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The Effects of Multidimensional Home-Based Exercise on Functional Performance in Elderly People

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Background. This study tested the hypothesis that a home-based exercise program would improve functional performance in elderly people.

Methods. We conducted a 6-month, single-blinded, randomized controlled trial. 72 community dwelling men and women (aged $\geq$70 years) with self-reported and laboratory-based functional impairment were recruited for the study. Participants were randomly assigned to either a home-based progressive strength, balance, and general physical activity intervention or an attention-control group that received home-based nutrition education. Functional performance was measured in the laboratory using the Physical Performance Test (PPT) and the Established Populations for Epidemiologic Studies of the Elderly (EPESE) short physical performance battery. Physiologic capacity was measured by strength (one repetition maximum), dynamic balance (tandem walk), gait speed (2-meter walk), and cardiovascular endurance (6-minute walk).

Results. 70 participants (97%) completed the 6-month trial. Compliance with study interventions within each group ranged from 75% in controls to 82% in exercisers. PPT increased by 6.1 ± 13.4% in exercisers and decreased by 2.8 ± 13.6% in controls ($p = .02$). EPESE improved by 26.2 ± 37.5% in exercisers and decreased by 1.2 ± 22.1% in controls ($p = .001$). Dynamic balance improved by 33.8 ± 14.4% in exercisers versus 11.5 ± 23.7% in controls ($p = .0002$). There were no differences between groups in the change in strength, gait speed, or cardiovascular endurance.

Conclusions. Minimally supervised exercise is safe and can improve functional performance in elderly individuals. The improvements in functional performance occurred along with improvements in balance but without a significant change in muscle strength or endurance.

DECLINES in physical performance (strength, balance, and mobility), whether from specific diseases, decreased physical activity, poor nutrition, or aging itself are associated with future disability, morbidity, nursing home admissions, and death (1,2). This loss of strength, balance, and mobility is no longer considered an inevitable consequence of aging. Physiological impairments related to functional dependency are potentially reversible with appropriate exercise interventions. Numerous studies have shown dramatic improvements in strength (3–6), balance (5,7), and mobility (4) even into advanced age using targeted exercise programs. Furthermore, strength, balance, and/or endurance training research programs have been especially helpful in improving physical performance and reducing falls (4,7–11).

Most studies to date have focused attention on center-based interventions (3–5,8). There are advantages to center-based interventions because there can be greater supervision and intensity of training—both of which facilitate robust adaptations to exercise in elderly individuals. However, lack of access to transportation and availability of these programs are major barriers to this type of exercise programming for elderly persons. We therefore decided to test the hypothesis that 6 months of home-based progressive strength, balance, and general physical activity training in functionally impaired elderly people would be safe and feasible with minimal supervision and would result in clinically important improvements in functional performance.

Methods

Study Design

The study was a randomized, controlled, 6-month clinical trial. A single assessor (A.N.), who was blinded to participants' group assignment, carried out all baseline and final testing. Testing was conducted at the Jean Mayer USDA Human Nutrition Research Center on Aging at Tufts

University in Boston. Participants were randomly assigned to either group in blocks of four by gender and age (70–79 years/80 years or older).

Participants

Elderly men and women were recruited from the greater Boston area to participate in the study, and gave their written informed consent. The protocol and consent forms were approved by the Tufts University Human Investigation Review Committee. All participants were aged 70 years or older and not currently exercising more than 1 day per week. Participants were recruited by newspaper and radio advertisements as well as community presentations by the first author. Participants were first screened over the telephone to ascertain preliminary eligibility. Participants needed to self-report at least two functional limitations during the telephone screening on the physical function subscale of the Medical Outcome Survey (12). If participants met the entrance criteria, they were asked to visit our Center for a medical history, physical examination, and urine and blood tests. Participants with unstable cardiovascular disease, psychiatric disorders, neurological or muscular disease, terminal illness, or cognitive impairment [<23 on the Folstein Mini-Mental State Examination (13)] were excluded from participation. In addition, participants needed to score 10 or less on the Established Populations for Epidemiologic Studies of the Elderly (EPESE) short physical performance battery (2) to ascertain moderate-to-marked lower body functional impairment. A total of 565 potential participants were screened by telephone. A total of 471 potential participants were not eligible for further consideration; most frequent reasons for not being considered were: did not meet the entrance criteria for self-reported functional impairment, too young, acute medical condition(s), or currently participating in a physical activity program. Ninety-four participants had a physical examination. Seventy-two were randomized to the study. Thirty-four participants were randomized to the exercise group, and 38 participants were randomized to the attention-control group. Reasons for not admitting participants into the study were as follows: 13 participants did not score ≤ 10 on the EPESE and 9 participants had exclusionary medical conditions.

Interventions

Exercise group.—Participants in the exercise group were given a 6-month exercise program that focused on strength and balance training with encouragement to increase overall physical activity. Each participant was given a (25-page) detailed booklet outlining the program, several sets of dumbbells, and a pair of 20-pound adjustable ankle weights (AllPro Equipment Company, Jerico, NY). The ankle weights were adjustable from 1 to 20 pounds, in 1-pound increments. An exercise physiologist (J.E.L.) went to the home of each participant to instruct him or her on how to safely and properly perform the exercises. Six home visits were conducted over the first month, with one home visit each month thereafter. The exercises were as follows:

- *Body weight exercise*—chair stand (3 levels—with use of hands, without use of hands, without use of hands using lower chair)
- *Lower body strength training with ankle weights*—knee extension, standing hip extension, standing hip abduction
- *Upper body strength training with dumbbells*—overhead press, biceps curl, triceps extension
- *Balance training exercises*—circle turns (3 levels—each step 45°, 90°, or 120°), plantar flexion (3 levels—on both feet using hands for support, using little or no hand support, on one foot with little hand support), ankle dorsiflexion, and tandem walk (forward tandem walk with hand support, forward tandem walk without hand support, and backward tandem walk with hand support).

Participants were asked to do the balance and strength exercises 3 times per week. They were instructed to do 2 sets of 8 repetitions for each exercise at a target exertion rate of 7–8 on the 10-point Borg scale (14) with the exception of the circle turns and tandem walk, which were to be done twice during each exercise session. Each week, participants were encouraged to increase the level at which they were working to maintain the proper intensity. Participants were also instructed to obtain 120 minutes of physical activity throughout the week. They were encouraged to walk, garden, do household activities, and any other type of physical activity that they enjoyed. Participants were not given specific instructions to perform this activity at any specific intensity, unlike the strength and balance exercises.

Attention-control group.—Participants in the attention-control group were given 6 months of nutrition education. The goal was to have participants increase the number of servings of fruits, vegetables, and calcium-rich foods in their diet to at least 5 fruits and vegetables and 3 calcium-rich foods (15) each day. Participants were given colorful instruction booklets, recipes, and articles on nutrition to help reinforce their motivation to change behavior. A registered dietitian (M.A.B.) made 2 home visits to each attention-control participant in the first month of study and 1 home visit per month thereafter. Optimally, we would have matched the number of home visits in the first month of the intervention to the exercise group (6); however, budget constraints would not allow for this. Since the primary outcome of the study focused on functional performance and not on self-reported measures, we are confident that this did not affect our results.

During a home visit each month, participants in both groups were asked about any new medical conditions or falls that they might have experienced during the preceding month. To enhance compliance in both groups, participants were asked to fill out their exercise or food log each day and send back the logs each month. Upon receipt of the log, the interventionists sent back a personal letter and a sticker that was to be placed on a small placard that noted each month of study completion. The goal for participants was to have them fill out 6 logs during the course of the study. In addition to home visits and logs, participants were contacted by phone 2 weeks after each monthly home visit to answer questions that they might have and to enhance compliance. At 4 of the home visits (spread out over time without prior knowledge), participants were given a small gift of appreciation for their efforts to provide positive reinforcement of behavior change. Gifts included a hat, t-shirt, refrigerator magnet, pen, and coffee mug.

Participant Characteristics

The study physician, through medical history and physical examination, determined the number of chronic diseases and medications taken by each participant. Body weight was measured in the fasting state, with minimal clothing, to the nearest 0.1 kg with an electronic scale (Seca, Baystate Scale & Systems, Inc., Cambridge, MA). Height was measured without shoes to the nearest 0.5 cm with a wall-mounted standiometer (Seca, Baystate Scale & Systems). Body mass index (BMI) was calculated from weight in kilograms divided by height in meters squared.

Outcome Measurements

All outcome measurements were conducted at baseline (prior to randomization) and at the end of the study period.

Functional Performance Measurements

Physical performance test (PPT).—The PPT is a direct observation measure of 8 different domains of physical function simulating activities of daily living (writing, dressing, eating, climbing stairs, walking, turning, bending, lifting) with a maximum score of 36 (16). A higher score represents better functional performance. The PPT has shown good validity with self-reported measures of physical function and high test–retest reliability with intraclass correlation coefficients (ICC) of 0.87–0.99 (16,17).

Short physical performance battery (EPESE).—Lower extremity function was measured using the EPESE (2). Performance on the 3 tests that make up the EPESE score incorporates strength, balance, power, and mobility skills, and has been shown to be associated with future self-reported disability and institutionalization (1). Each of the 3 performance measurements in the EPESE (timed balance by either side-by-side or tandem stand, speed at which participant completes 5 chair-stands without hands, speed at which participant covers 8 feet at habitual gait speed) has a score of 0–4 with a maximal total score of 12. A higher score represents better functional performance. The EPESE has shown a high test–retest reliability of 0.88–0.92 (ICC) (18).

Physical Performance

Tandem walk.—Dynamic balance was assessed using the timed forward tandem walk test over a 20-foot course. The participant was instructed to place one foot in front of the other making sure that, with each step, the heel of one foot was directly in front of the toes of the other foot. The participant was told to walk forward as fast as possible without falling or making any mistakes. The average time recorded to the nearest 0.1 seconds from 2 trials was used in the analysis. In addition to time, the number of mistakes (misplacement of steps) was also recorded. The reproducibility of this balance measurement in this population is high, with significant correlation between repeat measurements 1 week apart ($r = .94$, $p = .001$) (5).

One-legged stand.—The one-legged stand was used to assess static balance. Participants were asked to stand on one leg for a maximum of 30 seconds. During the test, participants were spotted (but not touched) to minimize risk of falling. The time until the participant needed to touch the examiner, put the other foot down, or move the foot on the floor to maintain balance was used for the measurement.

Maximal gait speed.—Maximal gait speed was assessed over a 2-meter course with an ultrasonic timer (Ultratimer, DCPB Electronics, Glasgow, Scotland). The best of three measurements was used.

Six-minute walk.—Cardiovascular endurance was measured using the 6-minute walk. Participants were asked to walk as fast as possible for 6 minutes with verbal encouragement given every 30 seconds. Distance was recorded by the assessor to the nearest meter by rolling a measuring wheel (Redi Measure, Redington, Windsor, CT) just behind the participant during the test.

Maximal gait speed and the 6-minute walk have high test–retest reliability (ICC) of 0.95–0.97 (19).

Strength

One Repetition Maximum (1RM).—The 1RM was used to measure dynamic muscle strength of the legs, arms, and shoulders using the knee extension, double leg press, chest press, and lat-pull down machines (Keiser Sports Health Equipment, Fresno, CA). To determine the 1RM, incremental loads were added until failure, despite verbal encouragement to exert maximal effort. Failure was defined as a lift short of the full range of motion (determined in the unweighted position) on at least two attempts, 45 seconds apart. The goal was to reach the 1RM in 6 to 12 lifts. Each lift was separated by 45 seconds. The highest successfully lifted load was used as the 1RM. The reproducibility of 1RM measurements is high, with a significant correlation between repeat knee extensor measurements 1 week apart ($r = .88$, $p = .001$) (5).

Hand Grip Strength.—Maximal hand grip strength was determined using a hand grip dynamometer (Takei Scientific Instruments Co., Ltd., Japan). The highest of three measurements of the nondominant side was used.

Self-Reported Measurements

Medical Outcome Survey.—The Medical Outcome Survey Short Form (SF-36) was used to assess a variety of aspects of perceived health status and quality of life (12). The SF-36 measured 8 domains (physical functioning, role physical, bodily pain, general health, vitality, social functioning, role emotion, and mental health), each ranging from 0–100, with higher scores reflecting better quality of

Table 1. Baseline Characteristics by Group

	Attention Control (N = 38)	Exercise (N = 34)
Age (y)	77.8 ± 5.3	77.7 ± 5.3
Female (n)	30	27
Height (cm)	158.9 ± 8.9	159.8 ± 8.2
Weight (kg)	72.4 ± 14.0	72.3 ± 16.4
BMI (kg/cm^2)	28.7 ± 5.4	28.2 ± 5.4
MMSE (0–30)*	28.7 ± 1.1	28.7 ± 1.3
GDS (0–30)†	5.9 ± 4.8	5.0 ± 3.4
Chronic diseases (no.)	3.6 ± 1.5	3.4 ± 1.9
Regular medications (no.)	3.3 ± 2.4	3.2 ± 2.7

Notes: Mean ± standard deviation, unless otherwise noted.

*Normal is ≥24.

†Normal is <9.

BMI = Body Mass Index; MMSE = Mini-Mental State Exam; GDS = Geriatric Depression Scale.

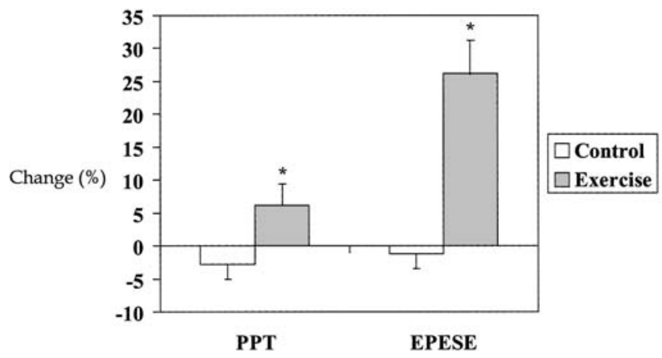

Figure 1. Functional performance changes. PPT = Physical Performance Test (16); EPESE = Established Populations for Epidemiologic Studies of the Elderly short physical performance battery (2). Data are presented as average percent change ± *SE* (standard error). *Refers to the group effect in the analysis of covariance model (p ≤ .05).

life. The questionnaire was interviewer administered. The SF-36 has reported reliability of 0.81–0.88 (12).

Geriatric Depression Scale (GDS).—The GDS is a 30-item yes/no questionnaire with scores ranging from 0–30. This questionnaire has been documented specifically in the assessment of depression in elderly individuals (20). The questionnaire was interviewer administered.

Compliance.—Compliance was measured by monitoring monthly logs returned to the interventionist. Exercise compliance was calculated by dividing the number of exercise sessions the participant reported performing by the number of sessions they were expected to perform throughout the study (3/week × 24 weeks = 72 sessions). Compliance for the attention-control group was calculated as the percentage of servings of fruits, vegetables, and calcium-rich foods reported consumed divided by the number of servings expected for full compliance throughout the study. In both groups, if a log(s) was not returned to the interventionist, the participant was considered noncompliant for that entire time period.

Adverse events.—Adverse events were monitored during the biweekly phone calls that were made throughout the study to each participant in both groups. An adverse event resulting from the intervention was counted if the participant needed to seek medical help for the event or if the event kept the participant from participating in the intervention for any period of time.

Statistical Analysis

All statistical analyses were performed using SAS software release 7 for Windows (SAS, Inc., Cary, NC). Baseline comparisons of the exercise group and the attention-control group were made using Student's t test for independent samples. All collected data from participants who had a final visit (all but 2 participants) were analyzed regardless of compliance to the interventions. Differences in outcomes between the two groups were tested with analysis of covariance adjusting for the corresponding baseline variable measure, age, and gender. Results are expressed as mean ± SD (standard deviation). Significance for all results was set at a $p \leq .05$ level.

Results

Baseline Characteristics

There were no significant differences between groups in any of the baseline characteristics (Table 1).

Adverse Events

Two participants were not able to complete the study; both participants were in the exercise group. One participant died suddenly, unrelated to the exercise, 5 weeks into the study. The other participant dropped out of the exercise group due to personal reasons. There were two adverse events during the study. One participant in the exercise group fell while doing the tandem walk at home, which resulted in bruises to both arms and one knee, and one participant in the attention-control group had an episode of food poisoning. Both participants were able to continue in the study once they recovered.

Compliance and Progression

Participants in the exercise group completed an average of 82% of their prescribed exercise sessions. The strength training portion of the exercise program was progressive. For example, average starting weight for the knee extension was 4.0 ± 2.4 lb and progressed to 9.6 ± 5.0 lb by the end of the study. The weights used for the other 2 leg exercises progressed similarly. Biceps curl progressed from 2.0 ± 2.0 to 7.4 ± 3.8 lb at the end of study. The overhead press and triceps extension progressed similarly. Participants in the attention-control group complied with their nutrition intervention an average of 75% of the time.

Functional Performance

The changes over the 6-month intervention for the two performance-based physical function outcomes are presented in Figure 1. PPT increased by 6.1 ± 13.4% in

Table 2. Physiologic Capacity Measurements

	Attention Control (N = 38)			Exercise (N = 32)			
	Baseline	Final	% Change	Baseline	Final	% Change	p Value
Tandem walk (s)	45.2 ± 15.7	39.0 ± 15.9	–11.5 ± 23.7	47.9 ± 10.6	30.9 ± 7.0	–33.8 ± 14.4	.0002
Mistakes (no.)	11.5 ± 5.5	10.9 ± 5.1	11.2 ± 62.6	12.2 ± 5.4	8.5 ± 4.9	–18.2 ± 58.2	.02
One-legged stand (s)	15.6 ± 11.4	12.1 ± 10.2	–3.5 ± 12.6	8.5 ± 8.7	15.7 ± 11.1	7.2 ± 8.1	.007
Maximal gait (m/s)	1.5 ± 0.4	1.6 ± 0.4	1.9 ± 13.5	1.7 ± 0.7	1.5 ± 0.5	–3.9 ± 15.4	.08
Six-minute walk (ft)	1268 ± 354	1307 ± 364	4 ± 13	1227 ± 348	1324 ± 351	10 ± 15	.15
Hand grip (kg/f)	20.6 ± 8.2	20.5 ± 8.2	0.0 ± 11.2	21.8 ± 6.3	22.4 ± 7.5	2.2 ± 9.3	.10
Knee extension 1RM (kg)	17.0 ± 6.7	18.7 ± 7.3	17.1 ± 46.5	17.1 ± 6.2	20.2 ± 7.4	26.3 ± 36.0	.18
Chest press 1RM (kg)	16.5 ± 5.1	16.9 ± 4.2	11.6 ± 44.3	16.5 ± 4.4	17.8 ± 5.1	15.7 ± 33.7	.13
Lat-pull down 1RM (kg)	13.8 ± 4.9	13.2 ± 5.1	–2.6 ± 12.7	13.1 ± 3.9	13.5 ± 4.5	2.6 ± 13.4	.09

Notes: Data are presented as mean ± standard deviation. All analyses are adjusted for baseline measurement, age, and gender.
p values refer to the group effect in the analysis of covariance model.
1RM = one repetition maximum.

exercisers and decreased by 2.8 ± 13.6% in controls (p = .02). EPESE improved by 26.2 ± 37.5% in exercisers and decreased by 1.2 ± 22.1% in controls (p = .001).

Physiological Capacity

Physiological capacity measurements between groups over time are presented in Table 2. The exercise group improved compared with the control group in tandem walk scores and one-legged stand (p = .0002–0.007). There was a trend for the exercise group to improve in maximal gait speed as well (p = .08). Cardiovascular endurance (6-minute walk) did not change. Although physiological capacity tended to improve in the exercisers, there was no significant group by time interaction on any measure of strength.

Self-Reported Measurements

There were no differences between groups for self-reported health status and quality of life (SF-36) or depression (GDS), and therefore data are not shown. The values for the SF-36 measurement domains ranged from 55 to 87 for both groups; GDS scores were on average <9.

Discussion

This study demonstrates that a 6-month, home-based exercise program consisting of progressive strength training, balance exercises, and general physical activity improves functional performance and balance in functionally impaired elders. There were, however, few significant changes in other intermediary measures of physiologic capacity and self-reported quality of life.

The improvements we saw in functional performance were robust. We saw a 1.4-point increase in the EPESE score in the exercise group compared to a 1.2-point reduction in the attention-control group. In the range of 6–10 on the scale, a 1-point increase in EPESE score is related to an approximate 10% reduction in disability over a 4-year period (1). The improvements seen in the PPT add confirmation that the exercise group improved in functional performance. Improved balance and coordination are the most likely contributors to the overall improvement seen in the exercise group.

Numerous laboratory and center-based strength training studies in frail or near-frail elders have shown improvements in strength (4,6,8,21,22), gait speed (4,23), stair-climbing ability (4), and falls reduction (7,8). The study by Judge and colleagues also included balance training (23). These studies demonstrate that laboratory-based or center-based strength and/or balance training can improve strength, mobility, and reduce falls.

Developing safe and effective, home-based multidimensional training programs for functionally impaired elderly individuals is essential if we are to positively impact the health of the fastest growing population in the United States today. However, few studies have evaluated the benefits of such programs to determine their effect on functional performance in this population. Functionally impaired elderly people have difficulty with transportation, which can become a limiting factor in exercise participation. To date, there are very few home-based strength training studies in adults aged older than 70 years. Two studies were chosen for comparison due to their similarity in study population (7,24). In the study of Chandler and colleagues (24), 100 functionally impaired men and women (average age 77.6 ± 7.6 years) were randomized into either a strength training group or a control group for 10 weeks. The exercises were progressive and used exercise bands and/or body weight for resistance. Each exercise session (3×/week) was supervised by a physical therapist. They saw 10%–16% increases in muscle strength in the exercise group with no changes in strength in the control group. Change in strength was related to improvements in mobility skills, gait velocity, and improvement in falls self-efficacy. In a study by Campbell and colleagues (7), 233 functionally impaired women aged 80 years or older were randomized to either a home-based strength and balance training program or a usual-care group. Participants in the exercise group received only 4 home visits and these were during the first month. They were asked to complete the exercise program 3 times per week and were also encouraged to walk outside the home 3 days per week. The active intervention lasted for 6 months, and there was a 1-year follow-up. Balance improved in the exercise group, and there were modest improvements in chair-stand times. Strength did not change in the exercise or the usual-care group, although the number of total falls and injurious falls were reduced during the follow-up period in the exercise group compared with the control group.

Our results demonstrated similar increases to those of Chandler and colleagues in several of our muscle strength measurements; however, in our study, the changes in strength were not significantly different from the attention-control group. One explanation for this difference may have been that the Chandler and colleagues study did not have an active attention-control group. Another explanation is that the Chandler and colleagues study had a physical therapist supervise each exercise session. In both the Campbell and colleagues study and our study, almost all exercise sessions were unsupervised. Without supervision, the functional impairment of the participants in both studies may have made it difficult for the participants to progress as rapidly. Our participants were reluctant to progress (lift more weight) on their own unless they were instructed to do so in person at the time of the home visits. This behavior meant that they most likely were not exercising at the prescribed intensity (7–8 on the 10-point scale). Neither the Campbell and colleagues study nor our study found significant changes in muscle strength. It should also be noted that two of the muscles groups tested with the equipment for the 1RM testing (lat-pulldown and chest press) in our study were not the muscle groups necessarily trained—this partially explains the lack of improvements in strength. A recent study in our laboratory on participants with osteoarthritis of the knee by Baker and colleagues (25) did see significant increases in muscle strength with a home-based program. During this study, there were several more home visits, and only lower body resistance training was performed; in addition, the participants were, on average, 15 years younger.

Based on the results from our study as well as those of Campbell and colleagues, it does appear that balance training with limited supervision is feasible in functionally impaired elderly people and has a powerful effect on balance, functional performance, and, as was shown in the Campbell study, a reduction in falls. In addition, one other study (9) included resistance, balance, and flexibility training as part of a multitreatment falls prevention program and saw reductions in falls. Therefore, it seems that improvements in balance—not strength—may be the primary etiologic factor for the improvements seen in these studies, and balance training appears to be an integral part of fall prevention.

Several important questions are raised by this study. Is it possible to significantly improve muscle strength and cardiovascular endurance in near-frail elderly people with minimal supervision? Second, is it important to improve physiologic capacity in order to preserve functional performance and, ultimately, to reduce disability? Our recent experience in the Baker and colleagues study (25) suggests that, with slightly more supervision, older adults can improve strength in a home-based setting. Only additional research with frail elderly individuals will help answer this question. The present study and the study by Campbell and colleagues suggest that meaningful improvements in functional performance (and falls in the case of the latter study) can occur without increases in strength or cardiovascular endurance. These findings challenge the linear model of disability (26). Future research must focus on determining the physiologic, psychosocial, and behavioral factors that ultimately contribute to disability and overall quality of life in elderly people. In addition, it would be prudent to investigate combining center-based and home-based interventions to increase supervision and progression. This combination of higher supervision in the initial stage of the exercise program may help to further individualize the program to target individuals' specific physical deficits and needs. Finally, with less than 6% (27) of elderly persons participating in any type of resistance training in the United States and even fewer doing balance training, more research on how best to implement these programs in home and community-based settings needs to be conducted.

One other aspect of the study merits mentioning. The active attention-control group allowed us to test the hypothesis that the exercise itself—not the physical and emotional contact of home visits or asking the participants to change health habits in a positive manner—is responsible for the changes in functional performance. We had specific behavioral health goals for the attention-control group also (15). Therefore, both groups were being asked to change their behaviors to improve health.

Summary

A home-based, multidimensional exercise program in community-dwelling elders with functional impairment is feasible and effective in improving functional performance, despite limited supervision. Home-based exercise programs that focus on strength and balance training improve functional performance in elderly people and should be promoted by the allied health community.

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