



Short communication

Factor analysis of the Hamilton Depression Rating Scale in Parkinson's disease



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ABSTRACT

Introduction: Several studies have validated the Hamilton Depression Rating Scale (HAMD) in patients with Parkinson's disease (PD), and reported adequate reliability and construct validity. However, the factorial validity of the HAMD has not yet been investigated. The aim of our analysis was to explore the factor structure of the HAMD in a large sample of PD patients.

Methods: A principal component analysis of the 17-item HAMD was performed on data of 341 PD patients, available from a previous cross sectional study on anxiety. An eigenvalue ≥ 1 was used to determine the number of factors. Factor loadings ≥ 0.4 in combination with oblique rotations were used to identify which variables made up the factors. Kaiser–Meyer–Olkin measure (KMO), Cronbach's alpha, Bartlett's test, communality, percentage of non-redundant residuals and the component correlation matrix were computed to assess factor validity.

Results: KMO verified the sample's adequacy for factor analysis and Cronbach's alpha indicated a good internal consistency of the total scale. Six factors had eigenvalues ≥ 1 and together explained 59.19% of the variance. The number of items per factor varied from 1 to 6. Inter-item correlations within each component were low. There was a high percentage of non-redundant residuals and low communality.

Conclusion: This analysis demonstrates that the factorial validity of the HAMD in PD is unsatisfactory. This implies that the scale is not appropriate for studying specific symptom domains of depression based on factorial structure in a PD population.

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1. Introduction

Depression is common in patients with Parkinson's disease (PD) and recent studies show that up to 35% of patients have clinically relevant depressive symptoms [1]. Adequate recognition and treatment lead to a better quality of life [2], which underlines the

importance of valid depression scales. The Hamilton Depression Rating Scale (HAMD) is the most commonly used measure of depressive symptoms [3]. It was developed in the late 1950s to assess the effectiveness of the first generation of antidepressants [4]. Throughout the years, several studies have demonstrated adequate reliability and construct validity of the HAMD in PD patients [5,6]. However, none of these studies addressed the factor structure of the HAMD in this population. Factor analyses of the HAMD in the general population are not easily generalizable to the PD population, since symptoms of PD and depression may overlap. The aim of this analysis is to explore the multidimensionality of the HAMD in a large PD population by conducting an exploratory factor analysis.

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2. Method

2.1. Population and assessment

The present study is a secondary analysis of a cross sectional observational study conducted in 2008 and 2009 that was aimed at validating anxiety rating scales [7]. The database included 341 patients with PD, diagnosed according to the Queen Square Brain Bank clinical criteria. Inclusion and exclusion criteria and assessment procedures were published previously [7]. All patients underwent a comprehensive neurologic and neuropsychiatric assessment, including the 17-item HAMD. The HAMD, an interview-based rating scale, consists of 17 items: 16 question-based items and one observational item. The scale covers the whole spectrum of depressive symptoms, including affective, cognitive and somatic symptoms. The item scores range from 0 to 4 (symptom is absent, mild, moderate, or severe) or 0–2 (absent, slight or trivial, clearly present). The total score can range from 0 to 54. A cut-off score of 9/10 has been suggested for screening purposes in PD patients [6]. The presence of a DSM-IV-defined depressive disorder was determined using the Mini International Neuropsychiatric Inventory (MINI), sections for depression (A, B). The local Medical Ethics Committees of all participating institutions approved the study. Patients gave written informed consent before inclusion in the study.

2.2. Statistical analyses

A principal component analysis (PCA) was conducted on the 17 items of the HAMD. Initially, we used an eigenvalue ≥ 1 to determine the number of factors, in combination with scree plots. Since we expected that underlying factors may be related, we used oblique rotation (direct oblimin) to optimise configuration on factors, allowing for maximum amount of non-orthogonality ($\Delta = 0$). We used factor loadings with an absolute value greater than 0.4, which explains around 16% of the variance in the variable [8]. When items loadings were >0.4 on more than one factor, one factor was selected based on the clinically most plausible solution. We then compared pattern and structure matrices to reveal the influence of shared variance. Communality was calculated to show the proportion of variance explained by the extracted factors. In addition, we conducted a Bartlett's test to check for intercorrelation between variables, measured the percentage of non-redundant residuals and calculated the component correlation matrix to check for correlations between the factors. The Kaiser-Meyer-Olkin measure of sampling adequacy (KMO) was computed to determine adequacy of sample size and the internal consistency of the scale was measured with Cronbach's alpha (α). To determine the most appropriate number of factors, we re-run the analysis with a fixed number of 2, 3, 4, 5, and 7 extracted factors. All analyses were computed with SPSS 20 (Chicago).

3. Results

The study population consisted of 207 men and 134 women (total $n = 341$) with an average age of 64.8 years (SD 9.2; range 34–87), mean disease duration of 8.3 years (SD 5.6), mean UPDRS III score 26.4 (SD 12.4), and an average Hoehn and Yahr stage of 2. Half of the patients experienced on/off fluctuations and 39% suffered from dyskinesias. Eighty-five percent of patients used levodopa and 62% dopamine agonists. Mean MMSE score was 28.5 (SD 1.7). Based on the MINI, 48 participants (14%) met the DSM IV criteria for a current major depressive episode, 19 (6%) met the DSM IV criteria for dysthymia, and 64 (19%) suffered from clinically relevant depressive symptoms (defined here as a HAMD score ≥ 12), but did not meet the DSM IV diagnostic criteria for major depressive episode or dysthymia. The mean HAMD-score of patients with a major depressive episode was 16.8 (SD 5.5) and 6.2 (SD 4.4) for patients without a major depressive episode. Cronbach's alpha (α) was 0.79, which indicates a good reliability of the total HAMD scale. More demographic and disease-related characteristics of the sample are listed in Table s1 of the supplementary data.

The Kaiser-Meyer-Olkin measure verified the sampling adequacy for the analysis. A KMO value of 0.78 confirms that sampling adequacy was tolerable. All but one KMO values for individual items were above the acceptable limit of 0.5. Item 17 *Insight-no acknowledgment of illness* had an individual KMO of 0.45. Bartlett's test of sphericity indicated that correlations between items were sufficiently large for PCA ($\chi^2(136) = 1114.315$, $p < 0.01$). An initial analysis was conducted to obtain eigenvalues for each component in the data. Six components had eigenvalues

over Kaiser's criterion of 1 and together they explained 59.2% of the variance. The scree plot showed many small inflexions. Table 1 shows the factor loadings after rotation for the six factor solution based on the Kaiser criterion. Only item 7 *Difficulty with work and activities* had more than one factor loading >0.4 . Based on the clinically most plausible solution, it was decided to place this item in component 1. Table 2 gives an overview of the items clustering when 2, 3, 4, 5, 6 or 7 components were extracted after direct oblimin rotation.

Results following PCA indicated that component 1 represents the core symptoms of depression: depressed mood, anxiety, decreased activity, psychomotor retardation and hypochondriasis. Component 2 represents sleep difficulties and component 3 clusters delusions, agitation and suicide together. Component 4 represents the only observation item insight of illness. Component 5 includes the general somatic symptoms and loss of libido, component 6 gastrointestinal symptoms and loss of weight. However, since a factor must consist of at least two joined items and component 4 represents only one item, the total number of genuine factors is 5.

3.1. Correlations

Although Bartlett's test turned out to be significant, the correlation matrix (Supplementary data, Table s2) shows that correlations between several items are not very strong (all $r < 0.3$). Especially item 17 *Insight (acknowledgment of illness)* appears to be weakly correlated to other items (all $r < 0.2$). In addition, variables 4 *Insomnia early (falling asleep)*, 12 *Somatic (gastro-intestinal and appetite)*, 14 *Genital symptoms* and 16 *Loss of weight* all have correlations below 0.3. To assess the fit of the model we looked at the differences between the observed correlations and the correlations based on the model, using the reproduced matrix (Supplementary data, Table s3). A good model should have low residual values (<0.05). However, this model shows 52% non-redundant residuals with absolute values greater than 0.05.

Table 1
Rotated factor loadings ($N = 341$).

Item	Rotated factor loadings					
	1	2	3	4	5	6
1. Depressed mood	0.46	−0.02	−0.35	−0.14	0.22	0.06
2. Feelings of guilt	0.08	0.04	−0.71	0.05	0.05	−0.04
3. Suicide	0.11	0.09	−0.74	−0.03	−0.04	−0.04
4. Insomnia early- falling asleep	−0.07	−0.46	−0.14	−0.09	0.31	−0.23
5. Insomnia middle- waking during night	0.16	−0.80	0.18	−0.04	0.02	0.01
6. Insomnia late- early morning waking	0.06	−0.72	−0.07	0.11	−0.03	0.20
7. Difficulty with work and activities	0.42	0.06	−0.06	−0.16	0.44	0.26
8. Retardation- psychomotor	0.59	0.23	0.10	0.05	0.30	0.11
9. Agitation	−0.06	−0.09	−0.66	−0.00	−0.04	0.16
10. Anxiety- psychic	0.78	−0.11	−0.09	0.17	−0.15	−0.11
11. Anxiety- somatic	0.62	−0.19	−0.24	−0.07	−0.07	0.10
12. Somatic- gastro-intestinal and appetite	−0.16	−0.01	−0.14	0.39	0.21	0.59
13. Somatic- general	−0.08	0.01	−0.29	0.11	0.71	−0.08
14. Genital symptoms	0.09	−0.11	0.22	−0.03	0.68	0.05
15. Hypochondriasis	0.61	−0.15	−0.01	0.02	0.01	−0.03
16. Loss of weight	0.06	−0.10	−0.02	−0.16	−0.08	0.80
17. Insight- no acknowledgment of illness	0.15	−0.03	0.02	0.92	−0.00	−0.08
Eigenvalues	4.06	1.52	1.22	1.13	1.09	1.04
% of variance	23.89	8.96	7.15	6.67	6.41	6.11
α	0.77	0.53	0.60	—	0.38	0.35

Note: Factor loadings over .40 appear in bold. Results of pattern analysis are shown.

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