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ORIGINAL COMMUNICATION

Social and clinical determinants of quality of life in Parkinson's disease in Austria: a cohort study

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Abstract Parkinson's disease (PD) is associated with a reduction of health-related quality of life (HrQoL). Demographic and clinical determinants of HrQoL in PD have been previously investigated, but less is known about its social determinants. Data on HrQoL in Austrian patients with PD are not available. The objective of this cross-sectional survey was to evaluate HrQoL of Austrian patients with PD and to provide a comprehensive analysis of its social and clinical determinants. Outpatients ($n = 100$) with idiopathic PD were recruited in the Department of Neurology of the University Innsbruck. Clinical status was estimated using the Unified Parkison's Disease Rating Scale (UPDRS). HrQoL was evaluated using a generic instrument, the EuroQol (EQ5D and EQ-VAS). Independent determinants of HrQoL were assessed in multivariate regression analysis. The proportion of PD patients with moderate or severe problems in at least one dimension of the EQ5D was significantly higher than in the general population (90.1 vs. 35.1%, $P < 0.001$). The mean EQ-VAS score in PD was lower than in the general population (48.9 ± 19.6 vs. 77.0 ± 20.8, $P < 0.001$). Social support (number of household members) was identified as an independent social determinant of HrQoL. Demographic and clinical determinants were age, depression, UPDRS and motor fluctuations. The analysis of determinants of HrQoL showed that a greater attention should be paid to social support and home care. Our data on HrQoL in PD should be considered in the development of new health care programs.

Keywords Parkinson's disease · Quality of life · EQ-5D · Austria

Introduction

Parkinson's disease (PD) is a chronic neurodegenerative disorder with a prevalence of 108–257 per 100,000 population [17]. There are approximately 1.2 million people with PD in Europe, 16,000 of whom live in Austria [1]. The main symptoms of PD are bradykinesia, rigidity and rest tremor, which are usually respond well to treatment with antiparkinsonian drugs in the early stages. However, the disease has a progressive course resulting in therapy-refractory motor complications (motor fluctuation, dyskinesia and dystonia) and non-motor signs (sleep disorders, urinary incontinence, gastrointestinal dysfunction, orthostatic hypotension and mental disorders).

While in the last century studies were concentrated on assessment of motor function, nowadays the focus has shifted to evaluation of the impact of PD on patients' daily lives, their physical and psychological well-being

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and social participation. The progressive nature of the disease is associated with growing disability and has a considerable impact on health-related quality of life (HrQoL). HrQoL is defined as an individual's perception of his or her well-being that is related to health status and can be affected by disease and its treatment [5]. The demographic and clinical determinants of HrQoL, such as age, disease severity, motor and non-motor symptoms, have been thoroughly investigated in previous studies [4, 7, 9, 20, 22, 23, 25, 32], whereas less is known about the role of social factors in HrQoL of patients with PD [3, 14, 32].

There are several studies evaluating HrQoL of patients with PD in the countries of Western Europe [4, 7, 9, 20, 22, 23, 25, 32] and two studies from Eastern Europe [14, 38]. However, HrQoL in Austrian patients with PD has not yet been investigated. The objective of this cross-sectional survey was to evaluate HrQoL of patients with PD in Austria and to provide a comprehensive analysis of its social and clinical determinants.

Patients and methods

Study design

This study was performed as part of a large international project investigating resource utilization and HrQoL in patients with PD (http://www.EuroParkinson.net) [24]. Five European countries (Austria, Czech Republic, Germany, Italy, Portugal) and Russia participated in the project [35, 36]. The patients were recruited from the EuroPa registry which was organized by the EuroPa study group to create a pool for research on PD. The EuroPa registry consists of approximately 2,000 patients with idiopathic PD randomized by a computer-generated scheme from the clinical databases of the outpatient departments of large European medical centers, such as university hospitals [24]. The participants of the Austrian cohort study were recruited from the Austrian pool of the EuroPa registy and consisted of outpatients ($n = 100$) with idiopathic PD who visited the neurological department of the University Innsbruck between July 1, 2003 and June 30, 2004. The inclusion criterion was the diagnosis of idiopathic PD based on the clinical diagnostic criteria of the UK Parkinson's Disease Society Brain Bank [8]. The study was approved by the local ethics committee and all participants gave informed consent. The study was designed as a cross-sectional survey. There were no treatment interventions in the course of this study. Of 100 initially recruited patients, 19 were excluded because their clinical records were not complete.

Clinical evaluation

Medical and neurological examination was performed by a specialist in movement disorders during adequate antiparkinsonian treatment (clinical 'on' state). The Unified Parkinson's Disease Rating Scale (UPDRS), which is a valid and reliable measure of clinical status in PD, was used to document disease severity [19]. The investigator documented, in specially developed case report forms, social characteristics (marital and employment status, social support, net income) and clinical data, such as UPDRS, age of symptom onset, disease duration, motor complications (motor fluctuations, dyskinesias, dystonia) and non-motor symptoms (e.g. sleep disorders, depression, psychosis and dementia). The motor fluctuations were defined as any shortening of response to Levodopa ("wearing-off") or unpredictable recurring parkinsonism not related to the timing of Levodopa ("on–off"). The definition of dyskinesias included drug-induced hyperkinetic or dystonic movements or postures. Dystonia was defined as sustained muscle contractions causing twisting and repetitive movements or abnormal postures. Psychosis was defined as the presence of delusions, hallucinations, or paranoia. Depression was diagnosed according to criteria of the ICD-10 [37]. Dementia was defined as a Mini-Mental State Examination score <24 [6].

Evaluation of HrQoL

HrQoL was evaluated using a generic instrument, the EuroQol [2], which is a valid measure of HrQoL in PD reflecting severity and complications of the disease [28]. The EuroQol is a patient-reported measure of HrQoL that consists of two sections [30]. The first section (so-called EQ-5D) comprises five questions with three levels of severity in each (1 = no problem, 2 = moderate problem, 3 = severe problem) that cover five dimensions of health: mobility, self-care, usual activities, pain/discomfort and anxiety/depression. The EQ5D generates 243 theoretically possible health states. Calculation of the EQ-5D-index score was performed according to the European recommendations [10]. The second section of the EuroQol is a vertical visual analogue scale (VAS) ranging from 0 (worst imaginable health state) to 100 (best imaginable health state).

Statistical analysis

SPSS Version 15.0 (SPSS Inc., Chicago, IL, USA) was used to calculate statistics. All values are presented as mean with 95% confidence interval (CI). The t test was used for comparisons if data followed normal distribution (Kolmogorov–Smirnov test). If normal distribution was not

present, group comparisons were performed by means of the Mann–Whitney U test (two independent groups), the Kruskal–Wallis test (more than two independent groups) or the Wilcoxon rank test (two dependent groups). A value of $P < 0.05$ was considered statistically significant. Independent predictors of HrQoL were determined in multivariate regression analysis. The following variables were used in the multivariate analysis: 1. Demographic variables (age and gender), which are commonly used in the multivariate analyses and have been shown to influence HrQoL in PD [4, 12, 18, 27, 38]. 2. Four variables describing social status (marital status, number of persons in household, income and employment situation), which are widely used in HrQoL studies [15]. 3. Clinical variables describing duration and severity of PD (age of onset, duration of the disease, UPDRS), motor complications (motor fluctuations, dyskinesias, dystonia) and non-motor symptoms (sleep disorders, depression, psychosis and dementia). The clinical variables were selected based on the results of previous studies [4, 7, 9, 20, 22, 23, 25, 32]. The list of the selected variables was approved by an expert forum of six movement disorders specialists. The R^2 method was used to explore the variability accounted for by independent predictors [11].

Table 1 Demographics and disease severity stratified by age groups

n	<70 years n (%) 46 (100%)	≥70 years n (%) 35 (100%)
Sex		
Male	30 (65.2%)	19 (54.3%)
Female	16 (34.8%)	16 (45.7%)
Motor complications		
No	14 (30.4%)	10 (28.6%)
Yes	32 (69.6%)	25 (91.3%)
Non-motor complications		
No	4 (8.7%)	0 (0.0%)
Yes	42 (91.3%)	35 (100.0%)
UPDRS II[a]	13.0 (3.0–30.0)	20.0 (9.0–34.0)
UPDRS III[a]	25.0 (9.0–49.0)	36.0 (23.0–50.0)
Duration of disease (y)[a]	9.6 (0.9–26.1)	11.2 (2.8–28.0)
Marital status		
Married	36 (78.3%)	23 (65.7%)
Divorced	2 (4.3%)	1 (2.9%)
Single	3 (6.5)%	2 (5.7%)
Widowed	5 (10.9%)	9 (25.7%)
Mean annual income (€)[a]	15,850 (4,750–32,340)	14,010 (4,030–31,680)

[a] Mean (95% confidence interval)

Results

Demographics and clinical features

Of 81 study-completers with a mean age of 69.3 ± 9.8 (range 44–85) years, 32 (39.5%) were female and 49 (60.5%) were male. The average age at onset of disease was 57.3 ± 11.6 (range 29–80). Demographics and clinical characteristics of the study cohort stratified by age group are shown in Table 1. The distribution of motor complications was as follows: 49 patients (60.5%) had motor fluctuations, 37 patients (45.7%) had dyskinesia, 38 patients (46.9%) had dystonia. Depression was present in 47 patients (58.0%), psychotic symptoms were found in 14 patients (17.3%), dementia was diagnosed in 13 patients (16.0%). The majority of study participants ($n = 60$, 74.1%) had sleep disorders.

Social situation

Fifty-nine patients (72.8%) were married or lived in a stable relationship, 3 patients (3.7%) were divorced, 5 patients (6.2%) were single and 14 patients (17.3%) were widowed. Eight patients (9.9%) stated that they were living alone, 55 patients (67.9%) were living with one person and 18 patients (22.2%) had more than one person in their household. The majority of patients ($n = 42$, 51.9%) were dependent in their activities of daily living. Home care was provided by family members and friends for 32 patients (76.2%). The mean age of caregivers was 64.5 ± 14.0 (range 36–83). The majority of caregivers were female ($n = 23$, 71.9%). Nineteen percent ($n = 6$) of caregivers were employed. All of them reported job change or reduction of working hours due to PD-related care duties. Ten patients (23.8%) received professional care.

Only one patient in our cohort was fully employed. Twenty-seven patients (33.3%) were age-retired and 34 patients (42.0%) were retired prematurely. In 20 patients (58.8%) premature retirement was due to PD. One person of working age was unemployed because of PD. The mean age of retirement in our study cohort was lower than in the general Austrian population (56.8 ± 7.2 in men and 55.7 ± 6.7 in women vs. 58.5 and 56.9, respectively) [29]. The mean net individual income of study participants was 15,050 € (95% CI 13,560–16,800) per year. If stratified by age groups, it was similar to the mean net income in the general population [29].

Health-related quality of life

Seventy-three patients (90.1%) reported moderate or severe problems in at least one dimension of the EQ-5D that was greater than that of the general European population (35.1%, $P < 0.001$) [15]. The dimension "mobility" was

most affected with 67 patients (82.7%) reporting moderate or severe problems. It was followed by dimensions "pain/discomfort" and "usual activities", with 61 (75.3%) and 58 (71.6%) patients, respectively, experiencing moderate or severe problems. In comparison, these figures are lower in the general European population with 13.6, 28.5 and 10.5% of individuals having moderate or severe problems in the dimensions "mobility", "pain/discomfort" and "usual activities", respectively ($P < 0.001$) [15]. The number of patients with severe problems was highest in the dimension "usual activities" ($n = 26$, 32.1%). In the dimension "self care", 37 (45.7%) patients had moderate and 13 (16.0%) patients had severe problems. The dimension "anxiety/depression" was less affected with 36 (44%) patients reporting moderate and 8 (9.9%) patients reporting severe problems.

The mean EQ-VAS score in participants of our study was lower than in the general population (48.91 ± 19.56 vs. 77.00 ± 20.80, $P < 0.001$) [15]. Association between HrQoL on the EQ-VAS and age in the study cohort and in the general population is depicted in Fig. 1. Table 2 shows the associations of demographic, social and clinical parameters with EQ5D-index score and EQ-VAS. The results of univariate analysis show that age, sex, disease severity, number of persons in household, motor fluctuations, dyskinesias and mental disorders (depression, dementia and psychosis) have a significant impact on HrQoL. Female gender was associated with reduced HrQoL. Interestingly, female patients tended to have more non-motor complications than male patients ($n = 31$, 96.9% vs. $n = 44$, 89.8%, $P = 0.09$). Mean scores on the EQ5D-index (48.81, 95% CI 19.86–97.50) and on the EQ-VAS (48.42, 95% CI 20.00–85.00) in patients with PD-related unemployment or premature retirement were not lower than in other patients (EQ5D-index: 51.77, 95% CI 20.04–97.50, $P = 0.48$; EQ-VAS: 50.33, 95% CI 11.00–75.00, $P = 0.49$).

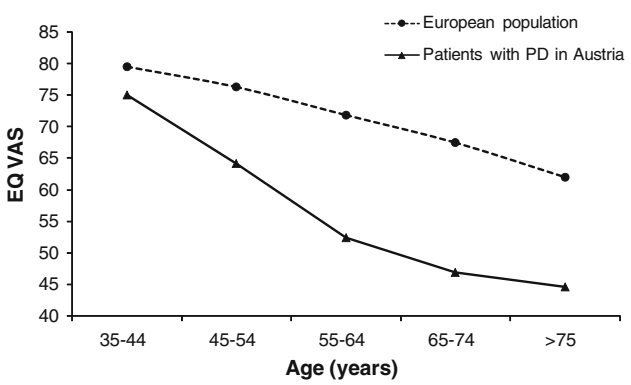

Fig. 1 Comparison of EQ VAS scores in Parkinson's disease and general population [15]

Independent predictors of HrQoL were determined using multivariate regression analysis (Table 3). The following potential determinants were included in Model 1: age, gender, disease severity as measured by UPDRS. Age and UPDRS were identified as independent predictors of the EQ-VAS. Gender was also found to be predictive for the EQ5D-index score. Motor and non-motor complications (motor fluctuations, dyskinesias, dystonia, mental and sleep disorders), age at onset, disease duration and social determinants (marital status, number of persons in household, net income of patients and PD-related unemployment or premature retirement) were added into Model 2. Age, disease severity, motor fluctuations, and number of persons in household were found to be independent predictors of the EQ-VAS. They could explain 41.0% (adjusted R^2) of the variance in EQ-VAS scores. The independent predictors of the EQ5D-index were age, gender, UPDRS, motor fluctuations and depression and could explain 50.6% of its variance.

Discussion

This is the first study investigating health-related quality of life and its determinants in patients with PD in Austria. HrQoL is an important aspect in health-care representing the impact of the disease on a persons's well-being. Outcome measures of HrQoL are increasingly incorporated in studies of chronic conditions such as neurodegenerative disorders. Earlier outcome research in PD was traditionally focused on the assessment of motor function. In the last decade, the importance of HrQoL in PD was recognized with growing numbers of studies investigating different aspects of HrQoL in these patents. Several HrQoL instruments were developed specifically for PD and include the Parkinson's Disease Questionnaire 39-item version (PDQ-39) [21], its 8-item version (PDQ-8), the Parkinson's Disease Quality of Life questionnaire (PDQL) [12] and the Parkinson's Disease Quality of Life scale (PDQUALIF) among others [34]. Generic instruments, such as the EuroQol and the Short-Form 36-item health survey (SF-36) [33], are not disease-specific and provide data allowing comparison with the general population or other diseases.

PD is a complex neurological disorder characterized by a broad spectrum of motor and non-motor symptoms, which are related to the disease itself or caused by medication. Thus, there are many factors impairing HrQoL in patients with PD. Motor dysfunction and depression are widely recognized as the main contributors to impairment of HrQoL in this chronic condition [4, 7, 20, 22, 23, 27, 32]. In the EQ5D, motor function contributes to HrQoL through the dimensions "mobility", "self-care" and "usual activities". "Mobility" was the dimension most impaired

Table 2 Associations of EQ-VAS and EQ5D index score with demographic, social and clinical variables

	EQ-VAS Mean (95% CI)	*P* value*	EQ5D-index score Mean (95% CI)	*P* value*
Total ($n = 81$)	48.91 (20.00–84.50)		49.58 (19.86–97.50)	
Gender				
Male ($n = 49$)	50.00 (20.00–82.50)	0.399	53.37 (19.86–97.50)	0.045
Female ($n = 32$)	47.25 (14.75–91.75)		44.31 (11.79–97.50)	
Age groups				
<60 ($n = 17$)	51.76 (5.0–97.50)	0.564	70.80 (24.78–97.50)	<0.001
60–69 ($n = 29$)	46.04 (20.00–87.50)		49.85 (12.52–97.50)	
≥70 ($n = 35$)	49.91 (18.00-77.00)		39.50 (18.96–71.74)	
Marital Status				
Married ($n = 59$)	49.27 (20.00–80.00)	0.676	49.37 (20.31–97.50)	0.766
Single/divorced/widowed ($n = 22$)	47.95 (11.50–94.25)		50.14 (16.03–97.50)	
Persons in household incl. patient				
1 person ($n = 8$)	44.29 (20.00–75.00)	0.218	39.79 (19.86–90.25)	0.048
2 persons ($n = 55$)	47.84 (20.00–80.00)		50.89 (17.83–97.50)	
≥3 persons ($n = 18$)	55.29 (20.00–87.50)		56.83 (28.34–98.50)	
Age of disease onset				
Age <50 ($n = 21$)	44.52 (5.50–89.50)	0.370	55.92 (6.65–97.50)	0.359
Age ≥50 ($n = 60$)	50.45 (20.25–80.00)		47.36 (20.33–96.27)	
Disease duration				
<5 years ($n = 23$)	50.74 (22.00–80.00)	0.605	51.70 (19.95–97.50)	0.675
≥5 years ($n = 58$)	48.19 (19.50–85.25)		48.74 (19.63–97.50)	
UPDRS				
Tertile 1 ($n = 12$)	61.25 (30.0–85.00)	0.001	70.24 (30.16–97.50)	<0.001
Tertile 2 ($n = 25$)	56.00 (31.50–82.00)		61.44 (31.60–97.50)	
Tertile 3 ($n = 44$)	41.52 (12.50–75.00)		37.21 (16.48–69.68)	
Motor fluctuations no ($n = 32$)	55.94 (26.50–91.75)	0.023	54.17 (23.66–97.50)	0.078
Motor fluctuations yes ($n = 49$)	44.33 (15.00–72.50)		46.58 (17.61–97.50)	
Dyskinesia no ($n = 44$)	52.73 (20.00–88.75)	0.047	51.19 (19.97–97.50)	0.342
Dyskinesia yes ($n = 37$)	44.38 (19.00–76.00)		47.66 (19.41–97.50)	
Dystonia no ($n = 43$)	48.37 (20.00–84.00)	0.623	50.31 (19.95–97.50)	0.943
Dystonia yes ($n = 38$)	49.53 (9.75–85.50)		48.75 (19.13–97.50)	
Depression no ($n = 34$)	53.59 (20.00–87.50)	0.068	55.39 (18.73–97.50)	0.025
Depression yes ($n = 47$)	45.53 (14.00–83.00)		45.38 (19.86–97.50)	
Sleep disorder no ($n = 21$)	53.10 (21.00–94.50)	0.403	55.71 (24.83–97.50)	0.076
Sleep disorder yes ($n = 60$)	47.45 (20.00–79.75)		47.43 (19.86–97.50)	
Dementia no ($n = 68$)	49.49 (20.00–82.75)	0.452	52.45 (19.86–97.50)	0.015
Dementia yes($n = 13$)	45.92 (20.00–80.00)		34.56 (5.18–70.50)	
Psychosis no ($n = 67$)	50.18 (20.00–83.00)	0.164	52.98 (20.04–97.50)	0.002
Psychosis yes ($n = 14$)	42.86 (10.00–75.50)		33.30 (5.18–70.02)	

*$P < 0.05$ was considered statistically significant

in participants of our study. We also identified the UPDRS clinical severity scale and motor fluctuations as independent predictors of HrQoL. Generally, physical components of HrQoL are better represented in the EQ5D and the effect of motor dysfunction on HrQoL in our cohort was more pronounced than the influence of depression. However, the majority of studies found depression to be the main contributor to HrQoL in PD [26, 27, 31, 32, 38]. Depression was present in every second patient in our study. HrQoL Clinical factors related to HrQoL in our study were disease severity (UPDRS), motor complications (on–off fluctuations and dyskinesias) and non-motor complications (depression, dementia, and psychosis). This is in line with previous studies [4, 13, 20, 23, 27]. However, we found

Table 3 Demographic, social and clinical determinants of HrQoL in multivariate regression analysis

	EQ-VAS						EQ5D-Index score					
	Model 1			Model 2			Model 1			Model 2		
	B	95% CI	*P* value	B	95% CI	*P* value	B	95% CI	*P* value	B	95% CI	*P* value
Constant	37.11	9.78; 64.45	0.008	31.99	−2.01; 65.99	0.065	119.97	93.04; 146.90	<0.001	104.81	71.44; 138.17	<0.001
Age	−0.58	0.14; 1.02	0.011	−2.59	−6.81; 11.99	0.037	−0.55	−0.99; −0.12	0.014	−2.02	−11.24; −1.21	0.041
Gender[a]	−3.96	−11.83; 3.91	0.319	−5.7	−14.04; 2.64	0.177	−8.23	−15.99; −0.48	0.038	−12.03	−20.21; −3.85	0.005
UPDRS	−0.56	−0.79; −0.33	<0.001	−0.39	−0.68; −0.11	0.007	−0.65	−0.87; −0.42	<0.001	−0.53	−0.8; −0.25	<0.001
Fluctuations				−12.63	−24.06; −1.2	0.031				−9.94	−21.15; 1.28	0.042
Dyskinesia				−1.29	−0.48; 12.05	0.812				−2.97	−3.59; 17.54	0.192
Dystonia				−11.58	−21.07; −2.09	0.078				−10.92	−20.24; −1.61	0.072
Dementia				−1.75	−15.46; 11.96	0.800				−6.33	−19.78; 7.12	0.350
Psychosis				−5.1	−9.8; 20.00	0.496				−2.92	−11.7; 17.54	0.691
Depression				−2.66	−11.36; 6.04	0.543				−5.05	−13.59; 3.48	0.041
Sleep disorder				−1.94	−11.92; 8.05	0.699				−4.36	−5.44; 14.15	0.377
Age at onset				2.11	1.43; 7.2	0.651				2.55	1.68; 6.59	0.579
Duration of PD				−2.58	−11.94; 6.79	0.584				−3.46	−12.64; 5.72	0.454
Marital status[b]				4.97	−5.15; 15.08	0.33				12.77	2.84; 22.69	0.113
Persons at home				3.21	0.58; 5.84	0.018				0.95	−1.63; 3.54	0.463
Unemployment[c]				−1.69	−11.15; 7.77	0.772				−1.23	−10.63; 8,16	0.794
Net income				0.92	−5.18; 6.99	0.766				0.45	−5.48; 6.46	0.870
		$R^2 = 0.242$			$R^2 = 0.412$			$R^2 = 0.448$			$R^2 = 0.506$	

[a] Female gender (reference male)

[b] Single, divorced or widowed (reference married)

[c] PD-related unemployment

only UPDRS, motor fluctuations and depression to be independent clinical determinants of HrQoL.

Among demographic factors, age was consistently shown as a predictor of declining HrQoL [4, 12, 18, 27, 38]. This finding is not specific for PD, because growing age is a factor also reducing HrQoL in the general population [15]. Data on the influence of gender are inconsistent [4, 13, 16, 27]. Our results show that female gender is associated with reduced HrQoL in PD. This could probably be explained by a larger proportion of non-motor complications in female patients in our study. All participants in our study were Caucasian, so we could not examine the role of ethnicity in HrQoL. Ethnicity, however, was not associated with HrQoL in a study by Carod-Artal et al. [3].

Social factors play an important role in the patients' well-being, however, they are less investigated in PD. One study found significantly better scores of emotional well-being on PDQ-39 in married patients [3]. However, marital status in our study was not associated with HrQoL. Consistent with results of other studies, unemployment was not among determinants of HrQoL in our analysis [3, 27]. However, this finding is discrepant with data of the general population. This could be explained by the fact that the majority of individuals with PD are of retirement age and studies of larger populations of PD patients are necessary to detect the effect of PD-related unemployment. An important finding of our study was that HrQoL is associated with the number of persons in the household. This is supported by data from the general population reporting better HrQoL in persons living with partners, however, this correlation in the general population is not strong [15]. We suggest that the number of persons in the household is a factor improving availability and the quality of home care. Thus, individuals with PD living alone require better social integration and support from social services.

Comparisons between studies are complicated by differences in recruitment settings, HrQoL instruments used and baseline characteristics of patients. The majority of studies used disease-specific instruments to investigate HrQoL in PD [3, 14, 27, 31]. We used a generic instrument, EuroQol, because our aim was to assess overall HrQoL and compare it with the general population. Three other European studies applied EuroQol and found better HrQoL in their cohorts of PD patients (EQ-VAS: 59.9 $\pm$ 18.0 in Germany, 64.0 $\pm$ 22.6 in the UK and 67.8 $\pm$ 14.2 in the Netherlands vs. 48.9 $\pm$ 19.6 in our study) [23, 26, 32]. The explanation lies in the more advanced stages of the disease and/or in more advanced age of patients in our cohort. Larger multicenter studies are necessary to compare HrQoL in PD in different European countries.

Our study has the following limitations: (1) We cannot exclude the possibility of selection bias. Generally, studies performed in an outpatient setting tend to include less severe patients. However, our patients were recruited in a tertiary academic center and were, on average, in more advanced stages as compared to other cohort studies [23, 32]. (2) We collected data in a cross-sectional design and could not provide information on HrQoL that changed dynamically with disease progression. (3) Residual confounding by unmeasured variables in the multivariate analyses of HrQoL determinants is possible.

In conclusion, HrQoL in PD is substantially decreased in comparison to the general population. HrQoL in Austrian patients with PD has not been evaluated and these new data should be considered in the development of national health care programs. Our analysis of determinants of HrQoL showed that more attention should be paid to social support and home care of patients with PD. Being one of the major clinical determinants of HrQoL in PD, depression should be more intensively incorporated in clinical trials as an outcome measure.

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