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Multidimensional decline in functionality associated with Parkinson's disease severity: a WHODAS 2.0 Parkinson Study (WHOPAS)

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Abstract

The following protocol has been used in the research title: **Multidimensional decline in functionality associated with Parkinson's disease severity: a WHODAS 2.0 Parkinson Study (WHOPAS).** This cross-sectional study aimed to characterize the decline of functionality related to disease severity progression in people with Parkinson's disease (PD) using the generic instrument WHODAS 2.0 (World Health Organization Assessment Schedule 2.0). WHODAS 2.0 was developed by the World Health Organization (WHO) to provide a comprehensive evaluation of functionality and disability based on the International Classification of Functioning, Disability and Health (ICF) framework. The following document describes in detail the protocols used.

Materials

1. A pen for writing answers to questionnaires;
2. Questionnaires, either printed on paper or available online;
3. A phone for calling participants and internet-connected device for video calls;
4. TIBCO statistical software installed on a computer for statistical analysis.

Study desing and Etich

1 A cross-sectional study in agreement with Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) statement.

2 The study was approved by the Ethics Committee of the Department of Physiotherapy, Speech Therapy, and Occupational Therapy at the University of São Paulo Medical School, São Paulo, Brazil (#CAAE 19504619.5.0000.0065) and conducted in accordance with the Helsinki Declaration.

Participants

3 **Inclusion Criteria:**

- People aged between 35-85 years of age;
- With confirmed diagnosis of idiopathic Parkinson's disease (PD) according to the diagnostic criteria of the UK Parkinson's Disease Society Brain Bank (1);
- In stages 1-4 according Hoehn and Yahr Classification (H&Y) (2);
- Using dopaminergic medication;
- With access to the internet for remote interview;
- Who agreed to participate in the study.

4 **Exclusion Criteria:**

- The presence of neurological disorders other than PD;
- The presence of other chronic debilitating diseases such as osteoarthritis, chronic obstructive pulmonary disease or cancer;
- The presence of major depression;
- The presence of cognitive, speech, and hearing disorders that could impair the interview process conducted by video or phone calls.

5 The participant's ability to properly answer the question about personal and socioeconomic information in the first section of the study questionnaire was used as clinical evidence of their minimal cognitive capacity to understand the study aim and the question contents. Their answers were confirmed by their caregivers.

Recruitment

6 A convenience sample of participants was recruited from the **AMPARO** Network. The AMPARO Network is part of the Research, Innovation and Dissemination Center for Neuromathematics (RIDC NeuroMat), and its main objective is to enhance the quality of life of people with PD in Brazil. This network comprises people with PD, their family members, caregivers, students, health professionals and researchers who are

interested in PD. Initial eligibility was determined through outreach via calls and/or telephone messages. Following this, detailed information about the study procedure was provided and participants were invited to provide their written consent for involvement. Clinical information, including disease severity according to H&Y, was obtained from the healthcare system records where patients receive care for PD. According to this scale, disease severity is classified into five stages: patients in stage 1 are only minimally disabled, while those in stage 5 experience severe disabilities (Table 1).

Table 1: Hoehn and Yahr Scale

Stage	Hoehn and Yahr Scale
1	Unilateral involvement only usually with minimal or no functional disability
2	Bilateral or midline involvement without impairment of balance
3	Bilateral disease: mild to moderate disability with impaired postural reflexes; physically independent
4	Severely disabling disease; still able to walk or stand unassisted
5	Confinement to bed or wheelchair unless aided

The records were no older than six months to ensure that they accurately reflected the participants' current condition and to avoid outdated information. All information was subsequently verified with the participants and their families. Details of dopaminergic treatment, including drug type and daily dose, were recorded to calculate the Levodopa Equivalent Daily Dose (LEDD) (3).

Interview

7 The participants were asked to choose their preferred day and time for the remote interview during the on-period of dopaminergic medication (40-120 minutes post the last intake). Additionally, they had to decide whether they would like a family member or caregiver to assist them during the interview.

8 All interviews were conducted by researchers trained in qualitative and quantitative interview methods and familiar with the tools and the study objectives.

Questionnaries

9 The researchers applied the questionnaire that included:

1. General information;
2. Information related to PD;
3. Socioeconomic condition (SEC);
4. Global cognitive capacity by Telephone-Montreal Cognitive Assessment (T-MoCA);
5. Self-perception of functionality by World Health Organization Assessment Schedule 2.0 (WHODAS 2.0);
6. Self-perception of non-motor and motor aspects of daily life experiences of PD by Movement Disorder

Society – Unified Parkinson's Disease Rating Scale - Part I (MDS-UPDRS I) and Part II (MDS-UPDRS II) respectively;

7. Depressive symptoms by Beck Depression Inventory (BDI).

9.1 **General Information:**

- Self-identified gender;
- Age (date of birth);
- Race: white (European or Western descendants), black (African descendants or persons who are perceived as dark-skinned compared to other populations), brown* (afro-brazilians/mixed-race people of different colors or ethnicity), yellow**(Asian descendants), Indigenous (Indigenous descendants/native people of Brazil) or no racial self-declaration;
- Marital status;
- Education level;
- City and state of residence.

9.2 **Information related to PD:**

1. What was the first physical change you noticed in your body related to Parkinson's disease?
2. When did you receive the definitive diagnostic?
3. Where are you currently receiving medical care for PD?
4. What medications are you currently taking for Parkinson's disease?

9.3 **SEC:**

The SEC was evaluated by the Socioeconomic Stratum (SES) entitled Brazil Economic Classification Criteria (BECC), a socioeconomic classification standard based on household comfort items, householder education and access to basic sanitation (paved street and treated water and sewer system) (4) (Table 2). The scores for each

question are summed to produce a total score that ranges from zero to 100. Higher scores indicate better SEC conditions.

Table 2: Score system according to BECC

	Points				
Items (quantify)	**0**	**1**	**2**	**3**	**4 or more**
Bathroom	0	3	7	10	14
Domestic Employees	0	3	7	10	13
Automobiles	0	3	5	8	11
Microcomputer	0	3	6	8	11
Dishwasher	0	3	6	6	6
Refrigerator	0	2	3	5	5
Freezer	0	2	4	6	6
Washing Machine	0	2	4	6	6
DVD	0	1	3	4	6
Microwave	0	2	4	4	4
Motorcycle	0	1	3	3	3
Clothes Dryer	0	2	2	2	2
Level of education					
No schooling / Incomplete elementary school*				0	
Elementary School Diploma / Incomplete Junior High School**				1	
Junior High School Diploma / Incomplete High School				2	
High School Diploma / Incomplete Higher Education				4	
Higher Education Degree				7	
Basic sanitation	NO			YES	
Treated water and sewer system	0			4	
Paved street	0			2	

Legend: The Brazilian Economic Classification Criteria (BECC) scoring system is based on the number of points according to household comfort items, householder education, and basic sanitation (treated water and sewer system and paved street). The total of points defines the economic stratum (social class). The higher scores indicate better socioeconomic conditions. Each answer about how many household items and domestic servants have in the home, how many householder years of schooling and which public services have corresponded to different numbers of points. In the Brazilian system, elementary education has nine years: *Elementary: the initial five years (from 6 to 10 years old); **Junior High School: the final four years (from 11 to 14 years old).

Available: **abep.org/criterio-brasil**

9.4 **T-MoCA:**

For global cognitive assessment, T-MoCA was used. It is an adapted version of the Montreal Cognitive Assessment (MoCA) 30 test administered by phone. It contains only the items that do not require pencil and paper or visual stimuli, so its maximum score is 22. Aims to perform a short-term cognitive screening to investigate possible mild cognitive impairment. The test is made up of seven domains. The categories tested are memory and attention (six points), language (three points), abstraction (two points), delayed recall (five points) and orientation (six points) (5). The Brazilian Portuguese version was used.

Available: **mocacognition.com**

9.5 **WHODAS 2.0:**

WHODAS 2.0 is a general assessment tool developed by the WHO to provide a standardized method for measuring health and disability across different cultures. It is based on a comprehensive set of items from the International Classification of Functioning, Disability and Health (ICF).

Systematic studies have confirmed WHODAS 2.0's applicability across different cultures and its reliability, validity, and usefulness in health services research. WHODAS 2.0 has effectively assessed health and disability levels within the general population through surveys and in measuring the clinical effectiveness and productivity gains from various interventions.

A distinctive feature of WHODAS 2.0 that sets it apart from other disability measures is its direct connection to the ICF. While other generic tools for assessing health status can also be aligned with the ICF, they often fail to clearly differentiate between the measurement of symptoms, disability and subjective assessment. WHODAS 2.0 stands out because it comprehensively covers ICF domains and is applicable to all types of diseases, including physical, mental and substance-use disorders. Additionally, it evaluates disability in a culturally sensitive manner using a standardized rating scale.

WHODAS 2.0 captures the level of functioning based on 36 question distributed in six domains:

- Domain 1: Cognition – Evaluates communication and cognitive functions; specific areas assessed include attention, memory, problem-solving, learning and verbal expression (questions D1.1 - D1.5);

- Domain 2: Mobility – Assesses activities related to physical movement, such as standing, navigating within the home, leaving the home and walking long distances (questions D2.1 - D2.5);

- Domain 3: Self-care –Evaluates abilities related to personal hygiene, dressing, eating, and managing alone (questions D3.1 - D3.4);

- Domain 4: Getting along – Assesses interactions with others and challenges that may arise in social situations due to health conditions; this includes relationships with close acquaintances (e.g., spouse, family members, friends) as well as interactions with strangers (questions D4.1 - D4.5);

- Domain 5: Activities Daily Living – Assesses difficulties in performing daily activities, including household tasks, leisure activities, employment and education (subdomain household activities questions D5.1 - D5.4 and if works or goes school responds questions D5.5 - D5.10);

- Domain 6: Participation – Assesses social dimensions, such as community activities; barriers and hindrances in the world around the respondent; and problems with other issues, such as maintaining personal dignity (questions D6.1 - D6-8).

- The questions do not necessarily and solely refer to the ICF participation component as such but also include various contextual (personal and environmental) factors affected by the health condition of the respondent (6).

There are three ways to administer the WHODAS 2.0: self-administration, interview format and proxy reporting. The present study used the remote interview.

Interviewers asked participants to answer the questions keeping the following frames of reference in mind:

Frame 1 – Degree of Difficulty: During the interview, participants were asked about the degree
of difficulty they experienced while performing various activities. Difficulty with an activity can refer to:

- Increased effort;
- Discomfort or pain;
- Slowness;
- Changes in how the person performs the activity.

Frame 2 – Due to Health Conditions: Participants were asked to consider the difficulties caused by PD.

Frame 3 – In the past 30 days: Since the recall has generally been most accurate in the short
term, participants were asked to consider their difficult over the last 30 days.

Frame 4—Averaging good and bad days: Some participants may have experienced variability in the degree of difficulty over the past month. In such cases, they were asked to provide an average rating reflecting good and bad days.

Frame 5 – As the respondent usually does the activity: When rating difficulty, participants were asked to consider how they typically perform the activity.

Frame 6 – Items not experienced in the past 30 days should not be rated: WHODAS 2.0 aims to assess the level of difficulty encountered in activities that a person has actually performed rather than those they would like to do or can do but have not engaged in. Then, participants were asked not to answer questions about activities they had not experienced in the last month.

WHODAS 2.0 provides specific scores for six different functioning domains. These domain scores offer more detailed information than the overall summary score. They can be useful for comparing individuals or groups and assessing performance against population standards over time. The total and domain scores of WHODAS 2.0 can be calculated using either simple or complex scoring methods, both of which were utilized in our study.

1. **Simple scoring:**

The scores for each item are categorized as follows: "none" (1), "mild" (2), "moderate" (3), "severe" (4) and "extreme/cannot" (5). These scores are summed to produce a total score. This approach is called simple scoring because it involves adding the scores for each item without recording or grouping response categories; consequently, individual items are not weighed. Simple scoring is practical for quick hand-scoring and is often preferred in busy clinical settings or during paper-and-pencil interviews (6). The psychometric properties of WHODAS 2.0 support this additive calculation. In classical psychometric analysis, the structure of WHODAS 2.0 is unidimensional and demonstrates high internal consistency (7). As a result, the straightforward sum of item scores across all domains effectively reflects the degree of functional limitations.

2. **Complex Scoring**:

The complex scoring method is also known as "item-response-theory" (IRT) based scoring. This method accounts for varying difficulty levels for each WHODAS 2.0

item, allowing for more detailed analyses by utilizing the full range of the response categories for comparative assessments across different populations or subpopulations. In this method, each item's responses—"none," "mild," "moderate," "severe," and "extreme/cannot" — are treated separately, and a computer algorithm is used to calculate the summary score by differentially weighing the items and their severity levels (6, 8). The scoring process involves three steps:

1. Summing the recoded item scores within each domain;
2. Summing the total scores from all six domains;
3. Converting the overall summary score into a metric that ranges from 0 to 100, where 0 indicates no disability and 100 indicates total disability.

Additionally, we used the dichotomous (yes/no) scoring system, allowing participants to answer with a simple "yes" or "no" to assess the activities most significantly impacted by PD, regardless of the specific domain or stage of disease. This scoring approach enabled participants to clearly indicate whether they encountered no difficulty (no) or some level of difficulty (yes) in carrying out particular activities. In this context, responses that reflect varying degrees of difficulty—such as "mild," "moderate," "severe," and "extreme/cannot"—were all grouped together as a single affirmative response (yes) (6).

In cases where participants left one or two questions unanswered—no more than one missing per domain and a maximum of two overall—we followed the WHODAS 2.0 guidelines to address these gaps. We calculated and used the median score from the relevant questions within the same category to ensure that the missing data did not distort the overall assessment.

Finally, for the participants who were not currently working, the total score was obtained with the sum of 32 items of WHODAS 2.0. According to WHODAS 2.0 validation, the 32-item version is effective and remains comparable to those obtained from the full 36-item version.

Available: **who.int/standards/classifications/international-classification-of-functioning-disability-and-health/who-disability-assessment-schedule**

WHODAS questionnarie.book.pdf 343.3KB

9.6 **MDS - UPDRS:**

It is a tool to measure the severity and progression of PD based on the difficulties presented in the last 7 days. It consists of four parts: Part I (non-motor experiences of daily living), Part II (motor experiences of daily living), Part III (motor examination) and

Part IV (motor complications). In this study, only Part I and Part II were used. There are 13 questions on Part I of the scale, assessing PD's non-motor impact on patients' daily living experiences. Part II consists of 13 questions that assess the motor impact. Each question is scored between 0 and 4. The score ranges from 0 to 52 in each of the parts. The higher the score, the worse the severity and progression of Parkinson's disease (9).

Available: **movimentdisorders.org**

9.7 **BDI:**

The BDI is a widely utilized self-report questionnaire designed to assess the severity of depressive symptoms in individuals aged 13 and above. Developed by Aaron T. Beck, Robert A. Steer, and Gregory K. Brown in 1961, the BDI consists of 21 items, each representing a symptom of depression such as sadness, guilt or fatigue. Respondents rate the severity of each symptom over the past two weeks. The score ranges from 0 to 63, with higher scores indicating more severe symptomatology. Scores between 0-9 indicate that the individual is not depressed, 10-18 indicate mild to moderate depression, 19-29 indicate moderate to severe depression and 30-63 indicate severe depression (10).

Available: **beckinstitute.org**

Statistical Analysis

10 Descriptive statistics of demographic, clinical and therapeutic data for each H&Y stage 1-4 were provided. The normal distribution of the samples was assessed by the Kolmogorov-Shapiro test. Categorical variables are reported in count and percentage, and variables in means and standard deviations (SD) or medians and interquartile ranges (IQR) according to their distribution. A descriptive analysis of the WHODAS 2.0 total score and seven subscores (the results related to home and work activities from Domain 5 were analyzed separately) was performed.

For variables with normal distribution (age), the group differences in the H&Y stage were tested by One-Way ANOVA. Tukey post test was applied to pair-to-pair comparisons when statistically significant differences were observed.

Nonparametric group differences (H&Y stages) were tested by Kruskal-Wallis. When statistically significant differences were observed, multiple comparisons of the average ranks for each pair of groups were applied; normal z-values were computed

for each comparison, and Dunn post-hoc (corrected for the number of comparisons) was used for a two-sided significance test.

Nonparametric Spearman's rank correlation coefficients were calculated to analyze the association between variables (coefficients higher than 0.59 were considered "high").

A significance level of $p < 0.05$ was used to determine the statistical significance of the findings. All statistical analyses were performed using Statistica Version 13 (TIBCO Software Inc. USA).

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