Published in final edited form as:
Top Stroke Rehabil. 2008 ; 15(5): 494–502. doi:10.1310/tsr1505-494.

Motivators for Treadmill Exercise After Stroke

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Abstract

Purpose—The purpose of this qualitative study was to explore factors that motivated older adults with ischemic stroke to engage in a task-oriented treadmill aerobic exercise (T-AEX) intervention study.

Method—Participants included community-dwelling individuals post stroke with mild-to-moderate hemiparetic gait deficits who completed a 6-month T-AEX study. A total of 29 participants attended focus groups or individual telephone interviews.

Results—Thirty-nine codes were identified and were reduced to 8 themes: personal goals supported by 7 codes, psychological benefits supported by 8 codes, physical benefits supported by 10 codes, research-associated supervised treadmill exercise benefits supported by 5 codes, objective and verbal encouragement received supported by 4 codes, social support related to exercise supported by 2 codes, improvement in instrumental activities of daily living supported by 2 codes, and self-determination supported by 1 code. All themes reflected factors that influenced subjects' willingness to participate in the study and adhere to the exercise intervention. Of the themes identified, personal goals, physical benefits, and psychological benefits occurred most frequently.

Conclusion—This qualitative study provides information that may be used to enhance motivation to exercise in individuals with stroke and promote carryover and integration of exercise behaviors into everyday life.

Keywords

exercise; recovery; stroke

Many older individuals with stroke struggle with persistent neurological deficits that cause functional limitations in their daily lives.[1–3] Recent research, however, affirms the health-

promoting and risk-reducing benefits of exercise for individuals living with the effects of stroke.[4–6] A meta-analysis[7] of the impact of aerobic exercise post stroke that included nine studies, of which seven were randomized clinical trials, consistently demonstrated that aerobic exercise improved peak VO_2, peak workload, walking velocity, and walking endurance, all enabling daily function and independence. Despite the increasing evidence of the benefits and safety of exercise post stroke, stroke survivors remain sedentary.[8,9]

For these individuals, adherence to exercise regimens that are designed to optimize function and modify risk factor profiles may seem an overwhelming task.[10] Neurological and functional changes, along with age-related declines, can present significant barriers to participation in exercise.[2] Alterations in perception and motivation that result from damage to specific areas of the brain can further compromise the ability of individuals with stroke to perform health-promoting behaviors such as exercise.[10,11] In addition, self-efficacy expectations for physical activity, balance[12] physical function,[12,13] and a history of falls[14,15] were all significantly related to participation in regular exercise post stroke. The purpose of our study was to explore factors that motivated a sample of older adults with stroke to participate in a rigorous 6-month treadmill exercise intervention study.[16]

Prior research has identified many factors that influenced motivation to exercise among older adults. Consistently, among older adults[7–19] self-efficacy and outcome expectations have been positively related to the adoption and maintenance of physical activity[20] and functional recovery following a stroke.[21] Outcome expectations are particularly relevant to older adults. These individuals may have high self-efficacy expectations for exercise, but if they do not believe in the outcomes associated with physical activity, such as improved function, then it is unlikely that there will be adherence to regular physical activity.[20,22] Verbal encouragement, exposure to similar others doing the exercise activity, elimination of unpleasant sensations associated with exercise, and mastering the exercise activity all strengthen self-efficacy and outcome expectations.[12,23,24] Other facilitators of exercise include resilience,[25,26] social support,[27] and sufficient knowledge about what type and amount of exercise in which to participate.[27,28]

Some additional factors associated with motivation to exercise among minority older adults have also been reported. Specifically, African American individuals reported that their age, health status, cultural self-consciousness (i.e., that it was not appropriate for them to exercise), and lack of access to exercise opportunities all influenced their willingness to engage in regular exercise.[18,19] It was also common for minority participants to report a fear of “overdoing” it and exacerbating underlying disease.[18,19]

Little work has been done to identify specific factors that motivate older individuals with stroke to engage in exercise activities. Because the condition of stroke introduces physical, sensory, and perceptual limitations that make exercise difficult, we sought to determine what factors motivated individuals who volunteered to participate in an intensive supervised treadmill rehabilitation exercise study.[16] A better understanding of these motivational factors may be valuable in the design and implementation of future exercise intervention studies and may help to motivate older stroke survivors in the community to initiate and adhere to regular exercise activities and thereby decrease the risk of recurrent stroke.[29]

Design

This was a qualitative study that included community-dwelling individuals post stroke who were over 45 years of age, had mild-to-moderate hemiparetic gait deficits, and completed a 6-month treadmill exercise intervention study conducted at the Claude D. Pepper Older Americans Independence Center at the University of Maryland and Baltimore Veterans

Administration Medical Center (Exercise Training for Hemiparetic Stroke; PI: R. Macko; National Institute on Aging [NIA] grant number 5-P60-AG12583).[16]

Community-dwelling volunteers for the treadmill-aerobic exercise (T-AEX) study responded to radio and newspaper advertisements and had to be at least 6 months post stroke and no longer receiving traditional rehabilitation services. The protocol was reviewed and approved by the University of Maryland Institutional Review Board, and participants provided informed consent prior to engaging in study activities. Participation in the qualitative focus group was included in the consent for the parent study. The volunteers then underwent a medical examination and review of their medical history to make sure they had no contraindications to exercising (Table 1). As part of the medical examination, subjects received a resting EKG, followed by a screening graded treadmill test with measurement of oxygen uptake to exclude those subjects who had asymptomatic exercise-related cardiac ischemia, to calculate baseline fitness levels, and to derive individualized exercise prescriptions.

All participants were at least 6 months post stroke with residual hemiparetic gait deficits. The majority had previously completed traditional rehabilitation therapies, consisting of physical and occupational therapy delivered in inpatient, home, and outpatient settings. Exclusion criteria were defined to protect participant safety and to control for factors besides hemiparetic stroke that might impact cardiovascular, metabolic, and functional outcomes. Participants were excluded from the sample if they had congestive heart failure (New York Heart Association class >II), unstable angina, peripheral arterial occlusive disease (Fontaine class >II), global or major receptive aphasia, screening criteria consistent with dementia (Mini-Mental State Exam <23), current untreated major depression (Center for Epidemiological Studies-Depression scale [CES-D] >16), or other major medical, neurological, orthopedic, or chronic pain conditions precluding participation in study activities. Participants had some preserved capacity for ambulation, most with assistive devices (cane, walker) and/or standby assistance, and could ambulate for a sufficient duration to allow treadmill testing at a speed of at least 0.2 miles per hour (.09 meters per second).

On completion of baseline testing, participants were randomized to either the T-AEX group or an attention-control stretching exercise group. Only participants who completed the T-AEX intervention for 6 months are included in this qualitative study.

Under the supervision of exercise physiologists, T-AEX subjects were expected to engage in three treadmill-training sessions per week. The speed of the treadmill was gradually increased until the subjects achieved a goal of 45 minutes of continuous walking at 60%–70% maximal heart rate reserve. For participants incapable of continuous treadmill walking at the start of the treadmill training program, intermittent exercise bouts were gradually increased to work up to the goal of continuous walking.

On completion of the T-AEX, we invited the 81 participants who completed 6 months of treadmill training to attend one of two focus groups. A focus group approach was selected as it was most likely to help us obtain the full range of ideas or feelings from the stroke patients who participated in the T-AEX.[30] The group interaction provided a forum for the participants to engage in dialogue about their experiences and to confirm or refute the statements of others.

In addition, calls were placed to those individuals who did not participate in the focus group to see if they would be willing to participate in a phone interview. An interview guide (Table 2) that included five open-ended questions was used to explore what helped these individuals participate in the exercise sessions, what were the barriers to participation, and what advice would they give to others regarding participation in a such a program. The focus groups were audiotaped and transcribed verbatim.

Data analysis

Data analysis was done using basic content analysis and inductive category development.[31, 32] An inductive approach formulates a definition for each code using the text, and categories are then deduced. Using a feedback loop as coding proceeds, categories are revised and themes are developed. In addition we used "in vivo" coding,[33] or "grounded" coding,[34] which involves using the informants' own words to capture a particular idea. This type of coding was done to avoid the introduction of preconceived notions.[34] The codes identified were grouped based on similarities and differences. For example, a number of codes arose from the data that focused on physical benefits (e.g., walking better, improved balance, improved endurance) associated with exercise. These were grouped together under the theme of physical benefits.

Coding and development of themes was initially completed by the first authors and then reviewed by four additional nurse researchers who were familiar with the study participants and T-AEX. The five-member research team then met and discussed the codes and themes until consensus was achieved. Coding from the second focus group did not add any new information and thus we believed that saturation had occurred.

Soundness of the qualitative data

As per Lincoln and Guba,[35] we considered the credibility and confirmability of the data refer to the believability, fit, and applicability of the findings to the phenomena under study.[35] Credibility of the data specifically focuses on demonstrating that the data support the study findings. The codes identified, participant data in support of the codes, and the consensus of the five individuals analyzing the data provided evidence of the credibility of the data. Confirmability or auditability of the data refers to the objectivity of the factual aspects of the data.[35] Confirmability of the data was considered through review of the study findings with a third focus group of individuals post stroke and a review by the T-AEX principal investigator, a neurologist who has extensive experience working with patients post stroke clinically and in exercise intervention research. The stroke participants and study principal investigator agreed with the findings, providing support for the confirmability of the data.

Results

A total of 29 participants responded to the qualitative questions either via one-on-one interviews or in two focus groups. Specifically, 14 individuals participated in individual interviews and 15 individuals participated in either of the two focus groups. The average age of the participants was 64 years (SD = 12.0). Forty-five percent of the participants were female, 55% were male, 47% were black, 48% were white, and the remaining participants were self-described as mixed, Hispanic, or Asian-Pacific. Forty-four percent were married or cohabitate, 39% were unmarried (divorced, separated, or widowed), and 17% were undisclosed.

From the interviews, a total of 38 codes were identified, which were reduced to eight themes (Table 3). All codes identified were included in the results. Personal goals, psychological benefits, physical benefits, the objective and verbal encouragement received, social support related to exercise, improvement in instrumental activities of daily living, self-determination, and research-associated supervised exercise benefits were themes that influenced subjects' willingness to participate in the study and adhere to the exercise intervention. Of the themes identified, personal goals, physical benefits, and psychological benefits were supported by the largest number of codes.

Personal goals

Participants identified a variety of personal goals that they believed motivated them to engage in the T-AEX. Goals such as regaining the ability to walk, more function in the affected leg, being able to go up and down the stairs, or resuming the role as a caregiver were some examples of goals set by participants.

Psychological benefit

The participants identified several psychological benefits they noted from participation in the T-AEX. These included improvement in their mood by "keeping spirits up" and having a "better overall attitude." In addition, participants reported that participation gave them a sense of independence, gave them something to do, helped keep them active, and engaged them in an activity they enjoyed.

Physical benefit

The participants described many physical benefits that they noted during the course of study that they associated with exercising. Specifically they reported feeling physically stronger, walking better, and having improved balance. Recognizing these exercise-associated benefits helped the participants continue to engage in the treatment intervention 3 days a week for 6 months. One participant, who had nicknamed the treadmill the "dreadmill," described her love/hate relationship with the exercise intervention. It was decreased falling that helped her adhere to the exercise program.

Research-based supervised exercise benefits

There were a number of study-associated benefits that the participants reported as critical to their ongoing participation in the intervention T-AEX. Specifically, participants appreciated the feeling of safety they had exercising on the treadmill under the supervision of an exercise trainer. They also appreciated the external structure of having to come to the gym for exercise sessions three times a week, as well as the accessibility to the use of a treadmill. Several participants also acknowledged that they were motivated to continue in the study because of the additional testing that was being done (e.g., blood pressure screening, lab work that helped them monitor their blood sugar and cholesterol) and the feedback they received from the study nurses about their test results.

Encouragement: objective and verbal

Participants described objective, tangible markers that helped them to continue to participate in the T-AEX sessions. Objective markers were things such as increases in the time or speed they were able to walk in the treadmill or lower blood pressure readings. Verbal encouragement from staff was also noted as an important source of motivation. This verbal encouragement was described as gentle and provided with kindness and caring. The positive encouragement and enthusiasm of the staff in terms of the benefits associated with the T-AEX was extremely beneficial to patients and helped them believe they could do the exercise and it would benefit them.

Social support

Social support was also noted as an important motivating factor to exercise. Social support came from families (spouses and children), other stroke participants, and the research staff. Although the T-AEX was not a group-based exercise intervention, social support associated with sharing transportation to the gym and exercising with other stroke patients had a strong

impact on the participants in this study. One participant described not wanting to miss any exercise sessions as she felt like she was part of a team. Others reported that children or spouses were the sources of encouragement that motivated and helped them get to the exercise sessions that were part of the T-AEX.

Benefits in instrumental activities of daily living

Participants felt that the benefits they were receiving from exercise influenced their ability to perform instrumental activities of daily living, such as shopping and driving. The men, in particular, reported that participation in the exercise intervention helped them improve their function such that they could resume driving.

Self-determination

Some participants reported that they had their own intrinsic self-determination to participate in the exercise program and did so independently. These individuals described themselves as determined, and this pushed them to adhere to all T-AEX sessions. The determination was often tied to a goal or a purpose.

Discussion

The most strongly supported themes (i.e., those with greatest number of supporting codes) were goals and the psychological and physical benefits that were associated with participation in the T-AEX. Participants reported being strongly goal-directed, hoping to regain lost function and resume previous activities and roles, and the T-AEX represented a method to achieve these goals. The progressive nature of the T-AEX focused on the attainment of intermediate goals in terms of speed, incline, and duration of training, which provided regular feedback and benchmarks of progress. These were noted to be important sources of reinforcement for the process of achieving goals and continuing to participate in the program. Benefits of participation in the study included physical and psychological benefits, such as regaining leg strength, building endurance, improving balance, and improving mood. The exercise intervention was intended to focus on improving walking and cardiovascular conditioning, but the participants also attributed benefits to the intervention that appeared to be unrelated to the study activities, such as being better able to manage household affairs and regaining the ability to drive. These reported benefits suggest that there may be individually interpreted, often unmeasured, benefits associated with exercise studies that have a bearing on well-being and quality of life.

Although the T-AEX was not focused on changing long-term behavior of the participants, the findings suggest that there were many motivational interventions that were consistent with the theory of self-efficacy. The theory of self-efficacy states that the stronger individuals believe in their ability to perform a course of action, and in the positive outcomes of those actions, the more likely they will be to initiate and persist in a given activity.[36] Bandura[36] described four sources of information that influence self-efficacy expectations (and presumably outcome expectations) and consequently behavior: (a) performance of the activity, (b) verbal encouragement from others, (c) exposure to role models, and (d) physiological feedback or physical sensations experienced during the activity. All four of these sources of information may have been present in the treadmill exercise study. The participants engaged in the exercise program and increased performance based on a specific protocol under the direction of an exercise physiologist. We have evidence that they were provided with encouragement and support to perform exercise from their peers as well as the exercise physiologists. Likewise they received important feedback about physiological sensations associated with exercise, and these were often focused on positive findings (i.e., improved cardiovascular findings). Future

research focused on engaging stroke survivors in exercise activities should purposely incorporate self-efficacy–based techniques to optimize participation.

Another important motivator that emerged from the discussions was social support. Even though the treadmill and stretching interventions were performed as solitary activities, they were done in the social context of a large gymnasium with visual contact with other participants and numerous staff members. Many of the participants also shared transportation to access the study sessions, and several friendships developed over the course of the study. One participant described the feeling of being part of a team and committed to the welfare of the team by doing her best. Prior work, particularly with samples of African American older adults, has reinforced the importance of social support to engage in regular exercise activities.[17,37] Group interventions are critical at least to the initiation of regular exercise among these individuals, and consideration should be given to ways to continue to maintain some level of social support such as through a buddy system or electronically via the Internet.[38]

Among the participants in this study, there was a striking lack of disclosure about barriers to exercise, although we specifically asked them to recall any barriers. Moreover, adherence to exercise sessions during the course of the study was impressive, with the major reason that participants did not complete a session being health related. There were several study participants who, upon questioning, admitted that when they could no longer come into the gymnasium to exercise, and when there was no external support and encouragement to do so, they found that they no longer exercised on a regular basis. Although this is not an unusual finding following any study-related intervention,[39–41] it suggests that it may be useful to incorporate theoretically based behavior change interventions so that the benefits achieved during the study associated with exercise can be maintained over time.

This study is limited by the small, select sample of stroke survivors. It is very likely that the study participants, all of whom volunteered for an exercise rehabilitation study and were committed to the extended time period of the intervention, had higher motivation to exercise than the general stroke population. Nonetheless, by gathering information about the factors that motivated this sample, we may be able to understand the critical factors that influence motivation related to exercise after stroke. Future research will use these findings to establish self-efficacy–based interventions to focus on improving adherence to exercise over time and helping individuals post stroke to integrate activities into their daily lives that optimize cardiovascular status, function, and overall quality of life.

The findings from this qualitative study provide information that may enhance the participation of individuals with stroke in structured exercise activities and promote carryover and integration of exercise behaviors into everyday life. By taking into consideration the most commonly reported motivators, we can design features into rehabilitation models that focus on goals, physical, and psychological benefits.

Acknowledgments

This study was supported in part by the Claude D. Pepper Center Older Americans Independence Center, National Institute on Aging (NIA) grant number 5-P60-AG12583; the University of Maryland, School of Medicine, Division of Gerontology; Maryland Exercise and Robotics Center of Excellence (MERCE); and the Baltimore Veterans Affairs Medical Center Geriatric Research Education Clinical Center (GRECC). Dr. Michael's work was also supported by National Institutes of Health Ruth L. Kirchstein Post Doctoral Fellowship, grant number F32 NR10058-01.

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Table 1

Inclusion and exclusion criteria

Inclusion criteria	
1	Ischemic stroke greater than or equal to 6 months prior in men or women ages 40–85 years. Hemorrhagic stroke greater than or equal to 1 year prior in men or women ages 40–85 years.
2	Residual hemiparetic gait deficits.
3	Already completed all conventional inpatient and outpatient physical therapy.
4	Adequate language and neurocognitive function to participate in exercise testing and training (specific screening instruments used).
Exclusion criteria	
1	Already performing aerobic exercise 3x/week.
2	Increased alcohol consumption.
3	Cardiac history of (a) unstable angina, (b) recent (less than 3 months) myocardial infarction or congestive heart failure (New York Heart Association category II-IV), (c) hemodynamically significant valvular dysfunction.
4	Medical history: (a) recent hospitalization (less than 3 months) for severe medical disease, (b) PAOD with claudication, (c) orthopedic or chronic pain condition restricting exercise, (d) pulmonary or renal failure, (e) active cancer, (f) untreated poorly controlled hypertension measured on at least two occasions (>160/100) or diabetes mellitus (fasting glucose >180 mg/dL, HgA1C > 10%) unable to be controlled medically within 3 months, (g) anemia defined by hematocrit <30.
5	Neurological history of (a) dementia with Mini-Mental State Score <23 (<17 if education level at or below 8th grade) and diagnostic confirmation by neurologist or psychiatrist; (b) severe receptive or global aphasia that confounds testing and training, operationally defined as unable to follow 2-point commands; (c) hemiparetic gait from a prior stroke preceding the index stroke defining eligibility; (d) nonstroke neuromuscular disorder restricting exercise (e.g., Parkinson's syndrome); (e) untreated major depression.

Table 2

Interview guide

1	Tell me what your experience was like participating in the exercise study? Encourage them to address the following areas: getting to the center, going through the recruitment process, meeting with staff, meeting other participants, doing the exercises; going through the follow-up testing.
2	What were some of the things that helped you to come in to the center and exercise? Encourage them to address experiences with trainers, other participants, study staff/investigators. Explore things others said to them, hope of recovery/improvement; noting physical findings from exercise (e.g., getting stronger).
3	What were things that prevented you from coming to the center to exercise? Encourage them to address experiences with trainers, other participants, study staff/investigators. Explore things they saw or heard that upset them, family issues or challenges, physical problems (get details of pain, shortness of breath, fatigue before, during, or after exercise), sweating, no hope of recovery/improvement, no improvement noted.
4	If you were asked to share your experiences in this study with someone who had a stroke, what would you tell them? Explore whether they would tell the individual to participate in the study or not.
5	Tell me what would help you at this point to continue to exercise in the way you did during the study? Explore home-based versus center-based activities.

Table 3

Codes and themes identified

Code	Theme
To increase use and function of the affected leg	Personal goal
To improve function overall in stroke recovery	Personal goal
To maintain weight	Personal goal
To be able to walk up and down the stairs	Personal goal
To return to baseline function	Personal goal
To resume caregiving roles	Personal goal
To prevent functional decline	Personal goal
A noted improvement in mood toward being more positive	Psychological benefit
A structure to their life activities	Psychological benefit
A source of inspiration/hope related to recovery	Psychological benefit
A sense of being independent	Psychological benefit
To participate in an enjoyable activity	Psychological benefit
Improved overall attitude about life	Psychological benefit
A decreased fear of falling	Psychological benefit
A sense of being engaged in an active lifestyle	Psychological benefit
An improvement in their ability to complete functional tasks	Physical benefit
An improved gait (better stepping and increased distance)	Physical benefit
Increased strength	Physical benefit
Improved affected arm movement	Physical benefit
Increased endurance in walking with the affected leg	Physical benefit
A way to maintain their optimal function	Physical benefits
Improved balance	Physical benefit
Better finger movement	Physical benefit
Improved endurance and less fatigue with daily activities	Physical benefit
Less shortness of breath	Physical benefit
Feeling safe when exercising	Research-based supervised exercise benefits
Receiving general health information from testing (blood pressure readings)	Research-based supervised exercise benefits
Regimentation/regular schedule of exercise	Research-based supervised exercise benefits
Altrustic belief that participation would contribute knowledge to science	Research-based supervised exercise benefits
Access to exercise options (e.g., treadmill)	Research-based supervised exercise benefits
Increased time and speed on the treadmill	Objective encouragement
Improved blood pressure	Objective encouragement
Verbal encouragement from staff	Verbal encouragement
Verbal expressions of staff kindness and competence	Verbal encouragement
Support from family to participate in the T-AEX	Social support
Group encouragement as part of the “team” at the exercise gym	Social support
Resumed ability to drive	Instrumental activities of daily living
Ability to engage in household tasks–laundry, shopping	Instrumental activities of daily living
Self-determination	Self-determination