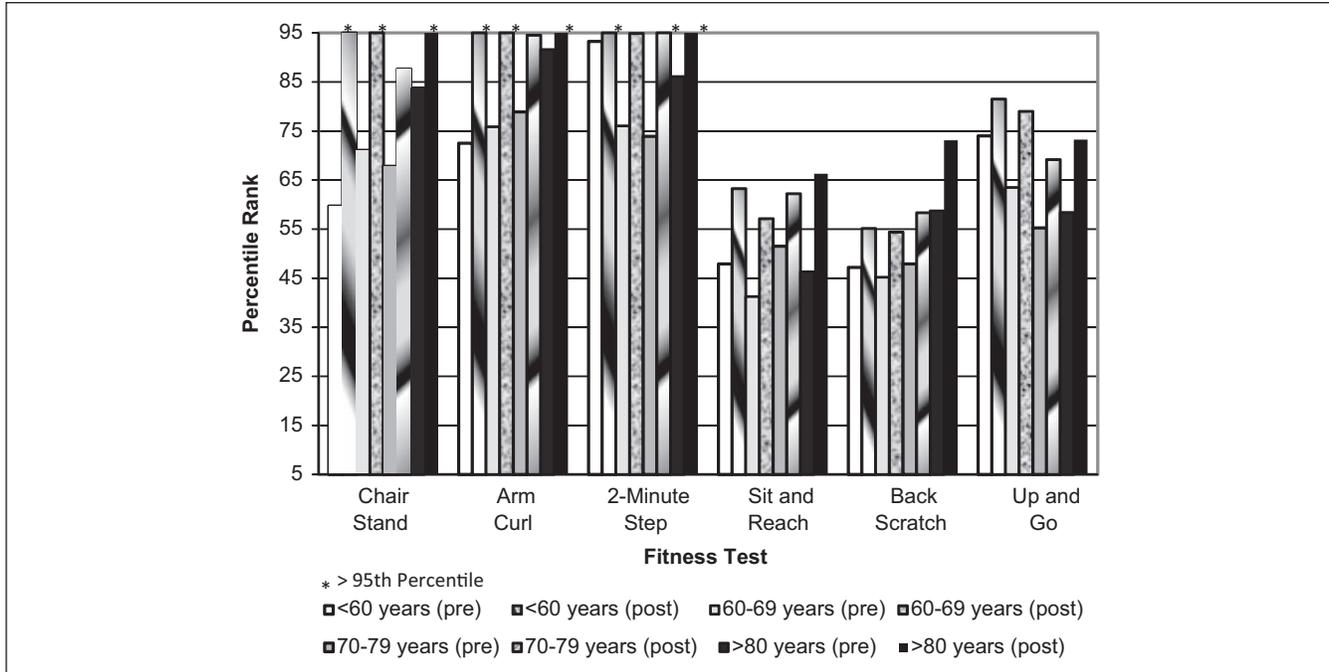
Finally, continuing program evaluations are essential; ongoing national data collections help provide our best estimates of reach. These data also provide a vital platform for continuing to document effectiveness, which helps community programs continue to obtain funding and helps community leaders gain support from their stakeholders to continue to allocate time and resources toward implementation and maintenance of programs.

There are both practical and scientific limitations within this research. First, conducting pre–post Senior Fitness Test evaluations are not without some time burden for both leaders and participants. Also, although all improvements were



**Figure 1.** Mean pre-post percentile rank for Senior Fitness Tests

Note. Participants completed each of the six Senior Fitness Tests prior to (pre) and at the completion (post) of their strength-training class session. With data combined across all age categories, percentile rank improvements ranged from 10 to 23 points. For scores ranked at >95 (the upper limit), a conservative value of 96 was used to calculate the mean; thus, for those two tests, final mean percentile rank is likely underestimating the improvements shown.



**Figure 2.** Mean pre-post percentile rank for Senior Fitness Tests by age category

Note. Among each decade-stratified age-group, improvements ranged from 2 to 36 points along the percentile age-based ranking scores as published by Rikli and Jones (2001). For scores ranked at >95 (the upper limit), a conservative value of 96 was used to calculate the mean; thus, for those two tests, final mean percentile rank is likely underestimating the improvements shown. This is particularly true among the <60 years age-group, because of the fact that Senior Fitness Test norms are only available starting at the age of 60 years, and thus, the 60-year-old percentile rank had to be used for comparison.

statistically significant and functionally relevant, there was no control group for comparison. Although local community leaders often pair up together to conduct assessments and therefore not all participants are tested by their own leader, there may still be an inherent bias in testing, since they are all participants in the program.

Despite these limitations, the improved overall scores as well as increased percentile ranking for age demonstrate effectiveness in positively affecting change across important domains of physical fitness among aging women—improvements that resulted from just 10 weeks of twice-weekly strength-training participation. Such improvements may help older adults maintain adequate strength, flexibility, and endurance required to accomplish everyday tasks. This study further demonstrates that it is feasible for community leaders to conduct pre–post physical fitness evaluations with participants, while also highlighting the value of regularly collecting and documenting reach and effectiveness, for this program and others.

In the SWP alone, there are more than 2,000 trained community leaders and an estimate of tens of thousands of participants across at least 40 states—and growing steadily each year. With continued momentum and public health support for community-based programs, there is clear promise and potential to use trained community leaders to help midlife and older individuals make meaningful physical activity behavior changes that result in improved muscular strength, agility, aerobic fitness, and flexibility through targeted programming.

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The authors declared the following potential conflict of interest with respect to the research, authorship, and/or publication of this article:

Dr. Miriam Nelson (coauthor) is author of the StrongWomen book series.

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