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Neuroticism and extraversion in association with quality of life in patients with Parkinson's disease

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Abstract

Purpose Personality traits appear as determinants of quality of life (QoL) in most chronic diseases. The aim of this study is to explore whether neuroticism and extraversion contribute to the variance in QoL in patients with Parkinson's disease (PD) when controlled for age, functional status and disease duration.

Methods The Parkinson's Disease Quality of Life Questionnaire (PDQ-39) was used to assess QoL and the Unified Parkinson's Disease Rating Scale (UPDRS) for disease severity. Neuroticism and extraversion were measured with the Eysenck Personality Questionnaire (EPQR-A). Multiple linear regression analysis was then used to assess the contribution of neuroticism and extraversion to QoL.

Results The sample consisted of 153 PD patients (48.4% women; 67.9 ± 9.3 years; mean disease duration 7.5 ± 5.8 years). Neuroticism was, after disease severity, the second most important variable associated with QoL in PD patients, in particular for domains associated with psychological processes: *emotional well-being*, *social support*, *stigma* and *communication*. A higher score in extraversion was significantly associated with better *emotional well-being* in males, but surprisingly, with worse *emotional well-being* in females.

Conclusions After functional status, personality traits were clearly associated with QoL in PD patients. Therefore, they should be taken into account by health-care professionals in their appraisal of patient complaints.

Keywords Parkinson's disease · Extraversion · Neuroticism · Quality of life · Gender

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Introduction

Parkinson's disease (PD) is a progressive neurodegenerative disease that affects 1% of all people over 60 years of age and around 2% of the population over 80 years of age. It includes both physical and mental symptoms that have an impact on the quality of life (QoL) of those with the disease [1, 2]. The physical symptoms of PD typically affecting QoL are tremor, rigidity, slowness, a blank stare (the so-called "Parkinson's mask") and troubles with manual dexterity [3]. Mental symptoms may include depression, sleep disorders, hallucinations and delirium, some of which may be related to therapy using dopaminergic drugs [4, 5]. The social components of PD involve isolation due to the embarrassment caused by the symptoms and problems with communication [6].

With regard to basic sociodemographic and clinical variables, increasing age and higher disease duration have been found to be associated with decreased QoL in PD patients [7]. In addition, mildly significant differences in disability and QoL have been noted between the genders in

general: women have reported greater disability and reduction of QoL than men [8]. Gender differences are also present in the incidence of PD: the disease occurs more frequently in men than in women in every decade of life [9]. One of the various theories explaining these differences is that they may result from the neuroprotective effects of estrogen [8, 10, 11].

Some personality traits, such as neuroticism and extraversion, are assumed to be factors that contribute to the perception of health status and thus lead to a worse perception of QoL by people with several chronic diseases [12–14]. People who score high on the neuroticism scale manifest more worries, uncertainties and anxiety [15]. Because these people are more likely to behave overly emotionally and react too strongly to all sorts of stimuli, their neuroticism seems to be associated with psychological dysfunction [15, 16]. Some authors have reported that neuroticism also appears to be associated with the tendency to recall physical symptoms as being worse than they really were [17, 18], thus indirectly contributing to a lower perceived QoL [19]. Quality of life of patients with chronic diseases may also be influenced indirectly by extraversion. Extravertly oriented people have a tendency to be sociable and to prefer changes, and there is a high probability that they will crave excitement and act impulsively [15]. It has been observed that people with a low score in extraversion are more self-centered and are more sensitive to stress than extraverted people [20]. Therefore, it might be hypothesized that extraversion influences the level of coping with chronic disease and can thus also influence the level of QoL [20, 21].

The QoL of patients with PD is frequently studied, but very little is known about the associations between personality traits and QoL in these patients. The aim of this study, therefore, is to explore whether personality traits (neuroticism and extraversion) contribute to the variance in QoL in patients with PD when controlled for disease severity, disease duration and age. In addition, this study analyzes whether gender differences in the QoL of PD patients can be attributed to gender-related differences in extraversion and neuroticism in these patients.

Methods

Subjects and procedure

Data collection took place between February 2004 and February 2006. One hospital in Bratislava as well as 4 hospitals and 17 outpatient neurology clinics in the eastern part of the Slovak Republic cooperated in this study.

Questionnaires were sent to patients diagnosed with Parkinson's disease 3 weeks before the interview. All patients were diagnosed according to the United Kingdom Parkinson's Disease Society Brain Clinical Criteria [22]. Exclusion criteria were defined as follows: (1) patients older than 85 years because of the high probability of other co-morbidities and movement disabilities of a non-parkinsonian character and (b) an MMSE score lower than 23 points.

An interview with each patient took place 3 weeks after the invitation. After each interview, a neurologist assessed the severity of the patient's disease using the Unified Parkinson's Disease Rating Scale (UPDRS Version 3.0) [23]. The patients' mental status was assessed with the Mini-Mental State Examination (MMSE) [24]. The structured interview consisted of questions about the patient's medical history and subjective feelings that were not part of the questionnaire. Sociodemographic data were derived from medical records and from questionnaires filled in by the patients themselves.

The study was conducted after informed consent was obtained from the patients prior to the study. The local Ethics Committee of the University Hospital in Kosice approved the study in Kosice on 17 December 2002.

Measures

Disease severity

The Unified Parkinson's Disease Rating Scale (UPDRS) is currently used as a standard reference scale in clinical practice and in research for assessing disease severity in patients with PD. Ratings are observation-based, and scores are obtained by interview and physical examination. The scale consists of four parts: mentation and mood (part 1), activities of daily living (part 2), motor function (part 3) and complications resulting from dopaminergic therapy, including motor fluctuations and dyskinesias (part 4). Parts 1, 2 and 4 are interview-based, while part 3 is based on a clinical examination by a health professional and represents the patient's condition at the time of the examination. Patients can score from 0 to 176, with higher scores indicating increased disease severity [23].

Extraversion and neuroticism

The Eysenck Personality Questionnaire Revised Abbreviated (EPQR-A) was used for measuring Extraversion and Neuroticism [25]. The questionnaire was validated in the Czech Republic in a sample of 3,565 people [26]. The Slovak and Czech languages are similar, and today's Czech and Slovak Republics were, prior to 1993, united in a single country. Thus, results from the Czech Republic could be valid also for the needs of this research. The questionnaire consists of 24 items divided into 4 subscales:

extraversion, neuroticism, psychoticism and the lie scale. Items are scored on a Yes (=1) No (=0) basis, and the overall score for each subscale ranges from between 0 and 6, with higher scores indicating higher levels for the personality traits. Internal reliability found across the samples was .74–.84 for the extraversion subscale and .70–.77 for neuroticism [27]. In the present study, Cronbach's alpha was .85 for extraversion and .72 for neuroticism.

Quality of life

The Parkinson's Disease Questionnaire—long form (PDQ-39) is a disease-specific instrument developed for measuring health-related quality of life in patients with Parkinson's disease. Its 39 items are divided into 8 scales: *mobility* (10 items), *activities of daily living* (6 items), *emotional well-being* (6 items), *stigma* (4 items), *social support* (3 items), *cognition* (4 items), *communication* (3 items) and *bodily discomfort* (3 items). In response to each question, respondents select from answers ranging from *never* (0), *occasionally* (1), *sometimes* (2), *often* (3) and a*lways* (4). Each scale and the summary index were transformed in order to have a range from 0 (= no problem at all) to 100 (= maximum level of a problem) [28]. We translated the questionnaire from its original source [28] into the Slovak language and then translated it back into English using another translator. Two Slovak native speakers with mastery of the English language first translated the questionnaires from English into Slovak. The questionnaires were then re-translated from Slovak back into English, this time by a native English speaker with mastery of the Slovak language. The discrepancies between the different versions of the questionnaires were then discussed. We checked the basic psychometric characteristics of the scale, but these have not yet been published. In the present study, the Cronbach's alphas were as follows: .93 (*mobility*), .91 (*activities of daily living*), .85 (*emotional well-being*), .88 (*stigma*), .75 (*social support*), .67 (*cognition*), .76 (*communication*) and .80 (*bodily discomfort*).

Statistical analysis

The Statistical Package for the Social Sciences (SPSS 14.0.1.) software was used to analyze the data. Firstly, independent sample *t*-tests were conducted to assess differences between the genders in disease severity, age, disease duration, extraversion and neuroticism. As a second step, a difference of proportions test (CIA) was used to assess gender differences in partnership and education [29]. Thirdly, Pearson's correlation coefficients were used to determine the strengths of the relationships between the study variables. Finally, multiple linear regression analyses were used to assess the contribution of the independent

variables age, gender, disease duration, functional status (UPDRS) and personality traits (E and N) and to explain the variance of the dependent variables—the dimensions of the PDQ-39. Identical multiple linear regression analysis was performed for males and females separately.

Results

Out of 512 patients with Parkinson's disease, 160 agreed to participate and filled in the questionnaires. Forty-one of the 512 refused to participate, and 311 did not respond to the invitation. Seven patients were excluded after the personal interview because of the exclusion criteria. The final sample consisted of 153 patients (response rate 31.3%). Non-respondents differed significantly from the analyzed group in age (mean difference 1.69 years, SE = .87; $t = -1.95$; 95% CI .010 to -3.39), and there were significantly more women than men among the non-respondents (difference $-.0110$; SE = .041; 95% CI $-.091–.069$).

Descriptive statistics

Females made up 48.6% of the participants and males 51.4%, with a mean age of 67.9 ± 9.3 years (range 44–83). The mean disease duration was 7.5 ± 5.8 years (range 0–34). One hundred and four patients from the sample (68%) lived with a partner, and 49 patients (32%) were widowed, divorced or single. Fifty-two patients (34%) had completed elementary education, 84 patients (55%) secondary education and 17 patients (11%) had a university education. Disease severity in the patients varied from 5 points to 97, with a mean score (38.8) on the UPDRS representing medium disease severity.

All patients used antiparkinsonian therapy according to international guidelines [30, 31].

Gender differences in the study variables

Males and females did not differ in age, disease duration and disease severity. No differences between genders were found with regard to the psychological variables extraversion and neuroticism. There were no differences between genders in the scores of the overall QoL and in PDQ-39 dimensions, except for *bodily discomfort* ($P = .05$), where women scored significantly higher (Table 1).

Results of correlation analyses

Table 2 presents the correlations between the PDQ-39 and age, disease duration, disease severity, extraversion and neuroticism for males and females separately. Disease severity significantly correlated with all scales of the

Table 1 Characteristics of the sample—percentages, means and standard deviations (SD) of study variables

	Males	Females	Total sample	t-tests/CIA
Number of subjects (%)	79 (51.6)	74 (48.4)	153 (100)	
Mean age in years (SD)	68.5 (9.2)	67.3 (9.3)	67.9 (9.3)	ns
Mean disease duration in years (SD)	7.7 (5.7)	7.4 (5.8)	7.5 (5.8)	ns
Disease severity—UPDRS (SD)	38.8 (22.2)	34.9 (18.7)	36.9 (20.6)	ns
Married or living with a partner (%)	66 (83.5)	38 (51.4)	104 (68)	
Education				
Elementary (%)	22 (27.8)	30 (40.5)	52 (34)	
Secondary (%)	44 (55.7)	40 (54.1)	84 (55)	
University (%)	13 (16.5)	4 (5.4)	17 (11)	
Quality of life—PDQ-39 total (SD)	56.9 (17.4)	61.2 (16.4)	58.9 (17.0)	ns
Mobility (SD)	60.2 (25.0)	66.4 (23.4)	63.2 (24.4)	ns
Activities of daily living (SD)	58.2 (26.0)	57.5 (27.3)	57.9 (26.6)	ns
Emotional well-being (SD)	59.9 (20.6)	65.5 (19.8)	62.6 (20.4)	ns
Stigma (SD)	53.7 (25.0)	54.5 (27.3)	54.1 (26.0)	ns
Social support (SD)	38.8 (18.0)	42.2 (20.7)	40.4 (19.4)	ns
Cognition (SD)	57.2 (20.1)	60.6 (18.6)	58.9 (19.4)	ns
Communication (SD)	49.9 (21.4)	48.9 (20.3)	49.4 (22.6)	ns
Bodily discomfort (SD)	69.7 (23.5)	80.9 (20.2)	75.2 (22.6)	$t \leq 0.05$
Extraversion (SD)	2.7 (2.2)	2.7 (2.3)	2.7 (2.2)	ns
Neuroticism (SD)	2.1 (1.8)	2.7 (1.9)	2.4 (1.9)	ns

Abbreviations: SD, standard deviation; ns, non-significant

PDQ-39, except for satisfaction with *social support* in men. In women it played a less important role.

Examining the relationships between variables by means of Pearson's coefficients showed significant correlations between extraversion on one hand and *mobility* and *activities of daily living* on the other. Females with higher scores for extraversion reported better QoL in the dimension of *activities of daily living*, in contrast to males, for whom extraversion did not appear to be important for any of the study variables.

The correlations show a strong relationship between nearly every sub-scale of PDQ-39 and neuroticism. For females, neuroticism is the main variable correlating with the QoL scales.

Overall QoL, represented by the PDQ-39 summary index, correlated with disease severity in both genders. In females it also correlated with neuroticism and in males with disease duration.

Model of predictors of QoL

Multiple linear regression analyses were performed in order to identify how much the variance of the dependent variables (*mobility, activities of daily living, emotional well-being, stigma, social support, cognition, communication* and *bodily discomfort*) could be explained by the personality traits if controlled for the relevant sociodemographic

and clinical variables (Table 3). Table 3 (and also Table 4) shows the beta values, which reveal the relationships between the dimension and each value in the model. The standardized beta values were all measured in standard deviation units and so are directly comparable; e.g., a beta of 0.78 means that increases of 1 point on the UPDRS total score are associated with an increase of .78 point on the ADL scale.

The analyses were controlled for both disease variables (disease severity and disease duration) and for age. Higher age predicted worse scores in the subscales *cognition* and *communication*. Disease duration explained some of the variance, but only in *communication*. As expected, disease severity was the strongest predictor in almost all dimensions of PDQ-39, particularly in *activities of daily living, mobility, emotional well-being, cognition, communication* and *bodily discomfort*, but it did not appear to be associated with the dimensions of *social support* and *stigmatization*.

The model for overall QoL was fully covered only by disease severity and neuroticism. Extraversion appeared to be a significant factor only for the dimension *communication*. Neuroticism was important mostly in the domains that are associated with some kind of psychological processes: *emotional well-being, stigma, social support* and *communication*. However, neuroticism also explained some of the variance in *activities of daily living* and *bodily discomfort*.

Table 2 Intercorrelations between the study variables for males and females

PDQ-39 subscales	Age		Disease duration		Disease severity		Extraversion		Neuroticism	
	M	F	M	F	M	F	M	F	M	F
Mobility	.03	.33**	.42**	.06	.70**	.72**	−.18	−.17	.10	.21
CI	(−.70; −.39)	(−.24; .22)	(−.02; .40)	(−.67; −.33)	(.67; .85)	(.71; .88)	(−.50; −.10)	(−.52; −.12)	(−.62; −.26)	(−.46; −.03)
Activity of daily living	.05	.25*	.44**	.10	.83**	.75**	−.17	−.25*	.07	.28*
CI	(−.67; −.35)	(−.39; .05)	(.03; .44)	(−.62; −.25)	(.90; .96)	(.77; .90)	(−.52; −.12)	(−.39; .05)	(−.65; −.32)	(−.34; .11)
Emotional well-being	−.11	.18	.33**	.13	.41**	.43*	−.21	.07	.37**	.52**
CI	(−.60; −.42)	(−.50; −.10)	(−.23; .21)	(−.58; −.20)	(−.05; .38)	(−.01; .43)	(−.46; −.04)	(−.66; −.31)	(−.14; .30)	(.22; .60)
Stigma	−.06	−.22	.24*	.13	.29*	.20	−.21	−.06	.14	.30**
CI	(−.66; −.33)	(−.45; −.01)	(−.40; .02)	(−.58; −.20)	(−.31; .13)	(−.48; −.06)	(−.46; −.04)	(−.67; −.33)	(−.56; −.18)	(−.30; .16)
Social support	.00	−.29*	.23*	.14	.16	.02	−.12	.05	.22	.33**
CI	(−.73; −.44)	(−.32; .14)	(−.42; 5.9)	(−.57; −.18)	(−.53; .14)	(−.71; −.40)	(−.59; −.22)	(−.68; −.35)	(−.44; −.02)	(−.24; .22)
Cognition	.29*	.31**	.44**	−.02	.38**	.50**	−.18	−.11	.00	.14
CI	(−.31; .13)	(−.28; .18)	(.03; .44)	(−.71; −.40)	(−.12; .32)	(.17; .56)	(−.50; −.10)	(−.61; −.24)	(−.73; −.44)	(−.57; −.18)
Communication	.09	.19	.40**	.17	.56**	.27	−.21	−.22	.06	.18
CI	(−.62; −.28)	(−.49; −.08)	(−.07; .36)	(−.52; −.12)	(.33; .66)	(−.36; .09)	(−.46; −.04)	(−.45; −.01)	(−.66; −.33)	(−.50; −.10)
Bodily discomfort	−.08	.11	.23*	.04	.47**	.13	−.04	.07	.19	.30**
CI	(−.64; −.30)	(−.61; −.24)	(−.42; 5.9)	(−.69; −.36)	(.10; .50)	(−.58; −.20)	(−.68; −.37)	(−.66; −.31)	(−.49; −.08)	(−.30; .16)
PDQ-39 summary index	.01	.15	.48**	.15	.67**	.63**	−.20	−.14	.20	.43**
CI	(−.72; −.42)	(−.55; −.16)	(.13; .52)	(−.55; −.16)	(.61; .82)	(.50; .77)	(−.47; −.06)	(−.57; −.18)	(−.47; −.06)	(−.01; .43)

$* P \leq .05$; $** P \leq .01$

Abbreviations: M, males; F, females; CI, confidence interval

Table 3 Hierarchical multiple linear regression analyses

	PDQ-39 subscales																	PDQ-39 summary index	
	Mobility		Activities of daily living		Emotional well-being		Stigma		Social support		Cognition		Communication		Bodily discomfort				
Variables	ΔR^2	β	ΔR^2	β	ΔR^2	β	ΔR^2	β	ΔR^2	β	ΔR^2	β	ΔR^2	β	ΔR^2	β		ΔR^2	β
Age	.01	.02	.00	−.06	.00	.06	.02	−.13	.03	−.11	.07	**.24***	.04	**.18***	.01	−.06		.00	−.01
Disease duration	.07	−.01	.09	−.02	.07	.13	.02	.06	.02	.14	.05	.09	.09	**.18***	.02	.04		.11	.11
UPDRS	.40	**.66***	.54	**.78***	.10	**.29***	.04	.16	.07	−.02	.07	**.26***	.08	**.24***	.06	**.24***		.29	**.53***
E	.00	−.07	.01	−.09	.00	−.01	.03	−.17	.01	−.06	.01	−.11	.05	**−.23***	.00	.05		.01	−.13
N	.01	.11	.01	.11	.24	**.50***	.05	**.23***	.07	**.23***	.01	.12	.02	**.16***	.05	**.24***		.11	**.34***
Model	Adj. R^2 = .46		Adj. R^2 = .64		Adj. R^2 = .38		Adj. R^2 = .12		Adj. R^2 = .09		Adj. R^2 = .17		Adj. R^2 = .24		Adj. R^2 = .10			Adj. R^2 = .50	
	F-value = 21.5***		F-value = 43.4***		F-value = 15.6***		F-value = 4.2***		F-value = 3.3**		F-value = 6.0***		F-value = 8.7***		F-value = 3.7**			F-value = 24.4***	

Age, disease duration, UPDRS, extraversion and neuroticism related to PDQ-39 subscales and PDQ-39 summary index

* $P \leq .05$; ** $P \leq .01$; *** $P \leq .001$

Abbreviations: UPDRS, disease severity; E, extraversion; N, neuroticism

Table 4 Hierarchical multiple linear regression analyses separately for males and females

| | PDQ-39 subscales | | | | | | | | | | | | | | | | PDQ-39 summary index | |
| | Mobility | | Activities of daily living | | Emotional well-being | | Stigma | | Social support | | Cognition | | Communication | | Bodily discomfort | | | |
	M	F	M	F	M	F	M	F	M	F	M	F	M	F	M	F	M	F
Age	.03	.07	−.04	−.09	.07	.08	.08	−.31*	.16	−.28*	.33**	.16	.27*	.18	−.04	.09	.12	−.09
Disease duration	−.04	−.03	−.06	.02	.08	.14	−.01	.11	.08	.14	.43**	−.13	.13	.15	−.09	.05	.08	.11
UPDRS	.69***	.69***	.86***	.73***	.28*	.39***	.22	.22	.06	.04	.02	.44***	.43***	.08	.47***	.04	.58**	.57***
E	−.16	−.01	−.03	−.15	−.27*	−.25**	−.23	−.14	−.23	.03	−.15	−.04	−.24*	−.25*	−.02	.07	−.22*	−.07
N	.09	.09	.08	.13	.42***	.59***	.21	.25*	.26*	.29*	.09	.07	.12	.18	.15	.33*	.26*	.39***
Model	Adj. $R_M^2 = .46$	Adj. $R_F^2 = .49$	Adj. $R_M^2 = .68$	Adj. $R_F^2 = .58$	Adj. $R_M^2 = .33$	Adj. $R_F^2 = .54$	Adj. $R_M^2 = .07$	Adj. $R_F^2 = .16$	Adj. $R_M^2 = .07$	Adj. $R_F^2 = .12$	Adj. $R_M^2 = .28$	Adj. $R_F^2 = .21$	Adj. $R_M^2 = .38$	Adj. $R_F^2 = .11$	Adj. $R_M^2 = .15$	Adj. $R_F^2 = .04$	Adj. $R_M^2 = .53$	Adj. $R_F^2 = .52$
	$F\text{-value}_M = 11.1^{***}$	$F\text{-value}_F = 12.4^{***}$	$F\text{-value}_M = 26.1^{***}$	$F\text{-value}_F = 17.4^{***}$	$F\text{-value}_M = 6.8^{***}$	$F\text{-value}_F = 14.6^{***}$	$F\text{-value}_M = 1.9$	$F\text{-value}_F = 3.3^{*}$	$F\text{-value}_M = 1.8$	$F\text{-value}_F = 2.6^{*}$	$F\text{-value}_M = 5.6^{***}$	$F\text{-value}_F = 4.2^{***}$	$F\text{-value}_M = 8.5^{***}$	$F\text{-value}_F = 2.4^{*}$	$F\text{-value}_M = 3.0^{*}$	$F\text{-value}_F = 1.4$	$F\text{-value}_M = 14.0^{***}$	$F\text{-value}_F = 13.2^{***}$

Age, disease duration, UPDRS, extraversion and neuroticism related to PDQ-39 subscales and PDQ-39 summary index

Displayed values are betas

$* P \leq .05$; $** P \leq .01$; $*** P \leq .001$

Abbreviations: M, males; F, females; ADL, activities of daily living; UPDRS, disease severity; E, extraversion; N, neuroticism

Gender differences in predictors of QoL

Table 4 presents the results of multiple linear regression analyses for men and women separately. Significant gender differences were found in the predictors of the PDQ-39 sub-scales and for its summary index.

Out of all sociodemographic variables, only age appeared to contribute significantly to the total explained variance. Lower age was significantly associated with *stigmatization by illness* and *social support* in women. Higher age was closely connected with lower scores in the domains *cognition* and *communication* in men. Disease duration had an impact on QoL only in the *cognition* subscale in men. Functional status was the only factor of the domains *mobility*, *activities of daily living* and *emotional well-being* in both genders. In males it also had an impact on *communication* and *bodily discomfort*, whereas in females it was connected with worse *cognition*.

Overall QoL was associated in both genders with disease severity and neuroticism. In men, 3.3% of the variance was also explained by extraversion. Extraversion explained 4.7% variance in *communication* in men and 6.4% in women. For both genders extraversion was an important part of the model of *emotional well-being*, though the observed relations were in the opposite direction. In women a high score for extraversion was associated with lower QoL in *emotional well-being*, whereas in men a higher score in extraversion was associated with a better score in this dimension. Neuroticism played an important role in *emotional well-being* and *social support* in both genders. In women neuroticism was also associated with *stigmatization by illness* and *bodily discomfort*.

Discussion

The aim of this study was to explore the contribution of personality traits (neuroticism and extraversion) to QoL in patients with PD and the contribution of possible gender differences in extraversion and neuroticism to QoL.

Disability, as expected, was the fundamental variable for QoL. In the intercorrelations between the variables, associations were found between disease duration and all PDQ-39 scales in men, but none in women. However, disease duration did not significantly contribute to the models for each scale, except *cognition* in men. In addition to disease severity, the second most important factor for QoL in PD patients was neuroticism. Patients with higher scores on the neuroticism scale reported significantly worse status in the domains of *emotional well-being*, *stigma*, *social support* and *bodily discomfort*. However, in separate models for males and females, neuroticism remained important only in the subscale of *emotional well-being* in both genders.

Neuroticism played a role in the subscales of *stigma* and *social support* in women, but it did not appear to be important in men due to the low validity of the *social support* model for men.

Our results for neuroticism correspond with studies focusing on other patient groups, including patients with cognitive impairments, chronic pain and depression. A high level of neuroticism predicts the use of ineffective passive coping strategies, and those patients reported worse perception of their health problems [32–34]. It seems that because of societal influences, males and females develop different ways of coping and experiencing the world [34]. This phenomenon was also found by researchers who observed that a different score in neuroticism reflects socially learned behavior rather than biological differences. Gender-role rather than gender had greater explanatory power with regard to neuroticism [35].

Extraversion was associated only with the subscale of *communication*: patients scoring higher on the extraversion scale seem to have fewer problems with communication skills. This corresponds with the study by Eysenck (1991) [15], where to be talkative is one of the characteristics of an extravertly oriented person. However, there were differences between males and females in the model of *emotional well-being*. For both genders, extraversion is an important variable, but in the opposite direction. Extraverted males perceived their *emotional well-being* as better, but a higher score in extraversion was associated with worse *emotional well-being* in females. An explanation might be the associations between extraversion and coping strategies that have been found in several studies [20, 21]. These differences could be explained by the supposed use of different coping strategies by males and females [36]. Our results support the findings of one Spanish study, which confirmed a close association between extraversion and active coping strategies, which are used mostly by males [20].

Analysis presented in this article explains only part of the variance in the QoL of patients with PD. The construct of QoL of those patients appears to be too complicated to be explained by psychological variables such as personality traits. Models of *stigma*, *social support*, *cognition* and *bodily discomfort* were significant in general, but the adjusted R^2 explains only a relatively small part of the variance. However, the relationships between study variables and these dimensions are significant. Differences in the significance between models for men and women suggest possible differences in the model variables. It can be hypothesized that models of QoL for men and women, especially in the dimensions *stigma*, *social support*, *cognition* and *bodily discomfort*, are composed from different variables. The gender aspect of QoL appears to be an important focus for further studies.

A limitation of this study was the relatively low response rate, which may have an impact on generalizations of the results to the total population of PD patients. Non-respondents were older than respondents, so one might hypothesize that they refused to participate in the study because of serious motor complications in the advanced stages of PD and because of an increased need for help from their social surroundings. Regrettably, we have no information about the disease duration and the disease severity of the non-respondents.

Future research should concentrate on explaining how PD patients cope with health problems. The impact of personality traits on QoL is known from different studies on several chronic diseases. For example, close associations between extraversion, neuroticism and mental condition of the patients were confirmed in hemodialysis patients [21]. However, in the field of PD this is a relatively new idea.

Currently, the management of patients with PD is primarily aimed at prolonging life expectancy and diminishing motor disabilities [37]. The results of this study show that psychological traits are clearly associated with QoL as well and therefore should be taken into account by health-care professionals in their appraisal of patient complaints. PD patients with high scores in neuroticism, especially females, may be considered as a population at risk for lower QoL.

Effective management of PD patients should include a specific approach to improve QoL in the course of treatment. Our results are important for neurologists; they could use them in the phase of diagnosis where patients with higher scores in neuroticism could aggravate their symptoms, and also in the phase of the treatment where patients could differ in their perception of the efficacy of the treatment.

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