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# Mobility, mood and site of care impact health related quality of life in Parkinson's disease

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ABSTRACT

*Objective:* Examine the correlates of Health Related Quality of Life (HRQL) in a large cohort of Parkinson's disease (PD) patients from National Parkinson Foundation (NPF) Centers of Excellence (COEs).
*Background:* Improving outcomes for PD will depend upon uncovering disease features impacting HRQL to identify targets for intervention and variables for risk-adjustment models. Differences in HRQL outcomes between COEs could uncover modifiable aspects of care delivery.
*Methods:* This cross-sectional study examined the relative contribution of demographic, social, clinical and treatment features potentially related to HRQL, as measured by the PDQ-39, in 4601 consecutive subjects from 18 COEs. Stepwise linear regression was utilized to identify correlates of HRQL.
*Results:* The variability in the PDQ-39 summary index score correlated with H&Y stage ($R^2 = 22\%$), Timed up and Go (TUG) (17%), disease duration (11%), comorbidities (8%), cognitive status (8%), antidepressant use (6%) and center at which a patient received care (5%). Stepwise regression reordered the importance of the variables, with the H&Y first and TUG and the center becoming equal and the second most important variables determining the PDQ-39 total score. All independent variables together accounted for 44% of the variability in HRQL.
*Conclusions:* We confirmed many but not all HRQL associations found in smaller studies. A novel observation was that the site of care was an important contributor to HRQL, suggesting that comparison of outcomes and processes among centers may identify best practices.


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## 1. Introduction

The National Parkinson Foundation Quality Improvement Initiative (NPF-QII) is a prospective, multi-center observational study that aims to improve health outcomes for patients with idiopathic Parkinson's disease (PD). The goal of NPF-QII is to identify clinical practices associated with better outcomes [1].

The data collected in NPF-QII longitudinally records demographics, interventions, and outcomes for subjects systematically drawn from the NPF network of Centers of Excellence (COE). These data are being analyzed to find associations between treatment patterns and outcomes. The outcomes measured include a clinical evaluation and patient-reported health-related quality of life (HRQL) as measured by the PDQ-39. HRQL reflects the effect of health or illness on an individual's physical, emotional and social well-being [2,3].

NPF-QII is unique for its size, with nearly 5000 subjects compared to the 100–400 subjects in most investigations of HRQL in PD [3]. NPF-QII also draws subjects from different COE, allowing for the first time a comparison of HRQL outcomes across different centers. Exploring the reasons for differences between centers, after case mix adjustment, has been used to determine best practices and thereby improve outcomes in other diseases [4,5]. In this report, we examine variables identified in previous smaller studies to correlate with HRQL for the entire cohort and by COE.

## 2. Methods

### 2.1. Study design

We conducted a cross-sectional analysis of the first 4601 subjects enrolled in NPF-QII between August 2010 and March 2012. Patients were recruited from 18 NPF COE (15 in the US and one each in Canada, the Netherlands and Israel). The purpose was to examine the impact of demographic, social, clinical and treatment variables on HRQL measured with the Parkinson's Disease Questionnaire (PDQ-39) [6]. The PDQ-39 is a disease-specific measure of HRQL with questions addressing eight domains impacted by PD (mobility, activities of daily living, emotional well-being, stigma, social support, cognition, communication and bodily discomfort) and has well-established and validated clinimetric properties [6,7]. For subjects with impaired cognition, caregivers were allowed to assist in completing the PDQ-39 and other patient-reported variables.

### 2.2. Subjects

Patients with a clinical diagnosis of PD [8] followed in NPF COE clinics were systematically recruited for the registry [1]. Neither disease severity nor dementia excluded enrollment if informed consent could be obtained from the patient, spouse or guardian. The registry protocol called for each center to recruit up to 500 patients with an expectation of a minimum of 200 subjects for each site. Patients gave informed consent to participate in a protocol approved by local institutional review boards (IRBs). The ClinicalTrials.gov protocol number is NCT01629043.

### 2.3. Assessments

Consented participants were asked to provide demographic information (date of birth, gender, ethnicity and living situation), symptoms, and co-morbid conditions, and to complete the PDQ-39. Research coordinators collected additional data including weight, height, the Timed Up and Go test (TUG) [9], and a brief cognitive assessment consisting of a 5-word immediate and delayed recall [10], and semantic fluency (animal naming) [10]. The registry was designed to allow data collection in the outpatient clinics as part of routine care. For that reason, the assessments were relatively brief with the majority of the data being collected by the research coordinator. The clinician needed only to record their confidence in the diagnosis of PD, Hoehn and Yahr (H&Y) stage [11], clinical state ("on" or "off"), and changes in treatments or services.

The TUG test was scored by rank-ordering the subjects, first by whether the subject completed the test (1) without using his or her arms to push off when rising from the chair, (2) pushing off to rise from the chair but without using an assistive device, or (3) using a cane or walker to complete the test. With each group, the scores were ranked by time to complete. For analysis, these ranks were normalized.

The scores on immediate and delayed 5-word recall and semantic fluency were combined into a single cognitive score to facilitate analysis. The combined cognitive score was evaluated for correlation with the full Montreal Cognitive Assessment (MoCA) results, concurrently collected at one center (UPenn).

### 2.4. Statistical analysis

The first step in the analysis was to summarize the characteristics of the population of patients (demographics, social variables, clinical variables, medications, treatments and PDQ-39 domain and summary index scores [7]) in the population as a whole and according to H&Y stage. The statistical significance of the differences by H&Y stage was determined using chi-squared tests for discrete variables (e.g. gender, living situation, rest tremor present) and analysis of variance for continuous variables (e.g, age, disease duration, cognition, etc.). Significance levels were set at $<0.0014$ to establish a 0.05 confidence level for the entire analysis, using the Bonferroni correction for multiple comparisons.

The second step in the analysis was to estimate the impact of independent (predictor) variables on the dependent (outcome) variables. The outcome variable, PDQ-39, was scored using the Summary Index score that included eight HRQL domains. Associations between independent variables and outcome variables were first tested with univariate linear regression, to show the proportion of variation explained (unadjusted $R^2$) by each respective independent variable. Subsequently, each independent variable was added to the model by serial linear regressions, applying the independent variable with the greatest explanatory power (adjusted $R^2$) from among all the independent variables not yet included in the model, until all remaining independent variables failed to meet the significance criterion. This "stepwise analysis" produced estimates of the incremental impact of each independent or predictor variable on explaining variation in outcomes after controlling for the effects of other independent variables.

## 3. Results

### 3.1. Characteristics of the study population and variation by H & Y stage

Of the 4601 enrolled subjects, 62% were male and the average age was 67 ± 10 years [Fig. 1 and Table 1]. The median symptom duration was 9 ± 6 years (range, 1–49). The distribution of H&Y stages at the time of the clinic visit, representing "on" status in 78% of the 2489 subjects reported to have motor fluctuations, is shown in Table 1. The majority was H&Y stage II (51%), but all stages were represented. All independent measures varied significantly between the H&Y stages except for three measures: investigator's confidence of the diagnosis of PD, use of stimulants, and use of anticholinergic drugs. The variables that differed the most across

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