Exercise adherence in the elderly: Experience with abdominal aortic aneurysm simple treatment and prevention

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Poor adherence to health-related behaviors can have serious health consequences. Cardiac rehabilitation has been documented to have physiological and psychosocial benefits; however, optimizing adherence to exercise in patients with cardiovascular disease is a particular challenge. We recently completed a large, 6-year randomized trial of exercise training in elderly patients with abdominal aortic aneurysm (AAA) disease (50-85 years), which provided an opportunity to describe adherence strategies in this unique group of elderly individuals. Patients were randomized to exercise therapy or usual care. Using a case-management approach, a combination of center and home-based training was used during which patients trained for up to 3 years. We observed that overall, 84% of subjects in the exercise group completed ≥1 year in the study, achieving a mean energy expenditure of 1,999 ± 1,030 kcals per week. Subjects in the exercise group were more likely to drop out of the study as compared with usual care, though none of the reasons for dropping out were associated with exercise participation (eg, exercise-related injury). Reasons for withdrawal included orthopedic problems, lost physician coverage, time constraints, and AAA repair. Although the groups were matched for AAA size at baseline, there was a trend for more AAA repairs among usual care subjects versus those in the exercise group (12 [17.6%] vs 5 [6.9%], P *= 0.09). The case-managed approach to optimizing adherence used was reasonably successful in achieving a training response (ie, improvement in exercise capacity) in elderly patients with AAA, a group for whom little is previously known regarding the effects of rehabilitation.* (J Vasc Nurs 2017;35:12-20)

The World Health Organization has defined adherence as the extent to which behavior, taking medication, following a diet, and/or executing lifestyle changes corresponds with recommendations from a health care provider.[1] The medical literature is replete with examples of poor adherence to health-related behaviors, even when nonadherence has serious adverse health consequences.[2–5] In patients with cardiovascular disease, adherence to a prescribed physical activity prescription has long been a challenge to health professionals in the cardiac rehabilitation field, despite the fact that there are widely recognized health outcome benefits associated with participation in cardiac rehabilitation programs.[6,7] For example, it has been reported that as many as half of cardiac rehabilitation participants drop out within a year.[7,8] Other reports suggest that the adherence rate to a cardiac rehabilitation program ranges between 40% and 60%, defined in terms of either attendance to program sessions or compliance with exercise recommendations.[9,10] Long-term adherence to exercise following completion of a cardiac rehabilitation program is particularly poor.

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In addition, despite its demonstrated benefits, cardiac rehabilitation is dramatically underutilized; in a recent meta-analysis, only 14% of eligible patients were referred for cardiac rehabilitation.[10] Studies have indicated that the reasons for underuse of rehabilitation include inadequate insurance coverage, lack of physician referral, and lack of accessibility and transportation.[9,10] In light of these barriers to rehabilitation, creative strategies have been used to increase participation and reduce costs. One option that has been used to lower costs and expand delivery of rehabilitation and secondary prevention is home-based programs.[11] Over the last two decades, home-based programs have become standard in many health care systems in the United States. One of the challenges to implementing home programs is assuring that patients remain motivated and that they achieve an adequate and appropriate training stimulus. Previous studies focusing on adherence have largely been conducted using traditional hospital-based programs, and adherence was largely based on percentage of exercise sessions attended rather than the more important metric, overall energy expenditure. Little is known regarding adherence to home-based exercise programs and the implementation of strategies to encourage compliance with physical activity.

We recently completed a National Heart, Lung, and Blood Institute funded randomized, longitudinal trial to study the

TABLE 1

INCLUSION AND EXCLUSION CRITERIA

Inclusion criteria:
- Male or female patients with small AAA ≤5.0 cm in size
- Aged 50-85 years and ambulatory

Exclusion criteria:
- Inability or unwillingness to complete exercise training for 3 y or a life expectancy of less than 5 y
- Inability to participate in an exercise stress test or inability to exercise consistently because of orthopedic or musculoskeletal problems
- Morbid obesity (body mass index ≥ 39 kg/m^2)
- Weight gain or loss of 20 lb over the past 3 mo
- History of severe liver disease (international normalized ratio >2, serum albumin >3.0 g/dL, jaundice)
- Unstable angina
- Uncontrolled atrial fibrillation, defined as mean 24-h heart rate >85 beats/min, or 24-h maximal ventricular rate >150 beats/min
- Uncontrolled ventricular arrhythmias, defined as recurrent ventricular tachycardia >3 premature ventricular contractions (PVCs) in succession or 24-h PVC count >20%
- Critical aortic stenosis (peak systolic pressure gradient of >50 mm Hg with an aortic valve orifice area of 0.75 cm^2 in an average size adult)
- Class III/IV heart failure and/or ejection fraction <20%
- Active pericarditis or myocarditis
- Any embolism within the past 6 mo
- Thrombophlebitis
- Hospitalized because of an infectious disease within the past 3 mo
- Pulmonary disease with a drop in oxygen saturation with exercise to 90% without oxygen

effects of up to 3 years of exercise training on the progression of small abdominal aortic aneurysm (AAA) disease (termed AAA simple treatment and prevention [AAA STOP]).[12] The structure of the program provided a unique opportunity to assess exercise adherence to a home-based exercise regimen and the effectiveness of surveillance techniques in a population of elderly patients with AAA. These patients are particularly challenging in that they present with multiple cardiovascular risk factors. In addition to the usual major risk markers that underlie this condition, AAA patients tend to be elderly and have numerous comorbidities that would hinder compliance with physical activity (eg, obesity, arthritis, chronic obstructive pulmonary disease, musculoskeletal conditions). This report details our experiences with patient adherence delivering a home-based exercise intervention lasting between 1 and 3 years.

METHODS

Three projects were included in the AAA STOP trial: 1) proteomic analysis of plasma and aortic tissue from AAA patients and age-matched controls, 2) computational analysis of AAA hemodynamics during rest and exercise, and 3) correlation of aortic diameter and AAA risk as a function of lifetime activity, exercise capacity, and exercise therapy to limit early disease progression. The present study focuses on the third component, in which patients underwent exercise training for a period between 1 and 3 years.

Study design, recruitment, and randomization

By study completion in April 2011, 765 small AAA subjects with an abdominal aortic diameter ≥3.0 and < 5.0 cm were recruited from Stanford University Medical Center, the VA Palo Alto Health Care System (PAVAHCS) and Kaiser Permanente of Northern California. Recruitment procedures and all study-related activities were reviewed and approved in advance by institutional review boards at Stanford University (including PAVAHCS) as well as the Kaiser Permanente Division of Research and an independent Data Safety Monitoring Board organized by the National Heart, Lung, and Blood Institute.

Study methods for all participants included extraction of medical history and drug information from medical records, completion of questionnaires regarding lifetime physical activity, and health history; aortic diameter measurement via transabdominal ultrasound; and blood analysis for lipid panels, high-sensitivity C-reactive protein, Lp-PLA2, matrix metalloproteinase-9, fasting insulin and glucose levels (serum), hemoglobin A1C, homocysteine, uric acid, plasma for proteomic profiling, and urine for cotinine testing. Study participation also included one follow-up visit 3 years after completion to repeat a portion of the study protocol.

A subset of 140 AAA participants with aortic diameters between 3.0 and 5.0 cm were recruited for secondary enrollment in a prospective, randomized, controlled longitudinal trial of exercise therapy to suppress small AAA progression, herein referred to as the exercise trial. Group assignment was performed by computer generated random numbers, stratified by age and gender. Participation in the exercise trial was designed to last for up to 3 years, depending on how early in the trial subjects were recruited. Inclusion and exclusion criteria are listed in Table 1. The hypothesized treatment effect was a reduction in the population average AAA growth rate, and improvements in functional capacity after exercise training compared to usual care. Initial aneurysm size was a covariate and check for interaction with the treatment effect, since larger aneurysms grow more rapidly. The primary analysis was intention to treat, including all outcomes according to the randomization; among the secondary analyses were the effects of noncompliance.

Exercise training

Participants in the exercise group were required to commit to a minimum of three hours of aerobic exercise each week and were encouraged to be as active as possible in their daily routines. These recommendations were in accordance with the American College of Sports Medicine guidelines of 30-60 minutes of moderate activity 5-7 days per week. Participants were given the option to have a gym or home-based program or a combination of the two. Exercise modalities included the PAVAHCS rehabilitation facility or local gyms, home exercise equipment, and/or walking programs. Efforts were made to individualize the exercise programs to make them as convenient as possible. Factors considered in determining the type of program appropriate for a given patient included work schedules, availability of facilities, distance patients lived from the training center, and the traffic that they encountered. In spite of distance and traffic, some patients elected to come to the VA gym because of the desire for structure and motivation needed to accomplish their goals.

A gym was available onsite at the PAVAHCS for the participants, but it was not a requirement that exercise was done onsite. Classes were offered three mornings each week. Patients warmed up for 5 minutes, exercised approximately 40 minutes at their target heart rate, performed 10 minutes of strength training, and 5-10 minutes of stretching. Patients would do a variation of the following modalities–treadmill, elliptical, stationary bike, Nustep machine, and seated rowing machine. The gym was staffed by a registered nurse and exercise physiologists.

Participants in the exercise group were initially provided an orientation session regardless of whether they had a gym or home-based exercise program. All patients were provided with an exercise prescription based on the results of a symptom limited exercise treadmill test. The initial exercise prescription was determined using 60%-75% of heart rate reserve. Polar heart rate monitors (Kempele, Finland) were provided to all participants along with educational materials, including a comprehensive exercise guide “Welcome to Your Home-Based Exercise Program” and handouts including information on improving balance, strength, and flexibility. All materials were reviewed with the patient during the orientation session. At this time, the patient did an abbreviated exercise session under supervision during which heart rate and rhythm were monitored by telemetry, and a heart rate monitor was worn. After completion of the exercise session, patients were instructed on the use of a weekly exercise log to record physical activities at home. All patients in the exercise group were given a pedometer as a motivational tool. They were asked to record daily steps throughout their involvement in the study. A case-management approach was used[13] in which subjects were contacted weekly to review activity logs, and a weekly activity recall questionnaire was completed. These weekly interviews served the purposes of recognizing study-related complications, quantifying energy expenditure, and encouraging subjects to comply with exercise prescriptions.

Quantification of energy expenditure

When completing the exercise logs, patients were instructed to be as precise as possible in terms of recording activities performed during awake hours, including the precise activity performed and its duration, and rating of perceived exertion (RPE). RPE is a scale used (ranging from 6 to 20 from least to most tiring) gauge the difficulty of a particular activity for a patient. The activity recall questionnaire included both work and leisure-time activities and was similar to widely used 5-day and 7-day recall tools.[14] The questionnaire was interviewer-administered, while the subjects used their activity logs to assist with recollection. Each activity was ascribed a metabolic equivalent (MET) value in accordance with the American College of Sports Medicine Compendium of Activities.[15] MET per hours were computed (the product of energy cost in METs and duration of activity in minutes), using (1 MET = 1 kcal/kg body weight/h), and energy expenditure was expressed in kcals/week. Tracking activity in kcals/week and MET/hours per week had the added benefit of being able to factor in both time and intensity of exercise.

The activity logs were reviewed by a staff member, and cases were reviewed at staff meetings on a weekly basis to lend creative ideas and support to optimize adherence. A comparatively ambitious goal of 2,000 kcals/week of energy expenditure (approximately 1 hour of moderate activity per day) was recommended. This level was largely intended to be a motivational tool for staff to use when working with patients, although we considered patients to be compliant if they achieved a more realistic 1,000 kcals/week.

Usual care

Subjects randomized to the usual care group received normal clinical follow-up from their physician and underwent the same schedule of evaluations as the exercise group. No contact was made with the usual care subjects between scheduled clinic visits.

Statistics

“Adherence” was defined as the achievement of ≥1,000 kcals/week energy expenditure during the period of time a given patient was enrolled in the study. While this is higher than the amount typically recorded in cardiac rehabilitation programs,[16,17] it is consistent with widely recognized minimal recommendations for physical activity from major health organizations.[18] We included time spent at the rehabilitation center and time set aside during the week specifically for exercise that subjects recorded in their daily logs. Clinical and demographic data between the exercise and usual care groups at baseline were compared using unpaired *t*-tests for continuous data and chi-square tests for categorical data. Descriptive statistics were used to characterize compliance; data are presented as mean ± standard deviation. The proportion of subjects undergoing AAA repair between groups was compared using a chi-square test.

RESULTS

Recruitment

Of the 765 subjects with AAA recruited for the study from the Bay Area, 137 (18%) qualified and agreed to be randomized in the exercise trial. An additional 3 subjects were recruited from a second arm of the study involving exercise tests and abdominal ultrasounds in 388 elderly subjects without known AAA before screening at the PAVAHCS (Figure 1). Seventy-two subjects were randomized to the exercise intervention and 68 to usual care. Clinical and demographic characteristics between groups were similar at baseline, with the exception that the exercise group was heavier (P = 0.002) and had a greater prevalence of diabetes (P = 0.01; Table 2).

Training response

The average duration of participation was 23.4 ± 9.6 months, with 84% of the subjects completing at least one year in the trial. A significant training response was achieved by subjects in the exercise group as reported previously[12]; this included improvements in peak VO_2, VO_2 at the ventilatory threshold, and exercise time. No untoward events occurred during any exercise testing or training procedures. Five subjects in the exercise group (6.9%) and 12 subjects in the usual care group (17.6%) underwent surgical repair of their aneurysms during the course of the study (P = 0.09).

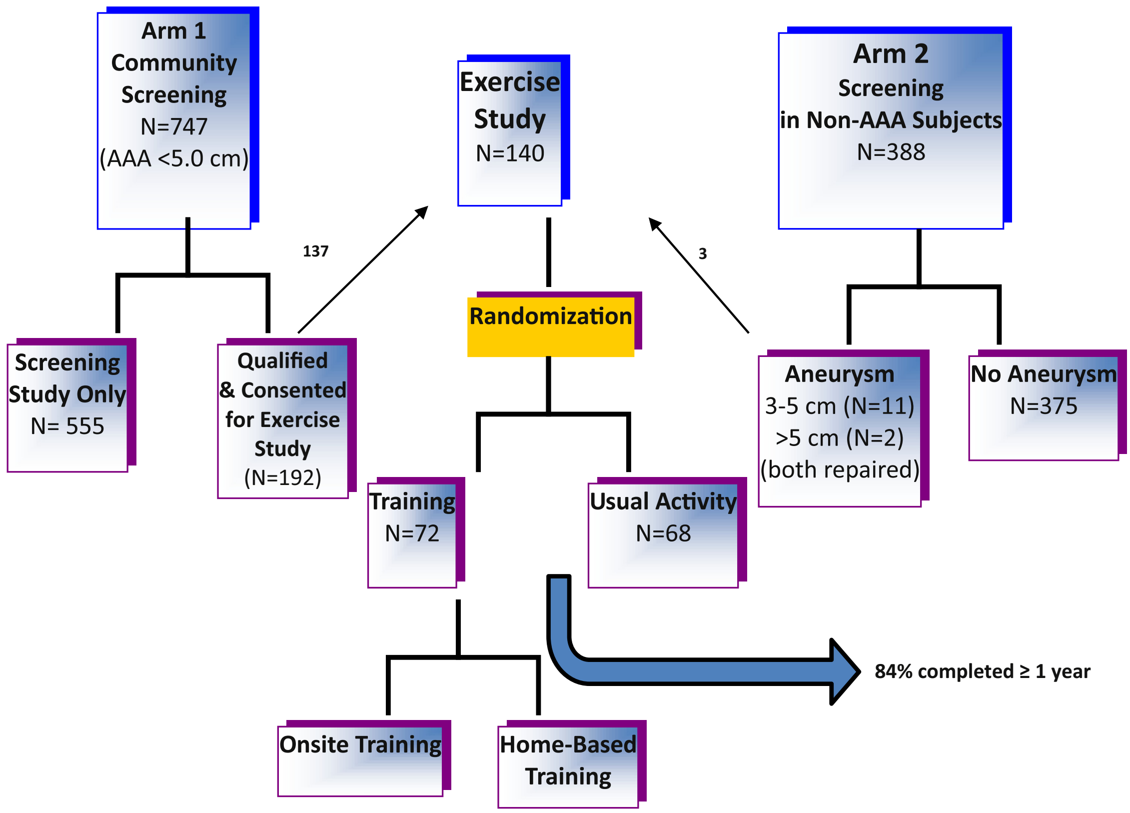

Figure 1. *Study recruitment flowchart.*

Dropouts

Eighty-four percent of subjects in the exercise group completed one year in the study. Duration of participation and reasons for dropping out of the study are summarized in Tables 3 and 4. Notably, 5 subjects (6.9%) in the exercise group dropped out due to time constraints, while no usual care subjects cited time constraints as a reason for discontinuation. There were more comorbidities and orthopedic problems in the exercise group versus usual care, though none of these were associated with exercise participation (eg, exercise-related injury). One patient in each group died due to causes unrelated to the study. Although the groups were matched for AAA size at baseline, there was a trend for more AAA repairs among usual care subjects versus subjects in the exercise group (12 vs 5, $P = 0.09$).

Compliance with energy expenditure

The mean energy expenditure among subjects in the exercise group was 1,999 ± 1,030 kcals/week, corresponding to a mean of 22.9 MET/hours/week (Figure 2). Eighty-five percent of patients achieved ≥1,000 kcals/week (which we considered adherent to exercise); 40% achieved ≥2,000 kcals/week. Heart rate (HR) recordings in the exercise group documented an overall mean training intensity of 98.8 ± 10% expressed as a percentage of target HR, corresponding to a mean RPE of 12.9 ± 1.2. Training intensity did not differ appreciably between participants training at the PAVAHCS (average HR = 96.8 ± 8% of target) versus those primarily training at home (average HR = 100.7 ± 11% of target).

DISCUSSION

Compliance to exercise

The current trial among elderly patients with vascular disease provided a unique opportunity to evaluate adherence to an exercise program involving a combination in-center and home-based exercise lasting between 1 and 3 years. We used a number of strategies that have been shown to be successful for improving compliance in various clinical interventions. These included education, encouragement, self-monitoring, and telephone follow-up. The metric that we used to define compliance to exercise was comparatively high (1,000 kcal/week; about 30 minutes of moderate activity daily). While this was a significantly higher standard relative to the energy expenditure reported by most cardiac rehabilitation programs,[16,17] it corresponds with the recognized minimal activity recommendation for cardiovascular health by national and international organizations.[18] We observed that 84% of participants randomized to an exercise group achieved ≥1,000 kcals/week energy expenditure, with 40% of subjects achieving a considerable ≥2,000 kcals/week. A great deal of effort was devoted to activity surveillance in our study, including case management, weekly phone calls, and logging of activities, heart rate, pedometer steps, and perceived exertion during daily activities. The overall mean energy expenditure among subjects in the exercise group was ≈2,000 kcals/week, an amount that reflects roughly one hour of modest activity per day. This degree of energy expenditure is unique relative to other randomized trials of exercise training in post-myocardial infarction (MI) or heart failure subjects. For example, energy expenditure

TABLE 2

DEMOGRAPHIC AND CLINICAL VARIABLES AT BASELINE IN THE EXERCISE AND USUAL CARE GROUPS

	Exercise (n = 72), n (%)	*Usual care (n = 68), n (%)*	P *value*
Demographics			
Age (y, mean ± SD)	71.8 ± 7	71.3 ± 8	0.74
Gender (% Male)	92	93	0.94
Race (% Caucasian)	85	74	0.09
BMI (kg/m^2, mean ± SD)	29.1 ± 4	27.0 ± 3	0.002
Clinical history			
Coronary artery disease	22	34	0.14
Hypertension (present)	74	76	0.80
Peripheral vascular disease	14	18	0.56
Diabetes	30	12	0.01
Smoking (current)	11	21	0.22
Smoking history	82	79	0.39
Smoking (pack years, mean ± SD)	32.9 ± 28	32.6 ± 30	0.96
Medications			
ACE inhibitors/ARB	12	6	0.15
Beta blockers	42	51	0.28
Statins	83	78	0.32
Calcium channel blockers	18	79	0.92

ACE = angiotensin-converting enzyme; ARB = angiotensin-receptor blocker; BMI = body mass index; SD = standard deviation.
Variables are prevalences (%) unless otherwise noted.

during typical outpatient rehabilitation programs has been reported to be 250-300 kcals/session,[16,17] resulting in a weekly energy expenditure less than the 1,000 kcals/week recommended for favorable changes in cardiovascular health.[18,19] While our estimates are likely higher because we include all recreational energy expenditure reported during a given week, it should also be noted that our data were collected in the context of a research trial, in which we had staff and resources to provide case management and surveillance not available to standard rehabilitation programs in which reimbursement is minimal. Even with these additional resources in our study, keeping patients on track with the intervention was a challenge.

Strategies that have been documented to be helpful for increasing compliance and retention of subjects include written contracts, exercise diaries, telephone contact, use of heart rate monitors, site team meetings, computerized tracking of compliance with rapid feedback, and Principal Investigator (PI) involvement.[7,10,20] Considering previous findings in the literature, we customized our approach to include the following:

- Signed consent forms, including information on expectations from study participants;
- Case management, in which each staff member was responsible for surveillance and optimizing compliance for a subgroup of participants;
- Exercise logs with envelopes to mail them back to staff on a monthly basis. Patients received an additional phone call if the logs were not returned on time;
- Weekly calls. Telephone appointments were made with participants who were difficult to reach. E-mail was also used for those patients who preferred it;
- Heart rate monitors were given to patients at the start of their exercise program, and they were encouraged to use them. Heart rate monitors have been shown to be effective for improving compliance because the patient is more involved in the process;
- Regular staff meetings were conducted to discuss individual cases and brainstorm strategies; monthly adherence reports were reviewed at these meetings;

TABLE 3

DURATION OF PARTICIPATION AND REASONS FOR DROPPING OUT AMONG SUBJECTS IN THE EXERCISE GROUP

	Orthopedic problems	*Medical comorbidities*	*AAA repair*	*Moved*	*Lost physician coverage*	*Time constraints*	*Death*	*Noncompliant*	*Total*
Never started	1	1	1					1	4
<6 mo	2	2	1						5
6-11 mo	2	1		1		2			6
12-17 mo	1	5			1	2	1		10
18-23 mo			2		1	1			4
24-29 mo									
30-36 mo			1						1
Totals	6	9	5	1	2	5	1	1	30

- The PI became involved with subjects having compliance issues; patients were either called or seen at their visit by the PI;
- One staff member was responsible for inputting information from the patient logs, generating reports which were shared at staff meetings.

Other recommended strategies not used due to funding constraints included home visits, booster sessions, newsletters, and financial incentives.

Withdrawals from the study

Over a three-year period of time, patients were placed on hold when medical or personal issues interfered with their ongoing participation. Factors that most significantly impacted participant's ability to adhere to exercise were similar to those that caused patients to drop out of the study. When these situations became protracted, a decision was often made that it was the best for the participant to withdraw. The major reason for withdrawal in the exercise group was medical comorbidities, whereas AAA repair was the most common reason for withdrawal in the usual care group (Tables 3 and 4). Although there was a trend for more AAA repairs among usual care subjects (12 vs 5, $P = 0.09$), this is unlikely due to benefits of exercise training on AAA growth rate, since we previously observed no significant differences between groups in terms of AAA growth.[12]

Overall reasons for withdrawal included (Tables 3 and 4):

- Orthopedic issues, specifically, knee and back, especially those exacerbated by routine activities or specific injuries to tendons and ligaments;

TABLE 4

DURATION OF PARTICIPATION AND REASONS FOR DROPPING OUT AMONG SUBJECTS IN THE USUAL ACTIVITY GROUP

	Orthopedic problems	*Medical comorbidities*	*AAA repair*	*Moved*	*Lost physician coverage*	*Time constraints*	*Death*	*Noncompliant*	*Total*
<6 mo			2					2	4
6-11 mo			2				1		3
12-17 mo			2						2
18-23 mo		1	2						3
24-29 mo			1	1				1	3
30-36 mo			3	1				1	5
Totals		1	12	2			1	4	20

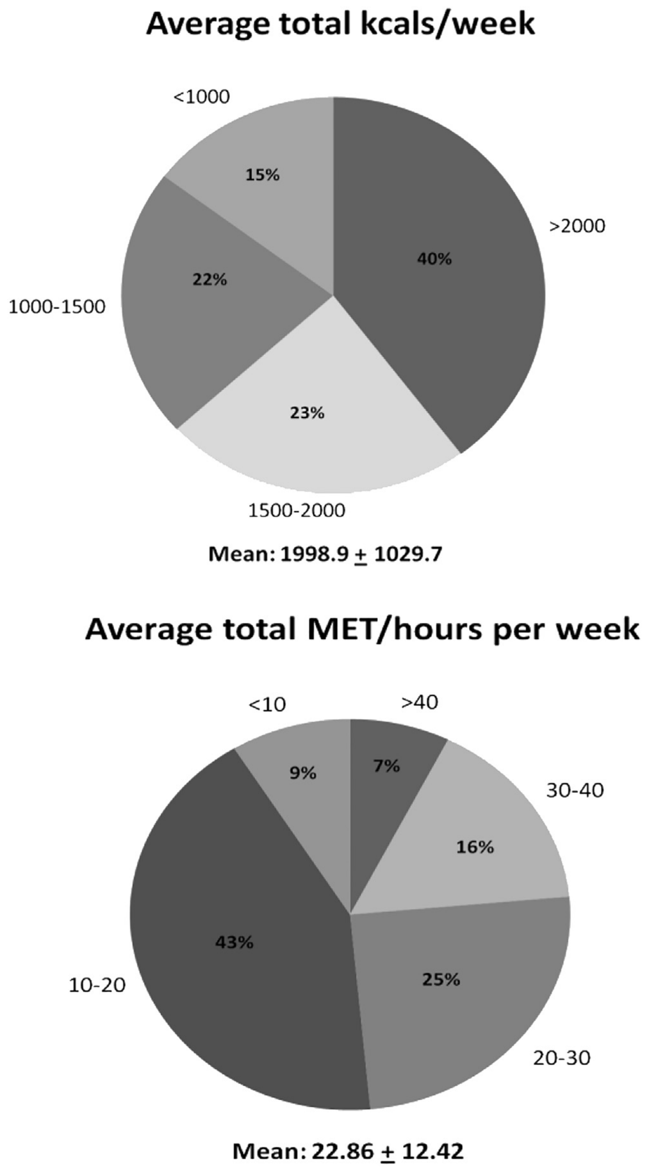

Figure 2. *Mean energy expenditure in the exercise group in kcals and MET/h per week.*

- Medical comorbidities which included worsening of chronic disease states such as coronary artery disease, chronic obstructive pulmonary disease, peripheral vascular disease, stroke, arrhythmias, heart failure, recurrent or newly diagnosed cancer, or gout;
- Surgeries, including knee replacement, back surgery, mastectomy, nephrectomy;
- Family crises, including ill spouse, need for the patient to become primary caregiver, or increased responsibilities at home;
- Unwillingness to continue to put forth the time required to participate;
- Fear of exercise and it's perceived effect on AAA disease;
- Misconceptions regarding the safety or value of increased levels of exercise;
- Chronic fatigue due to comorbidities

Many studies have been performed to examine factors affecting adherence to a prescribed exercise program, and the issues affecting compliance in the AAA STOP trial were typical of these studies. We had the additional obstacle of a population with advanced age (mean 72 years at baseline), contributing to a greater number of issues with compliance and withdrawal for the reasons listed above. The type of exercise regimen and duration of the intervention have been shown to have a considerable effect on patient success; our program duration was between 1 and 3 years, significantly longer than most. Less intense programs for limited amounts of time show higher compliance rates.[10] Common factors affecting compliance include lack of motivation, fatigue, musculoskeletal problems, aging, obesity, and other comorbidities.[7,8,10,20] While these and other factors affect a given patient's ability to comply with an exercise program, other factors affect one's willingness to participate at all. Dunlay et al[21] recently identified clinical and psychosocial factors as barriers to participation and reported that participation was the highest in those patients who felt that rehabilitation was important, were referred to a hospital-based program, or were referred by the hospital cardiologist. A recent Canadian study identified problems with physical health as the most common reason for dropping out of cardiac rehabilitation.[22] High levels of preprogram stress along with a normal exercise test also contributed to low compliance rates.

Referral patterns also influence participation rate and adherence to an exercise program. In an Australian cohort, Scott et al[23] reported that 59% of patients discharged with cardiac diagnoses were eligible to participate but only 29% were referred to an outpatient cardiac rehabilitation program. In addition, less than one-third of referred patients completed the program. In a recent Swedish study, participants were randomized to either intense lifestyle intervention for cardiovascular risk reduction or usual care for a three-year period. Compliance dropped as time passed with attrition greatest in the first year due to ill health, competing work schedules, or relocation. In the exercise group, 70% attended for the first 3 months with 60% completing exercise logs for the first year, 49% for the second year and 31% for the third year.[24] Women are typically underrepresented in cardiac rehabilitation programs, and when women do enroll, attendance is often poor. Their adherence has been shown to be related to educational level, age, sedentary lifestyle, obesity, smoking, anxiety, lack of social support, being unmarried, and transportation barriers.[25–27] Hays et al[26] examined the relationship between exercise self-definition and exercise participation among women. Women who defined themselves as exercisers were more likely to participate than those who did not. This definition can be strengthened over time by exercise behavior and improved self image.

Dolansky et al[27] studied both men and women's adherence to an exercise program after a cardiac event and found that 78% of participants were not adhering to the exercise guidelines of three sessions per week, with age being a critical barrier to adherence. A Belgian study assessed exercise session duration as a factor in adherence and found that there was no association between duration and adherence, while patients with MI and coronary artery bypass graph were more likely to complete the program.[28] The recent heart failure Action Trial demonstrated only 30% adherence to exercise among patients with heart failure despite concentrated efforts and resources directed toward optimizing compliance. While exercise has been demonstrated to be safe for heart failure patients, they exhibit many of the characteristics (chronic disease, age, and comorbidities) which contribute to noncompliance.[29] Corvera-Tindel[30] studied adherence to exercise training in heart failure patients and demonstrated a 67% adherence rate but as comorbid conditions increased and/or heart failure worsened, adherence rates decreased. Our subjects may have been biased toward better adherence in that they were recruited for potential participation in an exercise program and chose to participate knowing they were subjects in a research trial.

Summary

In the present study, we observed that elderly patients with vascular disease were generally compliant with an exercise regimen lasting from 1 to 3 years. An increasing body of knowledge has demonstrated the benefits of exercise training in many disease processes, but both referral to cardiac rehabilitation programs and adherence to exercise remain challenging. As the scientific literature in this area increases, it is critical that we find a way to move from the academic model to the clinical setting. Clinical trials have financial resources to assist patients in being successful, and we observed reasonable success in terms of exercise adherence in the AAA STOP trial. However, these resources are not available to the average practitioner. Even in clinical trials, adherence rates to exercise remain low. Little experience exists in terms of translating research findings into practice due to lack of trained personnel and financial resources.[31] Delivery of the type of intervention in AAA STOP is time intensive and costly and beyond the scope of most primary care practices.

As cost-effective delivery systems in health care continue to evolve, we hope to see administrators focusing on research that demonstrates the use of trained, skilled professionals to assist patients in making behavioral changes which will reduce their risk factors for disease. The Affordable Care Act of 2010 includes federally mandated preventive services for adults that incorporate counseling on health and wellness issues. While the Affordable Care Act faces challenges in terms of how Federal, state and local policy makers allocate new funding, it is hoped that greater resources will be directed toward cardiac rehabilitation.[32] On a global scale, exercise adherence and program success may improve in cardiac patients who have been motivated to change through a health-related event (ie, MI, cardiac-related surgery, and so forth). In a smaller scale setting in terms of small AAA disease, an aerobic exercise program needs to be started at the point when the aneurysm is first discovered. It is the long-term maintenance of exercise that has the potential to favorably influence the outcome of their disease. Chances of success will be much higher if individuals get an earlier start when they are younger and have fewer comorbidities. The exercise program, in itself, will delay the onset of many medical issues that have been shown to interfere with a successful outcome. While it is encouraging to see continued scientific support for exercise rehabilitation, more research efforts should be directed toward effective exercise therapy adherence strategies in patients with multiple comorbidities.

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