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Task-Oriented Exercise to Reduce Activities of Daily Living Disability in Vulnerable Older Adults: A Feasibility Study of the 3-Step Workout for Life

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Abstract

The purpose of this feasibility study was to evaluate the 3-Step Workout for Life program, a 10-week exercise program that included moderate-intensity muscle strength training followed by task-oriented training. Fourteen participants completed the program (mean age = 73 years; $SD = 6.83$). The *Box and Block test* ($Z = -2.24$, $p = .03$) and the *30-s chair stand test* ($Z = -2.21$, $p = .03$) indicate improved physical functioning of the upper and lower extremities. More importantly, results of the function component from the *Late-Life Function and Disability Instrument* ($Z = -2.04$, $p = .04$) and motor skills scale from the *Assessment of Motor and Process Skills* ($Z = -2.97$, $p = .003$) indicate subjective and objective improvements on performing activities of daily living. Supplementing moderate-intensity muscle strength exercise with task-oriented training components is feasible. Preliminary data support the effectiveness of 3-Step Workout for Life in reducing late-life disability.

Keywords

activities of daily living; aging in place; exercise; intervention studies; muscle strength

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The ability to take care for oneself, which includes performing activities of daily living (ADLs), is critical for older adults to age in place. Dependence on others to complete ADL is a top risk factor of long-term nursing home placement (Gaugler, Duval, Anderson, & Kane, 2007; Luppa et al., 2010). Although the ADL disability in older adults has decreased, with the greatest estimated rate of decline at −2.74% per year (Freedman, Martin, & Schoeni, 2002), the projected growing number of older adults in the next few decades will continue to strain health care costs if their ability to perform ADL is compromised. Thus, an effective intervention to reduce or delay ADL disability would have high impact.

Preserving the underlying physiological capacity, such as muscle strength, required to perform ADL has been a well-accepted restorative approach to reduce late-life ADL disability (Bean, Vora, & Frontera, 2004; Elsawy & Higgins, 2010). A rich body of literature has shown medium-to-large effect sizes of exercise on reversing the physiological decline in older adults such as muscle strength and walking speed (e.g., Liu & Latham, 2009). However, the effects of exercise on the ADL outcomes are often diminished, yielding either small effect sizes or nonsignificant results (Keysor, 2003; Keysor & Jette, 2001). A bottleneck seems to exist for older adults to fully translate physiological gains from exercise to functional gains in ADL.

Overlooking the disablement process may contribute to the discrepancy between physical gains and ADL gains in these exercise studies. According to the disablement process model (Verbrugge & Jette, 1994), “disability” is a linear reaction to “impairments” via “functional limitations.” For example, an impairment or decline in body systems (e.g., muscle weakness) leads to functional limitations (e.g., difficulty in walking and lifting), which further leads to disability in ADL (e.g., unable to take a shower or change a bed without task modifications or help from others). Most exercise studies mainly target the impairment dimension in the disablement process to restore the impaired or declined body system, for example, using progressive resistance strength training to increase muscle strength (Peterson, Rhea, Sen, & Gordon, 2010). The underlying assumption of these studies is that reducing impairment automatically leads to decreased disability and increased ADL independence. However, this assumption might be too simplistic.

First, older adults might not link physical fitness benefits with ADL performance when exercise is performed in a gym-like setting, outside the context of home where most ADLs are conducted. Second, older adults might not link the rote exercise movements to ADL performance because movements used to perform ADL are task oriented. Therefore, an exercise program addressing the disablement dimension of impairments, physical limitations, and disability, and is task oriented might be an ideal intervention to improve the ability to perform ADL in older adults. There is small but growing evidence that incorporating task-oriented training in exercise improves the ADL outcomes for older adults (Liu, Shiroy, Jones, & Clark, 2014). The training could include functional movements needed to perform ADL tasks (i.e., changing between lying, sitting, standing positions), simulated movements to perform an ADL task (i.e., carrying an object), or the actual ADL tasks (i.e., vacuuming and sweeping) (de Vreede, Samson, Van Meeteren, Duursma, & Verhaar, 2005; Dobek, White, & Gunter, 2007; Manini et al., 2007).

The 3-Step Workout for Life is a newly developed exercise program guided by the disablement process model (Verbrugge & Jette, 1994) and literature on task-oriented training (Liu et al., 2014). The target population of 3-Step Workout for Life is older adults aged 60 years or above who experience declined muscle strength and difficulty in ADL, but still reside in the community. The rationale for choosing this population is that age-related pathological and functional changes adversely affect older adults' muscle strength, physical functioning, and ADL independence (Hairi et al., 2010; Janssen, Heymsfield, & Ross, 2002). The 3-Step Workout for Life program addresses impairment, functional limitation, and disability in the disablement process through muscle strength training, functional training, and ADL training. Muscle strength training is used in the beginning of the program to build up muscle strength. Functional training and ADL training are added later in the program to facilitate transfer of muscle strength gains to ADL gains by practicing movement patterns similar to performing ADL and practicing the actual ADL tasks at home. The latter two training components are task oriented. The purpose of this study was to conduct a feasibility study of 3-Step Workout for Life to evaluate its safety, acceptability, and preliminary effects on reducing ADL disability in residents from two subsidized senior housing communities. Specifically, information on the adverse events, attendance rate, dropout, exit interview, physical functioning, and ADL performance would be examined.

Methods

A single-group pretest–posttest research design was used. This study was approved by the authors' Institutional Review Board. Participants were recruited from two subsidized senior housing communities between April 2013 and February 2014 in Indianapolis, Indiana. The two selected subsidized senior housing communities were one-bedroom apartment complexes offering affordable rent to low-income older adults through the support of public and private funding. A common room was available in both communities to conduct group exercise. Research information was advertised through the use of flyers and facility newsletters, face-to-face contact, word of mouth, and information sessions.

Participant Inclusion and Exclusion Criteria

Participants were eligible for the study if they were English speaking and 60 years of age or above. They must also have muscle weakness as indicated by a grip strength below the mean for their age (see Tables 3 and 4 in Bohannon, Peolsson, Massy-Westropp, Desrosiers, & Bear-Lehman, 2006), or a Five Times Sit-to-Stand Test time that was longer than 13.69 s or inability to perform the test (Guralnik et al., 1994). The eligibility criteria also included self-reported difficulty in performing one or more basic ADL, such as eating, dressing, grooming/personal hygiene, bathing/showering, using the toilet, or functional mobility/transfer. Potential participants were asked whether they had difficulty or needed assistance including the use of assistive devices or dependence on others to complete basic ADLs.

Participants were excluded from the study if they had a schedule conflict with the intervention timeline, three or more errors on a six-item cognitive impairment screener (Callahan, Unverzagt, Hui, Perkins, & Hendrie, 2002), engaged in moderate-intensity exercise for two or more days per week, or had any terminal illness, cardiovascular, neurological, psychiatric, orthopedic conditions that are contraindications to participating in an exercise program. Participants with neurological conditions such as stroke and Parkinson's disease that could affect motor movements were also excluded because the motor impairment may contribute to ADL difficulty. Health conditions gathered for the screening purpose were self-reported. All participants required medical clearance for moderate-intensity muscle strength training exercise before entering the study. A research assistant was responsible for obtaining the medical clearance from participants' health care providers.

3-Step Workout for Life

The 3-Step Workout for Life program includes three training components: muscle strength training, functional training, and ADL training. The three training components were delivered over a 10-week period, three times a week in a sequential order by a 3-Step Workout for Life trainer. Table 1 shows the training schedule and progression of the 3-Step Workout for Life program. Each training session took approximately 50–60 min, including warm-up with marching and cooldown with gentle stretching. The exercise intensity was maintained in the moderate-intensity range, between 3 (perceived as moderate) and 5 (perceived as strong) on the Borg 10-Point Rating of Perceived Exertion Scale throughout the 10 weeks (Borg, 1990). The trainer kept the exercise materials between sessions.

Muscle Strength Training—Muscle strength training is designed to reduce impairment in muscle strength in the disablement process (Verbrugge & Jette, 1994). The training follows the principle of overload in exercise. The external force is increased gradually to improve the strength of major muscles in the upper and lower extremities. The effect of progressive resistance strength training on improving muscle strength in older adults has been well documented (Liu & Latham, 2009; Martins et al., 2013; Peterson et al., 2010).

Muscle strength training consists of nine exercises that target major muscles of the upper and lower extremities: shoulder flexion, extension, and abduction; elbow flexion and extension; hip flexion and extension; and knee flexion and extension. Elastic tubing was used for each exercise. Participants performed each exercise in two sets with 12 repetitions per set during the first week. The number of sets was increased to three starting in Week 2. Perceived exertion was checked after each exercise. When a participant reported a value below 3 on the Borg 10-Point Rating of Perceived Exertion Scale (Borg, 1990), higher resistance elastic tubing was provided for that exercise.

A 3-Step Workout for Life trainer led the training in groups of four to six participants in a common room of the residential building. The training was delivered three times a week for the first four weeks and then reduced to one time a week for the remaining six weeks. Although the frequency of muscle strength training became one time a week after Week 4, the other two training components continue muscle strength building. The training schedule is presented in Table 1.

Functional Training—Functional training is designed to reduce functional limitations in the disablement process (Verbrugge & Jette, 1994). Functional training exercises muscles in coordinated multiplanar movement patterns and incorporates multiple joints for the purpose of improving function. The training in the 3-Step Workout for Life program specifically focuses on exercise movement patterns that are used to perform ADL tasks. Prior studies have applied a similar training approach to improve physical functioning in older adults (de Vreede et al., 2005; Krebs, Scarborough, & McGibbon, 2007).

The functional training consists of eight exercises: shoulder diagonal D1 and D2 extension, shoulder diagonal D1 and D2 flexion, chair stand, lifting above the head, leg press, rowing, reaching, and chest press. The distinct differences between functional training and muscle strength training are that functional training involves multiple joints and muscles in each exercise, and uses movements that simulate ADL performance. For example, the exercise of lifting above the head is similar to the movement pattern used to restore an object to an overhead cupboard or pick up a grandchild. Elastic tubing was used for each exercise, and each exercise was performed in three sets of 12 repetitions. Similar to muscle strength training, perceived exertion was checked after each exercise. When a participant reported a value below 3 on the 10-Point Rating of Perceived Exertion Scale (Borg, 1990), higher resistance elastic tubing was provided for that exercise.

The functional training started on Week 5. The 3-Step Workout for Life trainer led the training in groups of four to six participants for two sessions. Starting in Week 6, the training became once a week and in a one-on-one format at each participant's home. During the one-on-one training session, the trainer would help the participant link exercise with ADL by encouraging the participant to identify activities at home in which he or she would use movement patterns similar to those in the functional training exercises.

ADL Training—ADL training is designed to reduce ADL disability. This training applies the concept of specificity of training by practicing the actual ADL tasks at home, because training in a specific activity is the best way to maximize performance in that activity (Gamble, 2006). The principle of specificity of training has been applied by rehabilitation professionals to help people regain independence after illness or disability (da Silva, Antunes, Graef, Cechetti, & de Souza Pagnussat, 2015; Gliner, 1985; Hubbard, Parsons, Neilson, & Carey, 2009). Specificity of training has also been applied in athletics to improve sport performance (Young, 2006).

Participants started to receive one-on-one ADL training once a week on Week 6 at home. During each training session, participants practiced three to four ADL tasks in which they experienced difficulty and were essential for them to stay independent at home. The training used the identified ADL tasks as training exercises to increase older adults' ability to perform these tasks. Before Week 6, the 3-Step Workout for Life trainer and participant discussed and selected ADL tasks together. At least one task identified for practice needed to be a basic ADL task. The participant practiced each activity for 10– 15 min during the session. Participants were allowed to use their own mobility assistive device during the training. The 3-Step Workout for Life trainer used one or two training principles shown in Table 2 to keep the activity challenging and in the moderate-intensity range; between 3 and 5 on the 10-Point Rating of Perceived Exertion Scale (Borg, 1990).

Intervention Fidelity

Qualification and Training of the 3-Step Workout for Life Trainers—The two 3-Step Workout for Life trainers have a bachelor's degree in exercise sciences. They had received 20 hr of intervention training and completed cardiopulmonary resuscitation (CPR) training before field testing. The trainers were responsible for tracking attendance, adverse events, and physical activity logs for participants.

Intervention Delivery—Three to four exercise sessions were selected randomly for observation by the first author throughout the 10-week intervention period. Problems observed were corrected on-site either immediately or at the end of the session. Weekly meetings with the trainers were held to monitor the intervention progress and documentations.

Intervention Receipt—During the on-site observation, the author also checked whether the participants used a proper form to perform the exercise at the target intensity. Corrections were made on-site. Each participant was given a passport to record attendance.

Assessments

Physical functioning of the upper extremity was measured with the Box and Block Test (Desrosiers, Bravo, Hebert, Dutil, & Mercier, 1994); the lower extremity was measured with the 30-s chair stand test (Jones, Rikli, & Beam, 1999). ADL performance was measured with the Late-Life Function and Disability Instrument (Haley et al., 2002; Jette et al., 2002; Sayers et al., 2004) and the Assessment of Motor and Process Skills (Doble, Fisk, Lewis, & Rockwood, 1999; Fisher, 1997).

Box and Block Test—The test is a timed performance test measuring upper extremity gross manual dexterity and has been validated in older adults (Desrosiers et al., 1994). During the administration, the participant was seated at a table, facing a rectangular box that is divided into two compartments, one of which was filled with 150 wooden blocks (1-in. wide). The filled compartment was first placed on the participant's dominant side. The participant was instructed to move one block at a time from the filled compartment and cross the partition to the other compartment for 60 s. Each hand was measured separately. A 15-s practice trial was provided before formal testing of each side. The score is the number of blocks that were moved.

30-Second Chair Stand Test—It is a timed test developed to measure functional lower extremity strength in community-dwelling older adults and has been used in several research studies (Jones et al., 1999; Rikli & Jones, 1999). The participant was instructed to sit on a standard chair and place hands on the opposite shoulder crossed at the wrists. The score is the number of times that the participant can stand up from a seated position on the chair within 30 s.

Late-Life Function and Disability Instrument—The instrument is a self-report measure of "function" and "disability" for community-dwelling older adults (Haley et al., 2002; Jette et al., 2002). The function component of the instrument measures the ability to perform discrete actions or activities as part of daily routines. The participant was asked to report how much difficulty he or she had doing a particular activity without the help of others and the use of assistive devices. Raw scores from three domains were obtained from the function component: upper extremity functioning (items that measure activities of the hands and arms, such as holding a full glass of water), basic lower extremity functioning (items that measure activities primarily involving standing, stooping, and walking, such as walking around one floor of home), and advanced lower extremity functioning (items that measure activities that involve a high level of physical ability and endurance, such as walking several blocks). The raw scores were transformed to 0–100-scaled scores. A higher scaled score indicated less difficulty in the domain.

The disability component of the instrument measures the ability to perform socially defined life tasks that are expected of an individual within a typical sociocultural and physical environment. The disability component assesses frequency of performing the tasks (e.g., How often do you keep in touch with others?) and limitation in capacity to perform (e.g., To what extent do you feel limited in keeping in touch with others?). Therefore, the disability component assesses two dimensions of performing a social task: the frequency dimension and the limitation dimension.

Two role domains were obtained in regard to the frequency dimension: (a) social role (including items that measure the frequency of performing various social and community tasks, such as keeping in touch with others), and (b) personal role (including items that measure the frequency of performing various personal tasks, such as preparing meals for self).

Likewise, two role domains were obtained in regard to the limitation dimension: (a) instrumental role (including items that measure limitation in activities at home and in the community, such as going out with others to public places), and (b) management role (including items that measure limitation in organization or management of social tasks that involve minimal mobility or physical activity, such as taking care of household business and finances).

Similar to the function component, the raw scores of the disability component were transformed to 0–100-scaled scores. A higher scaled score in the frequency dimension indicates a higher level in frequency of participating in various social and community tasks. Similarly, a higher scaled score in the limitation dimension indicates a higher level in capability of participating in life and social tasks.

Assessment of Motor and Process Skills—The Assessment of Motor and Process Skills is a standardized observational test measuring an individual's ability to perform ADL (Fisher & Jones, 2012). The assessment can be administered on people from 2 to over 100 years of age (Fisher & Jones, 2012; Hayase et al., 2004). The assessment evaluates the quality of 16 ADL motor and 20 ADL process skills when an individual performs two familiar but somewhat challenging ADL tasks. The motor skills are the smallest observable units of performance that can be observed when a person moves himself/herself and task objects. For example, when a person gets dressed, he or she must *reach* for, *grip*, and *lift* the clothing. *Reach*, *grip*, and *lift* are motor skills in the example. The process skills are the smallest observable units that can be observed when a person logically enacts the task, selects and uses appropriate tools and materials, carries out task actions and steps, and responds to problems encountered. For example, when a person gets dressed, he or she must *search* for and *locate* the clothing, and dress in a proper order (*sequence*). *Search*, *locate*, and *sequence* are process skills in the example. The *Assessment of Motor and Process Skills* manual consists of over 120 standardized activities, including basic ADL and instrumental ADL with different degrees of difficulty. Based on the observation of the person's performance on the two tasks, each motor and process skill is scored using a 4-point ordinal scale, from markedly deficient (= 1), ineffective (= 2), questionable (= 3) to competent performance (= 4). These raw ordinal ADL skill item scores are then entered into the *Assessment of Motor and Process Skills* software, which uses many-faceted Rasch analyses (Fisher, 1993), to convert raw item scores into one logit score for ADL motor skills (score range: –3 to 4) and one logit score for ADL process skills (score range: –4 to 3). The scoring is adjusted to account for the challenge of the tasks the person performed, and the severity/ leniency of the rater who scored the person's task performances.

Adverse events, physical activities outside training sessions, and attendance rates were monitored and recorded in each training session by the 3-Step Workout for Life trainer. Adverse events are any unintended or undesirable outcomes that may or may not be associated with the intervention, such as muscle strain, joint pain, falls, dizziness, illness, or hospitalization.

A semistructured exit interview was conducted by the first author to gather feedback from participants who completed the study on acceptance, duration, frequency, length, intensity, and format of 3-Step Workout for Life. Participants knew her as the principal investigator of the study and had met her a few times when she was on-site to oversee the study. The exit interview was conducted one-on-one at the participant's home. No other family members were present during the interview. The interview was audio recorded.

Data Analyses

To describe the sample, we reported medians, means, and standard deviations when appropriate. The Wilcoxon signed-rank test, a nonparametric statistical test, was used to compare quantitative results between baseline and posttest. The nonparametric analytical approach was used because of a small sample size. Analyses were performed using IBM SPSS Statistics 22. The third author and a research assistant transcribed and summarized the interview audio recordings by the sequence of questions asked.

Results

Forty-seven residents were screened for the study: 21 were eligible, among which 17 consented and enrolled (enrollment rate of the full sample screened = 36%). Fourteen participants completed the 10-week 3-Step Workout for Life program (retention rate = 82%). Table 3 shows the demographic information, attendance rate, and adverse events of participants who completed the program and those who dropped out. Reasons for the three dropouts included having a schedule conflict (n = 2, dropped out after Weeks 3 and 7) and bedbug infestation ($n = 1$, dropped out after Week 6). The average attendance rate of the 14 participants who completed the program was 92%. Muscle strain and joint pain were the two most frequently reported adverse events. Among the 14 participants, 12 reported mild-to-moderate muscle strain, ranging from one to 16 incidents per participant. Thirteen participants reported mild-to-moderate joint pain, ranging from two to 29 incidents per participant. Two participants reported having a fall during outdoor activities unrelated to training. Three participants reported dizziness, related to either existing health conditions or medications. Three participants reported illness. None of the illness was related to the exercise program. One participant reported hospitalization due to a kidney infection.

Table 4 presents the descriptive results at baseline and posttest, as well as statistical results in participants who completed the study. On the Box and Block Test, participants showed a significant improvement on the nondominant hand ($Z = -2.24$, $p = .03$), but not on the dominant hand. On the 30-s chair stand test, participants showed a significant improvement ($Z = -2.21$, $p = .03$). On the function component of the Late-Life Function and Disability Instrument, significant improvements were found on the total scaled scores ($Z = -2.04$, $p = .04$), basic lower extremity ($Z = -2.23$, $p = .03$), and advanced lower extremity ($Z = -2.20$, $p = .03$). All results from the disability component of the Late-Life Function and Disability Instrument were nonsignificant. On the Assessment of Motor and Process Skills, participants showed a significant improvement on the motor skills ($Z = -2.97$, $p < .01$) but not on the process skills.

Data from the exit interview indicated that all participants liked the program; however, when asked whether they ever thought about quitting the program, two participants responded "yes." The reasons for thinking about quitting were joint pain and having to miss some social events. When asked about the duration, frequency, and length of the program, all responded that the length of 50–60 min/session was acceptable. Most participants expressed that three times a week for 10 weeks was an acceptable frequency and length. Two participants thought the frequency could be two times a week but one thought it could be four to five times a week. Four participants preferred a shorter program (5–8 weeks) but one thought the length could be 6 months. All participants except one felt that the exercise intensity was either good or at the right challenge level. The participant who thought the intensity was too hard had been bedridden for three months before the program. When asked about the format of the program, six participants liked the small group format in a common room as well as the one-on-one format at home, four preferred the small group format, and four preferred the one-on-one format.

When asked about the ADL training in which they practiced activities at home, two participants did not mind doing it but it was not their favorite training component. Four participants did not like it. Their reasons included not wanting to do things at home when they were not ready, felt stressed because of the challenge added on to the task by the trainer, and would like to feel comfortable at home and felt privacy was compromised.

> "Cause it kinda mess my time up when I do something as far as that. I have things to do sometimes." (Participant ID 6)

> "I feel like it was more stressful. She put weights on me, and we went up and down the steps. Now that was a little bit too stressful. Cause I went up and down myself, and then she put the weight jacket on." (Participant ID 11)

> "I like it somewhat, but I don't like it because ya'll making us clean up when we might don't want to, you know. I clean up like when I get ready … You know uhh … and take my time. (Participant ID 16)

> I just think it's entering our private life and I don't like it. I like to workout at my own speed at home. (Participant ID 21)

Eight participants expressed that they liked the training, although one of the participants stated that home is a place for living not for exercise. The training helped him to see what he could do. One participant stated the training gave him insight to understand that doing things at home is a form of exercise. Another participant stated that the training got her cooking again.

> "Yea, I want to move around in my house so I won't get stiff. Now, I can cook my own hotdogs. Yea, now I can cook one whole hotdog, now. Y'all got me cookin' now again. I hadn't did that before. Now I can do it." (Participant ID 14)

> "Like I told, I told Racheal, it gives me an idea. That even though you're sitting around the house and you're not doing anything and you go to do something. You don't think it's exercise. But every time you make a move in here, or if I help her take the trash out or, or whatever I'm going to go get a bottle of milk out of the refrigerator. I never even thought about it, until after they started bringing it up and I was moving stuff back and forth. I thought well, I guess. It gave me a new insight." (Participant ID 20)

Discussion

The study results support the feasibility of 3-Step Workout for Life in community-dwelling older adults who are at risk of ADL disability. Musculoskeletal-related adverse events are commonly reported in progressive resistance training trials among older adults (Liu & Latham, 2010). Our program appears to be safe because the most frequently reported adverse events are mild-to-moderate muscle strain or joint pain and no severe adverse events were identified.

In addition, the attendance rate of the program was high. The exercise delivery mode and format may have contributed to this result. The availability and accessibility of gym facilities are key factors to exercise adherence in older adults (Cohen-Mansfield, Marx, Biddison, & Guralnik, 2004). The current study provided the training program at senior housing communities which did not require travel by participants. Participants only missed sessions when they were sick or had doctor's appointments. Moreover, the program consists of group and one-on-one sessions, which addresses different preferences of group exercise versus individual exercise in older adults. Older adults have reported that they like to exercise with others who are similar in age (Beauchamp, Carron, McCutcheon, & Harper, 2007), while some older adults like individual exercise at home (Mills, Stewart, Sepsis, & King, 1997).

Results of the exit interview reflected both preferences. Participants liked having the opportunity to exercise together with their peers; however, they also liked having the opportunity to work individually with the trainer.

Similar to studies in which progressive resistance strength training is the main intervention component (Liu & Latham, 2009; Raymond, Bramley-Tzerefos, Jeffs, Winter, & Holland, 2013), our study shows significant improvement in physical functioning. The improvement may be associated with better ADL outcome. For example, the improvement on the 30-s chair stand test may relate to the improvement of the basic and advanced lower extremity functioning domains in the Late-Life Function and Disability Instrument. Although the improvements on the Box and Block test were significant (nondominant hand) or approached significance (dominant hand), the result of the upper extremity functioning domain in the Late-Life Function and Disability Instrument did not achieve statistical significance. This finding may suggest that this feasibility study was underpowered.

One significant feature of our study is that the degree of similarity between exercise content and ADL increases as the 3-Step Workout for Life progresses. Functional training incorporates movement patterns that are used to perform ADL tasks. ADL training lets the participants practice the actual ADL tasks as training. The highly significant result in the motor skills of Assessment of Motor and Process Skills supports the idea of combining functional training and ADL training. Prior studies have used similar training approaches and found positive outcomes in ADL measures as well (de Vreede et al., 2005; Dobek et al., 2007; Manini et al., 2007). de Vreede et al. (2005) used moving in a vertical or horizontal direction, carrying an object, and changing between lying–sitting– standing positions as training components. Their training program started with practicing short, simple tasks, and ended with practicing tasks that were similar to ADL. Their participants showed a significant improvement in an ADL performance measure at the end of the training as well as six months after. Manini et al. (2007) used tasks such as stair climbing, vacuuming a carpet with a weighted vacuum cleaner, and lifting and carrying a weighted laundry basket as part of training exercise. Times to perform functional tasks were reduced after the training. Likewise, Dobek et al. (2007) used stair climbing, laundry, grocery shopping, vacuuming, sweeping, and dressing as exercise training tasks. Participants in the study showed significant improvements in self-reported and performance-based ADL measures.

Several researchers have examined the effect of home-based exercise in older adults (Clegg, Barber, Young, Iliffe, & Forster, 2014; Geraedts, Zijlstra, Bulstra, Stevens, & Zijlstra, 2013; Thiebaud, Funk, & Abe, 2014), however, in very few have older adults performed ADL tasks at home as training (Clemson et al., 2012). Type and level of ADL difficulty vary across older adults. In addition, each older adult performs ADL differently depending on the habit and environment. As an alternative to a prescribed set of ADL tasks practiced a fixed number of times in all participants, our ADL training is adaptable to each individual because we use a principle-based approach. Clemson and her colleagues (2012) also used a principle-based approach to embed balance and strength exercise in daily tasks for the purpose of fall prevention. Both Clemson's study and our study found improvement in the function component of the Late-Life Function and Disability Instrument.

ADL disability could occur insidiously in physically frail older adults and force older adults to relinquish daily tasks over time (Gill, Allore, Holford, & Guo, 2004). The exit interview data suggest that our ADL training could help older adults realize what they can do at home and even encourage them to resume daily tasks that they had no longer performed, after physical capacity has accrued from prior training components in the 3-Step Workout for Life program. Although a few participants felt the training was somewhat stressful or their privacy was compromised, over half of the participants liked the ADL training. These negative experiences may be due to having rarely received trainer instruction on how to do daily tasks at home. A clear communication about the purpose and process of ADL training with participants in future trials may help ease these experiences and improve the acceptance of this training component.

Results from the ADL outcomes also demonstrate the specificity of the 3-Step Workout for Life program. The program targets muscle strength and helps older adults integrate improved muscle strength with ADL performance at home. Therefore, it is not expected to show improvement in the disability component of the Late-Life Function and Disability Instrument (Jette et al., 2002) or the process skills of the Assessment of Motor and Process Skills (Fisher & Jones, 2012). The disability component of the Late-Life Function and Disability Instrument includes social and community activities, thus making it less sensitive to change in ADL as a result of the 3-Step Workout for Life program. In addition, the process skills of the Assessment of Motor and Process Skills measure how a person enacts an ADL task by selecting and using appropriate tools and materials, carrying out the actions in appropriate steps and timing, and responding to problems and adjusting the action. These skills are not targeted by the 3-Step Workout for Life program.

Study Limitations

Several study limitations are notable. For example, due to the pilot nature of this project, the sample size was small and the study lacked a control or comparison group. A larger comparative effectiveness study is needed to test whether the 3-Step Workout for Life program is more effective at improving ADL performance than existing exercise programs in community-dwelling older adults. In addition, this study was conducted in the multiunit senior housing communities where a common area was available for the small group format. The small group format may not be feasible for older adults who live in single-family homes. To adapt the program to this population, further testing all the training components in one-on-one format is recommended.

Implications for Practice

It is without question that exercise is beneficial to most older adults. What is still under question, however, is the type of exercise most likely to reduce ADL disability. The training component in the 3-Step Workout for Life program is designed to disrupt the disablement pathway from the ground up by building muscle strength first and then transforming the muscle strength gains to improved ADL performance. The current study demonstrates that 3-Step Workout for Life, which supplements moderate-intensity muscle strength exercise with task-oriented training components, is feasible in community-dwelling older adults who have muscle weakness and experience ADL difficulty. A clear communication about the purpose and process of the ADL training may increase older adults' acceptance of the program.

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References

Bean JF, Vora A, Frontera WR. Benefits of exercise for community-dwelling older adults. Archives of Physical Medicine and Rehabilitation. 2004; 85(7 Suppl 3):S31–S42. DOI: 10.1016/j.apmr.2004.03.010 [PubMed: 15221722]

Beauchamp MR, Carron AV, McCutcheon S, Harper O. Older adults' preferences for exercising alone versus in groups: Considering contextual congruence. Annals of Behavioral Medicine. 2007; 33(2):200–206. DOI: 10.1007/BF02879901 [PubMed: 17447872]

Bohannon RW, Peolsson A, Massy-Westropp N, Desrosiers J, Bear-Lehman J. Reference values for adult grip strength measured with a Jamar dynamometer: A descriptive meta-analysis. Physiotherapy. 2006; 92(1):11–15. DOI: 10.1016/j.physio.2005.05.003

Borg G. Psychophysical scaling with applications in physical work and the perception of exertion. Scandinavian Journal of Work, Environment & Health. 1990; 16(Suppl 1):55–58. DOI: 10.5271/sjweh.1815

Callahan CM, Unverzagt FW, Hui SL, Perkins AJ, Hendrie HC. Six-item screener to identify cognitive impairment among potential subjects for clinical research. Medical Care. 2002; 40(9):771–781. DOI: 10.1097/00005650-200209000-00007 [PubMed: 12218768]

Clegg A, Barber S, Young J, Iliffe S, Forster A. The Home-based Older People's Exercise (HOPE) trial: A pilot randomised controlled trial of a home-based exercise intervention for older people with frailty. Age and Ageing. 2014; 43(5):687–695. DOI: 10.1093/ageing/afu033 [PubMed: 24742587]

Clemson L, Singh MAF, Bundy A, Cumming RG, Manollaras K, O'Loughlin P, Black D. Integration of balance and strength training into daily life activity to reduce rate of falls in older people (the LiFE study): Randomised parallel trial. British Medical Journal. 2012; 345:e4547.doi: 10.1136/bmj.e4547 [PubMed: 22872695]

Cohen-Mansfield J, Marx MS, Biddison JR, Guralnik JM. Socio-environmental exercise preferences among older adults. Preventive Medicine. 2004; 38(6):804–811. DOI: 10.1016/j.ypmed.2004.01.007 [PubMed: 15193902]

da Silva PB, Antunes FN, Graef P, Cechetti F, de Souza Pagnussat A. Strength training associated with task-oriented training to enhance upper-limb motor function in elderly patients with mild impairment after stroke: A randomized controlled trial. American Journal of Physical Medicine & Rehabilitation. 2015; 94(1):11–19. DOI: 10.1097/PHM.0000000000000135 [PubMed: 25122097]

Desrosiers J, Bravo G, Hebert R, Dutil E, Mercier L. Validation of the Box and Block Test as a measure of dexterity of elderly people: Reliability, validity, and norms studies. Archives of Physical Medicine and Rehabilitation. 1994; 75(7):751–755. [PubMed: 8024419]

de Vreede PL, Samson MM, Van Meeteren NL, Duursma SA, Verhaar HJ. Functional-task exercise versus resistance strength exercise to improve daily function in older women: A randomized, controlled trial. Journal of the American Geriatrics Society. 2005; 53(1):2–10. DOI: 10.1111/j.1532-5415.2005.53003.x [PubMed: 15667369]

Dobek JC, White KN, Gunter KB. The effect of a novel ADL-based training program on performance of activities of daily living and physical fitness. Journal of Aging and Physical Activity. 2007; 15(1):13–25. [PubMed: 17387226]

Doble SE, Fisk JD, Lewis N, Rockwood K. Test-retest reliability of the Assessment of Motor and Process Skills in elderly adults. The Occupational Therapy Journal of Research. 1999; 19(3):203–215.

Elsawy B, Higgins KE. Physical activity guidelines for older adults. American Family Physician. 2010; 81(1):55–59. [PubMed: 20052963]

Fisher AG. The assessment of IADL motor skills: An application of many-faceted Rasch analysis. The American Journal of Occupational Therapy. 1993; 47(4):319–329. DOI: 10.5014/ajot.47.4.319 [PubMed: 8322873]

Fisher AG. Multifaceted measurement of daily life task performance: Conceptualizing a test of instrumental ADL and validating the addition of personal ADL tasks. PM & R. 1997; 11:289–304.

Fisher, AG., Jones, KB. Volume 1: Development, Standardization, and Administration Manual. 7th., Revised. Fort Collins, CO: Three Star Press; 2012. Assessment of Motor and Process Skills.

Freedman VA, Martin LG, Schoeni RF. Recent trends in disability and functioning among older adults in the United States: A systematic review. Journal of the American Medical Association. 2002; 288(24):3137–3146. DOI: 10.1001/jama.288.24.3137 [PubMed: 12495394]

Gamble P. Implications and applications of training specificity for coaches and athletes. Strength and Conditioning Journal. 2006; 28(3):54–58. DOI: 10.1519/00126548-200606000-00009

Gaugler JE, Duval S, Anderson KA, Kane RL. Predicting nursing home admission in the U.S.: A meta-analysis. BMC Geriatrics. 2007; 7:13.doi: 10.1186/1471-2318-7-13 [PubMed: 17578574]

Geraedts H, Zijlstra A, Bulstra SK, Stevens M, Zijlstra W. Effects of remote feedback in home-based physical activity interventions for older adults: A systematic review. Patient Education and Counseling. 2013; 91(1):14–24. DOI: 10.1016/j.pec.2012.10.018 [PubMed: 23194823]

Gill TM, Allore H, Holford TR, Guo Z. The development of insidious disability in activities of daily living among community-living older persons. The American Journal of Medicine. 2004; 117(7): 484–491. DOI: 10.1016/j.amjmed.2004.05.018 [PubMed: 15464705]

Gliner JA. Purposeful activity in motor learning theory: An event approach to motor skill acquisition. The American Journal of Occupational Therapy. 1985; 39(1):28–34. DOI: 10.5014/ajot.39.1.28 [PubMed: 3976821]

Guralnik JM, Simonsick EM, Ferrucci L, Glynn RJ, Berkman LF, Blazer DG, et al. Wallace RB. A short physical performance battery assessing lower extremity function: Association with self-reported disability and prediction of mortality and nursing home admission. Journal of Gerontology. 1994; 49(2):M85–M94. DOI: 10.1093/geronj/49.2.M85 [PubMed: 8126356]

Hairi NN, Cumming RG, Naganathan V, Handelsman DJ, Le Couteur DG, Creasey H, et al. Sambrook PN. Loss of muscle strength, mass (sarcopenia), and quality (specific force) and its relationship with functional limitation and physical disability: The Concord Health and Ageing in Men Project. Journal of the American Geriatrics Society. 2010; 58(11):2055–2062. DOI: 10.1111/j. 1532-5415.2010.03145.x [PubMed: 21054284]

Haley SM, Jette AM, Coster WJ, Kooyoomjian JT, Levenson S, Heeren T, Ashba J. Late Life Function and Disability Instrument: II. Development and evaluation of the function component. The Journals of Gerontology Series A, Biological Sciences and Medical Sciences. 2002; 57(4):M217–M222. DOI: 10.1093/gerona/57.4.M217

Hayase D, Mosenteen D, Thimmaiah D, Zemke S, Atler K, Fisher AG. Age-related changes in activities of daily living ability. Australian Occupational Therapy Journal. 2004; 51(4):192–198. DOI: 10.1111/j.1440-1630.2004.00425.x

Hubbard IJ, Parsons MW, Neilson C, Carey LM. Task-specific training: Evidence for and translation to clinical practice. Occupational Therapy International. 2009; 16(3–4):175–189. DOI: 10.1002/oti. 275 [PubMed: 19504501]

Janssen I, Heymsfield SB, Ross R. Low relative skeletal muscle mass (sarcopenia) in older persons is associated with functional impairment and physical disability. Journal of the American Geriatrics Society. 2002; 50(5):889–896. DOI: 10.1046/j.1532-5415.2002.50216.x [PubMed: 12028177]

Jette AM, Haley SM, Coster WJ, Kooyoomjian JT, Levenson S, Heeren T, Ashba J. Late Life Function and Disability Instrument: I. Development and evaluation of the disability component. The Journals of Gerontology Series A, Biological Sciences and Medical Sciences. 2002; 57(4):M209–M216. DOI: 10.1093/gerona/57.4.M209

Jones CJ, Rikli RE, Beam WC. A 30-s chair-stand test as a measure of lower body strength in community-residing older adults. Research Quarterly for Exercise and Sport. 1999; 70(2):113–119. DOI: 10.1080/02701367.1999.10608028 [PubMed: 10380242]

Keysor JJ. Does late-life physical activity or exercise prevent or minimize disablement? A critical review of the scientific evidence. American Journal of Preventive Medicine. 2003; 25(3 Suppl 2): 129–136. DOI: 10.1016/S0749-3797(03)00176-4

Keysor JJ, Jette AM. Have we oversold the benefit of late-life exercise? The Journals of Gerontology Series A, Biological Sciences and Medical Sciences. 2001; 56(7):M412–M423. DOI: 10.1093/gerona/56.7.M412

Krebs DE, Scarborough DM, McGibbon CA. Functional vs. strength training in disabled elderly outpatients. American Journal of Physical Medicine & Rehabilitation. 2007; 86(2):93–103. DOI: 10.1097/PHM.0b013e31802ede64 [PubMed: 17251692]

Liu CJ, Latham NK. Progressive resistance strength training for improving physical function in older adults. Cochrane Database of Systematic Reviews. 2009; 3:CD002759.

Liu CJ, Latham N. Adverse events reported in progressive resistance strength training trials in older adults: 2 sides of a coin. Archives of Physical Medicine and Rehabilitation. 2010; 91(9):1471–1473. DOI: 10.1016/j.apmr.2010.06.001 [PubMed: 20801270]

Liu, Cj, Shiroy, DM., Jones, LY., Clark, DO. Systematic review of functional training on muscle strength, physical functioning, and activities of daily living in older adults. European Review of Aging and Physical Activity. 2014; 11:95–106. DOI: 10.1007/s11556-014-0144-1

Luppa M, Luck T, Weyerer S, König HH, Brähler E, Riedel-Heller SG. Prediction of institutionalization in the elderly. A systematic review. Age and Ageing. 2010; 39(1):31–38. DOI: 10.1093/ageing/afp202 [PubMed: 19934075]

Manini T, Marko M, VanArnam T, Cook S, Fernhall B, Burke J, Ploutz-Snyder L. Efficacy of resistance and task-specific exercise in older adults who modify tasks of everyday life. The Journals of Gerontology Series A, Biological Sciences and Medical Sciences. 2007; 62(2):616–623. DOI: 10.1093/gerona/62.6.616

Martins WR, de Oliveira RJ, Carvalho RS, de Oliveira Damasceno V, da Silva VZ, Silva MS. Elastic resistance training to increase muscle strength in elderly: A systematic review with meta-analysis. Archives of Gerontology and Geriatrics. 2013; 57(1):8–15. DOI: 10.1016/j.archger.2013.03.002 [PubMed: 23562413]

Mills K, Stewart A, Sepsis P, King A. Consideration of older adults' preferences for format of physical activity. Journal of Aging and Physical Activity. 1997; 5(1):50–58.

Peterson MD, Rhea MR, Sen A, Gordon PM. Resistance exercise for muscular strength in older adults: A meta-analysis. Ageing Research Reviews. 2010; 9(3):226–237. DOI: 10.1016/j.arr.2010.03.004 [PubMed: 20385254]

Raymond MJ, Bramley-Tzerefos RE, Jeffs KJ, Winter A, Holland AE. Systematic review of high-intensity progressive resistance strength training of the lower limb compared with other intensities of strength training in older adults. Archives of Physical Medicine and Rehabilitation. 2013; 94(8): 1458–1472. DOI: 10.1016/j.apmr.2013.02.022 [PubMed: 23473702]

Rikli RE, Jones CJ. Development and validation of a functional fitness test for community-residing older adults. Journal of Aging and Physical Activity. 1999; 7:129–161.

Sayers SP, Jette AM, Haley SM, Heeren TC, Guralnik JM, Fielding RA. Validation of the Late-Life Function and Disability Instrument. Journal of the American Geriatrics Society. 2004; 52(9):1554–1559. DOI: 10.1111/j.1532-5415.2004.52422.x [PubMed: 15341561]

Thiebaud RS, Funk MD, Abe T. Home-based resistance training for older adults: A systematic review. Geriatrics & Gerontology International. 2014; 14(4):750–757. DOI: 10.1111/ggi.12326 [PubMed: 25109883]

Verbrugge LM, Jette AM. The disablement process. Social Science & Medicine. 1994; 38(1):1–14. DOI: 10.1016/0277-9536(94)90294-1 [PubMed: 8146699]

Young WB. Transfer of strength and power training to sports performance. International Journal of Sports Physiology and Performance. 2006; 1(2):74–83. [PubMed: 19114741]

Table 1

3-Step Workout for Life: Three Sessions per Week Schedule

	Session 1	Session 2	Session 3
Week 1	M	M	M
Week 2	M	M	M
Week 3	M	M	M
Week 4	M	M	M
Week 5	M	F	F
Week 6	M	F*	A*
Week 7	M	F*	A*
Week 8	M	F*	A*
Week 9	M	F*	A*
Week 10	M	F*	A*

Note. A = activities of daily living training; F = functional training; M = muscle strength training.

*One-on-one home training session.

Table 2

Descriptions of the Six Activities of Daily Living Training Principles used in the 3-Step Workout for Life Program

Training Principle	Description	Example
1. Change of load	Changing of external load: Typically, weight is increased while performing an activity. Weight can be added to participant by wearing a weight or weight can be added to the activity.	Carrying a laundry basket versus wearing a 5-lb-weighted vest and carrying the basket.
		Carrying an empty laundry basket versus carrying a fully loaded laundry basket.
2. Change of movement distance	Increasing or decreasing movement distance to an activity.	Standing up from a tall kitchen chair versus standing up from a low couch.
		Restoring items to a shoulder-high cupboard versus overhead cupboard.
3. Change of movement direction	Practicing activity movements in one direction versus different directions.	Standing up from a chair and then walking straight versus walking to a different room each time.
		Organizing pantry by putting pantry items into different locations on the shelves.
4. Change of movement speed	Slowing down or speeding up while performing the activity.	Using a normal walking speed to carry a daily item across the room versus using a faster or slower speed.
		Standing up from a couch using a faster versus slower speed.
5. Change of endurance	Increasing or decreasing the number of movement repetitions or practice time.	Restoring five plates from a dishwasher to an overhead cupboard versus restoring 10 plates.
		Waking across one room versus walking across two rooms.
6. Change of activity complexity	Practicing a segment of an activity versus the whole activity, or two activities together.	Example of practicing a segment of showering activity: practicing stepping in and out of a bathtub.
		Example of practicing the whole showering activity: stepping into the bathtub, reaching to obtain toiletry, simulate showering movements, stepping out of the bathtub.
		Example of combining two activities. Combining functional mobility and showering: standing up from sofa, retrieving clothing or towel in the bedroom, and then showering.

Table 3

Demographic Information, Attendance Rates, and Adverse Events of Participants.

Total Participants	**Final Participants (*n* = 14)**	**Dropout (*n* = 3)**
Age (*M* ± *SD*)	73.26 ± 6.83	73.41 ± 6.42
Gender (*n*)		
Male	3	0
Female	11	3
Race (*n*)		
White	6	0
Black	8	3
Body mass index (*M* ± *SD*), kg/m^2	34.02 ± 5.84	32.11 ± 4.93
Education (*n*)		
Less than high school	4	1
High school	7	2
More than high school	3	0
Dominant hand (*n*)		
Right	12	2
Left	2	1
Attendance rate[a] (*M* ± *SD*), %	92.38 ± 9.12	42.22 ± 15.03
Adverse events reported[b]		
Muscle strain	12/79	3/20
Joint pain	13/198	3/28
Falls	2/2	0/0
Dizziness	3/10	2/14
Illness	3/3	1/1
Hospitalization	1/1	0/0
Other	10/25	0/0

Note.

[a]Attendance rate = number of sessions attended divided by 30.

[b]Calculated as number of participants/number of events.

Table 4

Descriptive Data of Outcome Measures at Baseline and Posttest

	Baseline				Posttest				
Outcome	***Range***	***Median***	***Mean***	***SD***	***Range***	***Median***	***Mean***	***SD***	**Wilcoxon Signed-Rank Test *z* (*p*)**
Box and Block Test ($n = 14$)									
Dominant hand	22–57	46.50	44.07	10.72	25–55	49.50	48.00	7.24	−1.73 (.08)
Nondominant hand	19–54	43.50	41.64	9.78	24–52	49.00	46.93	6.98	−2.24 (.03)*
30-second chair stand test	0–11	8.50	7.14	3.63	0–12	9.50	7.93	4.01	−2.21 (.03)*
LLFDI: Function ($n = 14$)									
Total	36.51–57.62	49.71	47.49	7.22	34.90–60.33	51.87	50.33	6.50	−2.04 (.04)*
Upper extremity	52.93–100	67.35	68.20	12.82	49.53–100	68.61	71.27	13.19	−0.91 (.36)
Basic lower extremity	37.93–68.64	57.30	54.88	10.38	35.75–74.31	59.66	59.25	9.94	−2.23 (.03)*
Advanced lower extremity	0–50.69	22.89	23.29	16.74	0–51.68	33.12	30.74	14.29	−2.20 (.03)*
LLFDI: Disability ($n = 14$)									
Frequency dimension									
Total	41.99–56.15	46.31	47.79	4.56	32.02–57.04	49.82	48.30	6.33	−0.41 (.68)
Social role	36.03–51.83	43.02	42.64	5.13	34.68–51.83	41.76	42.64	5.02	−0.15 (.88)
Personal role	36.04–73.83	53.99	53.36	10.97	17.07–83.99	61.03	57.84	16.97	−0.98 (.33)
Limitation dimension									
Total	48.55–89.31	58.39	59.72	10.26	45.68–71.33	62.32	60.50	8.08	−0.03 (.98)
Instrumental role	43.38–100	56.27	59.16	13.77	42.25–72.24	58.56	59.16	9.83	−0.53 (.59)
Management role	46.82–100	78.32	76.88	17.37	46.82–100	74.48	75.95	14.29	−0.16 (.88)
AMPS ($n = 13$)									
Motor skills	−0.28 to 2.72	1.05	1.16	0.79	0.76–2.82	2.12	2.03	0.59	−2.97 (.003)**
Process skills	0.86–1.96	1.43	1.41	0.39	0.62–2.21	1.56	1.60	0.41	−1.64 (.10)

Note. AMPS = Assessment of Motor and Process Skills; LLFDI = Late-Life Function and Disability Instrument.

* $p < .05$,

** $p < .01$.