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ORIGINAL ARTICLE

Self-rated health mediates the association between functional status and health-related quality of life in Parkinson's disease

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Aims and objectives. To explore whether self-rated health acts as a potential mediator in the association between functional status and health-related quality of life in Parkinson's disease.

Background. Older persons (as most patients with Parkinson's disease are) who reported poor self-rated health compared with those with excellent self-rated health were two-and-a-half times more likely to have experienced a decline in functional ability.

Design. Cross-sectional.

Methods. Socio-demographic and clinical data of the patients ($n = 176$) were obtained during a structured interview and from medical records. Functional status was measured with the Unified Parkinson's Disease Rating Scale (total score), self-rated health with the first item of the Short-Form 36-item Health Survey Questionnaire and health-related quality of life with the disease-specific questionnaire called the Parkinson's Disease Quality of Life Questionnaire-39. Multiple linear regression analyses and the Sobel test were employed to assess mediation.

Results. Self-rated health seems to have a mediating effect on the association between functional status and health-related quality of life. The Sobel test confirmed an indirect effect of functional status via self-rated health on health-related quality of life and showed a statistically significant indirect effect of functional status on health-related quality of life via self-rated health against the direct route without the mediator.

Conclusions. Self-rated health partially mediates the deteriorating effect of functional status on health-related quality of life.

What does this paper contribute to the wider global clinical community?

- Disease severity affects quality of life in patients with Parkinson's disease not only directly, but this relationship is partially mediated via self-rated health.
- Quality of life of patients with Parkinson's disease will increase when we succeed in improving their self-rated health via interventions focused at this.

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Relevance to clinical practice. Supportive and adaptation psychosocial intervention programmes leading to restored self-rated health may enhance the quality of life regardless of disability in Parkinson's disease.

Key words: functional status, health indicator, health-related quality of life, mediator, Parkinson's disease, self-rated health

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Introduction

Hardly any other measure of health is more widely used and more poorly understood than self-rated health (SRH) (Layes *et al.* 2012). Since the first study about the importance of SRH in 1982 (Mossey & Shapiro 1982, Muller 1982), several studies have confirmed its strong predictive power for future health outcomes, clinical management and therapeutic decisions (Idler & Kasl 1995, Alla *et al.* 2002, Benyamini *et al.* 2004). It has been reported that SRH predicts, besides others, functional ability (Idler & Kasl 1995, Majernikova *et al.* 2012) and morbidity (Moller *et al.* 1996). The general consistency of results in these studies is impressive, especially in the light of the simplicity of the measurement (Kaplan *et al.* 1996). Older persons who reported poor SRH compared with those with excellent SRH were two-and-a-half times more likely to have experienced a decline in functional ability as many as six years later (Idler & Kasl 1995). This association persisted in models with chronic conditions incorporating measures of functional status (Idler & Kasl 1995, Layes *et al.* 2012). The study of patients with Parkinson's disease (PD) has suggested that under certain circumstances, they arrive at an answer by comparing themselves with others of their own age, rather than with other patients with PD, and by performing this comparison, they feel worse in general (Kaplan & Baron-Epel 2003).

Background

One of the conceptualisations of SRH indicates the role of an individual's adaptability to and acceptability of chronic illness when perceiving one's health (Goldberg *et al.* 2001, Layes *et al.* 2012). People with longer disease duration may adjust better to the changes after disability by making adaptive changes, leading to improved SRH (Jamoom *et al.* 2008, Kim *et al.* 2012).

Self-ratings on health are most consistently influenced by disease severity (Bosworth *et al.* 1999, Nguyen *et al.* 2008). Wolinsky and Johnson (1992) concluded that this is to be expected, as functional status is thought to be central in the formation of perceived health. The neurodegenerative character of PD leads progressively to functional disability and reduces health-related quality of life (HRQoL) (Macphee & Stewart 2006, Pourfar *et al.* 2008). It has been suggested that PD has a more profound influence on HRQoL than congestive heart failure, stroke, diabetes or arthritis (Gage *et al.* 2003). One of the most robust factors that consistently correlate negatively with HRQoL is functional status (Karlsen *et al.* 2000, Chrischilles *et al.* 2002, Gage *et al.* 2003, Pechevis *et al.* 2005).

Improvement in HRQoL could occur via the process of accepting the consequences of illness (Goldberg *et al.* 2001), which is in line with Layes' concept of SRH (Layes *et al.* 2012). We hypothesise that for this adaptation, a certain cognitive style should be present regarding one's perception of health related to the community standard. In the chronically ill, it has been proven that SRH has an influence on functional status (Idler & Kasl 1995, Moller *et al.* 1996, Alla *et al.* 2002, Benyamini *et al.* 2004, Nguyen *et al.* 2008, Majernikova *et al.* 2012), but we found no evidence of SRH buffering the association between functional status and quality of life specifically in PD or in any other chronic diseases. Thus, the main objective of this study was to evaluate whether SRH acts as a mediator in the association between functional status and HRQoL in PD.

Methods

Sample and procedure

The sample consisted of 176 nondemented patients with PD. Patients were recruited from 25 neurology outpatient clinics in the eastern Slovakia region between June 2011–August 2012. All patients were diagnosed according to the United Kingdom PD Society Brain Bank Clinical Criteria (Fahn & Elton 1987), and their mental abilities were assessed using the Mini-Mental State Examination (MMSE) (Folstein *et al.* 1975). A total of 216 patients initially agreed to participate in the study. Patients with MMSE

scores lower than 24 ($n = 18$), those with forms of parkinsonism other than idiopathic Parkinson's disease ($n = 8$) and those who initially agreed to participate and filled in the questionnaire but did not come for the oral interview ($n = 14$) were excluded.

An invitation letter; a written informed consent form; questionnaires comprising questions on socio-demographic background, medical history, current medication; and self-report questionnaires were sent by postal mail to patients diagnosed with PD one week before the interview. All patients were interviewed by a trained interviewer on the relevant issues that were not part of the questionnaire, and their cognitive functions were assessed using the MMSE (Folstein *et al.* 1975). After this structured interview, a single neurologist specialised in movement disorders assessed each patient's disease severity using the Unified Parkinson's Disease Rating Scale (UPDRS) (Hughes *et al.* 1992), including Hoehn and Yahr Staging Scale. Patients who were unable to fill in the questionnaires by themselves because of motor impairment answered the questions with the help of a caregiver/spouse or during the oral interview. Participation in the research was voluntary. The study was conducted only after informed consent was obtained from each subject prior to the interview. The study was approved by the Ethics Committee of the Safarik University in Kosice.

Measures

Socio-demographic and clinical data

Socio-demographic data including age, gender and education were obtained from medical records and during the structured interview. Education level was classified as follows: elementary (apprenticeship or primary school only), secondary (secondary school) or university (undergraduate, postgraduate). Clinical data were obtained from medical records.

Disease severity

The UPDRS is a four-subscale combined scale (mental state, activities of daily living, motor examination and complications) (Fahn & Elton 1987). The questionnaire was translated from English into Slovak, and then, the Slovak version was translated back into English and compared with the original version. After this, the UPDRS was tested in a pilot study.

A further instrument was attached to the UPDRS, namely a modified Hoehn and Yahr Staging Scale, an ordinal scale that is applied to gauge the course of the disease over time. UPDRS allows for partial and total scores. A total of 199 points are possible, representing the worst (total) disability; 0 represents no disability. The total score of the UPDRS was used to measure functional status (Hughes *et al.* 1992).

Self-rated health

Self-rated health was measured using the first item of the Short-Form 36-item Health Survey (SF-36) (Ware *et al.* 1996). We applied a forward–backward translation procedure. The reliability of the SF-36 has been repeatedly tested in different populations, including patients with neurology conditions. The original study shows a Cronbach's alpha of 0·96. In our study, we found an alpha of 0·93 for the whole questionnaire. Skalska *et al.* 2000 validated the questionnaire in the Czech population. The questionnaire has been used in many patient populations worldwide.

The first item covers the SRH status of the patient. SRH has been widely used as an indicator of general health status because of its status of a good predictor of morbidity and mortality (Moller *et al.* 1996, Majernikova *et al.* 2012). SRH has five answering categories. They were transformed from scores between 1 (poor)–5 (excellent) into a standard scale from 0 (poor health)–100 (excellent health) in which a higher score indicates better health status (Ware & Sherbourne 1992).

Health-related quality of life

The Parkinson's Disease Quality of life Questionnaire-39 (PDQ-39) was used to measure HRQoL in patients with PD (Peto *et al.* 1998). We used the official Slovakian language version from the University of Oxford that was available for purchase. It is a disease-specific instrument, consisting of 39 items, divided into eight scales: mobility (10 items), activities of daily living (six items), emotional well-being (six items), stigma (four items), social support (three items), cognition (four items), communication (three items) and bodily discomfort (three items). In response to each question, respondents selected an answer from a range of 0–4 [never (0), occasionally (1), sometimes (2), often (3) and always (4)]. Each scale and the summary index were transformed to have a range from 0 (= no problem at all)–100 (= maximum level of a problem). The summary index represents the overall HRQoL (Peto *et al.* 1998). In the present study, Cronbach's alpha was 0·96.

Statistical analyses

First, mean scores and standard deviations were calculated for all variables. Next, univariate analyses in terms of Pearson's correlations were conducted to assess the relationships between the independent variables (age, gender, education, disease duration, UPDRS and SRH) and PDQ-39.

We assessed the mediation effect of SRH in the association between UPDRS and PDQ-39 using linear regression. Three models were made. The first model (M1) analysed the direct association between the main independent predictor (UPDRS) and the dependent variable (PDQ-39). It was built from three blocks in the following order: block 1 (age, gender, education), block 2 (disease duration) and block 3 (UPDRS total). In the second model (M2), the association between the main independent variable (UPDRS) and the dependent variable (SRH) was investigated. It consisted of three blocks that were identical to model M1. A third model (M3) was created to investigate the mediating effect of SRH on the association between UPDRS and PDQ-39. This last model consisted of four blocks: blocks 1–3 were identical to the previous models (M1 and M2), and in the fourth block, SRH was added into the equation. By adding SRH into the last model, with PDQ-39 as an outcome variable, we analysed changes in regression weight in the association between the independent predictor (UPDRS) and the outcome variable PDQ-39. We expected a decrease in the unstandardised B values in M3 compared with M1. Finally, the Sobel test (Baron & Kenny 1986, Frazier *et al.* 2004) as well as the proportion mediation method (Cheong 2011) was performed to explore the mediation further.

Data were analysed using the IBM SPSS Statistics for Windows, version 20.0 (IBM Corp., Armonk, NY, USA).

Results

The mean age of our sample was 69·4 ± 8·8 years, and the sample consisted of 51·1% males. 40·6% of the sample had an elementary education, and 19·4% had completed a university degree. More than half of our sample (53·4%) was without postural instability and moderately or fully independent in performing activities of daily living. The characteristics of the participants are presented in Table 1.

Table 2 shows that the relationship between UPDRS and PDQ-39 weakened when SRH was added into the model M3 compared with M1. UPDRS showed a statistically significant association with SRH (M2), indicating that SRH might mediate the relationship between UPDRS and PDQ-39. The Sobel test (2·42; $p < 0·01$) confirmed the statistically significant indirect effect of UPDRS via SRH on PDQ-39 (Fig. 1).

Discussion

The main objective of the study was to evaluate whether SRH acts as a mediator in the association between functional status and HRQoL in PD. We found SRH to be a partial mediator in the association between UPDRS and PDQ-39.

In line with our findings, Nybo *et al.* (2001) found that quality of life was satisfactory among elderly who considered their health to be good despite reporting disability. When rating their health, patients with PD compare themselves with others of their own age with no chronic conditions, rather than with other patients with PD (Kaplan & Baron-Epel 2003). Functional status in PD is most consistently associated with PDQ-39 from among all clinical and demographic factors (Karlsen *et al.* 2000, Chrischilles *et al.* 2002, Gage *et al.* 2003). Our results also show that the variable with the strongest association with PDQ-39 was functional status. SRH, however, further explained the variance of PDQ-39. This supports the findings by Layes *et al.* (2012) and Mosing *et al.* (2009) that SRH may potentially

Table 1 Description of demographic, clinical and psychosocial variables of the sample (n = 176)

Variable	Total sample (n = 176) n (%) or mean ± SD	Range
Gender (male)	90 (51·1)	
Age	69·4 ± 8·8	42–88
Education		
Elementary	71 (40·6)	
Secondary	70 (40·0)	
University	34 (19·4)	
MSPSS		
MSPSS family	23·9 ± 4·1	4–28
MSPSS friends	20·7 ± 4·8	4–28
MSPSS significant others	23·5 ± 4·3	4–28
Disease duration*	7·0 ± 4·7	1–30
UPDRS total score = (UPDRS I + II + III + IV)	43·8 ± 19·2	7–109
H & Y	2·4 ± 0·9	0–5
≤2·0	94 (53·4)	
>2·0	82 (46·6)	
Self-rated health (SF-36_Item 1)		
Excellent	1 (0·5)	
Very good	2 (1·2)	
Good	37 (21·0)	
Fair	80 (45·5)	
Poor	56 (31·8)	
PDQ-39 total score	32·9 ± 18·4	0–78

MSPSS, the Multidimensional Scale of Perceived Social Support. A high score means a high level of perceived social support; UPDRS, Unified Parkinson's Disease Rating Scale (UPDRS I–IV: subscale I – mental state, subscale II – activities of daily living, subscale III – motor examination, subscale IV – complications); H & Y, Hoehn and Yahr Staging Scale; SF-36, Short-Form 36-item Health Survey; PDQ-39, Parkinson's Disease Quality of Life Questionnaire-39.
*Disease duration is in years.

Table 2 The mediation model and multiple linear regression describing the associations between functional status (UPDRS total) and health-related quality of life (PDQ-39) ($n = 176$)

	Model 1 (M1)			Model 2 (M2)			Model 3 (M3)		
	UPDRS on PDQ-39 B (95% CI)	$R^2/\Delta R^2$	smc	UPDRS on SRH B (95% CI)	$R^2/\Delta R^2$	smc	UPDRS, SRH on PDQ-39 B (95% CI)	$R^2/\Delta R^2$	smc
Step 1									
Age	0·06 (−0·18, 0·31)	0·04/0·04		0·00 (−0·01, 0·02)	0·01/0·01		0·04 (−0·20, 0·27)	0·03/0·03	
Gender (male)	2·02 (−2·42, 6·46)			0·11 (−0·13, 0·37)			1·36 (−3·08, 5·61)		
Education†	−2·17 (−5·13, 0·79)		ns	−0·01 (−0·17, 0·16)		ns	−2·12 (−5·00, 0·71)		ns
Step 2									
Disease duration (in years)	0·60 (0·14, 1·07)*	0·11/0·06	***	0·02 (−0·01, 0·04)	0·03/0·02	*	0·50 (0·05, 0·95)*	0·11/0·07	***
Step 3 (M1, M2, M3)									
UPDRS total	**0·58 (0·47, 0·70)*** **	0·46/0·35	***	0·01 (0·01, 0·02)***	0·09/0·05	***	**0·53 (0·42, 0·64)*** **	0·46/0·35	***
Step 4 (M3)									
SRH‡							5·70 (2·96, 8·45)***	0·51/0·06	***

UPDRS, Unified Parkinson's Disease Rating Scale; SRH, self-rated health; SF-36, Short-Form 36-item Health Survey; PDQ-39, Parkinson's Disease Quality of life Questionnaire-39.
Smc: significance of model change for the added variable(s); improvement in the model due to the addition of the variable concerned the F change test.
Significant values are displayed in bold.
*$p < 0.05$, ***$p < 0.001$.
†Elementary education was set as the reference category.
‡SRH was used as continuous predictor (SF-36_Item 1).

diminish the impact of functional status on HRQoL. Interestingly, our sample included patients who rated their health as excellent or very good despite the progressive chronicity of PD. Kim *et al.* (2012) tried to identify factors associated with SRH; however, they did not succeed in explaining SRH with explanatory variables other than psychosocial adaptation; this indirectly supports the role of psychosocial adaptation regarding differences in SRH. This is in line with the contemporary assessment approaches of clinical outcomes, which have changed from the traditional focus on motor symptoms to a more comprehensive assessment that includes patient's own perceptions of their health, such as optimism and control (Ironson *et al.* 2005). Evidence supports the importance of optimism in predicting HRQoL in patients with chronic diseases (Taylor *et al.* 2000, Chesney *et al.* 2005) and in patients with PD specifically (The Global Parkinson's Disease Survey Steering Committee's 2002, Gruber-Baldini *et al.* 2009). In a study of ageing twins (Mosing *et al.* 2009), the genetic influences of optimism on SRH accounted for 14–20% of the genetic variance, indicating that in the elderly, genes predisposing a person to high optimism also predispose that person to good SRH.

From the work of Den Oudsten *et al.* (2011), the factor 'positive feelings' was revealed to be crucial for psychological health in the World Health Organisation Quality of Life. This also supports our expectation that despite worse functional status, a patient may experience a good quality of life when, as a psychosocial adaptation mechanism, his SRH is maintained well. Idler and Kasl presented some very suggestive findings when they described the image of the risk of functional decline, especially in the elderly and in those not manifesting any present disability, but nevertheless who rate themselves as being in poor health. They state that it is apparently not an image of 'positive thinking' (optimistic self-ratings) promoting recovery among those who are initially more disabled (Idler & Kasl 1995).

Strengths and limitations

The strengths of our study are that our response rate was high (81·5%) and that we used valid and reliable measurement of all the variables of interest. A certain limitation might be that our participants were those patients who were able to come for a neurological examination and participate in the interview; we can therefore assume that nonrespondents were patients with worse disease severity. Thus, our findings might be an underestimation because of the worse functional status of the nonrespondents. In addition, the

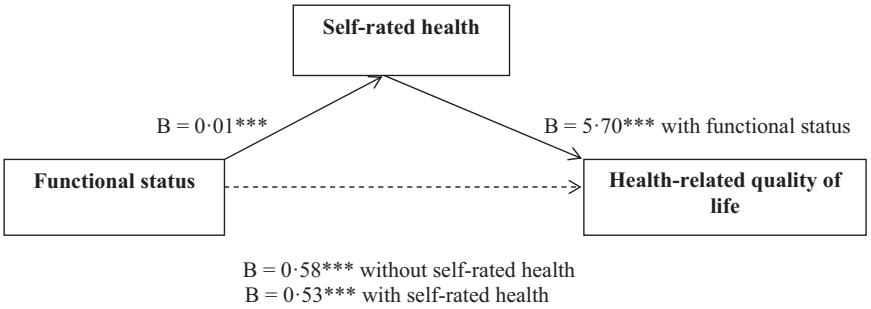

Figure 1 Self-rated health as a mediator between functional status and health-related quality of life. All associations are adjusted for age, gender, SES and disease duration.

cross-sectional design of the study did not enable us to explore possible causal pathways.

Conclusions

Our results shed further light on how HRQoL could be enhanced via SRH despite poor functioning. However, this mediating effect needs to be supported by further research with a longitudinal study design.

Relevance to clinical practice

We found SRH to be a partial mediator in the association between UPDRS and PDQ-39. In line with our finding, Bosworth *et al.* (1999) emphasise that when considering self-rated health, other psychosocial factors such as depression and social support need to be considered, because self-rated health is correlated with many psychosocial factors. Those with the largest impact on SRH are perceptually salient (Benyamini *et al.* 1999). Further research should investigate the role of such psychosocial factors and SRH. For example, differences in mediation in a depressed cohort could be compared with patients without depression. Also, different coping strategies (active, avoidant) and how these influence SRH and consequently impact HRQoL could be investigated. Moreover, psychological domains such as locus of control and optimism need to be explored further to create an interaction term to investigate the potential moderating effect of such psychological independent predictors on the association between SRH and HRQoL.

Our finding that SRH is a partial mediator in the association between UPDRS and PDQ-39 has practical implications as well. Parkinson's disease leads to significantly higher health-related costs up to 8 years prior to the diagnosis of the motor disorder (Jennum *et al.* 2011). A considerable attempt must be pursued to improve quality of life so that these costs for patients and society are reduced. This can be done by maintaining SRH as legitimate, reliable and cost-effective by means of the health assessment indicator that was found to mediate this association between functional status and HRQoL in PD. Adequate communication and getting information (education) to patients might help; a positive experience with information in a hospital setting could provide a solution for improving opinions about one's own self-rated health (Veenstra *et al.* 2006). This may help patients to maintain an 'efficient cognitive style' important for restoring SRH and counteracting the negative impact of functional status (Jylha 2009, Pagan-Rodriguez 2010, Kim *et al.* 2012) on HRQoL.

Disclosure

The authors have confirmed that they meet the ICMJE criteria for authorship credit (www.icmje.org/ethical_1author.html), as follows: (1) substantial contributions to conception and design of, or acquisition of, data or analysis and interpretation of data, (2) drafting the article or revising it critically for important intellectual content and (3) final approval of the version to be published.

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Conflict of interest

The authors declare that they have no conflict of interest.

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