

## Therapist Recertification Workshop

**Workshop Title: Designing Personalized Freezing of Gait Interventions to Benefit Both FOG and Functional Mobility**

**Date**

November 9, 2026

**Location**

Delivered via Zoom  
Eastern Time

**Workshop Fee**

\$375 per person

*Discounts available for groups of 2 or more*



**In this workshop you will learn to:**

- Appreciate the heterogeneity and the complexity of FOG and how that impacts our ability to identify “freezers / non-freezers” and capture their response to our clinical interventions.
- Develop personalized proactive and rescue-focused interventions for clients with FOG that are informed by a theoretical understanding of the mechanisms that underlie FOG.

**Who is eligible?**

- Physical Therapists, Physical Therapy Assistants
- Occupational Therapists, Occupational Therapy Assistants
- PT, PTA, DPT, OT, OTA students

For additional information see the PWR! Workshop registration page



501(C)3 Non-Profit Organization

**Are continuing education hours offered?**

For details see the continuing education information page at <https://www.pwr4life.org/ceu-information/>

Earn 5-6 contact hours

| My Time | Eastern Time    | Topic   |
|---------|-----------------|---|
|         | 10:00 am        | <b>Welcome and Housekeeping</b>   |
|         | 10:15 am        | <b>Freezing of Gait (FOG) Introduction</b> <ul style="list-style-type: none"> <li>• Terminology and Phenomenology</li> <li>• FOG / Festination vs. Non-Gait Freezing / Festination</li> </ul>   |
|         | 10:55 am        | <b>Mechanisms Underlying FOG and Implications for Intervention</b> <ul style="list-style-type: none"> <li>• Interference - Decreased reserve leads to crosstalk</li> <li>• Threshold - Gait instability</li> <li>• Decoupling - Posture with gait</li> <li>• Cognitive - Frontal executive dysfunction</li> <li>• Sensori-perceptual processing deficits</li> </ul> |
|         | <b>12:20 pm</b> | <b>Break</b>  |
|         | 12:30 pm        | <b>Implications of FOG on Functional Mobility</b> <ul style="list-style-type: none"> <li>• Techniques and training tools for learning and retention</li> <li>• New paradigms of ongoing access to rehab and exercise for life</li> </ul>  |
|         | 12:50 pm        | <b>Video Case Study #1</b> <ul style="list-style-type: none"> <li>• Assessment considerations and Level 3 goals for a <u>single</u> plan of care</li> <li>• Level 1-2-3 sample activities for addressing Level 3 goals</li> </ul>   |
|         | <b>2:00 pm</b>  | <b>Break</b>  |
|         | 2:10 pm         | <b>Video Case Study #2</b> <ul style="list-style-type: none"> <li>• Assessment considerations and changing Level 3 goals <u>over time</u></li> <li>• Level 1-2-3 sample activities for addressing Level 3 goals <u>over time</u></li> </ul>   |
|         | 3:15 pm         | <b>Q&amp;A</b>  |
|         | 3:30 pm         | <b>End of PWR!Moves Therapist Freezing of Gait Recertification Workshop</b>   |

Most people (~80%), if not all, persons with PD (PwPD) will experience freezing of gait (FOG) as the disease progresses into advanced stages. However, 21% to 27% of PwPD report FOG even in the early stages. This presentation will define the terminology and complex phenomenology underlying FOG. Participants will appreciate how this greatly interferes with research studies trying to clearly identify freezers from non-freezers so that we can better understand the data, the underlying mechanisms and the response to therapeutic interventions.

Participants will be introduced to screening tools and assessments that can be used for early identification or for therapy outcomes after FOG-focused interventions. We will review 5 theoretical hypotheses (models) to help understand the pathophysiology underlying FOG. These will include the categories of: Interference, Threshold, Decoupling, Cognitive or Sensori-perceptual. For each model, we will first discuss examples of behaviors that we may be able to observe or elicit in the clinic that support different models and how that can provide insight for designing interventions.

As we go through the models, we will introduce current research supporting interventions that may address one or more of these models. Emphasis will be on a recent meta-analysis that suggests that rehabilitation that targets multiple behavioral training modes related to 1) reducing the frequency or emergence of FOG episodes (proactive goals) and 2) circumventing and alleviating imminent FOG episodes (rescue goals) are efficacious. Altogether, these studies support the importance of starting early, incorporating cognitive strategies, challenging the intensity and complexity of training, targeting aerobic exercise to enhance neuroplasticity and addressing the unique challenges of sustained practice.

The severity of functional mobility impairment in PwP is affected by dopamine-dependent disturbances that alter cortico-striatal networks and interfere with the ability to express habitual-automatic actions in complex real-world scenarios. Therefore, each of the proposed mechanisms that underlie FOG; may also contribute to the loss of automaticity and the deterioration of functional mobility. In addition, freezing and festination can occur in non-gait functions that require repetition and/or coordination across limbs or multiple structures like speech, repetitive finger or hand movements, bilateral reach and grasp movements, and during upper or lower limb floor crawling movements.

For that reason, we propose that FOG interventions should consider the impact FOG has on ALL aspects of functional mobility. We will use Video case studies (n=2) to illustrate how FOG-specific interventions can be integrated within the PWR!Moves® Retrain Functional Mobility Framework allowing therapists to address personalized goals related to FOG but also everyday mobility and transfers in multiple positions or environments (home, work, recreation, community group exercise). Assessments used in the case studies, role of instruction, sensory feedback, use of simple multipurpose equipment and dosage consideration will be highlighted as part of case study discussion.

**Upon successful completion of this workshop, participants will be recertified as PWR!Moves Certified Therapists for another three years!**

---

### Methods of Instruction

- Brief lectures with time for Q&A and response to chat.
- Pre-recorded video cases (n=2) showing therapists implementing the curriculum with people with PD of varying disease severity with freezing of gait.
- Faculty led group discussion to answer questions and review highlights for each video case study.

---

### Course Objectives

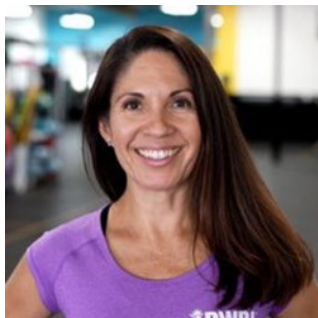
- Develop personalized functional mobility interventions for clients with FOG that include FOG-specific motor and cognitive challenges.
- Interpret the proposed mechanisms that underlie FOG to inform your clinical reasoning for designing and prioritizing FOG proactive and rescue-focused goals and activities.
- Utilize assessments and interview techniques that may help characterize and capture FOG and non-gait freezing episodes for early identification, setting goals and demonstrating therapy outcomes.
- Use training tools related to cueing, instruction, feedback, aerobic priming, and simple equipment to optimize quality of movement and learning.
- Recognize the importance of dosage and sustained practice



### **Becky G. Farley, PT, MSPT, PhD**

Dr. Becky Farley is a physical therapist, neuroscientist, Parkinson exercise specialist, Chief Scientific Officer and Founder of Parkinson Wellness Recovery | PWR!. She received a PhD in Neuroscience from the University of Arizona, a Master of Science in Physical Therapy from the University of North Carolina, and a Bachelor of Physical Therapy from the University of Oklahoma. She is a published author on exercise for people with Parkinson disease and gives public and medical seminars worldwide. Her postdoctoral research investigated the muscle activation deficits underlying bradykinesia in people with PD. She was awarded, and completed, an R21 NIH-funded randomized clinical trial to establish the benefits of LSVT BIG®, the first

whole-body, amplitude- focused, physical and occupational therapy exercise approach for individuals with PD. Dr. Farley also created PWR! Moves, a more flexible Parkinson-specific exercise approach that directly targets the training of amplitude into building blocks of function. Each building block counteracts a primary motor control deficit shown by research to interfere with everyday mobility. Dr. Farley has been training therapists and fitness professionals for the last 14 years and is now focusing on publishing data from the Tucson-based PWR!Gym and integrating new research into PWR!Moves® workshops and PWR!Gym programs. She believes lifelong access to integrated rehabilitation and community exercise and wellness programming is necessary to optimize and perpetuate functional mobility benefits and to slow disease progression.



### **Jennifer Bazan-Wigle, PT, DPT, CEEAA®**

Jennifer Bazan-Wigle has worked in neurological rehabilitation for the entirety of her physical therapy career. She is currently a physical therapist at Parkinson Wellness Recovery's PWR!Gym in Tucson, AZ, where she specializes in one-on-one rehabilitation and group exercise instruction with people with Parkinson disease. Since 2013, she has focused on honing her expertise in treating the movement disorder and Parkinson's population, emphasizing freezing of gait and advanced PD. Jennifer is a PWR! Moves Certified Therapist, PWR!Moves® Certified Instructor, and a Certified Exercise Expert for the Aging Adult (CEEAA). Jennifer has delivered community, academic, and peer-reviewed presentations on Parkinson disease in the

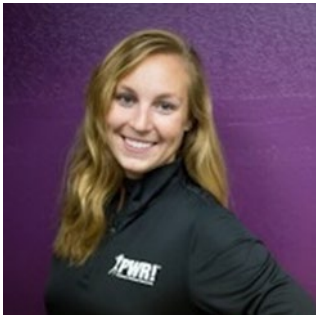
US and internationally. As an integral part of the NeuroFit faculty, Jennifer has worked closely with Dr. Becky Farley to develop course content for PWR!Moves® Therapist and Instructor Training and Certification Workshops, and has delivered over 70 continuing education workshops, across the US and world. In doing so, Jennifer has helped thousands of physical therapists, occupational therapists, and fitness professionals implement evidence-based rehabilitation and group exercise for people with Parkinson disease.



### **Shelley Hockensmith, PT, DPT**

Shelley Hockensmith is a physical therapist with over 20 years of experience in outpatient neurological rehab settings. She graduated from the University of Evansville with her MPT in 2003 and earned her transitional DPT from A.T. Still University in 2025. Shelley has been a Board Certified Neurologic Clinical Specialist since 2008. She has experience in private practice and hospital-based multi-disciplinary neurologic teams working with people with neurological disorders such as stroke, multiple sclerosis, brain injuries, spinal cord injuries, and movement disorders. She developed an interest in vestibular rehab and was fortunate to work with a team of audiologists and physical therapists in a

specialized vestibular and balance disorder clinic. As an avid believer in the power of exercise for people with Parkinson Disease, she became certified in LSVT BIG in 2007, attended one of the first PWR!Moves workshops, and eventually began working at the PWR!Gym in 2019 as a PWR! Moves Certified Therapist. She joined the PWR!Moves faculty in 2022.



### **Emily Borchers PT, DPT**

Emily Borchers is a physical therapist with almost 10 years of experience working with people with Parkinson disease throughout her career. After graduating from the Ohio State University with her DPT in 2014, she began working as a physical therapist at the PWR! Gym in Tucson, AZ where she developed a passion for helping people with Parkinson disease. In her 7 years of working at the PWR! Gym, she specialized in providing one-on-one rehabilitation and group exercise instruction for people with Parkinson disease, assisted with research conducted at the PWR! Gym including a peer-reviewed publication and was Physical Therapy Manager where she learned how to navigate Medicare reimbursement issues to

meet the ongoing rehabilitation needs of people with Parkinson disease. Emily also has experience working with people with Parkinson disease and other neurological conditions including stroke, brain injury, and spinal cord injury in the inpatient rehab setting as part of an interdisciplinary team. She now works at Banner Alzheimer's Institute in Tucson, AZ where she continues to develop her skills in working with people with Parkinson disease and other cognitive diseases including Alzheimer's and Lewy Body Dementia for outpatient rehabilitation services. She joined the PWR! Faculty in 2023. Emily is passionate about empowering people with Parkinson disease and implementing a proactive approach to ongoing rehabilitative and exercise services for improved quality of life.

1. Agosta F, Gatti R, Sarasso E, Volonté MA, Canu E, Meani A, Sarro L, Copetti M, Cattysse E, Kerckhofs E, Comi G, Falini A, Filippi M. Brain plasticity in Parkinson's disease with freezing of gait induced by action observation training. *J Neurol*. 2017 Jan;264(1):88-101. doi: 10.1007/s00415-016-8309-7. Epub 2016 Oct 24. PMID: 27778161.
2. Anke H. Snijders, Charlotte A. Haaxma, Yolien J. Hagen, Marten Munneke, Bastiaan R. Bloem, Freezer or non-freezer: Clinical assessment of freezing of gait, *Parkinsonism & Related Disorders*, Volume 18, Issue 2, 2012, Pages 149-154
3. Beck EN, Ehgoetz Martens KA, Almeida QJ. Freezing of Gait in Parkinson's Disease: An Overload Problem? *PLoS One*. 2015 Dec 17;10(12):e0144986. doi: 10.1371/journal.pone.0144986. PMID: 26678262; PMCID: PMC4682987
4. Bekkers EMJ, Dijkstra BW, Dockx K, Heremans E, Verschueren SMP, Nieuwboer A. Clinical balance scales indicate worse postural control in people with Parkinson's disease who exhibit freezing of gait compared to those who do not: A meta-analysis. *Gait Posture*. 2017 Jul;56:134-140. doi: 10.1016/j.gaitpost.2017.05.009. Epub 2017 May 11. PMID: 28544951.
5. Bekkers EMJ, Dijkstra BW, Heremans E, Verschueren SMP, Bloem BR, Nieuwboer A. Balancing between the two: Are freezing of gait and postural instability in Parkinson's disease connected? *Neurosci Biobehav Rev*. 2018;94:113-125. doi:10.1016/j.neubiorev.2018.08.008
6. Bekkers EMJ, Mirelman A, Alcock L, Rochester L, Nieuwhof F, Bloem BR, Pelosin E, Avanzino L, Cereatti A, Della Croce U, Hausdorff JM, Nieuwboer A. Do Patients With Parkinson's Disease With Freezing of Gait Respond Differently Than Those Without to Treadmill Training Augmented by Virtual Reality? *Neurorehabil Neural Repair*. 2020 May;34(5):440-449
7. Bezerra PT, Santiago LM, Silva IA, et al. Action observation and motor imagery have no effect on balance and freezing of gait in Parkinson's disease: a randomized controlled trial. *Eur J Phys Rehabil Med*. 2022;58(5):715-722. doi:10.23736/S1973-9087.22.07313-0
8. Boddy A, Mitchell K, Ellison J, Brewer W, Perry LA. Reliability and validity of modified Four Square Step Test (mFSST) performance in individuals with Parkinson's disease. *Physiother Theory Pract*. 2023 May;39(5):1038-1043. doi: 10.1080/09593985.2022.2031360. Epub 2022 Jan 29. PMID: 35098864.
9. Bryant MS, Workman CD, Hou JG, Henson HK, York MK. Acute and Long-Term Effects of Multidirectional Treadmill Training on Gait and Balance in Parkinson Disease. *PM&R*. 2016 Dec;8(12):1151-1158. doi: 10.1016/j.pmrj.2016.05.001. Epub 2016 May 10. PMID: 27178378.
10. Capato TTC, Nonnekes J, de Vries NM, Int'Hout J, Barbosa ER, Bloem BR. Effects of multimodal balance training supported by rhythmical auditory stimuli in people with advanced stages of Parkinson's disease: a pilot randomized clinical trial. *J Neurol Sci*. 2020;418:117086. doi:10.1016/j.jns.2020.117086
11. Capato TTC, de Vries NM, Int'Hout J, et al. Multimodal Balance Training Supported by Rhythmic Auditory Stimuli in Parkinson Disease: Effects in Freezers and Nonfreezers. *Phys Ther*. 2020;100(11):2023-2034. doi:10.1093/ptj/pzaa146
12. Capato TTC, de Vries NM, Int'Hout J, Barbosa ER, Nonnekes J, Bloem BR. Multimodal Balance Training Supported by Rhythmical Auditory Stimuli in Parkinson's Disease: A Randomized Clinical Trial. *J Parkinsons Dis*. 2020;10(1):333-346. doi:10.3233/JPD-191752
13. Capato TTC, Nonnekes J, Barbosa ER, Bloem BR. Internal and external compensation strategies to alleviate upper limb freezing in Parkinson's disease. *Parkinsonism Relat Disord*. 2019;64:335-336. doi:10.1016/j.parkreldis.2019.03.008
14. Chan JL, Amorelli G, Sarna JR. Elastic Priming of Gait: An Effective Patient-Created Strategy for Freezing of Gait. *Mov Disord Clin Pract*. 2022;10(1):141-142. Published 2022 Oct 27. doi:10.1002/mdc3.13594

15. Chen YA, Wu RM, Sheu CH, Lin CH, Huang CY. Attentional focus effect on dual-task walking in Parkinson's disease with and without freezing of gait. *Geroscience*. 2023;45(1):177-195. doi:10.1007/s11357-022-00606-3
16. Chow R, Tripp BP, Rzondzinski D, Almeida QJ. Investigating Therapies for Freezing of Gait Targeting the Cognitive, Limbic, and Sensorimotor Domains. *Neurorehabil Neural Repair*. 2021;35(3):290-299. doi:10.1177/1545968321992331
17. Cosentino C, Baccini M, Putzolu M, Ristori D, Avanzino L, Pelosin E. Effectiveness of Physiotherapy on Freezing of Gait in Parkinson's Disease: A Systematic Review and Meta-Analyses. *Mov Disord*. 2020 Apr;35(4):523-536. doi: 10.1002/mds.27936. Epub 2019 Dec 4.
18. Cosentino C, Putzolu M, Mezzarobba S, et al. One cue does not fit all: A systematic review with meta-analysis of the effectiveness of cueing on freezing of gait in Parkinson's disease. *Neurosci Biobehav Rev*. 2023;150:105189. doi:10.1016/j.neubiorev.2023.105189
19. Das J, Barry G, Walker R, Vitorio R, Morris R, Stuart S. The integration of technology into a home-based visuo-cognitive training intervention for people with Parkinson's: Is the future digital?. *PLoS One*. 2023;18(6):e0285100. Published 2023 Jun 15. doi:10.1371/journal.pone.0285100
20. Delgado-Alvarado M, Marano M, Santurtún A, Urtiaga-Gallano A, Tordesillas-Gutierrez D, Infante J. Nonpharmacological, nonsurgical treatments for freezing of gait in Parkinson's disease: A systematic review. *Mov Disord*. 2020 Feb;35(2):204-214. doi: 10.1002/mds.27913. Epub 2019 Nov 26. PMID: 31769904.
21. Delval A, Rambour M, Tard C, et al. Freezing/festination during motor tasks in early-stage Parkinson's disease: A prospective study. *Mov Disord*. 2016;31(12):1837-1845. doi:10.1002/MDS.26762
22. Dijkstra BW, Gilat M, Cofré Lizama LE, Mancini M, Bergmans B, Verschueren SMP, Nieuwboer A. Impaired Weight-Shift Amplitude in People with Parkinson's Disease with Freezing of Gait. *J Parkinsons Dis*. 2021;11(3):1367-1380. doi: 10.3233/JPD-202370. PMID: 33749618.
23. Dijkstra BW, Gilat M, D'Cruz N, Zoetewei D, Nieuwboer A. Neural underpinnings of freezing-related dynamic balance control in people with Parkinson's disease [published online ahead of print, 2023 May 12]. *Parkinsonism Relat Disord*. 2023;112:105444. doi:10.1016/j.parkreldis.2023.105444
24. Ehgoetz Martens KA, Shine JM, Walton CC, et al. Evidence for subtypes of freezing of gait in Parkinson's disease. *Mov Disord*. 2018;33(7):1174-1178. doi:10.1002/mds.27417
25. Espay AJ, Fasano A, Van Nuenen BFL, Payne MM, Snijders AH, Bloem BR. "On" state freezing of gait in Parkinson disease: A paradoxical levodopa-induced complication. *Neurology*. 2012;78(7):454-457. doi:10.1212/WNL.0b013e3182477ec0
26. Fietzek UM, Zwosta J, Schroeteler FE, Ziegler K, Ceballos-Baumann AO. Levodopa changes the severity of freezing in Parkinson's disease. *Parkinsonism Relat Disord*. 2013 Oct;19(10):894-6. doi: 10.1016/j.parkreldis.2013.04.004. Epub 2013 May 1. PMID: 23642712.
27. Frazzitta G, Maestri R, Uccellini D, Bertotti G, Abelli P. Rehabilitation treatment of gait in patients with Parkinson's disease with freezing: A comparison between two physical therapy protocols using visual and auditory cues with or without treadmill training. *Mov Disord*. 2009;24(8):1139-1143. doi:10.1002/mds.22491
28. Frenkel-Toledo S, Giladi N, Peretz C, Herman T, Gruendlinger L, Hausdorff JM. Treadmill walking as an external pacemaker to improve gait rhythm and stability in Parkinson's disease. *Mov Disord*. 2005 Sep;20(9):1109-14. doi: 10.1002/mds.20507.
29. Gan L, Yan R, Su D, et al. Alterations of structure and functional connectivity of visual brain network in patients with freezing of gait in Parkinson's disease. *Front Aging Neurosci*. 2022;14:978976. Published 2022 Sep 7. doi:10.3389/fnagi.2022.978976
30. García-Ruiz PJ. Gait disturbances in Parkinson disease. Did freezing of gait exist before levodopa? Historical review. *J Neurol Sci*. 2011;307:15-17. doi:10.1016/j.jns.2011.05.0191.
31. Gardoni A, Sarasso E, Agosta F, Filippi M, Corbetta D. Rehabilitative interventions for impaired handwriting in people with Parkinson's disease: a scoping review. *Neurol Sci*. 2023;44(8):2667-2677. doi:10.1007/s10072-023-06752-6
32. Georgiades MJ, Gilat M, Ehgoetz Martens KA, et al. Investigating motor initiation and inhibition deficits in patients with Parkinson's disease and freezing of gait using a virtual reality paradigm. *Neuroscience*. 2016;337:153-162. doi:10.1016/j.neuroscience.2016.09.019
33. Gilat M, Ginis P, Zoetewei D, et al. A systematic review on exercise and training-based interventions for freezing of gait in Parkinson's disease. *NPJ Parkinsons Dis*. 2021;7(1):81. Published 2021 Sep 10. doi:10.1038/s41531-021-00224-4

34. Giladi N, Nieuwboer A. Understanding and treating freezing of gait in parkinsonism, proposed working definition, and setting the stage. *Movement Disorders*. 2008;23(S2):S423-S425. doi:[10.1002/mds.21927](https://doi.org/10.1002/mds.21927)
35. Ginis P, Nackaerts E, Nieuwboer A, Heremans E. Cueing for people with Parkinson's disease with freezing of gait: A narrative review of the state-of-the-art and novel perspectives. *Annals of Physical and Rehabilitation Medicine*. 2018;61(6):407-413. doi:[10.1016/j.rehab.2017.08.002](https://doi.org/10.1016/j.rehab.2017.08.002)
36. Godi M, Giardini M, Nardone A, Turcato AM, Caligari M, Pisano F, Schieppati M. Curved Walking Rehabilitation with a Rotating Treadmill in Patients with Parkinson's Disease: A Proof of Concept. *Front Neurol*. 2017 Feb 28;8:53. doi: 10.3389/fneur.2017.00053.
37. Goh, L., Canning, C. G., Song, J., Clemson, L., & Allen, N. E. (2023). The effect of rehabilitation interventions on freezing of gait in people with Parkinson's disease is unclear: a systematic review and meta-analyses. *Disability and rehabilitation*, 45(19), 3199–3218. <https://doi.org/10.1080/09638288.2022.2120099>
38. Goh L, Paul SS, Canning CG, et al. The Ziegler Test Is Reliable and Valid for Measuring Freezing of Gait in People With Parkinson Disease. *Phys Ther*. 2022;102(12):1-8. doi:10.1093/ptj/pzac122
39. Hardeman LES, Kal EC, Young WR, van der Kamp J, Ellmers TJ. Visuomotor control of walking in Parkinson's disease: Exploring possible links between conscious movement processing and freezing of gait. *Behav Brain Res*. 2020;395:112837. doi:10.1016/j.bbr.2020.112837
40. Heimler B, Koren O, Inzelberg R, et al. Heart-rate variability as a new marker for freezing predisposition in Parkinson's disease [published online ahead of print, 2023 Jun 4]. *Parkinsonism Relat Disord*. 2023;105476. doi:10.1016/j.parkreldis.2023.105476
41. Heremans E, Nackaerts E, Vervoort G, et al. Amplitude manipulation evokes upper limb freezing during handwriting in patients with Parkinson's disease with freezing of gait. *PLoS One*. 2015;10(11):1-13. doi:10.1371/journal.pone.0142874
42. Heremans E, Nackaerts E, Vervoort G, Broeder S, Swinnen SP, Nieuwboer A. Impaired Retention of Motor Learning of Writing Skills in Patients with Parkinson's Disease with Freezing of Gait. *PLoS One*. 2016;11(2):e0148933. Published 2016 Feb 10. doi:10.1371/journal.pone.0148933
43. Herman T, Dagan M, Shema-Shiratzky S, Reches T, Brozgol M, Giladi N, Manor B, Hausdorff JM. Advantages of timing the duration of a freezing of gait-provoking test in individuals with Parkinson's disease. *J Neurol*. 2020 Sep;267(9):2582-2588. doi: 10.1007/s00415-020-09856-7. Epub 2020 May 7. PMID: 32383040.
44. Herman T, Giladi N, Gruendlinger L, Hausdorff JM. Six weeks of intensive treadmill training improves gait and quality of life in patients with Parkinson's disease: a pilot study. *Arch Phys Med Rehabil*. 2007 Sep;88(9):1154-8. doi: 10.1016/j.apmr.2007.05.015. PMID: 17826461
45. Hong M, Earhart GM. Rotating treadmill training reduces freezing in Parkinson disease: preliminary observations. *Parkinsonism Relat Disord*. 2008;14(4):359-63. doi: 10.1016/j.parkreldis.2007.07.003. Epub 2007 Aug 29. PMID: 17761449; PMCID: PMC2446473.
46. Horak FB, Mancini M. Objective biomarkers of balance and gait for Parkinson's disease using body-worn sensors. *Mov Disord*. 2013;28(11):1544-1551. doi:10.1002/mds.25684
47. Huang T, Li M, Huang J. Recent trends in wearable device used to detect freezing of gait and falls in people with Parkinson's disease: A systematic review. *Front Aging Neurosci*. 2023;15:1119956. Published 2023 Feb 15. doi:10.3389/fnagi.2023.1119956
48. Hulzinga F, Nieuwboer A, Dijkstra BW, Mancini M, Strouwen C, Bloem BR, Ginis P. The New Freezing of Gait Questionnaire: Unsuitable as an Outcome in Clinical Trials? *Mov Disord Clin Pract*. 2020 Jan 14;7(2):199-205. doi: 10.1002/mdc3.12893. PMID: 32071940; PMCID: PMC7011794.
49. Hunt D, Stuart S, Nell J, et al. Do people with Parkinson's disease look at task relevant stimuli when walking? An exploration of eye movements. *Behav Brain Res*. 2018;348:82-89. doi:[10.1016/j.bbr.2018.03.003](https://doi.org/10.1016/j.bbr.2018.03.003)
50. Jacobs JV, Nutt JG, Carlson-Kuhta P, Stephens M, Horak FB. Knee trembling during freezing of gait represents multiple anticipatory postural adjustments. *Exp Neurol*. 2009 Feb;215(2):334-41. doi: 10.1016/j.expneurol.2008.10.019.
51. Jansen JAF, Capato TTC, Darweesh SKL, et al. Exploring the levodopa-paradox of freezing of gait in dopaminergic medication-naïve Parkinson's disease populations. *npj Park Dis*. 2023;9(1):130. doi:10.1038/s41531-023-00575-0
52. José Luvizutto G, Souza Silva Brito T, de Moura Neto E, Aparecida Pascucci Sande de Souza L. Altered Visual and Proprioceptive Spatial Perception in Individuals with Parkinson's Disease. *Percept Mot Skills*. 2019;127(1):98-112. doi:10.1177/0031512519880421

53. Jung SH, Hasegawa N, Mancini M, et al. Effects of the agility boot camp with cognitive challenge (ABC-C) exercise program for Parkinson's disease. *npj Park Dis*. 2020;6(1):31. doi:10.1038/s41531-020-00132-z
54. Kadivar Z, Corcos DM, Foto J, Hondzinski JM. Effect of step training and rhythmic auditory stimulation on functional performance in Parkinson patients. *Neurorehabil Neural Repair*. 2011 Sep;25(7):626-35. doi: 10.1177/1545968311401627. Epub 2011 Mar 24. PMID: 21436393.
55. Kashif M, Ahmad A, Bandpei MAM, Syed HA, Raza A, Sana V. A Randomized Controlled Trial of Motor Imagery Combined with Virtual Reality Techniques in Patients with Parkinson's Disease. *J Pers Med*. 2022;12(3):450. doi:10.3390/jpm12030450
56. Khobkhun F, Santiago PRP, Tahara AK, Srivanitchapoom P, Richards J. An investigation of the contribution of different turn speeds during standing turns in individuals with and without Parkinson's disease. *Sci Rep*. 2022;12(1):22566. Published 2022 Dec 29. doi:10.1038/s41598-022-27217-4
57. Kim J, Kim I, Kim YE, Koh SB. The Four Square Step Test for Assessing Cognitively Demanding Dynamic Balance in Parkinson's Disease Patients. *J Mov Disord*. 2021 Sep;14(3):208-213. doi: 10.14802/jmd.20146. Epub 2021 May 26. PMID: 34030434; PMCID: PMC8490191.
58. King LA, Horak FB. Delaying Mobility Disability in People With Parkinson Disease Using a Sensorimotor Agility Exercise Program. *Phys Ther*. 2009;89(4):384-393. doi:10.2522/ptj.20080214
59. King LA, Mancini M, Smulders K, et al. Cognitively Challenging Agility Boot Camp Program for Freezing of Gait in Parkinson Disease. *Neurorehabilitation and Neural Repair*. 2020;34(5):417-427. doi:10.1177/1545968320909331
60. King LA, Peterson DS, Mancini M, et al. Do cognitive measures and brain circuitry predict outcomes of exercise in Parkinson Disease: A randomized clinical trial. *BMC Neurol*. 2015;15(1):4-11. doi:10.1186/s12883-015-0474-2
61. King LA, Priest KC, Nutt J, et al. Comorbidity and Functional Mobility in Persons with Parkinson Disease. *Arch Phys Med Rehabil*. 2014;95(11):2152-2157. doi:10.1016/j.apmr.2014.07.396
62. Klaver EC, van Vugt JPP, Bloem BR, van Wezel RJA, Nonnekes J, Tjepkema-Cloostermans MC. Good vibrations: tactile cueing for freezing of gait in Parkinson's disease. *J Neurol*. 2023;270(7):3424-3432. doi:10.1007/s00415-023-11663-9
63. Koehler PJ, Nonnekes J, Bloem BR. Freezing of gait before the introduction of levodopa. *Lancet Neurol*. 2021 Feb;20(2):97. doi: 10.1016/S1474-4422(19)30091-2. Epub 2019 Apr 11. PMID: 30982582.
64. Kwok JYY, Smith R, Chan LML, Lam LCC, Fong DYT, Choi EPH, Lok KYW, Lee JJ, Auyeung M, Bloem BR. Managing freezing of gait in Parkinson's disease: a systematic review and network meta-analysis. *J Neurol*. 2022 Jun;269(6):3310-3324. doi: 10.1007/s00415-022-11031-z.
65. Leung IHK, Walton CC, Hallock H, Lewis SJG, Valenzuela M, Lampit A. Cognitive training in Parkinson disease: A systematic review and meta-analysis. *Neurology*. 2015;85(21):1843-1851. doi:10.1212/WNL.0000000000002145
66. Lewis S, Factor S, Giladi N, Nieuwboer A, Nutt J, Hallett M. Stepping up to meet the challenge of freezing of gait in Parkinson's disease. *Transl Neurodegener*. 2022;11(1):23. doi:10.1186/s40035-022-00298-x
67. Li KP, Zhang ZQ, Zhou ZL, et al. Effect of music-based movement therapy on the freezing of gait in patients with Parkinson's disease: A randomized controlled trial. *Front Aging Neurosci*. 2022;14:924784. Published 2022 Oct 19. doi:10.3389/fnagi.2022.924784
68. Maidan I, Nieuwhof F, Bernad-Elazari H, Bloem BR, Giladi N, Hausdorff JM, et al. Evidence for Differential Effects of 2 Forms of Exercise on Prefrontal Plasticity During Walking in Parkinson's Disease. *Neurorehabil Neural Repair*. 2018 Mar;32(3):200-208. doi: 10.1177/1545968318763750.
69. Maidan I, Rosenberg-Katz K, Jacob Y, Giladi N, Hausdorff JM, Mirelman A. Disparate effects of training on brain activation in Parkinson disease. *Neurology*. 2017 Oct 24;89(17):1804-1810. doi: 10.1212/WNL.0000000000004576.
70. Mandal M, Khan A. Attention switching deficit in patients of Parkinson's disease who experience freezing of gait. *Appl Neuropsychol Adult*. 2023;30(4):389-400. doi:10.1080/23279095.2021.1951268
71. Martens KAE, Silveira CRA, Intzandt BN, Almeida QJ. Overload From Anxiety: A Non-Motor Cause for Gait Impairments in Parkinson's Disease. *J Neuropsychiatry Clin Neurosci*. 2018;30:77-80. doi:10.1176/appi.neuropsych.16110298
72. May DS, Tueth LE, Earhart GM, Mazzoni P. Using Wearable Sensors to Assess Freezing of Gait in the Real World. *Bioengineering (Basel)*. 2023;10(3):289. Published 2023 Feb 23. doi:10.3390/bioengineering10030289

73. Mezzarobba S, Ravizzotti E, Bernardis P, et al. Boosting motor imagery processing to improve gait in patients with Parkinson disease and freezing of gait: A pilot study. *Parkinsonism Relat Disord*. 2024;129:107173. doi:10.1016/j.parkreldis.2024.107173
74. Milane T, Hansen C, Chardon M, Bianchini E, Vuillerme N. Comparing Backward Walking Performance in Parkinson's Disease with and without Freezing of Gait-A Systematic Review. *Int J Environ Res Public Health*. 2023;20(2):953. Published 2023 Jan 4. doi:10.3390/ijerph20020953
75. Monaghan AS, Gordon E, Graham L, Hughes E, Peterson DS, Morris R. Cognition and freezing of gait in Parkinson's disease: A systematic review and meta-analysis. *Neurosci Biobehav Rev*. 2023;147:105068. doi:10.1016/j.neubiorev.2023.105068
76. Mori L, Putzolu M, Bonassi G, Galeoto G, Mezzarobba S, Trompetto C, Avanzino L, Marchese R, Abbruzzese G, Pelosin E. Haptic perception of verticality correlates with postural and balance deficits in patients with Parkinson's disease. *Parkinsonism Relat Disord*. 2019 Sep;66:45-50. doi: 10.1016/j.parkreldis.2019.06.026. Epub 2019 Jul 2. PMID: 31279636.
77. Nackaerts E, Heremans E, Vervoort G, et al. Relearning of Writing Skills in Parkinson's Disease After Intensive Amplitude Training. *Mov Disord*. 2016;31(8):1209-1216. doi:10.1002/mds.26565
78. Nackaerts E, Broeder S, Pereira MP, et al. Handwriting training in Parkinson's disease: A trade-off between size, speed and fluency. *PLoS One*. 2017;12(12):e0190223. Published 2017 Dec 22. doi:10.1371/journal.pone.0190223
79. Nieuwboer A, Giladi N. Characterizing freezing of gait in Parkinson's disease: Models of an episodic phenomenon. *Mov Disord*. 2013;28(11):1509-1519. doi:10.1002/mds.25683
80. Nieuwboer A, Rochester L, Herman T, et al. Reliability of the new freezing of gait questionnaire: Agreement between patients with Parkinson's disease and their carers. *Gait Posture*. 2009;30(4):459-463. doi:10.1016/j.gaitpost.2009.07.108
81. Nóbrega LR, Rocon E, Pereira AA, Andrade A de O. A Novel Physical Mobility Task to Assess Freezers in Parkinson's Disease. *Healthcare*. 2023;11(3):409. doi:10.3390/healthcare11030409
82. Nonnekes J, Giladi N, Guha A, Fietzek UM, Bloem BR, Růžička E. Gait festination in parkinsonism: introduction of two phenotypes. *J Neurol*. 2019;266(2):426-430. doi:10.1007/s00415-018-9146-7
83. Nonnekes J, Snijders AH, Nutt JG, Deuschl G, Giladi N, Bloem BR. Freezing of gait: a practical approach to management. *Lancet Neurol*. 2015;14(7):768-778. doi:10.1016/S1474-4422(15)00041-1
84. Nonnekes J, Nieuwboer A. Towards Personalized Rehabilitation for Gait Impairments in Parkinson's Disease. Brundin P, Langston JW, Bloem BR, eds. *Journal of Parkinson's Disease*. 2018;8(s1):S101-S106. doi:[10.3233/JPD-181464](https://doi.org/10.3233/JPD-181464)
85. Nutt JG, Bloem BR, Giladi N, Hallett M, Horak FB, Nieuwboer A. Freezing of gait: moving forward on a mysterious clinical phenomenon. *Lancet Neurol*. 2011;10(8):734-744. doi:10.1016/S1474-4422(11)70143-0
86. Pelosin E, Avanzino L, Bove M, Stramesi P, Nieuwboer A, Abbruzzese G. Action observation improves freezing of gait in patients with Parkinson's disease. *Neurorehabil Neural Repair*. 2010 Oct;24(8):746-52. doi: 10.1177/1545968310368685. Epub 2010 May 7. PMID: 20453155.
87. Pelosin E, Barella R, Bet C, Magioncalda E, Putzolu M, Di Biasio F, Cerulli C, Casaleggio M, Abbruzzese G, Avanzino L. Effect of Group-Based Rehabilitation Combining Action Observation with Physiotherapy on Freezing of Gait in Parkinson's Disease. *Neural Plast*. 2018 May 27;2018:489276. doi: 10.1155/2018/489276. PMID: 29977280; PMCID: PMC5994277.
88. Peterson DS, King LA, Cohen RG, Horak FB. Cognitive Contributions to Freezing of Gait in Parkinson Disease: Implications for Physical Rehabilitation. *Physical Therapy*. 2016;96(5):659-670. doi:[10.2522/ptj.20140603](https://doi.org/10.2522/ptj.20140603)
89. Rafferty MR, Nettnin E, Goldman JG, MacDonald J. Frameworks for Parkinson's Disease Rehabilitation Addressing When, What, and How. *Curr Neurol Neurosci Rep*. 2021;21(3):12. doi:10.1007/s11910-021-01096-0
90. Ribeiro de Souza C, Ávila de Oliveira J, Takazono PS, et al. Perturbation-based balance training leads to improved reactive postural responses in individuals with Parkinson's disease and freezing of gait. *Eur J Neurosci*. 2023;57(12):2174-2186. doi:10.1111/ejn.16039
91. Ruan X, Huang X, Li Y, Kuang Z, Li M, Wei X. Dysfunction of human brain network hierarchy in Parkinson's disease patients with freezing of gait [published online ahead of print, 2023 May 24]. *Parkinsonism Relat Disord*. 2023;112:105446. doi:10.1016/j.parkreldis.2023.105446
92. Rutz DG, Benninger DH. Physical Therapy for Freezing of Gait and Gait Impairments in Parkinson Disease: A Systematic Review. *PM&R*. 2020 Nov;12(11):1140-1156. doi: 10.1002/pmrj.12337. Epub 2020 May 19.

93. Sarasso E, Agosta F, Piramide N, Gardoni A, Canu E, Leocadi M, Castelnovo V, Basaia S, Tettamanti A, Volontè MA, Filippi M. Action Observation and Motor Imagery Improve Dual Task in Parkinson's Disease: A Clinical/fMRI Study. *Mov Disord.* 2021 Nov;36(11):2569-2582. doi: 10.1002/mds.28717. Epub 2021 Jul 19. PMID: 34286884
94. Schootemeijer S, van der Kolk NM, Ellis T, et al. Barriers and Motivators to Engage in Exercise for Persons with Parkinson's Disease. *J Parkinsons Dis.* 2020;10(4):1293-1299. doi:10.3233/JPD-202247
95. Scully AE, Tan D, Oliveira BIR, Hill KD, Clark R, Pua YH. Scoring festination and gait freezing in people with Parkinson's: The freezing of gait severity tool-revised [published online ahead of print, 2023 May 18]. *Physiother Res Int.* 2023;e2016. doi:10.1002/pri.2016
96. Shah V V., Vitorio R, Hasegawa N, et al. Effects of a Cognitively Challenging Agility Boot Camp Program (ABC-C) on Balance and Gait in People With Parkinson's Disease: Does Freezing of Gait Status Matter? *Neurorehabil Neural Repair.* 2022;36(9):603-612. doi:10.1177/15459683221119757
97. Silva-Batista C, Almeida FO, Batista A, Barbosa ER, Horak FB, Ugrinowitsch C. Complex Exercises Improve Cognition in People With Parkinson's Disease and Freezing of Gait. *Neurorehabil Neural Repair.* 2025;39(1):3-15. doi:10.1177/15459683241290793
98. Silva-Batista C, Corcos DM, Kanegusuku H, et al. Balance and fear of falling in subjects with Parkinson's disease is improved after exercises with motor complexity. *Gait Posture.* 2018;61(May 2017):90-97. doi:10.1016/j.gaitpost.2017.12.027
99. Silva-Batista C, Corcos DM, Roschel H, Kanegusuku H, Gobbi LT, Piemonte ME, Mattos EC, DE Mello MT, Forjaz CL, Tricoli V, Ugrinowitsch C. Resistance Training with Instability for Patients with Parkinson's Disease. *Med Sci Sports Exerc.* 2016 Sep;48(9):1678-87. doi: 10.1249/MSS.0000000000000945.
100. Silva-Batista C, Lima-Pardini AC, Nucci MP, et al. A Randomized, Controlled Trial of Exercise for Parkinsonian Individuals With Freezing of Gait. *Mov Disord.* 2020;35(9):1607-1617. doi:10.1002/mds.28128
101. Snijders AH, Haaxma CA, Hagen YJ, Munneke M, Bloem BR. Freezer or non-freezer: Clinical assessment of freezing of gait. *Park Relat Disord.* 2012;18(2):149-154. doi:10.1016/j.parkreldis.2011.09.006
102. Snijders AH, Nijkrake MJ, Bakker M, Munneke M, Wind C, Bloem BR. Clinimetrics of freezing of gait. *Mov Disord.* 2008;23(S2):S468-S474. doi:10.1002/mds.22144
103. Soke F, Guclu-Gunduz A, Ozkan T, Ozkul C, Gulsen C, Kocer B. Reliability and validity of the timed 360° turn test in people with Parkinson's disease. *Eur Geriatr Med.* 2020 Jun;11(3):417-426. doi: 10.1007/s41999-019-00285-y. Epub 2020 Jan 10. PMID: 32297254.
104. Son M, Cheon SM, Youm C, Kim JW. Turning reveals the characteristics of gait freezing better than walking forward and backward in Parkinson's disease. *Gait Posture.* 2022;94:131-137. doi:10.1016/j.gaitpost.2022.03.009
105. Sotirakis, C., Su, Z., Brzezicki, M.A. et al. Identification of motor progression in Parkinson's disease using wearable sensors and machine learning. *npj Parkinsons Dis.* 9, 142 (2023). <https://doi.org/10.1038/s41531-023-00581-2>
106. Sozzi S, Schieppati M. Stepping in Place While Voluntarily Turning Around Produces a Long-Lasting Posteffect Consisting in Inadvertent Turning While Stepping Eyes Closed. *Neural Plast.* 2016;2016:7123609. doi: 10.1155/2016/7123609.
107. Taghizadeh G, Fereshted SM, Martinez-Martin P, Joghataei MT, Mahdizadeh F, Sabbaghi S, Goudarzi S, Meimandi M, Habibi SAH, Mehdizadeh M. Clinimetrics of the Freezing of Gait Questionnaire for Parkinson Disease During the "off" State. *Basic Clin Neurosci.* 2021 Jan-Feb;12(1):69-78. doi: 10.32598/bcn.12.1.882.11. Epub 2021 Jan 1. PMID: 33995929; PMCID: PMC8114865.
108. Tosserams A, Bloem BR, Ehgoetz Martens KA, Helmich RC, Kessels RPC, Shine JM, Taylor NL, Wainstein G, Lewis SJG, Nonnekes J. Modulating arousal to overcome gait impairments in Parkinson's disease: how the noradrenergic system may act as a double-edged sword. *Transl Neurodegener.* 2023 Mar 26;12(1):15. doi: 10.1186/s40035-023-00347-z. PMID: 36967402; PMCID: PMC10040128.
109. Tosserams A, Fasano A, Gilat M, et al. Management of freezing of gait - mechanism-based practical recommendations. *Nat Rev Neurol.* 2025;21(6):327-344. doi:10.1038/s41582-025-01079-6
110. Tosserams A, Nijkrake MJ, Sturkenboom IHWM, Bloem BR, Nonnekes J. Perceptions of Compensation Strategies for Gait Impairments in Parkinson's Disease: A Survey Among 320 Healthcare Professionals. *J Parkinsons Dis.* 2020;10:1775-1778. doi:10.3233/JPD-202176

111. Tosserams A, Nonnekes J. How I Examine My Patient: A Practical Guide to the Evaluation of Compensation Strategies for Gait Impairment in Parkinson's Disease. *J Parkinsons Dis.* 2022;12:2005-2008. doi:10.3233/JPD-223296
112. Tosserams A, Weerdesteijn V, Bal T, Bloem BR, Solis-Escalante T, Nonnekes J. Cortical Correlates of Gait Compensation Strategies in Parkinson Disease. *Ann Neurol.* 2022 Mar;91(3):329-341. doi: 10.1002/ana.26306. Epub 2022 Feb 8. PMID: 35067999; PMCID: PMC9306676.
113. Tseng, Ing-Jy MSN; Yuan, Rey-Yue MD; Jeng, Chii PhD. Treadmill Training Improves Forward and Backward Gait in Early Parkinson Disease. *American Journal of Physical Medicine & Rehabilitation* 94(10):p 811-819, October 2015. | DOI: 10.1097/PHM.0000000000000273
114. Vieira-Yano B, Martini DN, Horak FB, et al. The Adapted Resistance Training with Instability Randomized Controlled Trial for Gait Automaticity. *Mov Disord.* 2021;36(1):152-163. doi:10.1002/mds.28298
115. Virmani T, Landes RD, Pillai L, et al. Gait Declines Differentially in, and Improves Prediction of, People with Parkinson's Disease Converting to a Freezing of Gait Phenotype. *J Parkinsons Dis.* 2023;13(6):961-973. doi:10.3233/JPD-230020
116. Witt I, Ganjavi H, MacDonald P. Relationship between Freezing of Gait and Anxiety in Parkinson's Disease Patients: A Systemic Literature Review. *Parkinsons Dis.* 2019;2019:6836082. Published 2019 Jul 24. doi:10.1155/2019/6836082
117. Walton CC, Mowszowski L, Gilat M, Hall JM, O'Callaghan C, Muller AJ, Georgiades M, Szeto JYY, Ehgoetz Martens KA, Shine JM, Naismith SL, Lewis SJG. Cognitive training for freezing of gait in Parkinson's disease: a randomized controlled trial. *NPJ Parkinsons Dis.* 2018 May 18;4:15. doi: 10.1038/s41531-018-0052-6.
118. Weiss D, Schoellmann A, Fox MD, et al. Freezing of gait: understanding the complexity of an enigmatic phenomenon. *Brain.* 2020;143(1):14-30. doi:10.1093/brain/awz314
119. Zhang LL, Canning SD, Wang XP. Freezing of Gait in Parkinsonism and its Potential Drug Treatment. *Curr Neuropharmacol.* 2016;14(4):302-6. doi: 10.2174/1570159x14666151201190040. PMID: 26635194; PMCID: PMC4876585.
120. Yamagami M, Imsdahl S, Lindgren K, et al. Effects of virtual reality environments on overground walking in people with Parkinson disease and freezing of gait. *Disabil Rehabil Assist Technol.* 2023;18(3):266-273. doi:10.1080/17483107.2020.1842920
121. Yogev-Seligmann G, Josman N, Bitterman N, Rosenblum S, Naaman S, Gilboa Y. The development of a home-based technology to improve gait in people with Parkinson's disease: a feasibility study. *Biomed Eng Online.* 2023;22(1):2. Published 2023 Jan 19. doi:10.1186/s12938-023-01066-2
122. Ziegler, K., Schroeteler, F., Ceballos-Baumann, A.O. and Fietzek, U.M. (2010), A new rating instrument to assess festination and freezing gait in Parkinsonian patients. *Mov. Disord.*, 25: 1012-1018. <https://doi.org/10.1002/mds.22993>
123. Zoetewei D, Ginis P, Goris M, et al. Which Gait Tasks Produce Reliable Outcome Measures of Freezing of Gait in Parkinson's Disease?. *J Parkinsons Dis.* 2024;14(6):1163-1174. doi:10.3233/JPD-240134

PWR! uses the latest research to inform our programs, workshops and resources. The full body of research referenced during the workshop is updated regularly and can be viewed at:

**[pwr4life.org/Parkinson-research](https://pwr4life.org/Parkinson-research)**