

AHA/ASA Scientific Statement

Physical Activity and Exercise Recommendations For Stroke Survivors

**A Statement for Healthcare Professionals from the American Heart
Association/American Stroke Association Council on Stroke**
The American Academy of Neurology affirms the value of this guideline as an
educational tool for neurologists.



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Purpose of Scientific Statement

- This statement provides an overview of the evidence on physical activity and exercise recommendations for stroke survivors.
- It guides practitioners to understand the benefits of physical activity and thus recommend and prescribe exercise throughout the stages of stroke recovery.

Stroke Council Professional Education Committee

This slide presentation was developed by a member of the Stroke Council Professional Education Committee.

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Physical Activity and Exercise Recommendations for Stroke Survivors

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Scientific Statement

Scientific Paper Methods	<p>Members of the writing group were appointed by the AHA Stroke Council's Scientific Statement Oversight Committee and the AHA's Manuscript Oversight Committee. The writers utilized literature reviews, references to published clinical and epidemiology studies, morbidity and mortality reports, clinical and public health guidelines, authoritative statements, personal files, and expert opinion to summarize existing evidence and indicate gaps in current knowledge.</p>
Results	<p>The body of evidence clearly supports the use of exercise training (both aerobic and strength training) for stroke survivors. Physical activity goals and exercise prescription for the stroke survivors need to be customized for the individual to maximize long-term adherence.</p>
Conclusion	<p>The promotion of physical activity in stroke survivors should emphasize low- to moderate-intensity aerobic activity, muscle-strengthening activity, reducing sedentary behavior, and risk management for secondary prevention of stroke.</p>
Key Words:	<p>aerobic exercise; exercise, physical activity; rehabilitation; strength training</p>

Introduction

- 795,000 strokes (new and recurrent) in the US per year
- Affects 1 person every 40 minutes
- About one quarter are recurrent strokes
- 7 million living with stroke

Estimated:

- 4 million will have a stroke by 2030 (25% increase from 2010)
- Stroke remains a leading cause of long-term disability in the United States.

Introduction continued

Framingham Study:

- Lifetime stroke risk is 1 in 5 for women and 1 in 6 for men among those 55 to 75 years of age.
- American adults with disability are likely to be obese, to smoke, and to be physically inactive.
- Stroke continues to be the fourth leading cause of death in the United States when viewed separately for other cardiovascular diseases.

Stroke Survivors:

- Often become deconditioned and predisposed to a sedentary lifestyle
- Are at increased risk for falls
- Are at risk for recurrent stroke and other CVDs
- Studies have found that participation in physical activity levels are lower than those of elderly persons with other chronic health conditions.

Defining Exercise and Physical Activity

Exercise	Any bodily movement produced by skeletal muscles that results in energy expenditure
Physical Activity	Is a subset of physical activity that is planned, structured, and repetitive and has as a final or an intermediate objective the improvement or maintenance of physical fitness

Post-stroke Sequelae

- 40% have difficulties with basic self-care 6 months after stroke (e.g., dressing and feeding)
- 30% of stroke survivors report participation restrictions (e.g., difficulty with autonomy, engagement, or fulfilling societal roles) even at 4 years post-stroke

Post Stroke Consequences

- Chronic sedentary lifestyle
- Many have the ability to reach higher levels of physical activity but choose not to due to the lack of
 - awareness that exercise is feasible or desirable
 - access to resources to support exercise
 - structured exercise sessions

Post-Stroke Fatigue

- Is common with a prevalence rate from 35% to 92%
- Screening of fatigue and depression prior to initiation of exercise treatment is vital.
- Exertional fatigue
 - is related to cardiorespiratory and skeletal muscle fitness
- Chronic fatigue
 - can be related to depression

Co-morbid Conditions

Participation in physical activity may be influenced by the following:

- stroke severity, pre-existing and co-morbid conditions, motivation, fatigue, depression, adaptability and coping skills, and cognition and learning ability
- societal and environmental influences
 - program costs, means of transportation, accessibility, family support, social policies, and social stigmas

Preexisting Conditions

- History of coronary artery disease (CAD)
- Pre-existing CVDs
- High rates of CAD (three times as many cardiac complications during rehabilitation)
 - hypertension
 - atrial fibrillation
 - hyperlipidemia
 - metabolic syndrome and/or diabetes mellitus
 - ischemic heart disease

Pre-stroke Disability

- 20% of patients already have moderate to severe disability
- 10% have dementia
- Poorer pre-existing function measured by greater disability

Pre-stroke Disability

- Low physical activity has been associated with greater stroke severity and poorer long-term outcomes
- Obese patients
 - less improvement in motor recovery and functional outcomes
 - decreased mortality rates when compared to those underweight

Vicious Cycle of Decreased Activity

Secondary complications are shown below:

- reduced cardiorespiratory fitness, increased fatigability, muscle atrophy/weakness, osteoporosis, and impaired circulation to the lower extremities, and
- diminished self-efficacy, greater dependence on others for ADLs, and reduced ability for normal societal interactions can have a profound negative psychological impact.

Comprehensive Stroke Care

- Objectives
 - reverse deficits & minimize impact
 - prevent, recognize, & manage secondary medical conditions
 - maximize independence
 - facilitate psychological/social adaptation and patient and family coping
 - optimize prior life-roles & community reintegration
 - enhance quality of life

Stroke Survivors

- 30% will have recurrent stroke
 - 18% of which will be fatal
- Recurrent event within 5 years of stroke
 - 24% in women
 - 42% in men
 - 10% in young adults (age less than 50 years)
- Recurrent strokes have
 - higher mortality rates
 - increased disability

Non-Modifiable Ischemic Stroke Risk Factors

- Age
- Race
- Gender
- Family history

Medically Modifiable Risk Factors

- previous transient ischemic attack
- carotid artery disease
- atrial fibrillation, CAD, hypertension
- cigarette smoking
- hyperlipidemia
- hypercoaguability
- diabetes mellitus
- hormone replacement
- inflammatory processes and sickle cell disease

Behavioral Modifiable Risk Factors

- physical inactivity
- obesity
- alcohol abuse
- drug abuse
- oral contraceptive
- diabetes mellitus
- cigarette smoking
- hyperlipidemia and hypertension

Physical Activity, Post Stroke Prevention

- Comprehensive Risk-Reduction Program
 - Exercise (consistent)
 - Diet modification
 - Cholesterol-lowering medications & antihypertensive medications
 - Aspirin (lowers secondary stroke risk by 80%)

Proposed Exercise Risk Reduction

- Lowers blood pressure
- Decreases weight
- Increases glucose tolerance
- Improves lipid levels
- Reduces arterial inflammation

Immediate Post Stroke Goals

- Preventing complications of prolonged inactivity
- Regaining voluntary movement
- Recovering basic activities of daily living

Detrimental Effects of Bed Rest

- Diuresis (loss of sodium and potassium)
- Decreased blood plasma volume
- Reduced cardiac output
- Depressed immune function
- Increased resting heart rate (0.5 beats per minute for each bed rest day)

Detrimental Effects of Bed Rest

- Loss of muscle strength (e.g., 25% loss of plantar flexor muscle strength over 5 weeks)
- Reduced peak VO_2 (0.8% daily loss)
- Orthostatic intolerance
- Increased risk of joint contractures and deep venous thromboembolism

Goals of Prescribed Physical Activity and Exercise

- Aim at preventing complications
- Exercise training regimen
- Develop and maintain an active lifestyle

Exercise Training Regimen

- When clinically stable
 - Inpatient rehabilitation
 - Supervised community
 - Home setting
 - Emphasis on progressive task difficulty, repetition, and functional practice

Rehabilitation Exercise Programs

- Optimize functional motor performance
- Aerobic exercise training
 - increase peak VO_2 while lowering the energy cost of walking
- Improve cardiorespiratory fitness
 - increase tolerance and endurance, thus the ability to execute activities of daily living

Pre-Exercise Evaluation

- Comprehensive History and Physical
 - Neurological complications
 - Co-morbidities
 - Weakness, balance impairment, cognitive or behavioral issues, and communication issues
 - Consider medical and functional status when selecting testing modality
- Minimize potential adverse effects
 - Appropriate screening
 - Program design monitoring
 - Education

Graded Exercise Testing

- Optimally assess functional capacity and cardiovascular response
 - Heart rate
 - Rhythm
 - ECG response to exercise
 - Systolic and diastolic blood pressures
 - Subjective response to exercise

Submaximal Testing

- In lieu of graded maximal exercise testing
 - 6-Minute Walk Test (6MWT)
- No literature available of how soon after stroke to undergo stroke graded exercise testing
- Options:
 - Graded exercise testing
 - Submaximal or symptom-limited maximal testing
 - Pharmacological stress testing (significant impairments or limited activity)

Early Physician Activity Rationale

- Prior to the 1950s, bed rest was advocated
- Out of bed activity 24-48 hours post stroke increases the following:
 - Heart rate
 - Blood pressure
 - Oxygen saturation
 - Improved conscious state

Rationale for Structured Exercise

- Fatigue in 40% of stroke survivors was the most debilitating symptom.
- Fatigue may be triggered by the following:
 - physical deconditioning
 - Self-perpetuating fatigue cycle
 - Avoidance of exercise
 - Decreased aerobic reserves

Rationale for Structured Exercise

- Regular aerobic exercise:
 - Increases aerobic capacity
 - Improves gait efficiency
 - Reduces fall risk
 - Enhances functional independence
 - Reduces recurrent cardiovascular events

Rationale for Structured Exercise

- Resistance (strength) training
 - increases independence in activities of daily living
- Flexibility training
 - increases range of movement and prevents deformities
- Neuromuscular training
 - enhances balance and coordination

Prescribing Exercise

R_x

- Prescribe a safe and effective program, avoid “overdosing or underdosing”
 - Frequency
 - Intensity
 - Time
 - Type

Recommended Training Programs

- Training Programs (depending upon functional capacity)
 - Single long session
 - ≥ 3 days per week and duration of 20 to 60 minutes per session
 - Interval training, a work-rest approach
 - Multiple short bouts of moderate-intensity physical exercise (e.g., three 10- to 15-minute exercise bouts), repeated throughout the day

Rehabilitation Approaches

- Survivors unable to walk with communication deficits
- Effective moderate-to-vigorous levels of physical activity of the upper and lower limbs
 - Interactive computer
 - Active-play video games
 - Virtual reality
 - Interactive video gaming (Wii Sports[®] and Wii Fit Plus[®])

Acute Phase of Stroke Recovery

- Little information available for aerobic exercise
- Evidence supports early mobilization (first 24 hours) to be safe and feasible (preliminary findings)
 - Associated with improved functional outcomes
 - May improve walking recovery
- Further research is needed.

Subacute Phase of Stroke Recovery

- Evidence supports exercise training for improving cardiorespiratory fitness
 - 3 minutes of low-intensity aerobic training
 - Cycle ergometers
 - Treadmill training
 - Robot-assist gait training
- Few randomized studies are available to guide exercise recommendations across the sub-acute recovery period.

Chronic Phase of Stroke Recovery

- Studies support the following:
 - aerobic exercise improves cardiorespiratory parameters
 - the use of regular exercise to improve overall health consistent with able-bodied individuals
 - allocating more time to aerobic exercise training and muscle strengthening to optimize patient outcomes

Exercise Trial Barriers



- Most studies include ambulatory stroke survivors.
- Promoting physical activity in more disabled stroke survivors is more challenging.

Perceived Barriers to Exercise

- Depression, fatigue, lack of interest or motivation, lack of perceived self-efficacy, negative belief systems concerning exercise, fear (of falling, subsequent stroke, and other adverse events), practical reasons (e.g., lack of family or other social supports, lack of availability of fitness resources, lack of transportation, lack of awareness of the availability of fitness services amongst health professionals), and cost

Physical Activity Motivators

- Meeting other stroke survivors
- Establishing goals
- Group exercise classes or with family
- Desire to carry out normal daily tasks
- Resumption of driving
- Reducing risk of recurrent stroke

Treatment Gaps

- Gaps exist between guideline recommendations and prescribing clinician behaviors
- Prescribing based upon observation and subjective reports rather than objective measures (peak HR or peak VO_2)
- Clinicians prescribing exercise based on evidence-based practice and actual patient compliance

Measuring Free-Living Physical Activity

- Accelerometry
 - A way to measure changes in free-living physical activity as a result of participating in exercise programs in the future
 - Tracking intervention compliance
 - Motivational tool
 - Self-management tool

CAD Model of Care

- Application of cardiac rehab to stroke is the focus of recent studies.
- Secondary prevention for CAD Program Model components include the following:
 - Assessment
 - Exercise training
 - Nutritional counseling
 - Management of risk factors
 - Psychosocial interventions

Stroke Model Consideration

- Studies have established feasibility and effectiveness of cardiac rehabilitation based interventions for individuals with mild-to-moderate disability from stroke.
- Future trials to examine similar models for TIA and stroke models

Markers of Vascular Health

- Subclinical silent ischemic strokes
 - Manifest as cognitive decline and dementia
 - Associated with hypertension, dyslipidemia, and diabetes
- Evidence shows improved cognition with exercise
 - Mechanism of resolution is known
 - Continued research is on-going

Economic Analysis

- Direct and Indirect cost of stroke are huge
- Secondary prevention strategy utilizing exercise and physical activity may provide future economic benefits
- Cost benefit analysis to include
 - morbidity, mortality, hospitalization rates, productivity, and quality of life years

Capitalizing on Technology

- Methods of utilizing technology to support exercise and physical activity need to be developed.
- Challenges with implementing technology-based programs for stroke survivors include the following:
 - Present solutions are not easy to use
 - Present solutions are not reliable
 - Older adults lack confidence in technology

Potential Technology Development

- Options are as follows:
 - Web-, mobile-, and tablet-based applications
 - Customized exercise program Apps
 - Devices for remote tracking and monitoring exercise progress
 - Track physiological responses and progress
 - Smart watches, bracelets, sensors, or interactive glasses
 - Video-based interactive gaming to provide repetitive high-intensity task-specific activities

Interventions for Severe Stroke

- Historically, research has focused on mild-to-moderate disability not severe stroke
- Potential interventions for the severe stroke subset include:
 - Electromechanical-assisted walking
 - Past focus on gait and mobility
 - Research focusing on the use of a robotic exoskeleton with treadmill testing has shown aerobic benefits

Future Research Areas

- Identify barriers and facilitators to exercise
- Identify effective models related to secondary prevention
- Determine effectiveness of different training types
- Determine if aerobic fitness improves cardiovascular health

Future Research Areas

- Explore the cost-effectiveness of different models
- Analyze the cost-benefit ratio of vigorous activity in stroke subsets
- Establish effectiveness of exercise on quality of life
- Establish testing protocols of exercise capacity for the stroke aggregate

Conclusion

- Exercise is valuable yet underutilized post-stroke.
- Evidence supports the benefits of exercise.
- Early recruitment of patients to trained exercise professionals in hospitals and communities will impact lifestyles and improve overall health.