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The Impact of Strong for Life on the Physical Functioning and Health of Older Adults Receiving Home and Community-Based Services

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Abstract

Background/Objectives—To test the effects of Strong for Life (SFL) on the physical performance and self-rated health of older adults receiving Home and Community-Based Services (HCBS).

Design—Randomized, two-group trial with pre-post measures.

Setting—In-home exercise program.

Participants—Clients aged 65–95 (n=42) and their Home Care Aide (HCA) (n=32) were randomly assigned to a usual care and SFL intervention or usual care control group.

Intervention—Clients were instructed in SFL by their HCA and completed SFL 3 times per week for 12-weeks.

Measurements—Outcomes included grip and quadriceps strength, Timed Up and Go, gait speed, Self-Efficacy for Exercise, pain, and PROMIS-global health measured at baseline and immediately following the intervention. Clients completed opened ended survey items on SFL program evaluation.

Conflict of Interest Disclosures:

Element	Financial/Personal Conflicts	Yes	No	Yes	No
Employment or Affiliation			X		X
Grants			X		X
Honoraria			X		X
Speaker's Bureau			X		X
Consulting			X		X
Stocks			X		X
Royalties			X		X
Expert testimony			X		X
Board membership			X		X
Patent			X		X
Personal relationship			X		X

Results—Effect sizes were moderate for grip strength ($d = .38$), pain ($d = .34$), and PROMIS-global health ($d = .27$). Small effect sizes were found for all other measures. Median quadriceps and TUG scores differentially improved among intervention participants versus controls. No adverse health events and high program satisfaction were reported. Frailty prevalence in the control group increased between baseline and post-test while frailty prevalence in the intervention group decreased during the same time period.

Conclusion—Strong for Life has the potential to improve the strength, mobility, health, and frailty of older adults receiving HCBS. This study provides initial evidence of the impact of SFL for older adults receiving HCBS, as well as the safety of the intervention evidenced by the lack of reported adverse events.

Keywords

resistance exercise; older adults; home and community-based services

Introduction

Despite the benefits of physical activity (PA) for older adults, engagement rates remain low (Office of Disease Prevention and Health Promotion 2014). Resistance exercise, in particular, shows even lower participation rates and fewer community settings offer resistance exercise programming (Hughes et al. 2005; Kruger et al. 2004). Furthermore, females, those with advanced age, lower levels of formal education, obesity, or self-reported fair or poor health are least likely to meet resistance exercise participation recommendations (Kruger et al. 2004). These findings suggest that challenges exist with respect to both engagement in and access to resistance exercise programming for older adults.

Low levels of resistance exercise engagement among older adults are concerning given the loss of muscle mass with aging. Sarcopenia is associated with impaired physical functioning, decreased quality of life, and higher mortality rates (Marcell 2003). Despite low rates of engagement, substantial evidence indicates resistance exercise is effective in improving muscle mass and functional outcomes (Liu and Latham 2009).

Despite proven effectiveness, homebound older adults who may benefit the most from resistance exercise are often unable to access these programs commonly offered in the community. Alternative delivery models, such as home-based DVD programs, are a potential broad-reaching mechanism to implement resistance exercise for this population. However, there is minimal literature documenting the safety and effectiveness of DVD-based resistance exercise programs for homebound older adults. An additional concern for this population is the risk of adverse outcomes in response to training (Liu-Ambrose et al. 2004). Given the frail nature of the homebound population, implementing a resistance PA program through a DVD alone without any instruction may be ineffective or harmful since participants are likely to need individualized instruction to modify exercises to accommodate functional limitations.

In Illinois, older adults with a determined need for long-term care can receive services through the Community Care Program, a Medicaid waiver program. The primary service

offered is home care aide (HCA) assistance with activities of daily living and home management. Physical activity programming is not offered and clients are unlikely to easily and safely navigate the community to access PA. Thus, alternative delivery mechanisms to bring PA directly into the homes of these vulnerable older adults are needed. Thus, the purpose of this study was to test the effects of Strong for Life (SFL), a DVD-delivered and HCA-assisted, resistance exercise program on physical function and health in older adults enrolled in the Community Care Program.

Methods

Design

We used a randomized controlled trial with pre- and posttest measures to assess the effects of the 12-week SFL intervention on client functioning and health. Clients and their HCA were randomized to receive SFL and usual care or usual care only. Randomization sequences were determined using a Matlab program designed to achieve balanced allocation of clients to intervention and control groups stratified by the number of hours of weekly care received from the HCA.

Participants and setting

Study participants were HCAs and their clients; community-dwelling older adults receiving HCA services through the Community Care Systems, Inc. This study was approved by the University of Illinois at Chicago Institutional Review Board (Protocol #2013-1152).

Inclusion criteria

Inclusion criteria for HCAs included primary English-speaking employees of the Community Care Systems, Inc. Cook County office that had one or more clients who received care two or more days per week and were able to attend a half-day training program. Inclusion criteria for clients included those receiving HCA services through the Community Care Systems, Inc. Cook County office who were primary English-speaking and did not participate in regular exercise as defined as 30 minutes three or more days per week. Clients were excluded if they were less than 65 years old or had health problems that contraindicated PA as determined by the EASY: Exercise Assessment and Screening for You (Resnick et al. 2008). If EASY results indicated a need for physician consent, a consent form was faxed to the client's primary care physician.

Procedures

We first recruited HCAs interested in assisting their clients with SFL. Home care aides were screened and if determined eligible, recruitment flyers were mailed to all clients in the eligible HCA's caseload. Interested clients participated in a separate telephone screening to determine eligibility. If a client was determined eligible, an in-home appointment was made to complete the informed consent and baseline measurement testing. Research staff performing measurement procedures were blinded to group allocation.

Intervention group HCAs attended a half-day SFL training session and control group HCAs attended a half-day back safety training session. Home care aides and clients assigned to the

control group participated in measurement procedures at baseline and following the intervention, but were not otherwise contacted by research staff during the study period. Home care aides completed SFL with their clients two times per week for the first two weeks of the program. Clients were encouraged by their HCAs to complete a third session independently. After the initial two-week period, HCAs provided their clients motivation at each usual care visit (two or three times per week) to perform SFL three times a week for an additional 10 weeks.

Measures

Sociodemographic measures—Demographic measures were collected at baseline only for both clients and HCAs and included age, gender, education, and ethnicity, and hours of caregiving services received.

Strength measures—Clients completed two trials of grip strength on each hand using a Jamar Hand Hydraulic Dynamometer testing following standardized procedures (Fess 1992). Clients completed two trials of maximal isometric quadriceps muscle strength on both legs following standardized testing procedures using a hand held dynamometer (Lafayette Manual Muscle Testing System – Model 01165) (Bohannon 1986). For both strength measures, the average of the two trials for each side was calculated and the greater value used for analysis, regardless of side of the body.

Mobility measures—We used the Timed Up and Go (TUG) and gait speed to assess client mobility. Clients were instructed to complete both measures at their normal, comfortable walking speed. Gait speed was measured as the time required to complete a 10-foot walking distance with a five-foot acceleration and deceleration length. Clients completed two trials of the TUG and gait speed with the average value in seconds and meters/second, respectively, used for analysis.

Self-report measures—We used the Self-Efficacy for Exercise scale to assess the confidence in the ability to exercise in the face of barriers (Resnick and Jenkins 2000). This 11-item scale was designed for older adults, and reliability and validity have been tested in a variety of elderly sub-populations (Resnick et al. 2004). Clients rated their confidence to exercise three times per week for 20 minutes from 0 (not confident) to 10 (very confident). We calculated the SEE score by summing the numeric ratings for all responses and dividing by the number of total responses. Client rated their average pain over the last seven days using the 11-point numeric pain rating scale (McCaffery and Beebe 1989; Herr et al. 2004). Clients completed the PROMIS-global health measure which captures general, overall health in the domains of physical function, fatigue, pain, emotional distress, and social health (Hays et al. 2009). We calculated an overall score, as well as separate physical and mental health summary scores (Hays et al. 2009).

Analyses

Data analyses were conducted with R software version 3.2.0 using intention-to treat analysis. We ran descriptive statistics and examined group differences at baseline. We examined attrition from posttest measurement, as well as frequencies of adverse event

reporting. We used the Wilcoxon-rank sum test to test the magnitude of difference in client performance by group between pretest and posttest for each outcome variable. The Wilcoxon-rank sum test was used due to non-normal distribution in the data. We calculated Cohen's *d* effect sizes to determine the strength of the association between study arm and outcome measure. Finally, clients completed a SFL program evaluation and we analyzed open-ended responses to the program evaluation using qualitative content analysis. Client responses were initially read and codes were developed. Answers were re-read and codes were applied with frequency of code response used to identify meaningful themes.

Results

We made contact with 64 HCAs of whom 34 had at least one client enroll in the study (Figure 1). There was approximately a one-month delay between telephone screening and intervention start date, during which clients were lost for a variety of reasons. Primary care physicians did not give medical clearance for participation (n=2). Upon arrival at the client's home to obtain informed consent, four clients could not be enrolled because they were not primarily-English speaking and were unable to provide informed consent. Seven additional participants deemed eligible during the telephone screening declined to enroll due to loss of interest. We were unable to reach eligible participants (n=2) after the telephone screening to sign informed consent and conduct baseline measurement. Finally, one client was hospitalized between the telephone screening and beginning of the intervention. Therefore, the final baseline sample consisted of 32 HCAs and their 42 clients.

As shown in Table 1, there were no significant differences in client demographics or baseline physical performance and self-rated health between intervention and control groups. There was, however, substantial within-group variability in physical performance measures. Overall, clients had a mean age of 74.8 years and the majority were female (83%) and ethnic minorities (57%).

Adverse events/attrition

Clients and HCAs were instructed to contact research staff regarding any problems with SFL implementation or adverse health events. We received no contact from participants over the course of the intervention, except for notification that one client had died in each of the intervention and control groups. These events were determined not to be related to the SFL intervention.

Of the 42 clients enrolled in the study, 35 completed the 12-week posttest measurement for a 83% retention rate. Of clients in the intervention group, 21 out of 24 (87.5%) completed the posttest compared to 14 out of 18 (77.8%) in the control group. Loss to follow-up in the intervention group included one client death, one unable to be contacted due to a disconnected telephone, and one who refused posttest measurement. In the control group, loss to follow-up included one client death and three clients who refused posttest measurement because of disappointment about being assigned to the control conditions (n=1) or feeling ill (n=2).

Physical performance and self-rated health outcomes

There were no significant differences between control and intervention groups in change scores between baseline and posttest for any physical performance or self-report measures (Table 2). However, intervention group participants showed trends towards improvements for the TUG, grip strength, quadriceps strength, PROMIS-global health, and PROMIS-mental health. Effect sizes were medium for grip strength ($d = .38$), pain ($d = .34$), and PROMIS-global health ($d = .27$).

Qualitative response to Strong for Life intervention

Strong for Life provided increased motivation for PA and clients noted improved physical health as a result of participating in the exercise program. Overall, clients viewed SFL positively. For many, the DVD format raised awareness of the client's own inactivity and encouraged behavior change. Clients reported that watching the DVD “*made me recognize that I have to do something*” and that the DVD “*got me thinking more about exercise*” and “*it got me exercising because I wasn't exercising*.” Clients attributed health benefits to the intervention including improved functioning, arm strength, flexibility, and balance. One client noted that after doing SFL, she “*improved on going up the stairs*.” Another client noted that SFL provided “*help on my arms and balance*.”

Impact of Strong for Life on frailty

Based on the baseline physical performance of clients on criteria in Fried's frailty classification (unintentional weight loss greater than 10 pounds, low physical activity, weak grip strength, slow gait speed, and self-reported fatigue), 72% of clients ($n=30$) were frail at baseline given their grip weakness, slow gait speed, and self-reported low physical activity levels. We examined changes in frailty status between baseline and follow-up for those clients who completed both measurement points. At baseline, five clients in the usual care group were considered frail. At the 13 week follow-up, seven clients' functioning rendered them frail. At baseline, nine clients in the intervention group met frailty classification. At the 13 week follow-up, the number of frail clients in the intervention group decreased to eight.

Discussion

This study examined outcomes of the 12-week SFL intervention for a sample ($n=42$) of older adult clients receiving HCBS. Median performance on the TUG, grip strength, quadriceps strength, PROMIS-global health, and PROMIS-mental health improved more for intervention participants than controls, but between-group differences were not statistically significant. Despite no statistically significant changes in performance measures, clients self-reported that they felt improved physical health and functioning as a result of the 12-week intervention. Despite a small sample size that was not adequately powered to detect statistically significant between group differences, Cohen's d effect sizes showed a medium effect for SFL on grip strength, pain, and PROMIS-global health. Furthermore, frailty prevalence increased over time in the control group compared with a decrease over time in the intervention group. These findings provide initial support that SFL has the potential to improve physical functioning, decrease pain, and increase self-rated health in older adults enrolled in the Community Care Program.

Other studies have examined the effects of SFL on older adult participants (Jette et al. 1996; Jette et al. 1999; Etkin et al. 2006). All found beneficial effects of SFL on participant outcomes but did not test the intervention with older adults receiving HCBS. Thus, this study is unique in assessing the impact of a resistance exercise intervention for a subpopulation of vulnerable adults with limited ability to access evidence-based resistance exercise programming in the community.

There are concerns over implementing strength-based exercise programs for frail older adults due to musculoskeletal complaints or adverse events (Liu and Latham 2009; Latham et al. 2004). Importantly, we had no reports of intervention-related adverse events. This finding provides encouraging evidence that SFL can be safely delivered to this population. It is also important to note that the program tested is evidence-based with instructor training protocols and uses a DVD to enhance fidelity of treatment delivery.

This study is not without limitations. First, study participants were limited to one Community Care Program agency and one geographic office location. We focused on an urban HCBS population and did not include rural older adults. Future studies should include a more diverse sample of older adults in order to test the generalizability of results across a broader HCBS population. We did not capture information on cognitive function on clients at baseline. Future studies would be strengthened by collecting this information to explore the relationship between cognition and resistance exercise training. While we had instructed HCAs and clients to log each completed sessions of SFL on a calendar, only eight of 24 clients (33%) provided completed logs at the end of the study. Therefore, our understanding of how dosage and adherence impacted client outcomes is limited. Future studies should examine the impact of SFL dose on exercise outcomes, as well as explore the effects of a longer duration intervention. It is likely that the short duration of the intervention did not provide adequate time to see statistically significant differences in performance measures.

Despite limitations, these results provide initial evidence that SFL has the potential to improve the strength, mobility, and self-rated health of older adults receiving HCBS. Given the growth of the older adult population and public health challenge of delaying costly nursing home placement, this study presents a novel solution by describing the impact of an evidence-based resistance exercise program on strength, mobility, and self-rated health in older adults. These findings are important in enabling public health practitioners to develop strategies and implement evidence-based programs to help older adults maintain their functioning to support aging-in-place.

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Table 1
Client Baseline Demographics by Group

	Total n=42 % or mean (SD)	Control Group n = 18 % or mean (SD)	Intervention Group n= 24 % or mean (SD)	p-value*
% Female	83	83	83	.99
Age in years	74.8	75.6	74.1	.60
Weekly Hours of Care	13.5	12.0	14.2	.27
Race				.39
African American	50	50	50	
White	43	39	46	
Hispanic	5	6	4	
Other	2	5	0	
Highest Education Achieved				.50
Some Grade School	2	0	4	
Grade School	17	22	13	
Some High School	21	11	29	
High School	26	28	25	
Some College	26	28	25	
College	7	11	4	
Grip Strength (kg)	17.3 (6.5)	17.3 (6.4)	17.3 (5.7)	.99
Quadriceps Strength (N)	23.7 (10.2)	22.0 (11.8)	24.9 (7.5)	.39
Gait Speed (m/sec)	0.5 (0.3)	0.5 (0.3)	0.5 (0.3)	.70
Timed Up and Go (sec)	22.5 (23.7)	21.8 (32.4)	24.4 (14.8)	.76
Pain	5.0 (3.0)	5.4 (2.9)	4.7 (3.2)	.31
SEE	6.9 (2.4)	7.0 (1.9)	6.8 (2.1)	.69
PROMIS-Global Health	29.7 (7.9)	28.7 (6.5)	30.4 (5.2)	.39
PROMIS-physical subscale	11.5 (3.1)	11.3 (2.2)	11.9 (3.0)	.51
PROMIS-mental subscale	12.7 (3.3)	11.7 (3.4)	13.4 (2.6)	.08

Note. SEE = Self-efficacy for Exercise Scale

Table 2
Client Physical Performance and Self-Report Change Scores Between Baseline and Post-test

	Control Group Median [IQR]	Intervention Group Median [IQR]	P value	Cohen's <i>d</i>
Quadriceps strength	0.15 [-1.15, 8.20]	4.55 [-0.35, 6.81]	0.83	0.11
Grip strength	-0.25 [-2.38, 0.88]	0.00 [-1.50, 3.50]	0.24	0.38
Gait speed	-0.01 [-0.16, 0.02]	-0.02 [-0.15, 0.02]	0.80	-0.10
TUG	0.51 [-1.44, 2.37]	-0.19 [-2.05, 5.33]	1.00	-0.20
Pain	0.00 [-1.75, 1.00]	0.00 [-2.00, 1.00]	0.69	0.34
Self-Efficacy for Exercise	-0.46 [-2.32, 0.98]	-1.09 [-2.64, 0.09]	0.56	0.22
PROMIS-global health	0.50 [-3.75, 2.75]	1.00 [-2.00, 4.50]	0.43	0.27
PROMIS-physical	0.00 [-1.00, 1.00]	0.00 [-1.00, 2.00]	0.54	0.15
PROMIS-mental	-1.00 [-1.75, 0.00]	1.00 [-1.00, 1.00]	0.22	0.20