Non-Pharmacological Intervention Society

Non Pharmacological Interventions Registry

Protocol : High-Intensity Endurance exercice program for Parkinson's Disease

Health Problem : Risk of fall

Bodily

Sheet Code
NPIS-0000000111

Designation

High-Intensity Endurance Exercise Program for Parkinson's Disease

Abbreviation

EHIP

Category

Bodily

Main Health benefit

Improve motor symptoms associated with Parkinson's disease (Miller and Koop 2019; Alberts 2020; de Almeida 2022; Zhen 2022; Tsai 2023; Ernst 2024; Langeskov-Christensen

2024).
ICD : 8400.0

Explanation

A supervised intensive endurance program improves the motor symptoms of Parkinson's disease through a combination of stimulating neuroplasticity, improving neuromuscular function, strengthening the cardiovascular system, promoting motor learning, and enhancing behavioral management of the disease (Zhen 2022).

Routine Test

UPDRS Scale (Unified Parkinson's Disease Rating Scale), Movement Disorder Society Task Force on Rating Scales for Parkinson's Disease 2003: http://medicalcul.free.fr/updrs.html

Threshold

The score ranges from 0 to 260, with 0 indicating no disability and 260 indicating complete disability. Each item is rated on a scale of 0 to 4: 0 (normal), 1 (mild), 2 (moderate), 3 (moderate), and 4 (severe). The scales are as follows:
Part I: Non-motor activities of daily living (13 items). A score of 10 or less corresponds to a mild disability, 22 or more to a severe disability.
Part II: Motor activities of daily living (13 items). A score of 12 or less corresponds to a mild disability, 30 or more to a severe disability.
Part III: Motor examination (18 items). A score of 32 or less corresponds to a mild disability, 59 or more to a severe disability.
Part IV: Motor complications (6 items). A score of 4 or less corresponds to a mild form, 13 or more to a severe form.

Minimal Clinically Important Change

A clinically significant change is defined as a change of 2.5 points or more on the UPDRS-III (Shulman 2010).

Secondary benefits

- Improved gait and walking speed (Arcolin 2016; de Almeida 2022; Sena 2023).
- Improved balance and mobility (Arcolin 2016; de Almeida 2022; Kóra 2025).
- Improved grip strength (Jansen 2021).
- Improved cognitive function (working memory, attention, and processing speed), partly through increased neurotrophic factors and cerebral perfusion (Luthra 2025).
- Improved mood (reduction in depressive and anxiety symptoms).
- Better sleep quality.
- Improved quality of life (Ernst 2024).

Direct Risks

This NPI is relatively safe, with few major adverse events when the program is supervised and tailored, and when a preliminary medical evaluation and monitoring (heart rate, shortness of breath, tolerance) are implemented (Ernst 2024; Rosenfeldt 2024).
- Falls.
- Freezing (temporary, involuntary inability to move, usually affecting the legs).
- Orthostatic hypotension (drop in blood pressure upon standing or after exertion, which may cause dizziness or a fall).
- Rare cardiovascular complications.
- Rare respiratory complications (oxygen desaturation or dyspnea during prolonged exertion).
- Functional decompensation.
- Tendinous and muscular pain.

Risks of interaction

- Dietary proteins and gastrointestinal motility issues can reduce or make the absorption of levodopa unpredictable. An exercise program can affect gastrointestinal motility and the timing of doses, which is why a medication-session schedule is important (Rusch 2023).
- Exercise can alter gastric emptying and splanchnic circulation, influencing the onset of the drug's effect; therefore, the ON/OFF status around exercise sessions must be documented to interpret variations (Figura 2024).
- Sedatives or anxiolytics may reduce exercise tolerance and increase the risk of falls.

Biological and Psychosocial Mechanisms

High-intensity endurance exercise stimulates corticostriatal plasticity and functional connectivity, which may slow the progression of motor deficits and improve movement

control in Parkinson's disease (Aguiar 2016; Luthra 2025). Brain imaging studies show both functional and structural changes (Johansson 2022).

HIT also reversed the expected decrease in dopamine transporter availability, leading to a significant increase in the substantia nigra and putamen (de Laat 2024). It also reversed the expected decrease in neuromelanin concentration in the substantia nigra (de Laat 2024). These results suggest an improvement in the functionality of remaining dopaminergic neurons through sufficiently sustained aerobic exercise.

Aerobic exercise increases blood levels of exerkinins. Exerkinins are bioactive substances synthesized and released during physical exercise that protect neuronal cells, according to in vitro studies and in vivo rodent models of Parkinson's disease (Mitchell 2024). While this physical exercise does not cure the disease, it has been shown to be a powerful neuroprotective mechanism that helps slow the progression of the disease (Mitchell 2024). This NPI increases cerebral blood flow and neurotrophic factors (BDNF), supporting neuronal survival and motor learning. These mechanisms partly explain the reduction in motor symptoms observed following endurance training programs.

This NPI improves aerobic capacity, which increases functional reserve, enhances cardiorespiratory function, reduces fatigue, and promotes endurance in activities of daily living.

This NPI enhances motor control through repeated practice during supervised sessions that provide relevant feedback. It improves muscle performance (Rosenfeldt 2022), speed, and rhythmic timing during walking, as well as balance and motor synchronization.

Under professional supervision, this NPI promotes adherence to all treatments and fosters positive relationships with other healthcare professionals. This sense of being supported by a multidisciplinary team and a single point of contact boosts commitment to managing the disease; specialists refer to this as sustainable empowerment. *Recent analyses show more pronounced effects for intensive programs (HIIT or sustained aerobic training) than for light/moderate exercise, particularly regarding walking speed and overall motor function (Sena 2023).

Responding population

- Early to moderate stage, as patients retain sufficient motor reserve to tolerate the exertion caused by intensive training and benefit from it. A high-intensity endurance program is feasible for most patients with early-stage Parkinson's disease, with equipment and instructional adjustments as needed (Schootemeijer 2022).

- Preserved cognitive function (memory/executive function) that allows patients to follow instructions, adhere to the program, and maintain adherence. Moderate cognitive impairment is not a contraindication in itself; it simply requires closer professional supervision.
- Low apathy, good motivation, and social support that encourage regular participation.
- Consider potentially limiting comorbidities (severe cardiorespiratory conditions, disabling musculoskeletal pain).
- Absence of severe orthostatic instability or uncontrolled anticoagulation.

Nonresponding population

- Advanced stage of the disease and significant functional limitations preventing the patient from reaching the target intensity.
- Severe cognitive impairment.
- Severe cardiorespiratory comorbidities (heart failure, unstable COPD).
- Severe autonomic dysfunction or symptomatic orthostatic hypotension.
- Disabling musculoskeletal pain or bone fragility.
- Severe and unstable dyskinesias.
- Major apathy, untreated depression, or low motivation.
- High-risk anticoagulation and history of bleeding.
- Lack of social or logistical support.

Participants

Individual

Duration

26 weeks.

Sessions per week

4 sessions

Procedure

Endurance exercise on a treadmill or any other aerobic activity is prescribed 4 days a week for 26 weeks. Participants are expected to attend at least 3 days a week throughout the entire period (> 78 sessions).
Participants use a heart rate monitor to record the intensity of all sessions. All sessions in weeks 1 through 2 are supervised on-site. Thereafter, participants come in at least once a month, when heart rate data is downloaded. Protocol adherence is monitored through monthly conference calls.

Assessment phase (1–2 sessions at the start of the program): 6-minute walk test, UPDRS-III, resting heart rate, MRC dyspnea scale with establishment of personalized goals, monitoring education (heart rate, RPE scale, tracking log).

Intensive supervised phase (1–8 weeks): Supervised sessions in the clinic, either individually or in small groups; weekly progression in duration and intensity; monitoring for warning signs (dyspnea, chest pain, syncope). Start at a moderate intensity of 60–65% of maximum heart rate [HRmax = 208 – (0.7 × age)] or a perceived exertion level of 12–13/20 on the Rating of Perceived Exertion (RPE) scale. Progress over the course of 8 weeks to a vigorous intensity (75 to 85% of HRmax or 14 to 17/20 on the RPE scale, when physiologically appropriate and safe).

Transition phase (8–16 weeks): Gradual reduction in supervision (1 supervised session for every 2 to 3 independent sessions), reinforcement of adherence strategies (weekly plan, reminders, app/pedometer).

Maintenance phase (17–26 weeks): Individualized program 4 times per week (30–45 min) with follow-up appointments at 1 month and then 3 months; periodic reassessments (6-minute walk test, adherence).

Components

The session includes a 5- to 10-minute warm-up, followed by 30 minutes of aerobic exercise at the target heart rate, and finally a 5- to 10-minute cool-down.
Exercise intensity is increased during weeks 1 through 8 to reach the target levels. The target intensity is moderate to vigorous, ranging from 60 to 85% of maximum heart rate or 12 to 16 on the RPE scale, which reflects the perceived level of exertion. It is possible to alternate continuous exercise sessions with HIIT-style interval sessions depending on the patient's tolerance and preference.

Subsequently, the target heart rate is maintained by adjusting the speed and/or incline if the exercise is performed on a treadmill. The perceived exertion scale is used to monitor

exercise intensity in participants who have started taking chronotropic medications during the intervention.

Choose the patient's preferred endurance activity and stick with it for 26 weeks to track progress. This activity should engage major muscle groups, such as brisk walking or walking uphill, running, cycling, swimming, rowing, or using an elliptical trainer (Parkinson's Foundation 2025).

Equipment

- Aerobic exercise equipment (non-slip treadmill with safety rails, stationary exercise bike, stepper, etc.).
- Heart rate monitor (belt or watch) to track intensity (target HR / %HRmax).
- Pulse oximeter to monitor oxygen saturation in patients with respiratory issues or those who are frail.
- Stopwatch.
- Pedometer.
- Measuring tape, RPE scale, 6-minute walk test sheet, tracking log. - First aid kit.
- Blood pressure monitor, defibrillator accessible according to local protocol, emergency contacts.
- Camera/computer/tablet with microphone and stable connection for remote supervision.
- Headset or external microphone for clear communication and audio/video monitoring.
- App or platform for session recording, HR tracking, and exercise reminders.
- Pedometer or cardio-GPS watch to track activity and motivation.

Location

A rehabilitation or adapted exercise room within a healthcare facility (neurology department, rehabilitation unit, or specialized center), equipped for supervised exercise (treadmill, exercise bike, secure area, monitoring equipment).

Best implementation practices

- Adapt the equipment to the patient (balance, pain, respiratory comorbidities, stationary bike if there is a risk of falling).
- Adhering to minimum exercise doses is important to ensure benefits (Cui 2023).
- Break up the exercise into shorter sessions for certain patients with comorbidities (e.g.,

COPD).
- Standardize measurements (same distances, same parameters to track progress).
- Train the patient in self-monitoring before transitioning to independent exercise. For example, use a pedometer or heart rate monitor, a logbook to record HR/RPE and symptoms, and incorporate functional goals (walking to the market, climbing stairs).
- Have a recovery plan in place in case of an exacerbation.
- Some remote sessions at the patient's home are feasible (van der Kolk 2018; van der Kolk 2019).
- A high-intensity interval training (HIIT) protocol is a possible alternative to the high-intensity continuous endurance protocol (Kathia 2024).
- The presence of a caregiver promotes persistence and thus the clinical effect.
- Professional supervision by a trained physical therapist ensures safety, individualized progress, and adherence.
- Promote motor learning.
- Quality of life and participation
- Improved quality of life: measurable improvements on quality-of-life questionnaires and in the ability to perform activities of daily living, with positive social and emotional outcomes.
- Functional transfer: the incorporation of specific exercises (dual-task exercises, training in real-world environments) promotes the transfer of training gains to daily tasks.
- Encourage group participation.
- Personalize guidance.
- While the intensity of endurance training is important, the volume and type of training are equally important (Panassollo 2024). The trainer must be able to help the patient step outside their "comfort zone," in other words, go beyond submaximal thresholds.

Best practices for sustainability

- Foster motivation by helping patients achieve small, incremental goals recorded in their journals (gradual, small victories).
- Reinforce successes with positive feedback.
- Encourage support from other patients and loved ones.
- Build confidence in one's ability to succeed.
- Help patients use self-monitoring tools (heart rate monitor, smartwatch, app, etc.).
- Gradually reduce the frequency of supervision while ensuring that sessions are completed independently at the expected frequency.
- Provide practical solutions in case of exacerbations or relapses.
- Schedule follow-up sessions and "booster" sessions to adjust the exercise plan and maintain motivation.

Precautions

- Use the absence of warning signs during 4 weeks of independent exercise as a safety criterion.
- Review the patient's medication regimen before starting (levodopa timing, antihypertensives, anticoagulants, psychotropic drugs, etc.).
- Request a preliminary medical evaluation (cardiopulmonary, ENT if necessary) and a stress test if risk factors are present.
- Have an initial supervision session with a trained physical therapist to adjust the intensity and ensure safety.
- Schedule sessions during the ON period whenever possible and ask the patient to bring their day/night self-assessment log.
- Measure blood pressure and heart rate before and after the session during the first week, then periodically thereafter.
- Train to recognize orthostatic hypotension, dizziness, dyskinesias, and other motor complications, and document them.
- Develop anti-freezing strategies (visual cues, rhythms, etc.).
- Take comorbidities into account (e.g., musculoskeletal, cardiorespiratory, and cognitive).
- Provide fluids in cases of orthostatic hypotension until rest periods for hydration are established, including after exercise.
- Stop immediately in the event of chest pain.
- Break up the exercise in cases of respiratory desaturation.
- Monitor for warning signs (excessive shortness of breath, chest pain, dizziness, pallor, hemoptysis, or hoarseness) to stop immediately and seek medical evaluation.
- Simplify instructions for individuals with cognitive impairments.
- Establish an emergency plan with a local protocol, medical contacts, and access to a defibrillator if necessary.
- Record assessments in an individual monitoring log (heart rate, RPE score, symptoms, 6-minute walk test performance, UPDRS-III, etc.).
- Train in Parkinson's disease-specific INM.

Regulatory specification

Medical prescription and supervision.
This practice must be carried out within a healthcare organization, even if some sessions take place at home and others are supervised remotely.

Main Initiator

Angela L Ridgel, Jerrold L Vitek, Jay L Alberts, Department of Biomedical Engineering, Cleveland Clinic, Cleveland, OH 44195, USA (Ridgel 2009).

Qualification required

Physical therapist trained at the INM.

Adapted physical activity (APA) instructor working in a healthcare facility.

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Author(s) of the Sheet

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Contact the NPIS
5, rue des Reculettes, 75013 Paris - France
Phone: +33 (0)1 56 79 17 91
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