Fitness; Older Adults

Comparison of the Effects of a Home-Based and Group-Based Resistance Training Program on Functional Ability in Older Adults

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Abstract

Purpose. *To compare the effectiveness of home- and group-based, progressive resistance training programs and a group walking program in improving functional performance in older adults.*

Design. *A quasi-experimental trial, in which retirement villages were assigned to one of three groups: home-based resistance training, group-based resistance training, and group-based walking.*

Subjects. *One hundred sixty-seven retirement village residents aged 65 to 96 years.*

Intervention. *Nine resistance training exercises, using graded exercise bands and body weight, two balance exercises, and 10 stretches. Home-based participants were given an exercise booklet, 8 hours of instruction, and telephone support. Instructors supervised the group-based resistance training and walking programs. Each group exercised twice weekly for 20 weeks.*

Measures. *Functional performance (strength, aerobic endurance, flexibility, and agility/dynamic balance) was assessed using the Senior Fitness Test.*

Analysis. *Intervention effects were evaluated using mixed-model, repeated measures analysis of variance.*

Results. *Significant between-group differences were observed only for the lower-body flexibility test. Group resistance training participants improved, but home resistance training and walking participants did not. However, strength, lower-body flexibility, and agility/dynamic balance improved in the group-based resistance training participants, and strength and upper-body flexibility improved in the home-based participants. No improvements were observed in the walking group.*

Conclusion. *Findings support the implementation of both home- and group-based resistance training programs in retirement villages. Encouraging residents to adopt and maintain a resistance training program remains a research priority. (Am J Health Promot 2008;23[1]:13–17.)*

Key Words: Aged, Resistance Training, Intervention, Exercise. Manuscript format: research; Research purpose: program evaluation; Study design: cluster-randomized trial; Outcome measure: functional ability; Setting: retirement villages; Health focus: fitness/physical function; Strategy: skill building; Target population age: seniors; Target population circumstances: independent-living/retirement village residents; geographic location

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This manuscript was received March 1, 2007; revisions were requested April 19 and August 3, 2007; the manuscript was accepted for publication August 9, 2007.

0890-1171/08/$5.00 + 0

PURPOSE

In older adults, maintaining muscular strength is critical for preserving physical function, preventing chronic disease, and performing activities of daily living.[1] A recent systematic review has shown that older adults can increase their strength and functional abilities through progressive resistance training.[2] Most studies reviewed, however, were conducted in highly controlled and closely supervised settings, using specialized equipment and high-intensity resistance training programs (typically 80% of a one-repetition maximum).

Many older people may be unwilling or unable to participate in these programs because of real or perceived barriers, including poor health, fear of injury, and transportation problems. To address this issue, recent resistance training research studies have been conducted, with some success, in real world settings, including people's homes[3] and other informal community facilities, without expensive equipment.[2,4,5]

Although an individual, home-based, aerobic endurance program was as effective as a group-based program in improving older adults' cardiovascular fitness,[6] no research study to date has directly compared home- and group-based programs for improving older adults' functional abilities. The aim of this study was to evaluate and compare the effectiveness of the same resistance training program, delivered in either a home- or group-based format, for improving the functional performance of independently living, older adults.

METHODS

Design

This was a quasi-experimental trial conducted in nine retirement villages, which were selected based on size and geographic location and were assigned to one of two intervention groups or to a comparison walking group. Assignment was random, except that one village was precluded from the group program assignment because it did not have a hall in which to conduct the program. An overview of the study design is shown in Figure 1.

Sample

Face-to-face meetings were used to recruit participants at each site. Residents who agreed to participate provided written informed consent. One hundred sixty-seven older adults (132 women and 35 men) aged 65 to 96 years (mean = 78.8 years, standard deviation [SD] = 6.4), enrolled in the study (32% of residents contacted; Figure 1). Consenting participants underwent a health screening interview, and the study protocol was approved by the Research Ethics Committee at The University of Queensland.

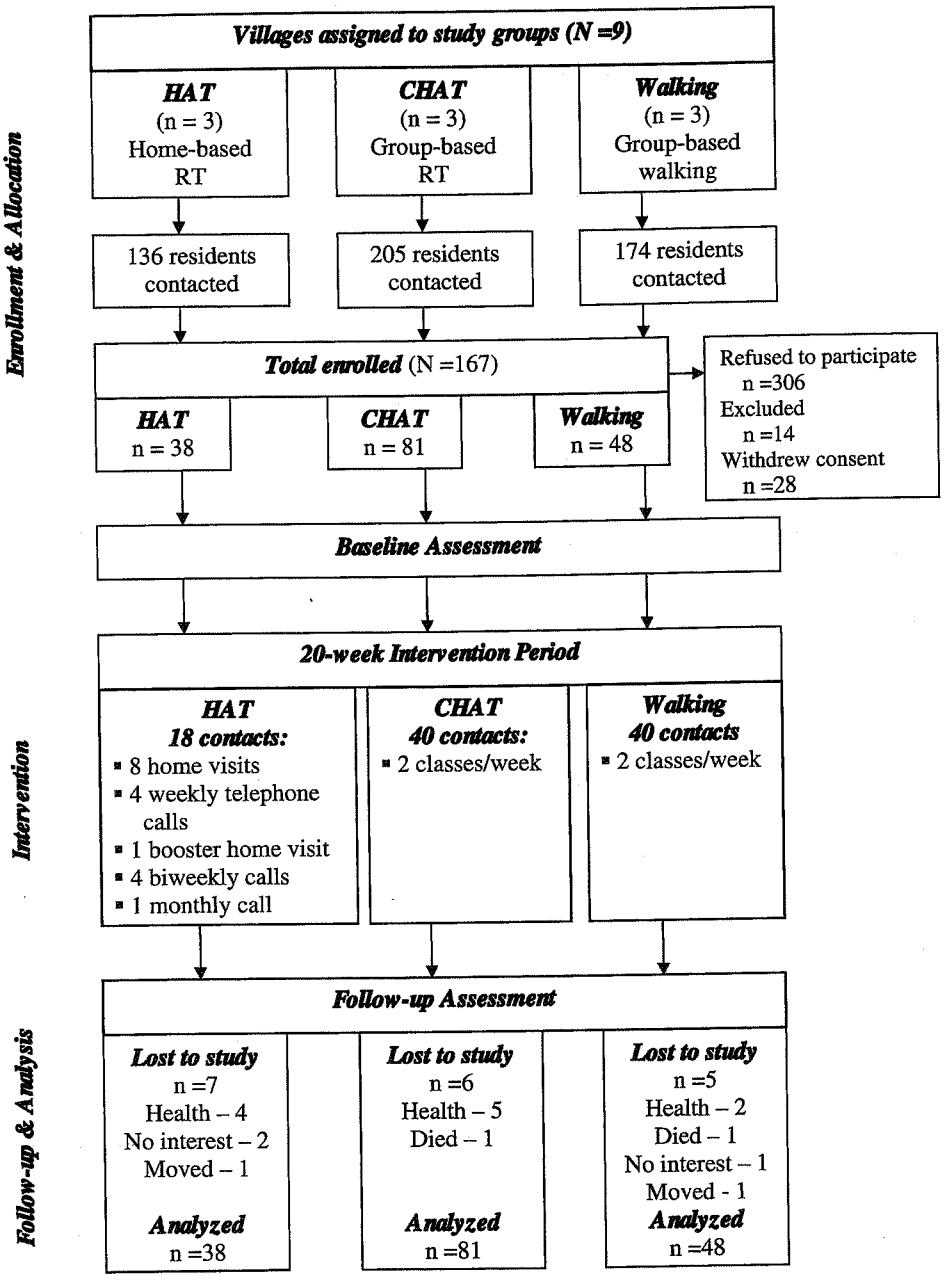
Measures

Testing sessions were conducted in the retirement villages at baseline and at 20 weeks, using trained assessors who were blinded to site allocation. Standard demographic and health-related data were collected using a self-administered questionnaire. The Senior Fitness Test was used to measure functional ability,[7] according to standard protocols. It has been shown to be a reliable[8] and valid[9] battery of tests. The tests are a 30-second chair-stand test (lower-body strength); a 30-second arm-curl test (upper-body strength); a chair sit-and-reach test (lower-body flexibility); a back-scratch test (upper-body flexibility); and an 8-foot, up-and-go test (agility/dynamic balance).[7] Because of space limitations, the 2-minute step test was conducted, instead of the 6-minute walk test, to assess aerobic endurance.

Interventions

All participants were asked to complete two exercise sessions per week during the 20-week intervention. The resistance training program included

Figure 1
Study Design and Flow of Participants Through the Trial HAT indicates Have-A-Try; CHAT, Come-Have-A-Try; RT, resistance training



a 5-minute circulatory warm-up, nine progressive resistance training exercises, two balance exercises, and a 10-minute stretching/cool-down period. Graded exercise bands (North Coast Medical Inc, Morgan Hills, CA, USA) and body weight were used for resistance. Participants started with two sets of five repetitions for each exercise and were instructed to progress to two sets of 15 repetitions.

Participants in the home-based, Have-A-Try program received 8 hours of one-on-one instruction during the first month and an exercise booklet comprising photographs and descriptions of each exercise. Participants were asked to record the number of

sets and repetitions for each exercise session they completed and the level of resistance used (where applicable) in a log book. After the first month, instructors provided telephone support to answer questions, to encourage progression, and to remind participants to complete their log books (Figure 1). The content of the telephone calls, based on social cognitive theory, was adapted with permission from King et al.[10] The group-based, Come-Have-A-Try program was conducted in a common room within each village and was supervised by trained instructors. Come-Have-A-Try participants completed a log sheet after each class.

The attention-control comparison group was a supervised, group walking program, which provided the opportunity to examine the impact of the presence of a leader on outcome measures. Walk durations progressed to 30 minutes at self-selected paces. Stretches were performed indoors after walking. For both the Come-Have-A-Try group and the walking group, adherence data were obtained from attendance records kept by instructors.

Analysis

Data were analyzed using SAS, version 9.1 (SAS Institute Inc, Cary, NC) and SPSS, version 13.0 (SPSS Inc, Chicago, IL). Significance was set at $p < 0.05$. Intervention effects were evaluated using mixed-model, repeated measures analysis of variance (SAS PROC Mixed), which controlled for clustering of participants within villages. Square root and inverse transformations were used to normalize the back-scratch and the up-and-go test scores. All data were analyzed by intention-to-treat methods, and baseline scores were substituted for missing follow-up data.

RESULTS

Most participants were women (80%), were Caucasian (98%), and did not have a postsecondary education (76%). Almost 70% reported taking three or more prescribed medications. Arthritis (54%), hypertension (45%), and hypercholesterolemia (36%) were the most commonly reported health problems. At baseline, there were significant group differences in age ($F^{2,164} = 4.06$; $p = 0.019$), number of chronic medical conditions ($F^{2,164} = 3.48$; $p = 0.033$), and marital status ($\chi^2 = 10.31$; $df = 2$; $p = 0.006$). Therefore, these variables were included as individual-level covariates in the mixed models.

Eighteen participants (11%) were lost to follow-up (Figure 1): seven Have-A-Try group, six Come-Have-A-Try group, and five walking participants, representing 18%, 6%, and 10%, respectively, of the total number of participants in each group. Participants withdrew from the study primarily because of health problems. There were no statistically significant differences in baseline demographics or in Senior Fitness Test scores between those who remained in the study and those who withdrew. On average, the Have-A-Try and Come-Have-A-Try participants completed or attended almost two-thirds of the 40 prescribed sessions (63%; SD = 33% and 66%; SD = 28%, respectively), whereas the walking-group participants attended slightly more than half of the scheduled sessions (53%; SD = 31%).

Two adverse events occurred during the study. One person in the comparison group fell while walking; after a brief absence, she was able to resume the program. One Come-Have-A-Try participant stopped doing the arm-curl and side leg-lift exercises because of joint pain but was able to perform the other exercises.

There were no significant differences in baseline Senior Fitness Test scores across the three groups (Table 1). After adjusting for age, marital status, and number of health conditions, significant improvements over time were found for the Come-Have-A-Try group in four tests: chair-stand ($F^{1,6} = 22.06$; $p < 0.01$), arm-curl ($F^{1,6} = 27.64$; $p < 0.01$), sit-and-reach ($F^{1,6} = 11.74$; $p < 0.05$), and up-and-go ($F^{1,6} = 23.75$; $p < 0.01$). In contrast, the Have-A-Try participants improved in three tests: chair-stand ($F^{1,6} = 6.68$; $p < 0.05$), arm-curl ($F^{1,6} = 12.52$; $p = 0.01$), and back-scratch ($F^{1,6} = 6.35$; $p < 0.05$). No significant pre- to post-activity improvements were observed in the walking group.

The only Senior Fitness Test component that showed a significant group-by-time interaction was the sit-and-reach test ($F^{2,6} = 12.02$; $p < 0.01$). Among the Come-Have-A-Try participants, lower-body flexibility increased by 3.0 cm, whereas there was no significant change among the Have-A-Try participants (Come-Have-A-Try vs. Have-A-Try $t = 2.44$; $df = 6$; $p = 0.05$), and there was a significant decline (of 3.8 cm) among the walking-group participants (Come-Have-A-Try vs. walking $t = -4.85$; $p < 0.01$).

DISCUSSION

Summary

The results showed that the resistance training programs performed either at home or in groups improved several functional measures in this group of older people. The home- and group-based resistance training participants showed significant gains in three and four Senior Fitness Test components, respectively, whereas those who walked did not improve. However, the only significant difference observed among the three groups was for the sit-and-reach test, in which the group resistance training participants improved but the others did not. Although the presence of an instructor may have ensured that the stretches were held for the required 30 seconds in the Come-Have-A-Try groups, the unsupervised, Have-A-Try participants may not have held the stretches for long enough to improve their flexibility or may have completed the stretches inconsistently. Because the walking groups had instructors, the significant decline in lower-body flexibility is not easily explained by a lack of supervision during the stretching period. However, because it was impossible to avoid hills on the routes, perhaps the stretching performed during the cool-down period was insufficient to counteract the effect of the uphill and downhill walking on the hamstring muscles. Compounding this issue is the possibility that some participants may have left the class early after returning from the walk and missed the stretching exercises altogether.

To our knowledge, the Senior Fitness Test has been used as an outcome measure in only three other published papers; all involved group-based resistance training programs.[4,5,8] Compared with the present study, smaller

Table 1

Mean (SE) and 95% CI for Baseline and Follow-Up Scores for the SFT for Each Study Group†

Variable‡	HAT (n = 38)		CHAT (n = 81)		Walking (n = 48)	
	Baseline	Follow-up	Baseline	Follow-up	Baseline	Follow-up
Chair stand Mean reps (SE)	7.0 (0.8)	8.4 (0.8)*	8.2 (0.6)	9.9 (0.6)*	6.9 (0.7)	7.8 (0.7)
95% CI	5.0–8.9	6.4–10.3	6.8–9.6	8.5–11.3	5.1–8.7	6.1–9.6
Arm curl Mean reps (SE)	10.6 (0.9)	13.7 (0.9)*	11.1 (0.6)	14.4 (0.6)*	9.7 (0.8)	11.4 (0.8)
95% CI	8.5–12.7	11.6–15.9	9.6–12.6	12.9–15.9	7.8–11.6	9.6–13.3
2-min step test§ Mean steps (SE)	64.6 (7.2)	61.3 (7.2)	60.2 (6.0)	65.3 (6.0)	56.3 (6.4)	60.8 (6.4)
95% CI	47.0–82.2	43.7–78.9	45.4–75.1	50.4–80.1	40.4–72.1	45.0–76.6
Sit-and-reach Mean cm (SE)	−6.3 (1.7)	−6.9 (1.7)	−5.8 (1.2)	−2.8 (1.2)*,**,***	−5.1 (1.5)	−8.9 (1.5)*
95% CI	−10.6– −2.1	−11.3– −2.7	−8.9– −2.8	−5.8–0.2	−8.9–1.3	−12.7– −5.1
Back scratch‖ Mean cm (SE)	−7.7 (2.1)	−5.8 (2.1)*	−8.3 (1.5)	−8.3 (1.5)	−11.1 (1.8)	−10.3 (1.8)
95% CI	−13.0– −2.5	−11.0– −0.5	−12– −4.6	−12.0– −4.6	−15.6– −6.7	−14.8–−5.8
Up-and-go¶ Mean s (SE)	8.7 (0.7)	8.1 (0.7)	8.4 (0.5)	7.8 (0.5)*	8.7 (0.6)	8.3 (0.6)
95% CI	7.0–10.3	6.4–9.7	7.2–9.5	6.6–8.9	7.2–10.2	6.9–9.8

† SE indicates standard error; CI, confidence interval; SFT, Senior Fitness Test; HAT, Have-A-Try; CHAT, Come-Have-A-Try; reps, repetitions.
‡ Variables adjusted for age, marital status, and number of health conditions.
§ Missing n = 2 for CHAT.
‖ Missing n = 4 for HAT and n = 3 for CHAT.
¶ A faster time indicates better agility.
* Significant difference compared with baseline, $p < 0.05$.
** Significantly different change from pre- to post-intervention compared with HAT, $p \leq 0.05$.
*** Significantly different change from pre- to post-intervention compared with walking group, $p < 0.05$.

samples of younger participants (19 to 42 participants, mean age 70–75 years) were recruited for these trials. DiBrezzo et al.[4] and Cavani et al.[8] recruited community-dwelling older adults, whereas Toraman et al.[5] evaluated participants who were retirement village residents. The program offered by DiBrezzo et al.[4] most resembled our resistance training program, because it used dumbbells, elastic bands, and body weight for resistance.

Compared with their nonexercise control groups, Cavani et al.[8] found significant increases in all components of the Senior Fitness Test; Toraman et al.[5] observed significant improvements in strength measures, agility/balance, and endurance (6-minute walk). Both studies used a gym-based program with resistance machines. From pre- to post-intervention (no control/comparison group), DiBrezzo et al.[4] also reported significant increases in chair-stand and arm-curl repetitions and in agility/balance and upper-body flexibility. However, chair-squat and dumbbell biceps-curl exercises, which mimic the Senior Fitness Test measures, were included in two of the programs and may have contributed to the observed increases in strength.[4,5] Although these exercises were not part of the Have-A-Try or Come-Have-A-Try programs, our percentage increases in chair-stand and arm-curl test scores were comparable with values reported in the other three studies (data not shown).[4,5,8]

Limitations

This study did not have a no-intervention control group, because we wanted the comparison program to mirror the group intervention in terms of participants being part of an exercise group with a leader. Participants were asked to complete only two sessions per week for the resistance training programs, because improvements in strength and function have been reported after participating in programs of this frequency[11] and because potential participants had indicated that a requirement to attend three sessions per week would be a deterrent to participation. Given the modest improvements in the Senior Fitness Test measures observed in this study, participants in home- or group-based programs may need to exercise more often to obtain greater benefit.

Significance

Community-dwelling, older women with poor hand-grip and knee-extensor strength report more difficulties completing tasks, such as lifting 10 pounds, walking one-fourth of a mile, walking up 10 steps, and doing heavy housework,[1] so encouraging retirement village residents to adopt and maintain a resistance training program is important. The results of this study suggest that both home and group resistance training programs may be helpful in maintaining strength and functional ability in retirement village residents.

Acknowledgments

This study was supported by the Australian Government, Department of Health and Ageing: Office for an Ageing Australia and by Blue Care, a health- and aged-care organization that operates under the auspices of Uniting Care Queensland. This research was carried out while Dr.

Cyarto was holding an International Postgraduate Research Scholarship at The University of Queensland. The authors wish to thank the individuals who took part in this study.

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