

# The Psychometric Properties of the Voice Handicap Index in People With Parkinson's Disease

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**Summary: Background.** Psychosocial impact of dysphonia in people with Parkinson disease (PD) has been described with the Voice Handicap Index (VHI); however, its psychometric properties when applied in this population are not described.

**Objective.** The objective of this study was to examine the psychometric properties of the VHI in people with PD.

**Methods.** A cross-sectional study of 151 subjects without cognitive impairment (90 people with PD and 61 controls) was carried out. The VHI was applied along with clinician-based (Mini Mental State Examination, Hoehn and Yahr staging, and Movement Disorder Society–Unified Parkinson's Disease Rating Scale) and patient-based (self-rated voice severity) outcome measures. The psychometric properties of the VHI analyzed were the feasibility, reliability, and construct validity.

**Results.** The average age of the PD population studied was 67 years; 51% had a primary level of education and 81% were retired. On average, they had disease onset duration of 11 years, a mild disease stage, mild to moderate global motor disability and impairment, and a normal to mild self-rated voice severity. The psychometric attributes of the VHI demonstrated that the questionnaire is feasible (missing data less than 1%), reliable (Cronbach  $\alpha > 0.9$ ), and valid (71.5% of the total variance is explained by five factors, correlates with voice severity, PD disability, and impairment, and differentiates subjects with PD from subjects without PD).

**Conclusion.** The VHI is a reliable and valid tool that can be recommended for the population under study although further work is required to investigate its utility in advanced stages of disease.

**Key Words:** Voice Handicap Index–Parkinson's disease–voice complaints–psychometrics–self-assessment.

## INTRODUCTION

Parkinson's disease (PD) is a chronic degenerative neurologic disorder with an estimated incidence of 1%–5% in people older than 60 years of age.<sup>1,2</sup> Nearly 70%–90% of people with PD show dysphonia sooner than other speech disorders, and nearly one third cite dysphonia as their most debilitating communication deficit.<sup>3</sup>

Self-perception of how voice dysfunction may cause a disadvantage is an important supplementary information to the clinical decision-making process in the chronic health care. To address this need, Jacobson et al developed and validated the Voice Handicap Index, VHI, a generic standardized patient-based voice outcome measure that has been adopted widely in the field of voice because it has a solid conceptual framework,<sup>5</sup> good psychometric properties, several applications in different clinical and healthy population groups, and an impressive background of reference data.<sup>4,5</sup> Nowadays, it is freely available, it is considered the 'reference-standard' tool in the voice rehabilitation field and follows the criteria recommended by the Agency for Healthcare Research and Quality for determining disability in speech-language disorders.<sup>6</sup>

However, whether the VHI is specific enough to capture the voice impact subtleties in people with PD is not yet entirely clear.

Only few studies focused specifically on the psychometric properties of the VHI are available.<sup>3,7</sup> The VHI showed convergent validity with the Movement Disorder Society–Unified Parkinson's Disease Rating Scale (MDS-UPDRS)—part III and sensitivity to distinguish between PD and other non-PD populations.<sup>3,7</sup> Interestingly, the VHI has frequently been used in PD multidimensional studies as an outcome (eg, pre-to-post Lee Silverman Voice Treatment (LSVT), or subthalamic nucleus deep brain stimulation or vocal fold collagen injection) and has been responsive to interventions.<sup>8–17</sup>

The VHI complies with the guideline criteria required for outcome measures to be considered a "recommended" tool to be used in the PD as outlined by the Movement Disorders Society Task Force<sup>18</sup> because it was applied to populations with PD,<sup>3,7,10,11,14,15</sup> has been applied by authors different from the original VHI developers, and psychometric data are available with respect to PD.<sup>3,7</sup> Regardless of the information provided, there is only limited evidence to support or refute the VHI psychometric properties specifically in people with PD (eg, no evidence of feasibility, reliability, construct validity, and known-groups validity was identified).

Therefore, the aim of this study was to gather information about VHI psychometric properties, specifically its feasibility, reliability, and validity, to be considered a "recommended" tool for use in people with PD.

## PATIENTS AND METHODS

### Subjects

Participants with PD were recruited from the outpatient movement disorders clinics of Hospital de Santa Maria (Centro Hospital Lisboa Norte, Portugal). They were referred by neurologists

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specialists in movement disorders and diagnosed according to the UK PD Society Brain Bank criteria. As a control group, we recruited age- and sex-matched subjects without PD who denied current or historical voice complaints.

Inclusion criteria were European Portuguese as the first language, no history of hearing impairment, and without cognitive decline that could prevent the understanding of the VHI content or interfere with the purpose of the study.

## Materials and procedures

Upon enrollment, all volunteers gave written informed consent previously approved by the ethics committees of both the Faculty of Medicine and Hospital de Santa Maria (Lisbon, Portugal).

First, a structured questionnaire that elicited demographic and clinical information was applied; second, the cognitive screening test, the Mini Mental State Examination,<sup>19,20</sup> was administered to recruit only people without cognitive impairment thus avoiding bias because cognitive impairment leads to difficulty in language understanding and selection. All people with PD were assessed in “on” state with the MDS-UPDRS<sup>18</sup> and with the Hoehn and Yahr (H&Y) scale.<sup>21,22</sup>

Finally, each participant completed the VHI questionnaire in paper format in their own time in accordance with written instructions on the questionnaire. All participants were asked to give their opinion about their voice severity on the day of assessment through a Likert scale format.

The VHI questionnaire quantifies the patients' perception of psychosocial impact due to voice difficulties. It consists of 30 statements equally distributed over three domains: functional, physical, and emotional. Each answer is rated based on the frequency of symptoms from zero (never) to four (always) (Supplementary Appendix S1). The possible overall score varies from a minimum of zero to a maximum of 120 (negative perceived psychosocial impact due to voice difficulties).<sup>4</sup> The VHI used in the present study was the European Portuguese version that was cross-culturally validated with six European versions.<sup>23,24</sup>

The self-rated “voice severity” scale is a four-point scale with zero representing “no voice complaints,” one corresponding to “mild complaints,” two corresponding to “moderate,” and three corresponding to “severe voice complaints” that was suggested for the original VHI and is commonly used in voice research.<sup>23–25</sup>

## Statistical analyses

Data from all participants were analyzed using *SPSS Statistics 22* software (SPSS Inc., Chicago, IL).

Descriptive statistics were reported for all participants. Data for people with PD were reported for disease onset duration, impairment and disability (MDS-UPDRS), disease severity (H&Y stage zero to II as mild, stage III as moderate, and stages IV and V as severe), and self-rated “voice severity today” (group 1 comprises “no voice complaints” and “mild complaints,” and group 2 comprises “moderate” and “severe” complaints).

The statistical analysis involved a multifaceted validation process using tests of the following: (1) *feasibility*—determined based on the data quality (less than 1% of missing data);

(2) *acceptability*, scoring (less than 15% of floor or ceiling effects), and burden (questionnaire administration); (3) *reliability*—internal consistency was analyzed by obtaining the Cronbach alpha correlation coefficient for overall and subscale VHI scores. A value greater than 0.90 was considered excellent, a value between 0.90 and 0.80 was considered good, and a value less than 0.80 was considered satisfactory. The magnitude of the relationship between the subscales was assessed using Pearson product moment correlation; and (4) *construct validity*—exploratory factor analysis (EFA), principal components with varimax rotation, was carried out to determine the scale structure following the Kaiser-Meyer-Olkin measure of sampling adequacy (1–0.9 very good and 0.8–0.9 good) and the Bartlett test of sphericity criteria. The only retained factors were those with eigenvalues greater than one. The item loading is considered large if  $\geq 0.80$ , moderate if between 0.79 and 0.41, and small if  $\leq 0.40$ . Convergent validity was checked primarily by examining the relationship of the overall and subscale VHI scores to the self-rated “voice severity” scale categories, disease onset duration, and disease severity (H&Y and MDS-UPDRS). It was performed using nonparametric correlation coefficient (Spearman rho  $> 0.7$  was considered good, between 0.7 and 0.4 was considered moderate, and lower than 0.40 was considered weak). The known-groups comparison method, as an indicator of construct validity, compares scale scores across groups known to differ in the health construct being investigated. It was used to consider the ability of the VHI to discriminate between people with PD and people without PD, and between people with different degrees of voice severity. It was assessed by using an independent *t* test. Significance was established at  $P \leq 0.05$  for all statistical analyses.

## RESULTS

### Demographic and clinical characteristics

A total of 151 individuals were included in the study. Demographic and clinical characteristics are presented in Table 1. The men-to-women ratio was 1.3:1 and 0.85:1 for people with PD and for people without PD, respectively. Although the women were slightly older than men (in the healthy participants), no gender effect was found ( $P > 0.05$ ) within or between the groups. More than half of the participants had a primary school level of education and a high percentage was retired (especially among people with PD).

Women with PD scored higher than men (using the MDS-UPDRS), and this gender effect was statistically significant ( $t = -2.698$ ,  $df = 74$ ,  $P < 0.05$ ). The majority of people with PD self-rated themselves with a normal to mild voice complaint.

### Feasibility

The VHI fully computable data percentage was higher than 99%. More than 15% of the people with PD scored the lowest VHI values (floor effect). The observed VHI overall range was between zero and 100. The majority of people with PD found the questionnaire easy to use and, overall, they took about 10 minutes to complete it, and could do so independently. However, reading difficulties were found with those with only primary school

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