Burden and health-related quality of life among caregivers of Brazilian Parkinson's disease patients

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ABSTRACT

Purpose: To analyze the main determinants of burden and health-related quality-of-life (HRQoL) in caregivers of Brazilian Parkinson's disease (PD) patients.
Methods: Caregivers answered Hospital Anxiety and Depression Scale (HADS), Zarit caregiver burden interview (ZCBI) and EQ-5D, a generic measure of HRQoL. Patients were assessed with Hoehn and Yahr (H&Y) staging; Scales for Outcomes in Parkinson's disease (SCOPA) Motor, Cognition, Psychosocial and Sleep scales; Non-Motor Symptoms Scale; HADS; Clinical Impression of Severity Index; EQ-5D and Parkinson's Psychosis Rating Scale.
Results: 50 Caregiver-patient dyads were assessed. Caregivers were significantly younger (55.7 vs. 65.4 years), $p < 0.0001$. Eighty-eight per cent of caregivers were females, and 78% were spouses. The proportion of caregivers who scored ≥11 points in the HADS-anxiety or HADS-depression subscales was 12% and 14% respectively. ZCBI mean score was 20.2 (SD 12.8), and significantly worsened as severity of disease, based on H&Y, increased (H&Y 1–2: 16.4, H&Y 3–5: 24.6; $p = 0.02$). Caregiver's EQ-5D Index and visual analog scale mean scores were 0.7 (SD: 0.26) and 76.3 (SD: 16.2) respectively. Weak to moderate association ($r = -0.27$ to -0.39) between EQ-5D Index and ZBCI mean scores was observed in caregivers. Patient outcomes (sleep disorders and behavioral-psychotic symptoms) and caregiver outcomes (mood, time of caregiving) were independent predictors of caregiver burden (adjusted $R^2 = 0.55$; $p < 0.0001$) in the multivariate regression analysis. Caregiver's mood status was a significant determinant of caregiver's HRQoL, as measured by the EQ-5D Index (adjusted $R^2 = 0.28$; $p = 0.006$).
Conclusions: Patients' psychiatric and sleep disorders and caregiver's mood significantly influenced burden and HRQoL in Brazilian PD caregivers.

1. Introduction

Parkinson's disease (PD) is a chronic neurodegenerative disorder causing motor and non-motor disorders that result in progressive disability [1]. The disease has a considerable impact on many areas of the psychosocial functioning of patients including cognition, mood, social function, psychological status, communication, and occupational functioning [2]. As a consequence, PD importantly decreases the quality of life of patients and their caregivers [3].

Health status of PD patients, the intensity of direct care, the help and support that caregivers obtain from family and society influence

their perceived level of burden and their social participation [4]. Indeed, caring PD patients has been deemed a task that becomes increasingly complex and demanding as the severity of the disease progresses [4]. Caregivers are at high risk of burn-out when social support network is scarce. Emotional exhaustion is an important dimension of burnout syndrome, and in close relationship with other types of mental illness such as depression and anxiety disorders [5].

Nevertheless, little is known about the long term psychosocial consequences of caregiving PD patients in South American countries. In order to expand our knowledge of caregivers in different cultures, Brazilian caregivers of PD patients were assessed. Because of the population aging process, the prevalence of PD in Brazil is expected to increase accordingly. Caregiver burden can be perceived differently depending on the society and culture in which caregivers live. The aim of this study was to assess the prevalence of

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mood disorders and the burden severity in PD caregivers, and analyze the main determinants of burden, and health-related quality of life (HRQoL) in PD caregivers. It was hypothesized that the HRQoL and the degree of burden in Brazilian caregivers are related with: 1) PD overall severity and several specific aspects such as patients' disability, psychiatric and sleep disorders; 2) caregiver's factors such as that their perceived health status and mood.

2. Subjects and methods

2.1. Design

Unicenter, observational, cross-sectional study.

2.2. Patients and caregivers

Fifty PD patients and their primary caregivers were consecutively recruited at the outpatient Neurology Clinic of the Sarah Hospital in Brasilia DF, between January and September 2008, and included in the study.

2.3. Definition and inclusion criteria

Patients with diagnosis of PD by a neurologist with competence in movement disorders and based on the United Kingdom Parkinson's Disease Society Brain Bank Criteria, with age >40 years at onset of disease were included [6].

Designation of primary caregiver was done as per Martinez–Martin's definition [3]: "Any relative or person who is not a professional caregiver or member of a social support network, usually living with the patient and directly involved in caring the patient or directly affected by the patient's health problem".

Spouses (wife or husband), children (son or daughter), parents and other close relatives were the main categories inside the group of caregivers. For the purpose of this study, professional and paid caregivers were excluded, whereas informal caregivers were eligible only if they were living with the patients or in close contact with them.

The study protocol was approved by the institutional review board and informed consent was obtained from all the patients and caregivers before their participation in the study.

2.4. Assessments

Sociodemographic data of caregivers (age, sex, educational level, duration of caregiving, relationship to care-recipient) and PD patients was prospectively collected through a questionnaire.

Assessment of PD patients included neurologist-based evaluations, and patient and caregivers self-assessments.

Neurologist-based assessments included the Hoehn and Yahr staging (H&Y) [7], the Clinical Impression of Severity Index for Parkinson's disease (CISI-PD) [8], the Scales for Outcomes in Parkinson's disease-Motor (SCOPA-Motor) [9], SCOPA-Cognition [10], the Parkinson's psychosis rating scale (PPRS) [11] and the Non-Motor Symptoms Scale (NMSS) [12]. PD self-assessment included the SCOPA-Sleep Scale (PDSS) [13], the SCOPA-Psychosocial [14], the Hospital Anxiety and Depression Scale (HADS) [15] and the EQ-5D [16].

Caregivers completed the HADS [15], the Zarit caregiver burden interview (ZCBI) [17] and the EQ-5D [16].

CISI-PD is a neurologist-based global score that represents a subjective estimation of PD severity. The scale is based on evaluation of four domains: motor signs, disability, motor complications, and cognitive impairment [8]. Global evaluation of the domains is combined to provide the CISI-PD global score, which runs from 0 (normal) to 24 (severe).

The SCOPA-Motor [9] contains 21 items that are grouped in three sections: motor impairment, activities of daily living (ADL), and motor complications. All items score in a scoring range from 0 (normal) to 3 (severe). Total score ranges from 0 to 75 points and the higher the score, the greater the severity.

The SCOPA-Cognition [10] has four domains: memory, attention, executive functions and visuo-spatial functions. The scale consists of 10 items with a maximum score of 43, and higher scores reflect a better cognitive performance.

The PPRS was used to assess the severity of levodopa-induced psychotic symptoms in PD patients [11]. The scale consists of six items: hallucinations, delusions, paranoid ideation, vivid dreams/nightmares, confusion and sexual ideation. Each individual item is rated from 1 (no symptoms) to 4 (extreme symptoms), and total score ranges from 6 to 24 points.

The NMSS [12] consists of 30 items that are grouped in nine domains: Cardiovascular, Sleep/fatigue, Mood/apathy, Perceptual problems/hallucinations, Attention/memory, Gastrointestinal tract, Urinary function, Sexual function, and Miscellaneous. Score for each specific item is based on a multiple of severity (from 0 to 3) and frequency scores (from 1 to 4). The theoretical maximum total score is 360 points.

The SCOPA-Sleep [13] assesses night-time sleep problems and daytime sleepiness in the past month. The night-time sleep subscale has 5 items, scored from 0 (not at all) to 3 (a lot), and global score range from 0 to 15. The daytime sleepiness subscale is composed of 6 items with response options ranging from 0 (never) to 3 (often), with a range score between 0 and 18.

The SCOPA-Psychosocial evaluates psychosocial functioning during the past month. It consists of 11 items scoring on a scale from 0 (not at all) to 3 (very much) [14]. The summary index is calculated as a percentage on the maximum possible score (33 points). The higher the summary index, the worse the patient's quality of life.

In this study, the HADS was used to assess anxiety and depression in both, caregivers and PD patients [15]. The HADS consists of 7 items for assessment of anxiety (HADS-anxiety subscale) and 7 for depression (HADS-depression subscale), with each item scored from 0 (no problem) to 3 (severe problem). Scores on individual items can be summed to calculate scores for anxiety (HADS-anxiety) and for depression (HADS-depression). The maximum score for each subscale is 21, and scores ≥11 points (cut-off value) for subscales are indicative of mood disturbance.

The EQ-5D, a generic measure, addresses health status through three main components: 1) a descriptive, composed of five items (mobility, self care, usual activities, pain and anxiety, and depression), scoring from 1 (no problems or symptoms) to 3 (serious problems or symptoms); 2) change in health status in the preceding 12 months (one question); and 3) a visual analog scale (EQ-VAS) for evaluating current health status (from 0, worse imaginable, to 100, best imaginable). Score profiles for the descriptive part can be converted (time trade-off technique) into a HRQoL preference index (EQ-5D Index) ranging from 0 (death) to 1 (perfect health) [16].

The ZCBI evaluates burden of caregivers and has 22 items. In addition, the presence of two dimensions has been observed using confirmatory factor analysis: Personal Strain dimension such as personal stress from care, consisting of 12 items; and Role Strain dimension, including social role limitations from caregiving, consisting of 6 items. The ZCBI total score, Personal Strain and Role Strain scores range from 0 to 88, 0 to 48 and 0 to 24, respectively. Higher scores indicate higher burden [17].

The applied scales were cross-culturally adapted versions to Brazilian setting and have been previously tested [18].

2.5. Data analysis

Chi-squared, Mann–Whitney and Kruskal–Wallis test were used for comparison between PD patients and caregivers. Significance level was established at 0.05. Spearman rank correlation coefficient (rS) was used to determine the association between patient assessments and caregiver measures. A moderate correlation between PD assessments and caregiver's burden and HRQoL was hypothesized (rS = 0.30–0.50) [19].

In spite of the relatively small size, multiple regression analyses were performed trying to obtain orientation about factors potentially influencing caregiver's burden and HRQoL. ZCBI and EQ-5D index were considered the dependent variables and the following independent variables were considered: 1) Patient-related variables: age, sex, motor disability as measured by the SCOPA-Motor ADL subscale, SCOPA-Cognition, PPRS, nocturnal sleep as measured by SCOPA-Sleep, and HADS-depression or anxiety subscales; and 2) Caregiver-related variables: age, duration of caregiving, and HADS-anxiety or HADS-depression subscales. Significant variables were tested for collinearity to prevent overparametrization of the prediction model, and those with correlation higher than 0.60 were excluded from analysis. Furthermore, a multicollinearity analysis was performed, and condition index and eigen values were analyzed. The highest condition index observed was 11.86, far away from the maximum limit of 20.

Statistical Package for the Social Science 16.0 for Windows (SPSS, Chicago, IL) was used for data analysis.

3. Results

The 28.5% (20) of the 70 PD patients admitted at the Outpatient Neurology clinic did not have a caregiver, and were excluded from the study; then, the final sample was composed by fifty patient/caregiver dyads. Demographic characteristics of PD patients and their caregivers are shown in Table 1. All caregivers were close relatives of the patients, and most of them cared PD patients on a permanent basis, with a mean duration of caregiving of 6.5 ± 4.1 years.

Functional evaluation of PD patients and their caregivers are shown in Table 2. Median H&Y was 3 (inter-quartile range: 2–3). Fifty-four per cent of patients were in H&Y stage ≤2; about 46% had H&Y stage ≥3; one patient was in H&Y stage 5. Duration of the disease, as reported by patients was 8.7 ± 4.9 years (range: 2–25).

Table 1
Demographic characteristics of PD patients (n = 50) and caregivers (n = 50).

	PD patients		Caregivers		
	n	%	n	%	p
Gender					
Male	40	80	6	12	<0.0001
Female	10	20	44	88	
Education					
Illiteracy	5	10	2	4	ns
Basic school	18	36	14	28	
Secondary school	13	26	17	34	
College	2	4	1	2	
University	12	27	16	32	
Marital status					
Married	44	88	42	84	ns
Single	4	8	4	8	
Widower	2	4	2	4	
Divorced	0	0	2	4	
Relation to care recipient					
Spouse			39	78	
Daughter/son			7	14	
Other family members/friends			4	8	
Mean age, years (SD)	65.4	(10.3)	55.7	(13.1)	<0.001
Years of education, mean (SD)	9.1	(5.3)	10.9	(4.9)	0.003

ns, non significant.

3.1. Caregivers' mood, burden and perceived health status

Sixteen per cent of PD patients experienced anxiety whereas the 26% suffered depression (cut-off value ≥11 points). The proportion of caregivers who scored ≥11 points in the HADS-anxiety and depression subscales was 12% and 14% respectively. ZCBI mean score was 20.2 (SD: 12.8). Twenty-two per cent of PD caregivers recognized that they were exhausted. Neither caregiver's age nor gender was associated to the ZCBI mean scores.

EQ-5D Index (0.5 vs. 0.7) and EQ-VAS mean scores (63.6 vs. 76.3) were significantly lower among patients (p < 0.0001). As measured by the EQ-5D Index, no difference by gender was observed in caregiver's quality of life. The percentage of caregivers who scored the EQ-5D Index under 0.50 and the EQ-VAS less than 50 points were 16% and 10% respectively. Neither caregiver's age nor PD duration correlated with caregiver HRQoL and health status as measured by the EQ-5D Index and EQ-VAS. Caregiver educational level was not associated with EQ-5D Index and EQ-VAS mean scores.

Table 3 displays significant correlations between patient and caregiver functional scales. Caregiver's HADS-depression mean scores moderately correlated with the following caregiver-related measures: EQ-5D Index (r = −0.57), EQ-VAS (r = −0.46) and Zarit's Role strain (r = 0.37). Similar finding were observed between caregiver's HADS-anxiety mean scores and the following measures: EQ-5D Index, EQ-VAS and ZCBI.

ZCBI mean scores moderately correlated, as a whole, with PD related measures (H&Y, CISI total score, SCOPA-Motor, NMSS, SCOPA-Sleep and HADS-depression and Anxiety subscales; r = 0.25−0.51) and caregiver outcomes (HADS subscales, EQ-5D Index and EQ-VAS). Highest correlations were observed between ZCBI mean scores and SCOPA-Nocturnal Sleep (r = 0.52) and patients' HADS-anxiety subscale (r = 0.51).

Table 4 displays ZCBI and EQ-5D Index mean scores of caregivers broken down by PD functional status. Caregiver's Zarit Role strain mean scores significantly increased as functional status of PD patients worsened (Bonferroni correction: p < 0.007.)

3.2. Determinants of burden and perceived health status

Hierarchical regression was performed, and entered first patient variables and then caregiver variables. Results of multiple regression analysis are showed in Table 5. Patient-associated variables (sleep disorders as measured by the SCOPA-sleep, and behavioral-psychotic symptoms as measured by the PPRS), time of caregiving and caregiver mood (as measured by the HADS-anxiety subscale) were independent predictors of caregiver's burden (adjusted $R^2 = 0.55$; p < 0.0001).

Caregiver's mood status as measured by the HADS-depression subscale was a significant determinant of caregiver's HRQoL, as measured by the EQ-5D Index (adjusted $R^2 = 0.28$; p = 0.006).

4. Discussion

PD is a disabling disease that causes a progressive lack of autonomy. As the disease progresses, patients suffer increasing physical limitations and need to be helped in their ADLs, social participation, and medical compliance [20]. The presence of symptoms that constantly fluctuates on a daily or even hourly basis, and the apparition of cognitive and psychiatric (hallucinations)

Table 2
Functional evaluation of Parkinson's disease patients (n = 50) and their caregivers (n = 50).

	Patients			Caregivers			
	Mean	SD	Range	Mean	SD	Range	p (Mann−Whitney)
Mean age at onset, years (SD)	56.8	11.1	[35−76]				
CISI-PD[b]	10.1	4.0	[2−18]				
SCOPA-motor[b]	18.3	11.1	[3−47]				
NMSS[b]	54.5	31.4	[8−140]				
SCOPA-cognition[b]	20.6	7.8	[5−39]				
PPRS[b]	1.6	1.4	[0−5]				
SCOPA-sleep[b]	10.1	6.1	[0−14]				
SCOPA-psicosocial[b]	30.4	18.3	[0−72.7]				
HADS-anxiety subscale[b]	7.0	3.9	[1−18]	5.7	3.7	[0−12]	ns
HADS-depression subscale[b]	7.5	4.2	[0−18]	5.9	4.1	[0−16]	<0.0001
Zarit caregiver burden inventory[b]				20.2	12.8	[1−61]	
Zarit role strain[b]				4.4	4.1	[0−20]	
Zarit personal strain[b]				10.5	6.2	[1−29]	
EQ-5D index[a]	0.5	0.3	[−0.24 to 1]	0.7	0.3	[−0.031 to 1]	<0.0001
EQ-VAS[a]	63.6	19.8	[0−100]	76.3	16.2	[40−100]	0.0005

SD, standard deviation; CISI-PD, Clinical impression severity index-Parkinson's disease; SCOPA, Scales for Outcomes in Parkinson's disease; NMSS, Non-motor symptom scale; PPRS; Parkinson psychosis rating scale; ns, non significant; HADS, Hospital Anxiety and Depression Scale; EQ-5D, EuroQoL questionnaire; VAS, visual analog scale. Bonferroni correction: p < 0.0125.
[a] Higher scores indicate better function.
[b] Higher scores indicate worse function.

Table 3
Correlation between patient and caregiver functional scales.

	Zarit caregiver burden inventory			EQ-5D (caregiver)		HADS-caregiver	
	Total score	Role strain	Personal strain	Index	VAS	Anxiety	Depression
Caregivers							
HADS-anxiety	0.45[c]	0.36[a]	0.39[b]	−0.58[c]	−0.50[c]		
HADS-depression	0.34[a]	0.37[a]	0.22	−0.57[c]	−0.46[c]		
EQ-5D index	−0.30[a]	−0.27[a]	−0.39[b]				
EQ-VAS	−0.30[a]	−0.26[a]	−0.25[a]	0.52[c]			
Patients							
H&Y	0.28[a]	0.43[b]	0.20	0.20	−0.01	−0.14	−0.07
CISI-PD total score	0.43[b]	0.59[c]	0.39[b]	−0.15	−0.22	0.11	0.19
SCOPA-motor	0.31[a]	0.43[b]	0.13	0.04	−0.1	−0.01	−0.02
NMSS	0.25[a]	0.35[a]	0.12	−0.27[a]	−0.25[a]	0.18	0.37[a]
SCOPA-cognition	−0.02	−0.01	−0.01	−0.07	−0.08	0.30[a]	0.24
PPRS	0.21	0.15	0.16	−0.12	−0.22	0.07	0.20
SCOPA-sleep	0.52[c]	0.52[c]	0.39[b]	−0.26[a]	−0.25[a]	0.32[a]	0.23
SCOPA-psychosocial	0.52[c]	0.52[c]	0.38[b]	−0.25[a]	−0.30[a]	0.32[a]	0.23
HADS-anxiety	0.51[c]	0.09	0.24	−0.20	−0.12	0.24	0.35[a]
HADS-depression	0.39[b]	0.19	0.20	−0.13	−0.23	0.27[a]	0.37[a]

HADS, Hospital Anxiety and Depression Scale; EQ-5D, EuroQoL questionnaire; VAS, visual analog scale; H&Y, Hoehn and Yahr stage; CISI-PD, Clinical impression severity index-Parkinson's disease; SCOPA, Scales for Outcomes in Parkinson's disease; NMSS, Non-motor symptom scale; PPRS, Parkinson psychosis rating scale.
For coefficients: (a) $r > 0.24$, $p < 0.05$; (b) $r > 0.37$, $p < 0.001$; (c) $r > 0.43$, $p < 0.0001$.

complications usually result in a more highly demand and additional burden for caregivers [21].

Whereas most research about PD caregiver-related problems have been conducted in western countries [3,20], studies about burden of PD caregivers in South America and other developing countries are scarce [22,23]. The cross-cultural assessment of factors associated with caregiver burden in PD is needed, because early identification of their determinant might alleviate part of the burden through appropriate interventions.

This study provides further insights about PD Brazilian caregivers by means of a standardized battery of instruments to assess burden, mood disorders, and health status. In Brazil, most of PD patients are assisted in their homes by their family members who act as informal caregivers and provide them physical and psychological care, and even financial support. Brazilian families and primary caregivers assume a considerable role and the main cost of caregiving that otherwise should have to be performed by the Brazilian national health system.

In this study, most caregivers were females and spouses, with an average age of about 56 years, and the majority was taking care of the PD patients for an average of 6.5 years. Caregiver burden was unrelated to caregiver's age, a finding also reported in the literature [3]. Burden in Brazilian PD caregivers was associated with caregiver's mood disorders, time of caregiving and the presence of sleep and behavioral symptoms in PD patients.

Table 4
Burden, mood and quality of life mean scores for extreme groups of Parkinson's disease severity.

Caregiver measures	H&Y		p (Mann−Whitney)
	1−2	3−5	
	$n = 27$	$n = 23$	
HADS-anxiety	5.9 ± 3.4	8.2 ± 4.2	0.04
HADS-depression	6.4 ± 3.9	8.8 ± 4.2	0.04
Zarit caregiver burden inventory	16.4 ± 9.2	24.6 ± 15.2	0.02
Zarit role strain	3.1 ± 2.7	6.1 ± 4.9	0.007
Zarit personal strain	9.3 ± 5.1	12.1 ± 7.1	0.11
EQ-5D index	0.7 ± 0.3	0.8 ± 0.2	0.34
EQ-VAS	75 ± 17.8	77.8 ± 14.4	0.54

H&Y, Hoehn and Yahr stage; HADS, Hospital Anxiety and Depression Scale; EQ-5D, EuroQoL questionnaire; VAS, Visual analog scale.
Bonferroni correction: $p < 0.007$.

Non-motor symptoms are quite common in PD patients, with a prevalence ranging from 21% at the diagnosis of PD to around 90% after seven years of disease duration [1,2]. The most common PD non-motor symptoms are mood disturbances, cognitive and neuropsychiatric symptoms, sleep disorders, autonomic dysfunction, fatigue, and sensory symptoms [2]. Many patients experience an increased number of non-motor symptoms as PD progresses; and this fact may increase the burden of their caregivers.

Data from a systematic review of prevalence studies of dementia in PD has shown that between 24% and 31% of PD patients has dementia [24]. Significant risk factors for the development of dementia in PD include older age, longer disease duration, increasing severity of motor symptoms, and the onset of hallucinations [25]. The Brazilian population is becoming older, and the proportion of people with PD and dementia is expected to increase accordingly. This fact may add more burden and higher risk of depression in Brazilian PD caregivers. Other studies have also reported that quality of life is worse and caregiver burden is higher in caregivers of PD patients with dementia as compared to caregivers of PD without dementia [25].

Psychopathological behavior and hallucinations may increase caregiver's burden [22]. These symptoms can be frequently associated to cognitive dysfunction and dementia in PD. Some studies have found that caregiver's burden may be higher in PD patients with dementia than in Alzheimer disease; in patients with PD and dementia, neuropsychiatric problems could be one of the major contributors to the higher observed burden [23]. In our study, Brazilian caregiver's burden was found to be proportional to the degree of psychiatric and cognitive symptoms that patients suffered.

The link between dementia, hallucinations and other non-motor symptoms may provoke a continuous feed-back on the degree of burden, anxiety and depression of caregivers. PD patients with cognitive disturbances or advanced dementia usually present a more severe motor impairment, higher rates of depression and disability and lower functionality [26]. In addition, PD patients in the advances stages of the disease may present more frequently agitation, psychotic symptoms, and aberrant motor behaviors and sleep disturbances [26]. In this study, sleep disturbances and psychotic symptoms in Brazilian PD patients were associated with the degree of burden in their caregivers.

An association between caregivers strain and patient's depression has been reported in the literature [3,20]. In addition,

Table 5
Determinants of burden and perceived health status among Parkinson's disease caregivers.

Measures	Standardized Coefficient	Standard Error	t-Value	p	F	R^2 adjusted
Zarit caregiver burden inventory				<0.0001	6.9	0.55
Patient's age	0.05	0.18	0.35	0.73		
Patient's sex	0.20	4.01	1.58	0.12		
Caregiver's age	0.17	0.13	1.22	0.23		
Time of caregiving	0.38	0.37	3.21	0.002*		
SCOPA-ADL	−0.03	0.43	−0.23	0.82		
SCOPA-cognition	−0.04	0.19	−0.36	0.72		
PPRS	0.29	0.95	2.79	0.008*		
Patient's HADS-depression subscale	0.04	0.35	0.38	0.71		
Caregiver HADS-anxiety subscale	0.34	0.41	2.89	0.006*		
SCOPA-sleep	0.38	0.30	2.67	0.01*		
EQ-5D index				0.006	3.2	0.28
Patient's age	−0.15	0.01	−0.86	0.39		
Caregiver's age	0.14	0.00	0.84	0.41		
Time of caregiving	−0.14	0.01	−1.04	0.30		
SCOPA-ADL	−0.08	0.10	−0.46	0.65		
SCOPA-cognition	0.06	0.01	0.41	0.68		
PPRS	0.12	0.03	0.89	0.38		
SCOPA-sleep	−0.25	0.01	−1.81	0.08		
Patient's HADS-depression subscale	0.27	0.01	1.74	0.09		
Caregiver's HADS-depression subscale	−0.62	0.01	−4.05	0.0002*		

PPRS, Parkinson psychosis rating scale; HADS, Hospital Anxiety and Depression Scale; SCOPA, Scales for Outcomes in Parkinson's disease; ADL, activities of daily living; EQ-5D, EuroQoL questionnaire; *, statistically significant.

significant differences in burden and HRQoL between depressed and non-depressed PD caregivers have been previously reported [3]. The most important factor associated to HRQoL in Brazilian caregivers was the presence of depressive symptoms.

In this study, average prevalence of anxiety and depression in caregivers of Brazilian PD patients was 12% and 14%. Reports about anxiety and depression in Brazilian population studies are highly variable, a fact that hinders a consistent conclusion about the potential increase of these disorders in PD patients' caregivers. The São Paulo Ageing & Health Study showed that average prevalence of ICD-10 depression in 2072 individuals aged 65 years or over living in São Paulo was 4.8% [27]. Another population study performed in Brazilian women aged 40–65 years detected a prevalence of depressive symptoms in one third of the females [28]. In other cultural setting, depressive symptoms were also significant predictors of burden in spouses of PD patients [29]. A close relationship exists between caregiver's quality of life, the experienced burden and the presence of depressive and anxiety disorders. Depression and anxiety are consistent predictors of HRQoL in PD [30], and the relationship between caregiver distress and quality of life deterioration is remarkable. The association between depression in PD patients and depression in caregivers may reflect the direct influence of patient's mood on caregiver's mood [20]; nevertheless, an indirect effect has also been proposed because depression in PD patients significantly correlated with disability [20,30]. In addition, caregiver's burden may be influenced by other factors such as perceived social support, the quality of caregiver-PD patient relationship, caregiver's coping, burn-out syndrome and the absence of social participation [4,5,20].

This study has some weak and strength points. Study limitations include a small sample size, and a relatively low number of PD patients at either extreme of the severity classification. Results should be regarded with caution as the number of analyses performed introduces the need for adjustment for Type I error. In addition, they could be related to chance characteristics of the sample. Thus, replications of these findings are important before results can be regarded as conclusive or generalizable. Strength points include the use of a standardized assessment of PD patients and caregivers by means of a protocol battery of validated scales, and the inclusion of patients and caregivers with wide range of age, years of evolution and stages of the disease.

In conclusion, the most important predictors of burden in Brazilian PD caregivers were the presence of cognitive and behavioral symptoms in PD patients, the time of caregiving and the occurrence of mood disorders in caregivers. The findings of this study suggest that chronically caring for a PD patient may have a significant negative effect on health and psychosocial functioning of Brazilian caregivers. Burden in caregivers may increase with increasing disability and non-motor symptoms, mainly depression and hallucination symptoms. From a clinical perspective, these factors should be taking into account and early treated when designing interventions to reduce burden of PD caregivers, and for supporting caregivers in their role. The assessment of Brazilian PD caregivers by means of this standardized battery is recommended. Further longitudinal studies are needed to establish causality relationships between less known caregiver factors and burden.

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