

# Aerobic Exercise After Stroke

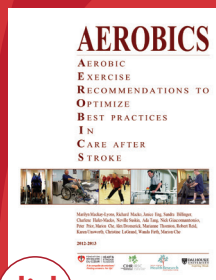
Clinician's  
GUIDE

## AEROBICS GUIDELINES



This resource is an **easy reference summary for clinicians** of the **Aerobic Exercise Recommendations to Optimize Best Practices In Care after Stroke (AEROBICS)** guidelines.

For more detailed information, please consult this full 63-page document.



click

also located at:

The Canadian Stroke Best Practice Recommendations website:  
[strokebestpractices.ca/wp-content/uploads/2013/07/AEROBICS-FINAL-July-2013.pdf](http://strokebestpractices.ca/wp-content/uploads/2013/07/AEROBICS-FINAL-July-2013.pdf)



HEART & STROKE FOUNDATION

**Canadian Partnership  
for Stroke Recovery**



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## Development of the AEROBICS Guidelines

This guide consolidates what is known about aerobic exercise for people after stroke or TIA into a concise set of recommendations for overall management of individuals at all phases of recovery.

The highest quality evidence on aerobic exercise in stroke management was used in the development of these recommendations and takes into account the severity (TIA, non-disabling, moderate and severe) and the continuum of post-stroke recovery (acute, rehabilitation, community reintegration, and long-term adaptation).

The target audiences for these recommendations are **health professionals involved in care of stroke/TIA patients across the care continuum** (from acute care to home to community), health administrators and managers responsible for the coordination and delivery of services.

### These recommendations were developed through a comprehensive, multi-step process:

- A comprehensive **literature search and synthesis** was conducted of findings from clinical trials, case series, systematic reviews, meta-analyses, and guidelines that addressed the role of aerobic exercise in stroke management. The rigors of the research findings were comprehensively assessed to evaluate the quality of the evidence.
- An **international and inter-professional consensus panel of experts** was assembled to draw up an initial draft of the recommendations, comprised of Canadian and American experts representing physical therapy, stroke neurology, cardiology, psychology, nutrition and health policy.

- **A subgroup** was formed to further develop each recommendation.
- The revised draft recommendations were sent to an **international group of 12 external experts** for their review, evaluation and commentary.
- Finally, the recommendations were distributed to consensus panel members for approval and assignment of grades of strength.

The final document consists of **11 recommendations**, each evaluated with respect to:

1. **Level of Evidence** based on multiple layers of evaluations and input from international experts, stroke survivors and caregivers
2. **Grades of Strength** that considered:
  - Quality of evidence;
  - Benefits versus risks;
  - Patients' preferences and values;
  - Relevance and importance from clinicians' perspectives; and,
  - Use of limited resources (i.e., feasibility, personnel, time, equipment, space)
3. **Rationale** for each recommendation in terms of its potential impact and its relevance to stroke care delivery or patient outcomes
4. **System implications** that considered the structures and operational strategies needed to ensure effective implementation of the recommendations
5. **Performance measures** to provide managers, administrators, and health-care providers with strategies for implementation and for measuring and monitoring the impact of the recommendations
6. **Summary of the evidence** that provides the strongest evidence available related to each recommendation.

**AEROBICS Recommendations at a Glance****SECTION 1.0 PRE-PARTICIPATION SCREENING FOR  
AEROBIC TRAINING AFTER STROKE OR TIA**

<b>1.1</b> Who should be considered for participation in aerobic training after stroke or TIA?	All patients following a cerebrovascular event (stroke or TIA) should be considered for potential participation in aerobic exercise interventions.
<b>1.2</b> When should an individual post-stroke or TIA be screened for possible participation in aerobic training?	Patients should be screened for aerobic training as early as possible after onset of a stroke or TIA and when the patient is medically stable in terms of cardiovascular, hemodynamic, and neurological status. To ensure continuity of appropriate interventions, screening should be repeated at transition points along the continuum of stroke care based on the individual's changing neuro-motor and cardiopulmonary capacities to participate in aerobic training.
<b>1.3</b> Who should determine if an individual post-stroke or TIA is ready to begin aerobic training?	Pre-participation evaluation for aerobic training after stroke or TIA should be provided by appropriately qualified health-care professionals, consistent with their scope of practice and practice setting.
<b>1.4</b> What patient information is needed to determine if an individual post-stroke or TIA is ready to begin aerobic training?	Before engaging in aerobic training, all individuals post-stroke or TIA must undergo a screening assessment to identify medical conditions that require special consideration or constitute a contraindication to exercise. Information to support screening should include: <ul style="list-style-type: none"> <li>i. General patient information: demographics, medical history, medications, cardiac history, seizure history, diabetes control, presence of anemia, lifestyle habits (smoking, physical activity)</li> </ul>



	<ul style="list-style-type: none"> <li>ii. Assessment of contraindications to exercise testing and training</li> <li>iii. Evaluation of level of motor recovery, mobility, balance, swallowing status, and ability to express pain or distress and follow instructions for safe prescription in an exercise program.</li> </ul>
<p><b>1.5</b> When is an exercise stress test indicated in the pre-participation screen for aerobic training after stroke or TIA?</p>	<p>An exercise stress test should be an integral component of pre-participation screening for aerobic training after stroke or TIA. However, if the targeted intensity of the planned training program is light (e.g., &lt;45% of predicted heart rate reserve, or HRR) and the participant is without symptoms or a known history of cardiovascular disease and has a normal resting ECG, then an alternative clinically-based submaximal test may be an option.</p>
<p><b>1.6</b> How should exercise testing, as a component of the pre-participation screen for aerobic training after stroke or TIA, be conducted?</p>	<p>A peak effort symptom-limited protocol should be used whenever possible. The exercise test should be administered by appropriately trained and experienced health-care professionals with direct access to physician support and an external defibrillator. The patient should be on usual medications, avoid any strenuous activity for 24 hours prior to testing, and avoid a heavy meal, caffeine, or nicotine within 3 hours of testing. If low-intensity aerobic exercise (e.g., &lt;45% of predicted heart rate reserve) is planned for a participant who is without symptoms or a known history of cardiovascular disease and has a normal resting ECG, a submaximal test that demonstrates the cardiopulmonary tolerance at the planned intensity of exercise testing, such as the Six-Minute Walk Test or Shuttle Walk Test, may be an option.</p>
<p><b>1.7</b> What should be monitored during exercise testing?</p>	<p>Heart rate and electrical activity of the heart should be continuously monitored using electrocardiography during exercise stress testing. Blood pressure monitoring and rating of perceived</p>



exertion should be done intermittently throughout the test, often at each stage of an incremental exercise protocol. Monitoring should continue after termination of the test until baseline values are approximated.

## SECTION 2.0 PRESCRIPTION OF AEROBIC EXERCISE INTERVENTIONS AFTER STROKE OR TIA

- |  |   |
|--|---|
| <p><b>2.1</b> How does aerobic training fit into the overall management of patients after stroke or TIA?</p> | <p>Aerobic training should be incorporated into a comprehensive, inter-professional program of stroke rehabilitation, vascular risk reduction, and secondary stroke prevention. Aerobic training should be implemented as part of an overall exercise program that may also include, but is not limited to, muscle strengthening and task-oriented training of motor control, balance, gait, and functional use of the upper extremity. Physical activity designed to maintain cardiovascular fitness is an important aspect of community reintegration after stroke.</p> |
| <p><b>2.2</b> Where should aerobic exercise interventions be conducted?</p>                                  | <p>Aerobic exercise programs can be administered in a variety of barrier-free and accessible settings: hospital, outpatient clinics, community, and home. Training of high-risk individuals must be done in a setting with immediate access to external defibrillation and emergency medical response. For lower-risk individuals, supervised home-based aerobic exercise programs may be a safe and effective option.</p>  |
| <p><b>2.3</b> Who should design and supervise the aerobic exercise intervention?</p>                         | <p>An aerobic exercise program for a person post-stroke should be designed by appropriately qualified health-care professionals, such as physical therapists or cardiac rehabilitation specialists. The level of supervision is determined by the health-care professional based on the</p>   |





	<p>individual participant's health condition. High-risk individuals require constant supervision whereas low-risk individuals with demonstrated ability to exercise safely and effectively may require only intermittent supervision. Supervision may be provided by a qualified health-care professional or an exercise instructor who has been trained by the health-care professional. Progression of the exercise program should be monitored by the health professional.</p>
<p><b>2.4</b> What format (individual, group) should be used for aerobic training after stroke or TIA?</p>	<p>Aerobic exercise interventions can be conducted in either a one-on-one or group format, with the ratio of participant to supervising personnel determined by the severity of the participant's neurological and cardiac status as well as the planned exercise intensity and mode of training.</p>
<p><b>2.5</b> What mode of exercise should be used for aerobic training after stroke or TIA?</p>	<p>A variety of exercise modes can be used to induce an aerobic training effect. Task-specific exercise that activates large muscle masses is recommended.</p>
<p><b>2.6</b> Over what period of time should the aerobic training sessions be conducted?</p>	<p>A minimum of 8 weeks of aerobic exercise is recommended to achieve a clinically meaningful training effect. However, physical activity should be sustained indefinitely to ensure maintenance of health benefits.</p>
<p><b>2.7</b> How frequently should aerobic training sessions be conducted after stroke or TIA?</p>	<p>Although physical activity should be done "most days of the week" for general health, structured aerobic exercise should be conducted a minimum of 3 days/week. On the other days of the week, participants are encouraged to engage in lighter forms of physical activity.</p>



**2.8 How long should each aerobic exercise session be?**

Aerobic exercise sessions of  $\geq 20$  minutes are recommended, depending on exercise frequency and intensity. In addition, warm-up and cool-down periods of 3-5 minutes are advised. A gradual progression in the duration may be required, starting with bouts of 5 minutes or less, alternating intervals of rest or lower-intensity exercise, as needed.

**2.9 What intensity of aerobic exercise should be used?**

Intensity of aerobic exercise must be determined on an individual basis, depending on response to the exercise stress test, health status (neurologic status, cardiac, and other comorbidities), and planned exercise frequency and duration. Frequent heart rate monitoring and periodic blood pressure monitoring are recommended for safety and assurance that exercise is being performed at the planned intensity.

Surrogate markers of intensity, such as rating of perceived exertion (RPE), should be used, particularly when the linear relationship between cardiopulmonary exertion and heart rate is compromised by medication or autonomic dysregulation.

- Low-intensity exercise:  $<45\%$  of HRR\* or RPE 0-10  $<4$  or RPE 6-20 of  $<10$
- Moderate-intensity exercise: 45-60% of HRR or RPE 0-10 of 4-5 or RPE 6-20 of 11-13
- High-intensity exercise:  $>60\%$  of HRR or RPE 0-10  $>6$  or RPE 6-20 of  $>14$ .

Exercise intensity should be progressed as tolerated by the participant.

\*Calculated as  $[\text{Maximum HR} - \text{Resting HR}] \times \% + \text{Resting HR}$ , or you can refer to "Heart Rate Reserve Reference Chart"



2.10

**What clinical outcome measures should be used to monitor the effect of aerobic exercise interventions?**

Outcomes that reflect patient-oriented goals of aerobic exercise interventions should be measured periodically to monitor change over time, progress the intervention, or transition to other interventions or physical activities. Measures to consider include assessments of cardiovascular health (e.g., blood pressure, blood lipids, fasting plasma glucose, waist circumference, medication adherence, tobacco use), cardiovascular endurance/functional capacity (e.g., Six-Minute Walk Test, Shuttle Walk Test, heart rate at a fixed sub-maximal workload, daily step counts) and other health domains (e.g., mobility, goal attainment, emotional wellbeing, quality of sleep, and quality of life).

2.11

**What are strategies to overcome barriers to participant engagement in aerobic training after stroke or TIA?**

A participant-focused approach, endorsed by all relevant health-care providers, should be used to encourage sustained involvement in aerobic exercise interventions. A planned and gradual transition from participation in a structured clinical program of aerobic exercise to less structured, more self-directed engagement in physical activity at home or in the community may facilitate the lifestyle changes needed for long-term commitment. Multiple strategies to deal with specific barriers related to health-care providers, the environment, and participants are recommended.



## **AEROBICS Recommendations Key Messages**

### **WHO**

Given the wide range of known and potential benefits of aerobic exercise, all individuals following a cerebrovascular event (stroke or transient ischemic attack (TIA)) should be considered for participation (AEROBICS 1.1).

### **WHY**

Physical inactivity is an independent risk factor for vascular disease, including stroke. Post-stroke impairments such as weakness and balance impairment can restrict mobility, contribute to sedentary behaviours and development of secondary consequences, and compound the effects of co-morbidities, such as high blood pressure and diabetes mellitus.

**The good news is that there is now strong evidence suggesting that aerobic activity can be implemented safely across the continuum of stroke recovery.**

Engaging in aerobic activity can break the cycle of physical inactivity and negative health consequences by:

- Improving walking speed and endurance
- Increasing exercise capacity
- Increasing muscle strength and improving motor function
- Reducing vascular risk, such as lowering blood pressure
- Improving cognition, emotional wellbeing, quality of life

Aerobic activity should be regarded as a core component of stroke care, and importantly, incorporated into an overall program of physical activity.

**WHEN**

Since exercise is known to confer benefits in the early and late phases following stroke and TIA, aerobic activity can be introduced at any point in the stroke recovery continuum. Screening for participation in aerobic activity should occur once the individual is medically stable in terms of cardiovascular, hemodynamic, and neurological status (AEROBICS 1.2).

**HOW**


**PRE-EXERCISE SCREENING ASSESSMENT** should be conducted by a qualified health-care professional to identify contraindications and special considerations for exercise. It will include:

- i. **General personal information and medical history** for acute myocardial infarction, unstable angina, vertigo, and other medical conditions that may affect ability to participate.
- ii. **Level of function**, including mobility, vision or sensory changes, cognition and communication.
- iii. An **initial exercise assessment** that establishes baseline fitness level, provides information to screen for cardiovascular disease, and evaluates cardiovascular responses to exercise.
- iv. **Goals for recovery.**  
(AEROBICS 1.4-1.7)

Refer to the AEROBICS guidelines for detailed information regarding pre-exercise screening and testing.

Advise the patient to stop exercise immediately if they experience any of the following signs and symptoms, and to seek medical attention: angina, pain or aching in the jaw, neck, down the left or right arm, or across the shoulders and back, unusual shortness of breath, dizziness, lightheadedness, or abnormal heart rhythm.

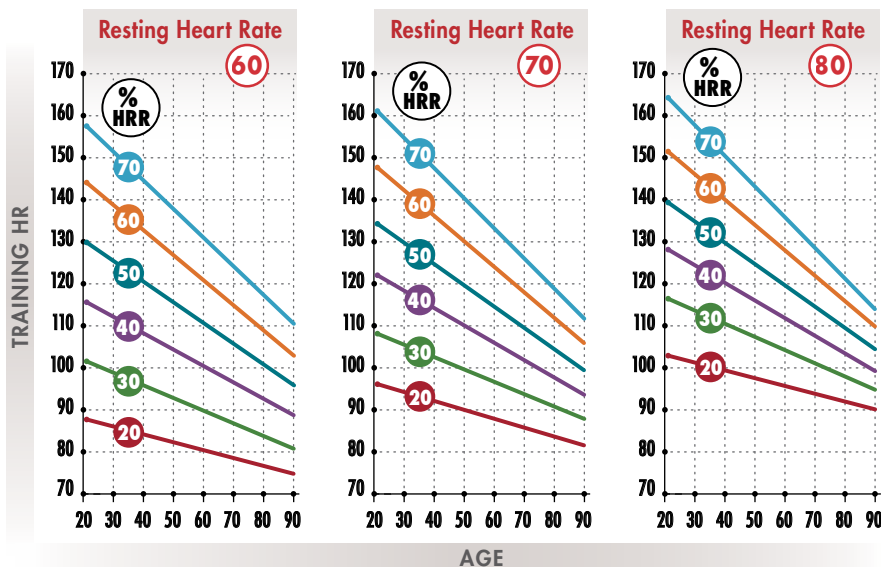
### Elements and Considerations of an Aerobic Activity Program (AEROBICS 2.4-2.9)

	EARLY after stroke	LATER stages after stroke
<b>Warm up</b>	5-10 minute warm up	
<b>How often?</b>	<b>Most days of the week.</b>	<b>At least 3x/week, but aim for most days of the week.</b> Encourage light physical activity on the other days of the week.
<b>What kind of activity?</b>	Activity(ies) should engage large muscle groups, and that relate to interests and goals for recovery. Functional or task-specific activities are recommended.	
	Some examples may include: <ul style="list-style-type: none"> <li>• Bed exercises and bed mobility</li> <li>• Exercises in standing, such as marching on the spot, mini squats, step-ups</li> <li>• Stationary bike</li> <li>• Recumbent steppers</li> </ul>	Some examples may include: <ul style="list-style-type: none"> <li>• Walking overground or on treadmill</li> <li>• Stationary bike</li> <li>• Steppers</li> <li>• Walking circuits</li> </ul>
	May be offered in individual or group settings. As fitness, strength and activity tolerance improves, progress activities to provide ongoing challenge.	
<b>How hard?</b>	<ul style="list-style-type: none"> <li>• If initial tolerance is low, start at <b>Low intensity &lt;45% heart rate reserve (HRR) or RPE &lt;4.</b></li> <li>• Progress to <b>moderate intensity 45-60% HRR or RPE 4-5 or high intensity &gt;60% HRR or RPE &gt;6.</b></li> </ul> <p>If age and resting heart rate are known, the "Heart Rate Reserve Reference Charts" may be used to quickly determine training heart rate. See <i>Figure next page</i> </p>	
<b>How long?</b>	<ul style="list-style-type: none"> <li>• Aim for <b>20 to 30 minutes continuous activity</b></li> <li>• If initial tolerance is low, <b>start with shorter bouts</b> (e.g. 5 minutes) at multiple times throughout the day, or intersperse with rest or lower-intensity active rest. Build up gradually until 20 minutes can be completed at one time.</li> </ul>	

	EARLY after stroke	LATER stages after stroke
<b>Cool down</b>	5-10 minute cool down	
<b>Where?</b>	Aerobic activity can be implemented in a variety of barrier-free and accessible settings (AEROBICS 2.2).	
	Some examples include: <ul style="list-style-type: none"> <li>• In the hospital room or ward</li> <li>• Therapy areas</li> <li>• Home</li> </ul>	Some examples include: <ul style="list-style-type: none"> <li>• Outpatient clinics</li> <li>• Community centres</li> <li>• Fitness centres</li> <li>• Walking outside or in a mall</li> <li>• Home</li> </ul>

Refer to the AEROBICS guidelines for detailed information regarding details of the exercise prescription.

## Heart Rate Reserve Reference Charts



Adapted with permission from Janice Eng

### How to use the Heart Rate Reserve Reference Charts:

1. Select the graph that best reflects the participant's Resting Heart Rate.
2. Locate their participant's Age on the horizontal axis.
3. Draw a vertical line up to the % heart rate reserve. For example, if you want training to occur at 60% HRR, go up to the orange-coloured line.
4. Draw a line across to the vertical axis to determine the target training heart rate.

### Outcome Measures

Outcome measures can be included to establish baseline levels and to track change over time. Consider including assessments of:

- **Cardiovascular health**, such as resting blood pressure, heart rate, waist circumference
- **Cardiovascular endurance or functional capacity**, such as walking speed, 6-Minute Walk Test, Shuttle Walk Test, daily step counts
- **Other health domains**, such as goal attainment, emotional well being, quality of life (AEROBICS 2.10)

### Overcoming Barriers to Participation

Some strategies that can be used to overcome barriers to participation and encourage lifelong exercise include:

- Using a participant-focused approach
- Tailoring the program to the individual's goals, interests, and level of function
- Involving all relevant members of health-care team and community service providers
- Encouraging sustained involvement
- Facilitating seamless transition from structured clinical programs to more self-directed engagement in physical activity (AEROBICS 2.11)

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*The information in this guide is for general use and has been prepared based on scientific evidence that was current at the time of publication. Relevant evidence published after these guide could influence the recommendations contained herein. When using this material, it is the user's responsibility to ensure that interventions are consistent with reasonable clinical practice, consider clinical judgment, knowledge and preferences of the client, and contextual factors such as resource availability in their decision-making processes. In no event shall the developers, contributors, and supporting institutions of this guide be liable for any damages of any kind, including without limitation, any direct, special, indirect, punitive, incidental, or consequential damages incurred in connection with your use, misuse, or reliance upon these recommendations and associated material.*









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