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The Impact of Motor Symptoms on Self-Reported Anxiety in Parkinson's Disease

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Abstract

Objective—Anxiety is commonly endorsed in Parkinson's disease (PD) and significantly affects quality of life. The Beck Anxiety Inventory (BAI) is often used but contains items that overlap with common PD motor symptoms (e.g., “hands trembling”). Because of these overlapping items, we hypothesized that PD motor symptoms would significantly affect BAI scores.

Methods—One hundred non-demented individuals with PD and 74 healthy control participants completed the BAI. PD motor symptoms were assessed by the Unified Parkinson's Disease Rating Scale (UPDRS). Factor analysis of the BAI assessed for a PD motor factor, and further analyses assessed how this factor affected BAI scores.

Results—BAI scores were significantly higher for PD than NC. A five-item PD motor factor correlated with UPDRS observer-rated motor severity and mediated the PD-control difference on BAI total scores. An interaction occurred, whereby removal of the PD motor factor resulted in a significant reduction in BAI scores for PD relative to NC. The correlation between the BAI and UPDRS significantly declined when controlling for the PD motor factor.

Conclusions—The results indicate that commonly endorsed BAI items may reflect motor symptoms such as tremor instead of, or in addition to, genuine mood symptoms. These findings highlight the importance of considering motor symptoms in the assessment of anxiety in PD and point to the need for selecting anxiety measures that are less subject to contamination by the motor effects of movement disorders.

Keywords

Parkinson's disease; anxiety; motor symptoms

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Conflict of interest

The authors do not have a conflict of interest.

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1. Introduction

Anxiety is prevalent in Parkinson's disease (PD) and has a significant impact on quality of life [1]. The neuropathology of PD gives rise to anxiety—that is, it is intrinsic to the disease [2]—and the individual's response to progressive disease symptoms may additionally elicit or exacerbate mood dysfunction [3]. Anxiety may occur independently of motor symptoms [4] or may occur simultaneously [5]. Disease-specific anxiety can develop, such as apprehension toward physical symptoms (e.g., freezing of gait) or the stigma of being perceived as physically disabled [6]. Such experiences may compound the limitations that the disease imposes on independence and quality of life (e.g., social withdrawal) [7]. Mood disorders in PD are underdiagnosed [8] and there are few treatments [2].

Misinterpreting anxiety symptoms as PD motor symptoms, or vice versa, can raise the risk of mismanaging the complex symptomatology of PD. For example, anxiety measures often contain items that can represent either genuine mood symptoms, or motor or other physical symptoms of PD -- muscle tension, fatigue, concentration deficits, sleep difficulties, shakiness. In the normative samples from which these measures were derived, such symptoms are typically consequences of mood disturbances. In PD, these symptoms may manifest independently of mood, or may occur in conjunction with mood disturbances. Accordingly, common anxiety measures may inaccurately assess mood symptoms in PD, and despite their widespread use in research and clinical evaluations, they lack clinimetric support for use in PD (reviewed in Leentjens et al., 2008) [9].

The purpose of this study was to assess the impact of motor symptoms on self-reported anxiety in mild to moderate PD. The Beck Anxiety Inventory (BAI) [10] is a standard measure of anxiety that was developed with the intention of reliably distinguishing anxiety from mood disorders in a psychiatric population (i.e., discriminant validity). The BAI has been widely used to assess anxiety in this disorder, and concerns have been raised regarding construct validity and potential under-recognition of anxiety in PD [11]. Considering the widespread use of the BAI, an understanding of the impact of motor symptoms on self-reported anxiety would either increase confidence in its continued use or instead promote the selection of more PD-specific anxiety measures.

We hypothesized that a factor analysis of the BAI would reveal a PD motor factor consisting of items that also reflect hallmark motor symptoms, and that endorsement of motor symptoms would affect self-reported anxiety scores. We expected that tremor severity would impact BAI scores, and that BAI motor items would be significantly more elevated for those with moderate to severe tremor than for those with absent or mild tremor. We also assessed a group of age-matched individuals without PD in order to ask the question of whether anxiety in PD was still elevated after considering the motor items on the measure.

2. Methods

2.1 Participants

We assessed 100 individuals with idiopathic PD (45 women, 55 men) and 74 age- and education- matched normal control adults (NC) (42 women, 32 men) (Table 1). All

procedures were approved by the Institutional Review Board of Boston University, and consent was obtained according to the Declaration of Helsinki.

PD participants were recruited through the Parkinson's Disease Clinic at Boston Medical Center and through other community resources including Fox Trial Finder and PD support groups. NC participants were recruited from the general community. For both groups, exclusion criteria included coexisting serious chronic illness (including psychiatric or neurological); use of psychoactive medications besides antidepressants and anxiolytics in the PD group; use of any psychoactive medication in the NC group; history of intracranial surgery, traumatic brain injury, and alcoholism or other drug abuse. All participants scored above 26 on the modified form of the Mini-Mental State Examination [12], on conversion to standard MMSE scoring.

Diagnosis of idiopathic PD was made by the participants' neurologists, using United Kingdom Parkinson's Disease Society Brain Bank clinical diagnostic criteria [13]. The participants met clinical criteria for mild to moderate disease, with a modified Hoehn and Yahr stage range of 1–3 [14]. The sample included 13 in stage 1, 17 in stage 1.5, 37 in stage 2, 15 in stage 2.5, and 18 in stage 3. Disease severity was assessed with the Unified Parkinson's Disease Rating Scale [15, 16]. The mean UPDRS total score was 37.1 (SD = 15.3), with a mean motor score of 21.4 (SD = 10.3). Average disease duration was 6.1 years (SD = 4.3). Levodopa equivalent dosages (LED), available for all participants with PD, were calculated according to Tomlinson and colleagues' conversion formulae [17]. All participants were tested in the "on" medication state. Subjective quality of life was measured with the 39-item Parkinson's Disease Questionnaire [18]. The participants completed the UPDRS at the same time as completing the self-report questionnaires.

For both the PD and NC groups, mood was assessed with the Beck Anxiety Inventory [10] and the Beck Depression Inventory-II [19]. No participant had a clinical diagnosis of anxiety.

2.2 Procedures

Participants completed self-report questionnaires at Boston University's Vision and Cognition Laboratory:

Beck Anxiety Inventory (BAI): Standard 21-item anxiety measure (Beck & Steer, 1990).

Beck Depression Inventory (BDI): Standard 21-item depression measure (Beck, Steer, & Brown, 1996).

Parkinson's Disease Questionnaire-39 (PDQ-39): Standard 39-item measure of subjective quality of life in PD (Peto, Jenkinson, Fitzpatrick, & Greenhall, 1995).

Unified Parkinson's Disease Rating Scale (UPDRS): Standard measure of PD severity assessing: (A) Mentation, Behavior, and Mood; (B) Activities of Daily Living (ADL); (C) Motor Examination (observer rated); (D) Complications (Fahn & Elton, 1987; Levy et al., 2005).

To assess tremor symptoms, UPDRS tremor item (item #16) was used to characterize participants who reported absent-to-slight tremor (score of 0 or 1; $n = 65$) or moderate-to-severe tremor (score of 2 or 3; $n = 35$). The UPDRS tremor items from the objective motor examination (items 20–26) were summed and used as a continuous measure for analyses.

2.3 Statistical analyses

To assess the loading of PD motor symptoms, a factor analysis was conducted with principal axis factor and varimax rotation.

Items were considered if they had a coefficient greater than .40 [20]. We hypothesized that BAI symptoms that represented motor symptoms of PD (shaky, hands trembling, unsteady) would load onto the same factor.

To assess the impact of these motor items on self-reported mood, comparisons were made between the total score and the total score minus PD motor symptoms (i.e., BAI modified). The following procedures were used to determine the impact of these motor items on mood scores:

A mixed design repeated measures ANOVA with one between group variable (PD vs NC) and one within group variable (BAI total vs BAI modified) was used, with specific interest in the interaction effect. If motor items had a greater impact on total scores from PD than from NC, removal of these items would result in a significant interaction. The same analysis was conducted according to tremor severity (absent-slight tremor vs. moderate-severe tremor) to assess whether tremor severity had an impact on self-reported anxiety specifically for PD.

Mediation analyses were conducted with the SPSS mediation modelling software, PROCESS [21], to consider whether motor-like items mediated the difference between PD-NC on total mood scores. The analysis considered the total effect of group on anxiety (BAI), and the indirect effect mediated by BAI motor items. A bootstrap estimation approach with 1,000 samples was used to measure the indirect effect [22], with 95% confidence intervals. The indirect effect was considered significant when the 95% confidence intervals did not contain zero [23]. A significant mediator was indicated when the total effect was significant, the indirect effect was significant, and the confidence intervals of the direct effect contained zero [21].

For PD only, one-tailed Pearson correlations were used to assess the relation between BAI motor symptoms and the following disease characteristics: 1) objective tremor severity (UPDRS #20–26), 2) UPDRS motor severity (UPDRS Section C), 3) disease severity (H&Y), 4) quality of life (PDQ-39), 5) depression (BDI-II), and 6) disease duration. To account for multiple comparisons, alpha was set at .01. Follow-up partial correlations were conducted, controlling for motor-like symptoms, and Fishers r -to- z transformations were conducted to determine if controlling for motor symptoms had a significant impact on the relation between mood and disease characteristics. Analyses were performed with SPSS 18.0 (SPSS, Inc., Chicago, IL).

3. Results

The BAI factor analysis yielded a 5-factor solution, cumulatively accounting for 47.2% of the variance in the BAI. Three items were not included in the analysis: “numbness” and “feelings of choking” did not reach a coefficient of .4, and none of the participants endorsed “terrified”. The PD motor items that were selected *a priori* for consideration loaded onto the first factor, which accounted for 11.3% of the variance in the BAI. The five factors consisted of the following BAI items:

[Factor 1]: *Shaky, hands trembling, unsteady, wobbliness in legs, nervous*

[Factor 2]: *Scared, fear of the worst, fear of dying*

[Factor 3]: *Faint, dizzy or lightheaded, fear of losing control, heart pounding*

[Factor 4]: *Sweating, feeling hot, face flushed*

[Factor 5]: *Indigestion, unable to relax, difficulty breathing*

3.1 Interaction Effect: BAI by Group

Removing the BAI motor factor resulted in a significant reduction in the BAI for both PD [$t(99) = 13.54, p < .0001$] and NC [$t(73) = 4.89, p < .0001$], but the reduction was significantly greater for PD than NC [$F(1, 172) = 86.88, p < .0001, \eta^2 = .34$] (Figure 1). PD had higher scores than NC on BAI total [$t(164.16) = 8.03, p < .0001$], the BAI motor factor [$t(133.81) = 10.39, p < .0001$], and the BAI modified [$t(171.36) = 4.93, p < .0001$].

We compared BAI scores for those with absent-slight vs. moderate-severe tremor (UPDRS tremor item). Removing the BAI motor factor resulted in a significant reduction in the BAI in both PD groups: absent-slight tremor [$t(64) = 10.02, p < .0001$] and moderate-severe tremor [$t(34) = 9.84, p < .0001$]. The reduction was significantly greater for those with moderate-severe tremor [$F(1, 98) = 7.73, p < .007, \eta^2 = .07$]. Those with moderate-severe tremor had higher scores on the BAI motor factor [$t(98) = 2.82, p < .006$] but did not differ from the absent-slight tremor group on BAI total [$t(98) = 1.34, p < .18$] or BAI modified [$t(98) = .172, p < .86$].

3.2 Mediation Analysis

The results of the mediation analysis are presented in Table 2. When the BAI motor factor was entered as a mediator of group and BAI total scores, the total effect was significant [$\beta = -4.78, p < .0001$], the indirect effect was significant [$\beta = -4.23, 95\% \text{ CI: } -5.60, -3.15$], and the direct effect approached zero [$\beta = -0.54, 95\% \text{ CI: } -1.63, .55$]. That is, the BAI motor factor fully mediated the effect of PD on BAI total scores.

3.3 Correlations: Mood and Disease Characteristics

BAI total score correlated significantly with poorer quality of life (PDQ-39), higher BDI-II scores, and longer disease duration (Table 3). There were additional trends for correlations of BAI total score with poorer motor function (UPDRS motor score) and with tremor severity (sum of tremor items from the UPDRS motor section). The BAI motor factor related to tremor severity, poorer motor function, poorer quality of life, and greater depression.

There were additional trends for correlations with greater disease severity and greater disease duration.

For the partial correlations controlling for the BAI motor factor, the correlation remained significant between the BAI and quality of life, depression severity, and disease duration. Fisher's *r*-to-*z* transformations indicated that the difference in the size of the correlation was significant for the relation between BAI and tremor severity, motor function, quality of life, and disease severity.

4. Discussion

The results of this study addressed the impact of motor symptoms on self-reported anxiety. As hypothesized, PD motor symptoms grouped together on factor analysis of the BAI. The BAI motor factor significantly correlated with disease characteristics – tremor severity, motor function (UPDRS), quality of life, and depression. The BAI total score correlated with poorer quality of life, higher BDI-II scores, and longer disease duration. Controlling for the BAI motor factor resulted in a significant decrease in the strength of the correlation between the BAI and quality of life.

The impact of the BAI motor factor on BAI total scores highlights the importance of considering motor symptoms when measuring self-reported anxiety. After removing the BAI motor factor, the PD group showed a significantly greater decrease in BAI scores than did NC. As expected, tremor severity related to symptom report on the BAI motor factor; for individuals with moderate or severe tremor, the removal of BAI motor items had a significantly greater impact on the anxiety score than for those with absent or slight tremor. The BAI motor factor mediated the effect of PD on anxiety. Though PD is associated with greater anxiety disturbances than seen in the general population [1, 24], on the widely-used BAI the effect of PD was significantly influenced by their scores on motor items. BAI scores remained significantly higher for PD than NC even when accounting for motor items, however, indicating that the BAI does measure anxiety (apart from motor disturbances) in PD relative to a non-PD population. In another study that assessed the BAI in a sample of 294 individuals with PD, a single 6-item affective factor was independent of motor or somatic symptoms [25].

The question remains as to whether those with PD erroneously endorse motor symptoms as mood symptoms, or whether they are endorsing genuine mood disturbance on these motor items, or whether there is an interaction between mood and motor symptoms. It is possible that these motor symptoms operate independently of mood and offer a more general index of disease severity. It is also possible that the motor symptoms operate in conjunction with mood, exacerbating or causing mood disturbances. For example, the manifestation of motor symptoms may promote social withdrawal [3], thereby promoting anxiety and depression. Interactive motor-mood effects such as anxiety related to motor fluctuations may affect motor and mood disturbance [5]. Future work is needed in order to address these questions of causes, mechanisms, and treatment targets. In particular, a wider range of individuals should be sampled than are described in the present study, which was limited to participants with mild to moderate PD who did not have a clinical diagnosis of a mood disorder.

Nevertheless, PD motor symptoms significantly contributed to anxiety scores in this sample, suggesting that their impact may be even stronger in a sample with more severe disease.

The complexity of motor-mood symptoms in PD is noteworthy in its potential contribution to how the disease is understood and managed. Misinterpretation of mood symptoms may result in symptom mismanagement. For example, there are a host of adverse side effects associated with pharmacological treatments for neuropsychiatric symptoms in PD [26], and unnecessarily introducing such treatments may have a negative impact on quality of life. In contrast, misinterpreting mood as motor symptoms may result in entirely overlooking mood symptoms. One study of 362 individuals with PD found that clinicians who completed a self-report questionnaire on behalf of their patients endorsed less anxiety than individuals with PD who completed the same self-report questionnaire [27]. In this instance, failure to recognize mood symptoms in PD can result in untreated mood dysfunction, which is a significant determinant of quality of life.

Continued consideration of mood dysfunction in PD, and its measurement, is warranted in order to direct proper assessment, diagnosis, and treatment. Despite the well documented prevalence and burden of mood dysfunction in PD, there remains widespread use of mood measures lacking psychometric validation for PD. The Movement Disorders Society has noted that popular anxiety scales lack sufficient psychometric properties for use in PD and can only be classified as “suggested” rather than “recommended” measures of mood in this population [9]. It has more recently been suggested that the BAI and the Hamilton Anxiety Rating Scale together provide a valid, multi-domain assessment of anxiety including generalized anxiety, non-specific somatic symptoms, respiratory symptoms, and cardiovascular symptoms [28]. Leentjens et al. (2014) extended this work by creating the 12-item Parkinson’s Anxiety Scale [27] to assess persistent anxiety, episodic anxiety, and avoidance behavior; the items assessing persistent and episodic anxiety were found to have acceptable reliability and validity. The Parkinson’s Anxiety Scale showed better reliability than the BAI [29], and was found to be more suitable for assessing anxiety in PD [30]. The results of the present study further demonstrate the importance of employing mood measures specifically validated for individuals with PD; failure to do so may yield uninterpretable results, and ultimately raise the risk of mismanaging PD symptoms. Future research might consider determining the barriers to assessing mood with PD-specific measures. The use of valid measures and efficacious treatments for mood dysfunction will have important implications for the care of individuals with PD and for the enhancement of their quality of life.

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References

1. Broen MP, et al. Prevalence of anxiety in Parkinson's disease: a systematic review and meta-analysis. *Mov Disord.* 2016
2. Chen JJ, Marsh L. Anxiety in Parkinson's disease: identification and management. *Ther Adv Neurol Disord.* 2014; 7(1):52–9. [PubMed: 24409202]
3. Soundy A, Stubbs B, Roskell C. The experience of Parkinson's disease: a systematic review and meta-ethnography. *Scientific World Journal.* 2014;613592. [PubMed: 25525623]
4. Mondolo F, et al. Evaluation of anxiety in Parkinson's disease with some commonly used rating scales. *Neurol Sci.* 2007; 28(5):270–5. [PubMed: 17972042]
5. Leentjens AF, et al. Anxiety and motor fluctuations in Parkinson's disease: a cross-sectional observational study. *Parkinsonism Relat Disord.* 2012; 18(10):1084–8. [PubMed: 22771284]
6. Stanley-Hermanns M, Engebretson J. Sailing the stormy seas: The illness experience of persons with Parkinson's disease. *The Qualitative Report.* 2010; 15(2):340.
7. Pachana NA, et al. Clinical issues in the treatment of anxiety and depression in older adults with Parkinson's disease. *Mov Disord.* 2013; 28(14):1930–4. [PubMed: 24123116]
8. Prediger RD, et al. Anxiety in Parkinson's disease: a critical review of experimental and clinical studies. *Neuropharmacology.* 2012; 62(1):115–24. [PubMed: 21903105]
9. Leentjens AF, et al. Anxiety rating scales in Parkinson's disease: critique and recommendations. *Mov Disord.* 2008; 23(14):2015–25. [PubMed: 18792121]
10. Beck, AT., Steer, RA. BAI, Beck Anxiety Inventory. Psychological Corporation; 1990.
11. Leentjens AF, et al. Anxiety rating scales in Parkinson's disease: a validation study of the Hamilton anxiety rating scale, the Beck anxiety inventory, and the hospital anxiety and depression scale. *Mov Disord.* 2011; 26(3):407–415. [PubMed: 21384425]
12. Stern Y, et al. Modified Mini-Mental State Examination: Validity and reliability. *Neurology.* 1987; 37(suppl 1):179. [PubMed: 3808297]
13. Hughes AJ, et al. Accuracy of clinical diagnosis of idiopathic Parkinson's disease: a clinico-pathological study of 100 cases. *Journal of Neurology, Neurosurgery & Psychiatry.* 1992; 55(3): 181–184.
14. Goetz CG, et al. Movement Disorder Society Task Force report on the Hoehn and Yahr staging scale: status and recommendations. *Mov Disord.* 2004; 19(9):1020–8. [PubMed: 15372591]
15. Fahn, S., Elton, R. Recent developments in Parkinson's disease. Florham Park. New York: Macmillan; 1987. Unified rating scale for Parkinson's disease; p. 153-163.
16. Levy G, et al. Contribution of aging to the severity of different motor signs in Parkinson disease. *Arch Neurol.* 2005; 62(3):467–72. [PubMed: 15767513]
17. Tomlinson CL, et al. Systematic review of levodopa dose equivalency reporting in Parkinson's disease. *Mov Disord.* 2010; 25(15):2649–53. [PubMed: 21069833]
18. Peto V, et al. The development and validation of a short measure of functioning and well being for individuals with Parkinson's disease. *Quality of Life Research.* 1995; 4(3):241–248. [PubMed: 7613534]
19. Beck, AT., Steer, RA., Brown, GK. Beck Depression Inventory-II. San Antonio: 1996.
20. Costello A, Osborne J. Best practices in exploratory factor analysis: four recommendations for getting the most from your analysis. *Pract Assess Res Eval* 2005;10. 2011; 10(7) <http://pareonline.net/getvn.asp>.
21. Hayes, AF. Introduction to mediation, moderation, and conditional process analysis: A regression-based approach. Guilford Press; 2013.
22. Shrout PE, Bolger N. Mediation in experimental and nonexperimental studies: new procedures and recommendations. *Psychol Methods.* 2002; 7(4):422–45. [PubMed: 12530702]
23. Preacher KJ, Hayes AF. SPSS and SAS procedures for estimating indirect effects in simple mediation models. *Behav Res Methods Instrum Comput.* 2004; 36(4):717–31. [PubMed: 15641418]
24. Reynolds GO, et al. The therapeutic potential of exercise to improve mood, cognition, and sleep in Parkinson's disease. *Mov Disord.* 2016; 31(1):23–38. [PubMed: 26715466]

25. Rutten S, et al. Anxiety in Parkinson's disease: Symptom dimensions and overlap with depression and autonomic failure. *Parkinsonism Relat Disord*. 2015; 21(3):189–93. [PubMed: 25557888]
26. Connolly B, Fox SH. Treatment of cognitive, psychiatric, and affective disorders associated with Parkinson's disease. *Neurotherapeutics*. 2014; 11(1):78–91. [PubMed: 24288035]
27. Leentjens AF, et al. The Parkinson Anxiety Scale (PAS): development and validation of a new anxiety scale. *Mov Disord*. 2014; 29(8):1035–43. [PubMed: 24862344]
28. Martinez-Martin P, et al. Designing a new scale to measure anxiety symptoms in Parkinson's disease: item selection based on canonical correlation analysis. *Eur J Neurol*. 2013; 20(8):1198–203. [PubMed: 23581431]
29. Forjaz MJ, et al. Rasch analysis of anxiety scales in Parkinson's disease. *J Psychosom Res*. 2013; 74(5):414–9. [PubMed: 23597329]
30. Dissanayaka NN, Torbey E, Pachana NA. Anxiety rating scales in Parkinson's disease: a critical review updating recent literature. *Int Psychogeriatr*. 2015; 27(11):1777–84. [PubMed: 26100107]

Highlights

- The Beck Anxiety Inventory (BAI) assesses Parkinson's disease (PD) motor symptoms.
- Hallmark PD motor symptoms loaded onto one factor, and affected BAI scores.
- BAI scores significantly declined when PD motor items were removed.
- Motor items mediated the BAI difference between PD and normal control participants.
- PD anxiety assessments should distinguish between motor and mood symptoms.

Figure 1.
Interaction: BAI by Group

Table 1

Participant characteristics

	Group	N	Mean	SD	p
Age	PD	100	65.0	7.1	0.30
	NC	74	63.7	9.2	
Women:Men	PD	45:55	--	--	0.13 ^a
	NC	42:32	--	--	
Education	PD	100	17.4	2.2	0.39
	NC	74	17.1	2.2	
BAI	PD	100	6.8	4.9	<.0001 [*]
	NC	74	2.0	2.9	
BDI-II	PD	93	7.1	4.7	<.0001 [*]
	NC	74	3.2	3.7	
PD Duration (years)	PD	100	6.1	4.3	--
Hoehn & Yahr (median, range)	PD	100	2 (1–3) ^b	--	--
UPDRS Total	PD	100	37.1	15.3	--
UPDRS Motor Score	PD	100	21.4	10.3	--
PDQ-39 _{Total}	PD	100	34.6	19.5	--
LED (mg/day)	PD	100	531.1	339.5	--

^{*} Significant group difference
^a Chi square test;
^b Median, range.

PD = Parkinson's disease; NC = Normal control participants. UPDRS = Unified Parkinson's Disease Rating Scale; H&Y = Hoehn & Yahr stage; LED = Levodopa equivalent dose; PDQ-39 = 39-item Parkinson's Disease Questionnaire; BAI = Beck Anxiety Inventory; BDI-II = Beck Depression Inventory-II; Values presented are means (standard deviations), unless otherwise indicated. The last six measures were specific to PD.

Table 2

Mediation analyses

Model 1	IV: Group	DV: BAI Total	Mediator: BAI Motor Factor		
	Path	B	SE	t	p
	a	-2.51	.27	-9.28	<.0001**
	b	1.69	.13	13.31	<.0001**
	c	-4.78	.64	-7.46	<.0001**
total effect					
direct effect	c - (a * b)	-0.54	.55	-0.98	.33
indirect effect	c'	-4.23	.63		

* Significant group difference

BAI = Beck Anxiety Inventory; IV = independent variable; DV = dependent variable; β = Beta; SE = Standard Error; t = t-value; 95% CI = 95 percent confidence interval

Table 3

Correlations between BAI scores and demographic/disease characteristics

		UPDRS Tremor	UPDRS Motor	PDQ- 39 total	H&Y	BDI-II	Duration	Age
BAI Total	<i>r</i>	.18 *	.17 *	.68 **	.15	.55 **	.26 **	-.14
	<i>p</i>	.03	.04	.000	.07	.000	.005	.09
BAI Motor Factor	<i>r</i>	.34 **	.34 **	.52 **	.21 *	.44 **	.18 *	-.04
	<i>p</i>	.000	.000	.000	.02	.000	.04	.34

Correlations controlling for BAI Motor Factor							
BAI	<i>r</i>		UPDRS Tremor	UPDRS Motor	PDQ- 39 total	H&Y	BDI-II
			.05	.04	.62 **	.08	.49 **
	<i>p</i>		.32	.37	.000	.23	.000
	r-to-z ^a (p-value)		2.02 * (.02)	2.06 * (.02)	1.82 * (.03)	1.94 * (.03)	1.61 (.05)
							0.49 (.31)
							.054
							0.14 (.44)

* p<.05,
** p<.01

^a Fisher's r-to-z transformation.

PD = Parkinson's disease; NC = Normal control participants. UPDRS = Unified Parkinson's Disease Rating Scale; H&Y = Hoehn & Yahr stage; LED = Levodopa equivalent dose; PDQ-39 = Parkinson's Disease Questionnaire; BAI = Beck Anxiety Inventory; BDI-II = Beck Depression Inventory-II