


CASE REPORT

Applying Updated Clinical Criteria for Differential Diagnosis of Parkinson's Disease in Practice: A Changing Perspective

Karen Marie Blood ^{1*} , Justin Thomas Mierzwicki ², Mariana Wingood ^{3,4,5}, Barbara Billek-Sawhney ⁶

¹ Department of Physical Therapy, Quinnipiac University, Hamden, CT 06518, USA

² Department of Physical Therapy, Lebanon Valley College, Annville, PA 17003, USA

³ Department of Implementation Science, Wake Forest University School of Medicine, Winston-Salem, NC 27101, USA

⁴ Section of Gerontology and Geriatric Medicine, Department of Internal Medicine, Wake Forest University School of Medicine, Winston-Salem, NC 27101, USA

⁵ Sticht Center for Healthy Aging and Alzheimer's Prevention, Internal Medicine, Gerontology and Geriatric Medicine, Wake Forest University School of Medicine, Winston-Salem, NC 27101, USA

⁶ Independence Health System–Rehabilitation Services, Butler Memorial Hospital, Butler, PA 16001, USA

ABSTRACT

Providing holistic physical and occupational therapy requires a generalist's perspective, even within the confines of specialist practice. In all settings, physical and occupational therapists must practice at the top of their scope to evaluate the whole person to identify potential pathologies which may impact success in the receipt of services related to their referral. As the population worldwide advances in age, and more individuals are living with Parkinson's disease, it is crucial for all healthcare professionals, including rehabilitation specialists, to be able to accurately assess for signs of neurodegenerative disease. By reporting a patient case, this perspective provides clinicians with contemporary information related to the differential diagnosis of a neurodegenerative disease and introduces how the Geriatric 5M model can serve as a framework to inform the examination and intervention of a patient with undiagnosed Parkinson's Disease. Traditional criteria for the clinical diagnosis of Parkinson's disease are compared to updated, contemporary diagnostic criteria along with supportive criteria. This case-based perspective article emphasizes the importance of examining the whole person, not just the referring

*CORRESPONDING AUTHOR:

Karen Marie Blood, Department of Physical Therapy, Quinnipiac University, Hamden, CT 06518, USA Email: Karen.Blood@quinnipiac.edu

ARTICLE INFO

Received: 17 December 2024 | Revised: 21 January 2025 | Accepted: 29 January 2025 | Published Online: 8 February 2025

DOI: <https://doi.org/10.30564/jgm.v7i1.13039>

CITATION

Blood, K.M., Mierzwicki, J.T., Wingood, M., et al., 2025. Applying Updated Clinical Criteria for Differential Diagnosis of Parkinson's Disease in Practice: A Changing Perspective. *Journal of Geriatric Medicine*. 7(1): 12–18. DOI: <https://doi.org/10.30564/jgm.v7i1.13039>

COPYRIGHT

Copyright © 2025 by the author(s). Published by Bilingual Publishing Group. This is an open access article under the Creative Commons Attribution-NonCommercial 4.0 International (CC BY-NC 4.0) License (<https://creativecommons.org/licenses/by-nc/4.0/>).

diagnosis, the ethical need of physical and occupational therapists to maintain contemporary expertise in clinical practice, and to refer when appropriate. New diagnostic criteria for Parkinson's disease are included to promote the immediate application of these concepts into clinical practice.

Keywords: Parkinson's Disease; Physical Therapy; Case-Report; Geriatric 5Ms

1. Introduction

The provision of physical and occupational therapy services to older adults requires a holistic approach. Physical and occupational therapists in all practice settings may be called upon to look beyond their primary area of expertise to provide comprehensive patient evaluations. Recent recommendations encourage physical therapists to embrace the Geriatric 5Ms (Matters Most, Mind, Mobility, Medications, Multicomplexity) as a guiding framework for clinical practice improvement^[1]. Through consideration of a patient case, this perspective paper challenges rehabilitation professionals to appreciate that the reason for physical therapy (PT) and/or occupational therapy (OT) referral may not reflect all the patient's needs.

The Geriatric 5M framework was first developed for physicians to best communicate the unique needs of older adults^[2]. All clinicians must consider older adults with a systematic framework that includes how the patient moves (Mobility); is there a presence of delirium, depression, or dementia (Mind); and consider the impact of polypharmacy (Medications)^[1]. Clinicians must consider the individual goals of the patient (Matters most) and how normal age-related changes, potential for multiple comorbidities, and social determinants of health (Multicomplexity) may impact older adults^[3].

Parkinson's Disease (PD) is a neurodegenerative disease of the basal ganglia, with the majority of cases affecting individuals over the age of 50, with an estimated 10 million people worldwide living with the disease^[4]. By 2050, it is estimated that 22% of the world population will be age 65 years and older^[5]. The ageing population, coupled with PD being the fastest-growing neurological disorder globally^[6-8], suggests that rehabilitation specialists may be the first health care providers to recognize the presence of PD in a patient.

Non-modifiable factors, including male sex, age, genetics, and Hispanic ethnicity, increase one's risk for developing PD^[9,10]. Other modifiable risk factors, including tobacco

use, caffeine intake, decreased physical activity, prior head injury, and the use of medications such as beta-blockers, calcium channel blockers, or non-steroidal anti-inflammatory drugs, have been linked to PD development^[9-12]. Environmental risk factors contributing to PD development include exposure to pesticides and herbicides, as may be seen in individuals with agricultural occupations, rural living, and well water consumption^[9]. The complex interaction of modifiable and non-modifiable risk factors for PD highlights the multifactorial nature of the disease and supports the consideration of a holistic approach to diagnosis and management.

Concurrent with the basal ganglia dysfunction in individuals with PD, there is a reduction of the neurotransmitter dopamine in the substantia nigra, leading to the hallmark manifestations of PD^[13,14]. Key features of PD are bradykinesia and the presence of either rigidity or resting tremor^[15], which differ from the historical requirements for a clinical diagnosis described by James Parkinson. James Parkinson is attributed to identifying PD as 'shaking palsy' in 1817, although symptoms associated with PD were first described over 100 years earlier. In 1680, Sylvius de la Boë described the resting tremor and festination^[16], and in 1690, Ferenc Pápai Páriz presented the four cardinal motor symptoms: bradykinesia, rigidity, tremor, and postural instability, which historically have been used to establish a clinical diagnosis of PD^[17,18].

Diagnostic certainty of PD can only be attained post-mortem; therefore, motor criteria remain the core feature of the diagnosis^[15]. Knowledge about PD continues to evolve, with the Movement Disorder Society establishing revised clinical criteria in 2015, which stress that clinical expert opinion is the 'gold standard' for diagnosis. **Table 1** presents a comparison of the historical and current diagnostic criteria for PD. The current criteria require the presence of bradykinesia and either resting tremor or rigidity; absent is postural instability. In addition to the updated motor criteria, four supportive criteria for PD have been described as: (1) beneficial response(s) to dopaminergic therapy that are clear

and dramatic; (2) levodopa-induced dyskinesia presence; (3) resting tremor in a limb; and (4) olfactory loss or cardiac sympathetic denervation^[15]. Asymmetry of symptom onset,

responsiveness to dopaminergic therapy, and responsiveness to audio and/or visual cueing separate PD from other basal ganglia disorders^[15].

Table 1. Comparison of diagnostic criteria for Parkinson’s disease, historical and current.

Historical Criteria ^[17]	Contemporary Diagnostic Criteria ^[15]
Presence of 2 of 4 cardinal signs	
1. Tremor	Diagnosis made by clinical exam
2. Rigidity	Presence of bradykinesia and either resting tremor or rigidity
3. Bradykinesia	
4. Postural Instability	

2. Case Presentation

A 72-year-old man was referred to PT in an acute care hospital one day following an elective right reverse shoulder arthroplasty secondary to failed conservative management of osteoarthritis. The orthopedic surgeon’s post-operative orders were specific: ‘consult PT for active range of motion of the elbow, wrist, and hand.’ Chart review revealed past medical history of anxiety, osteoarthritis, benign prostatic hypertrophy, obesity (BMI 34.9), pre-diabetes, tinnitus, chronic renal insufficiency, gout, and right total hip arthroplasty 3 years ago. Prior to initiating the evaluation, the nurse informed the physical therapist that the patient was medically stable but was demonstrating Parkinsonian-like movement patterns as well as slower processing when responding to questions.

During the initial interview, the patient exhibited delayed responses to the 3-item STEADI fall screening^[19,20]. The patient reported that 2 of the 3 screening questions were positive, indicating a high fall risk and the need for further examination^[19]. With 1 in 4 older adults falling annually, fall risk screening is critical for all individuals over age 65^[19,20]. Secondly, the Physical Activity Vital Sign (PAVS) was used to assess the patient’s activity level. As a worldwide health initiative, ACSM Exercise is Medicine[®] encourages the assessment of physical activity through a 2-item questionnaire^[21–23]. The patient’s PAVS before surgery was 150 mins/week. The patient further stated that he felt “stiff and has difficulty initiating his walking and standing up” (from sitting), and the patient’s primary goal was the elimination of shoulder pain.

On observation, a pill rolling tremor was noted in his left hand, and the patient was wearing a post-operative right shoulder immobilizer. Bed mobility and scooting in sitting

required moderate assistance, necessitating assistance with approximately 50% of the task^[24]. The patient required assistance moving his legs over the edge of the bed and to assume a short sitting position. When performing a sit-to-stand transfer from the edge of the bed, the patient required several attempts and moderate assistance to stand from an elevated bed height (higher than the standard chair height of 18 in/45 cm) using his left upper extremity to assist. The therapist identified that the patient had difficulty with phase II of the transfer, i.e., hip lifting from the edge of the bed with maximal hip flexion^[25]. The patient ambulated without an assistive device for 40 feet (12 m) with a shuffling gait pattern; the patient required between contact guard and moderate assistance, with increased assistance needed during turns and ambulating through doorways. Gait parameters and quality were characteristic of PD: reduced gait velocity, decreased step and stride length, increased double limb support, decreased trunk rotation, and decreased arm swing on his non-immobilized side^[26]. With the application of rhythmic auditory cueing during gait, ‘big step left, big step right, big step left...,’ improvements in gait parameters were visibly evident, most notably with step length^[27]. When cueing was withdrawn, the patient returned to a shuffling gait deviation.

The initial evaluation continued with further assessment of fall risk with the Timed Up and Go test. In adults with low fall risk, this standardized, reliable, and valid test requires 12 s or less to rise from sitting, walk 10 feet (3 m), turn, walk back to the chair, and sit down^[19,28,29]. This patient required 52 s, indicating a high fall risk.

The patient denied changes in sensation, numbness, tingling, or radiating symptomatology. Light touch sensation was intact in the distal extremities; therefore, a comprehen-

sive sensory examination was deferred. The patient was not asked about olfactory sensation. The synthesis of clinical examination findings was consistent with PD, including the presence of bradykinesia, coupled with rigidity, high fall risk, a pill-rolling tremor, and a shuffling gait responsive to audio cues.

In clinical practice, there may be variability in the performance of tests and measures. To standardize the testing of bradykinesia and rigidity, the Movement Disorder Society-sponsored revision of the Unified Parkinson’s Disease Rating Scale (MDS-UPDRS), Part III, Sections 3.3 to 3.8, is recommended for the motor examination^[15].

The MDS-UPDRS describes bradykinesia as both a “slowness of movement AND decrement in amplitude or speed (or progressive hesitations/halts) as movements are continued.”^[15] (p. 1594). The steps for testing bradykinesia follow: the therapist explains and demonstrates the task; the patient performs 10 repetitions on each limb separately, as the therapist evaluates movements for “...speed, amplitude, hesitations, halts, and decrementing amplitude.”^[16] (pp. 2158–2160). Sections 3.4 to 3.8 of the MDS-UPDRS include

finger tapping (thumb to index finger), opening the hand fully and closing into a fist, forearm pronation-supination with shoulder flexion to 90 degrees and elbows extended, tapping toes on the floor with heel down, and stomping (lifting the entire foot from the floor and stomping the foot down). For a diagnosis of PD, bradykinesia in a limb must be present.

The presence of rigidity may be subtle in the early stages of PD. Rigidity, unlike spasticity, is neither velocity nor directionally dependent. Activation maneuvers are described in the MDS-UPDRS, Section 3.3. Initially, therapists assess for the presence of rigidity in each extremity, then repeat the assessment of each extremity while the patient performs rapid alternating repetitive movements on the contralateral side. For example, the therapist may have the patient repetitively tap their thumb to their index finger on the left hand, while the therapist passively moves the wrist on the right side to assess for rigidity^[16]. **Table 2** presents detailed clinical test descriptions for examining bradykinesia and rigidity. A video of these tests can also be found on the University of Stanford’s website (<https://stanfordmedicine25.stanford.edu/the25/parkinsondisease.html>).

Table 2. Clinical tests are critical for a clinical diagnosis of Parkinson’s Disease. Bradykinesia, a hallmark feature, must be combined with resting tremor or rigidity^[16,30].

<u>Bradykinesia</u>	<u>Rigidity—Subtle Early in Disease Stages Critical to Employ ‘Activation Maneuvers’ to Make Rigidity More Evident</u>
<ul style="list-style-type: none"> • To test for bradykinesia, have the patient perform rapid alternating movements <ul style="list-style-type: none"> ○ 10x as FAST and BIG as possible ○ The movements most affected are the finest, i.e., fingers and toes ○ (+) if range of motion (ROM) and/or speed reduce over time à PRESENCE OF BRADYKINESIA • Movements for the upper extremity: <ul style="list-style-type: none"> ○ Finger tapping—index finger to thumb ○ Fist Open Close ○ Pronation/Supination suggested to perform at 90 deg of shoulder flexion, elbow extended • Movements for the lower extremity: <ul style="list-style-type: none"> ○ Toe tapping while the heel is on the ground ○ Heel tapping (whole foot on the ground, i.e., marching) 	<ul style="list-style-type: none"> • Increased resistance to passive movement that is not velocity or direction-dependent • Test PASSIVELY; may need to employ ACTIVATION maneuvers, i.e., perform repetitive movements with the contralateral limb to the one being tested • Testing the upper extremity—wrist is the most sensitive; the therapist passively rotates the wrist; the therapist supports the forearm—ROM normal, may feel resistance <ul style="list-style-type: none"> – Unmask rigidity by having the patient tap the opposite hand on the knee as an activation maneuver • Testing the lower extremity—provide support to the distal femur posteriorly, hold the foot to test the ankle; then test the knee; unmask rigidity by having the patient tap the other hand on the knee as an activation maneuver

See the Movement Disorder Society-sponsored revision of the Unified Parkinson’s Disease Rating Scale (MDS-UPDRS), Part III, for a detailed explanation of complete examination techniques.

The following video demonstrates the clinical examination of someone suspected of having Parkinson’s disease as described by Dr. Kathleen Posten, University of Stanford (<https://stanfordmedicine25.stanford.edu/the25/parkinsondisease.html>)

Therapists may employ external cues, such as rhythmic auditory, visual, verbal, or attentional cues, to assess if changes are evident with gait parameters, quality, or repeti-

tive movements. External cues are effective for improving gait deviations, such as reduced step length, in patients with PD^[6,31]. The use of cueing to improve gait is characteristic

of PD, but not other basal ganglia disorders^[32]. For this case, the therapist stated, ‘big step left, big step right, big step left...’ and there was a corresponding increase in step and stride length.

The presence of bradykinesia, rigidity, resting tremor, increased fall risk, shuffling gait, and slow mental processing post-operatively demonstrates multicomplexity in older adults. Several resources describe the impact of anesthesia on neurological symptoms^[33–35]. The following quotations relate to disease-drug interactions between PD and anesthesia, which are of key importance to physical and occupational therapists:

“General anesthetic drugs produce extensive neuronal changes in the central nervous system by enhancing inhibitory and reducing excitatory neurotransmission.”^[33] (p. 324).

“...general anaesthesia may mask neurological symptoms in the intraoperative period and exacerbate them postoperatively. Moreover, the drugs administered in general anaesthesia more likely interact with anti-Parkinson drugs and may have side effects.”^[34] (p. 280).

“...the anesthetics used in general anesthesia have clear interactions with the drugs used to control PD.”^[35] (p. 10).

With the growing incidence of PD, all healthcare providers require awareness that older adults may have undiagnosed PD^[36]. In addition, general anesthesia may exacerbate PD symptomatology postoperatively^[34,35,37].

Rehabilitation professionals have the advantage of spending time with patients to appreciate the patient as a whole and the interplay of the Geriatric 5Ms^[2]. Pre-morbidly, the patient in this case study reported stiffness and difficulty initiating walking and standing up from a sitting position. Post-operatively, the patient demonstrated impaired functional mobility, bradykinesia, rigidity, resting tremor, slow processing, and reduced functional independence. The absence of shoulder pain mattered most to this patient, and the presentation of these symptoms was multicomplex. **Figure 1** demonstrates the application of the Geriatric 5Ms.

Therapists are ethically bound to provide competent care to all patients. The provision of competent care demands that therapists stay current with clinical practice guidelines,

perform thorough evaluations, and communicate with the interprofessional team. In this case study, the therapist documented concerns about possible PD in their clinical assessment and advocated for neurology consultation.

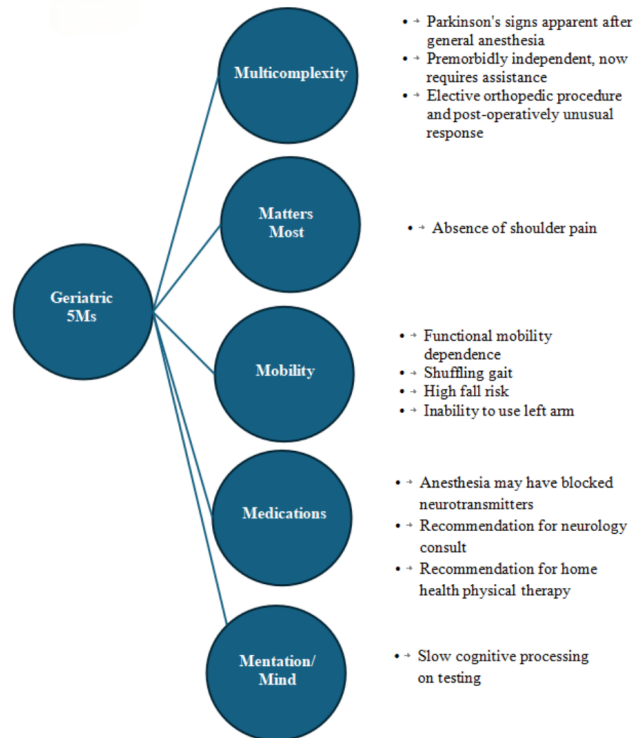


Figure 1. Geriatric 5Ms applied to the case study.

3. Conclusion

The practice analysis survey by the Federation of State Boards of PT revealed that > 53.5% of responding clinicians spent > 50% of their time treating older adults^[38]. With the aging of the population and a rising number of patients being diagnosed with PD, physical therapists specializing in all settings must be able to recognize the signs of PD. Occupational therapists, like physical therapists, work in various practice settings, with approximately 56% working in areas with adults^[39]. As health care providers, it is essential to evaluate each patient in a holistic manner and look beyond the referring diagnosis. Early identification of PD serves two important benefits: (1) promotes access to sound medical care and management, possibly including gene-related therapies^[40]; and (2) allows rehabilitation professionals to initiate interventions to address secondary and tertiary prevention, thus positively impacting the quality of life of people with Parkinson's.

Funding

This work received no external funding.

Institutional Review Board Statement

The information for the presented case was obtained through a retrospective chart review. Ethics approval from the Institutional Review Board was granted (Quinnipiac University #04226).

Informed Consent Statement

Patient consent was waived as the information for the presented case was obtained through a retrospective chart review. Ethics approval from the Institutional Review Board was granted (Quinnipiac University #04226).

Data Availability Statement

No datasets were generated or analyzed for this study.

Conflicts of Interest

The authors have no conflicts of interest to disclose.

References

- [1] Blood, K.M., Mierzwicki, J.T., Billek-Sawhney, B., et al., 2025. Development of the revised entry-level essential competencies in the care of older adults: Linking domains of competence, Commission on Accreditation in Physical Therapy Education standards, and the Geriatric 5Ms. *Journal of Geriatric Physical Therapy*. 48(4), 202–209. DOI: <https://doi.org/10.1519/JPT.0000000000000000436>
- [2] Tinetti, M., Huang, A., Molnar, F., 2017. The geriatrics 5M's: A new way of communicating what we do. *Journal of the American Geriatrics Society*. 65(9), 2115. DOI: <https://doi.org/10.1111/jgs.14979>
- [3] Leach, S.J., Larkin, M., Gras, L.Z., et al., 2025. A Movement Framework for Older Adults: Application of the Geriatric 5Ms. *Journal of Geriatric Physical Therapy*. 48(4), E161. DOI: <https://doi.org/10.1519/JPT.0000000000000000473>
- [4] Parkinson's Foundation, n.d. Statistics: Get informed about Parkinson's disease with these key numbers. Available from: <https://www.parkinson.org/understanding-parkinsons/statistics> (cited 9 December 2024).
- [5] World Health Organization, 2025. Ageing and Health. World Health Organization: Geneva, Switzerland. Available from: <https://www.who.int/news-room/fact-sheets/detail/ageing-and-health>
- [6] Osborne, J.A., Botkin, R., Colon-Semenza, C., et al., 2022. Physical Therapist Management of Parkinson Disease: A Clinical Practice Guideline From the American Physical Therapy Association. *Physical Therapy*. 102(4), pzab302. DOI: <https://doi.org/10.1093/ptj/pzab302>
- [7] Li, M., Ye, X., Huang, Z., et al., 2025. Global burden of Parkinson's disease from 1990 to 2021: A population-based study. *BMJ Open*. 15(4), e095610. DOI: <https://doi.org/10.1136/bmjopen-2024-095610>
- [8] Xu, L., Wang, Z., Li, Q., 2025. Global trends and projections of Parkinson's disease incidence: A 30-year analysis using GBD 2021 data. *Journal of Neurology*. 272(4), 286. DOI: <https://doi.org/10.1007/s00415-025-13030-2>
- [9] Kalia, L.V., Lang, A.E., 2015. Parkinson's disease. *The Lancet*. 386(9996), 896–912. DOI: [https://doi.org/10.1016/S0140-6736\(14\)61393-3](https://doi.org/10.1016/S0140-6736(14)61393-3)
- [10] Belvisi, D., Pellicciari, R., Fabbrini, G., et al., 2020. Modifiable risk and protective factors in disease development, progression and clinical subtypes of Parkinson's disease: What do prospective studies suggest? *Neurobiology of Disease*. 134, 104671. DOI: <https://doi.org/10.1016/j.nbd.2019.104671>
- [11] Ascherio, A., Schwarzschild, M.A., 2016. The epidemiology of Parkinson's disease: Risk factors and prevention. *The Lancet Neurology*. 15(12), 1257–1272. DOI: [https://doi.org/10.1016/S1474-4422\(16\)30230-7](https://doi.org/10.1016/S1474-4422(16)30230-7)
- [12] Deng, H., Wang, P., Jankovic, J., 2018. The genetics of Parkinson disease. *Ageing Research Reviews*. 42, 72–85. DOI: <https://doi.org/10.1016/j.arr.2017.12.007>
- [13] Cheng, H.-C., Ulane, C.M., Burke, R.E., 2010. Clinical progression in Parkinson disease and the neurobiology of axons. *Annals of Neurology*. 67(6), 715–725. DOI: <https://doi.org/10.1002/ana.21995>
- [14] Fearnley, J.M., Lees, A.J., 1991. Ageing and Parkinson's disease: Substantia nigra regional selectivity. *Brain*. 114, 2283–2301. DOI: <https://doi.org/10.1093/brain/114.5.2283>
- [15] Postuma, R.B., Berg, D., Stern, M., et al., 2015. MDS clinical diagnostic criteria for Parkinson's disease. *Movement Disorders*. 30(12), 1591–1601. DOI: <https://doi.org/10.1002/mds.26424>
- [16] Goetz, C.G., Tilley, B.C., Shaftman, S.R., et al., 2008. Movement Disorder Society-sponsored revision of the Unified Parkinson's Disease Rating Scale (MDS-UPDRS): Scale presentation and clinimetric testing results. *Movement Disorders*. 23(15), 2129–2170. DOI: <https://doi.org/10.1002/mds.22340>
- [17] Berezcki, D., 2010. The description of all four cardinal signs of Parkinson's disease in a Hungarian medical

- text published in 1690. *Parkinsonism & Related Disorders*. 16(4), 290–293. DOI: <https://doi.org/10.1016/j.parkreldis.2009.11.006>
- [18] Gelb, D.J., Oliver, E., Gilman, S., 1999. Diagnostic criteria for Parkinson disease. *Archives of Neurology*. 56(1), 33–39. DOI: <https://doi.org/10.1001/archneur.56.1.33>
- [19] CDC, n.d. STEADI—Older Adult Fall Prevention. Available from: <https://www.cdc.gov/steady/index.html> (cited 9 December 2024).
- [20] Stevens, J.A., Phelan, E.A., 2013. Development of STEADI: A fall prevention resource for health care providers. *Health Promotion Practice*. 14(5), 706–714. DOI: <https://doi.org/10.1177/1524839912463576>
- [21] Thompson, W.R., Sallis, R., Joy, E., et al., 2020. Exercise Is Medicine. *American Journal of Lifestyle Medicine*. 14(5), 511–523. DOI: <https://doi.org/10.1177/1559827620912192>
- [22] ACSM Exercise is Medicine, 2021. Health Care Providers Action Guide. Available from: <https://www.exerciseismedicine.org/eim-in-action/health-care/health-care-providers/provider-action-guide/> (cited December 2024).
- [23] Golightly, Y.M., Allen, K.D., Ambrose, K.R., et al., 2017. Physical Activity as a Vital Sign: A Systematic Review. *Preventing Chronic Disease*. 14, 170030. DOI: <https://doi.org/10.5888/pcd14.170030>
- [24] Malone, D., Bishop, K., 2020. *Acute Care Physical Therapy: A Clinician’s Guide*, 2nd ed. Slack. Routledge: New York, NY, USA.
- [25] Schenkman, M., Berger, R.A., Riley, P.O., et al., 1990. Whole-body movements during rising to standing from sitting. *Physical Therapy*. 70(10), 638–648. DOI: <https://doi.org/10.1093/ptj/70.10.638>
- [26] Hausdorff, J.M., 2009. Gait dynamics in Parkinson’s disease: common and distinct behavior among stride length, gait variability, and fractal-like scaling. *Chaos*. 19(2), 026113. DOI: <https://doi.org/10.1063/1.3147408>
- [27] Ghai, S., Ghai, I., Schmitz, G., et al., 2018. Effect of rhythmic auditory cueing on parkinsonian gait: A systematic review and meta-analysis. *Scientific Reports*. 8(1), 506. DOI: <https://doi.org/10.1038/s41598-017-16232-5>
- [28] Kegelmeyer, D., Ellis, T., Esposito, A., et al., n.d. Parkinson EDGE Task Force Recommendations: Research. Academy of Neurologic Physical Therapy: Saint Paul, MN, USA. Available from: https://www.neuropt.org/docs/default-source/parkinson-edge/pd-edge-measures-research-final.pdf?sfvrsn=fa0d5543_0
- [29] Dibble, L.E., Lange, M., 2006. Predicting falls in individuals with Parkinson disease: A reconsideration of clinical balance measures. *Journal of Neurologic Physical Therapy*. 30(2), 60–67. DOI: <https://doi.org/10.1097/01.npt.0000282569.70920.dc>
- [30] Stanford Medicine, n.d. Approach to the Exam for Parkinson’s Disease. Available from: <https://stanfordmedicine25.stanford.edu/the25/parkinsondisease.html> (cited 9 December 2024).
- [31] Rocha, P.A., Porfirio, G.M., Ferraz, H.B., et al., 2014. Effects of external cues on gait parameters of Parkinson’s disease patients: A systematic review. *Clinical Neurology and Neurosurgery*. 124, 127–134. DOI: <https://doi.org/10.1016/j.clineuro.2014.06.026>
- [32] Morris, M.E., 2000. Movement Disorders in People with Parkinson Disease: A Model for Physical Therapy. *Physical Therapy*. 80(6), 578–597. DOI: <https://doi.org/10.1093/ptj/80.6.578>
- [33] Najafi, A., Etezadi, F., Moharari, R.S., et al., 2017. The Role of Neurotransmitters in Anesthesia. *Archives of Anesthesiology and Critical Care*. 3(2), 324–333.
- [34] Oğuz, E., Öztürk, İ., Özkan, D., et al., 2014. Parkinson’s Disease and Spinal Anaesthesia. *Turkish Journal of Anaesthesiology and Reanimation*. 42(5), 280–282.
- [35] Bani Hani, D.A., Aleshawi, A.J., Al Shalakhti, M.H., et al., 2020. Spinal versus General Anesthesia for Patients with Parkinson’s Disease. *International Journal of General Medicine*. 13, 9–15. DOI: <https://doi.org/10.2147/IJGM.S232770>
- [36] Muravchick, S., Smith, D.S., 1995. Parkinsonian symptoms during emergence from general anesthesia. *Anesthesiology*. 82(1), 305–307. DOI: <https://doi.org/10.1097/00000542-199501000-00039>
- [37] Bailey, P.L., Wilbrink, J., Zwanikken, P., et al., 1985. Anesthetic Induction with Fentanyl. *Anesthesia & Analgesia*. 64(1), 48–53.
- [38] Federation of State Boards of Physical Therapy, 2022. 2022 No. 094: Analysis of Practice for Physical Therapy Profession: Entry-Level Physical Therapists, Final Report. Federation of State Boards of Physical Therapy: Alexandria, VA, USA. Available from: <https://www.fsbt.org/Portals/0/documents/free-resources/F SBPT-PT%202022-FINAL-REPORT.pdf>
- [39] National Board for Certification in Occupational Therapy, 2023. 2022 Practice Analysis Executive Summary. National Board for Certification in Occupational Therapy: Gaithersburg, MD, USA.
- [40] Martins, I., 2017. Dietary Interventions reverse Insulin and Synaptic Plasticity defects linking to Diabetes and Neurodegenerative diseases. *SL Nutrition & Metabolism*. 1, 111.