Published in final edited form as:

J Geriatr Psychiatry Neurol. 2012 September ; 25(3): 131–137. doi:10.1177/0891988712455236.

Components of Depression in Parkinson Disease

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Abstract

Depression is a clinically heterogeneous disorder common in Parkinson disease (PD). The goal of this study was to characterize PD depression in terms of components, including negative affect, apathy, and anhedonia. Ninety-five, nondemented individuals with idiopathic PD underwent a diagnostic interview and psychological battery. Twenty-seven patients (28%) met Diagnostic and Statistical Manual of Mental Disorders (Fourth Edition [DSM-IV]) criteria for a current depressive episode. The best-fitting confirmatory factor analysis model had 3 factors (negative affect, apathy, and anhedonia). Apathy loaded most strongly onto a second-order factor representing global psychological disturbance. All factors are uniquely associated with depression status. Negative affect exhibited the strongest relationship. Psychological disturbance in PD is heterogeneous and can produce symptoms of apathy, anhedonia, and negative affect. Apathy appears to be the core neuropsychiatric feature of PD, whereas negative affect (eg, dysphoria) seems to be most pathognomonic of depression. Future studies should examine the specific neural correlates and treatment response patterns unique to these 3 components.

Keywords

apathy; anhedonia; negative affect; dysphoria; anxiety; confirmatory factor analysis

Objective

In Parkinson disease (PD), nonmotor symptoms such as depression, cognitive impairment, and psychosis are highly prevalent and have been demonstrated to reduce the quality of life to a greater extent than motor symptoms.^{1,2} Depression is one of the most common and disruptive of these nonmotor features. Depressive symptoms are experienced by as many as 90% of patients with PD.^{3–5} Major depressive disorder occurs in approximately 17% to 31% of patients, and minor depression may be present in an additional 25%.^{3,6,7} Importantly, depression repeatedly emerges as the single strongest predictor of quality of life in PD, even after accounting for motor functioning.^{8–10} Depression in PD is believed to be a direct consequence of the neurodegenerative process, and not merely a reaction to having a chronic disease.^{11–13} Unfortunately, depression has been underdiagnosed and undertreated in PD

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Declaration of Conflicting Interests

The author(s) declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

historically.¹⁴ This underidentification may be due, in part, to phenomenological differences between PD depression and the primary affective disorder. Indeed, multiple studies have suggested that PD depression features fewer dysphoric symptoms such as guilt and suicidal ideation, and more somatic and cognitive symptoms.¹⁵⁻²¹ Despite these preliminary findings, a recent National Institute of Neurological Disorders and Stroke (NINDS) workgroup concluded that a distinctive profile of depression has not yet been clearly identified in PD.⁷

To study the phenomenology of complex disorders, contemporary biological psychiatry commonly examines individual components, which can be identified through psychometric analyses of symptom rating instruments.²² A meta-analysis of 33 different factor analytic studies of nearly 14 000 individuals who completed the Beck Depression Inventory (BDI), one of the most widely used and well-validated depression rating scales in PD, supported the existence of 3 discrete components: (1) negative affect, (2) mood-motivation and anhedonia, and (3) somatic concerns.²³ In this meta-analysis, approximately one-third of the studies involved patient samples, one-third involved student samples, and one-third involved nonclinical adult samples.

The present study sought to better characterize depression in PD in terms of these cognitive-affective components. While “negative affect” and “mood-motivation and anhedonia” are well-replicated cognitive-affective components of depression in non-PD samples, the present study divided the latter into “apathy” and “anhedonia” due to the extremely high prevalence of apathy (ie, up to 70%) that appears to be distinctive of PD.²⁴ Further, a recent factor analysis of items from the BDI-II and the Apathy Scale that included 161 nondemented patients with PD reported that apathy and anhedonia loaded on separate factors.²⁵ The present study had 3 specific aims: (1) to confirm the existence of 3 separate cognitive-affective components (ie, negative affect, apathy, and anhedonia) in PD; (2) to compare the relative associations of these components with general psychological disturbance in PD; and (3) to determine which components were most related to Diagnostic and Statistical Manual of Mental Disorders (Fourth Edition [DSM-IV]) defined depression in PD. It was predicted that the 3 components could be separated that apathy would be more strongly related to general psychological disturbance and that negative affect would best discriminate patients currently experiencing DSM-IV defined depressive episodes.

Methods

Participants

The present sample included 95 patients with idiopathic PD who visited the University of Florida Center for Movement Disorders and Neurorestoration and agreed to participate in a study on depression in PD. The patients who met the United Kingdom Brain Bank diagnostic criteria for idiopathic PD were AQ3 included in the study.²⁶ Specific exclusion criteria were (1) comorbid neurological illness (eg, stroke, Alzheimer disease); (2) history of significant brain trauma due to injury or surgery (including deep brain stimulation); (3) history of severe psychiatric disturbance (eg, schizophrenia and rapid-cycling bipolar disorder); and (4) evidence of dementia, defined as a score less than 26 on the Mini-Mental State Examination (MMSE).²⁷ Individuals with dementia were excluded because participants had to be able to complete a large number of self-report instruments with complex instructional sets. Dementia can also be associated with reduced awareness, which limits the ability to accurately report symptoms.

Demographic and disease characteristics are shown in Table 1. On average, patients were well-educated men in their mid-60s. The majority of patients were Caucasian of non-Hispanic origin (91%). Four patients were African American, 3 patients were Hispanic, 1

patient was Asian American, and 1 patient was native American. Thirty-two percent of patients were taking an antidepressant at the time of assessment.

Measures

Motor symptom severity was quantified with the Unified Parkinson Disease Rating Scale, motor portion (UPDRS-III).²⁸ Depressive episodes were identified during a diagnostic interview conducted by an advanced doctoral student in Clinical Psychology. They were defined using DSM-IV clinical and research criteria for major or minor depressive episodes using an inclusive approach recommended by a NINDS/National Institute of Mental Health workgroup.⁷ Specifically, a determination of a depressive episode required the presence of either sad mood or loss of interest/pleasure along with 4 (major) or 1 (minor) additional depressive symptom/symptoms. Psychological symptoms were quantified with well-validated self-report or structured interview measures. Table 2 displays relevant information about these scales and their dependent variables. Multiple measures were chosen to index each of the 3 constructs in order to allow for the extraction of latent factors.

Statistical Analysis

Data were analyzed using Mplus 6.11 maximum likelihood estimation for continuous variables.³⁶ Model fit was evaluated with the following commonly used statistics: chi-square, Akaike information criterion (AIC), root mean square error of approximation (RMSEA), comparative fit index (CFI), and the Tucker-Lewis Index (TLI). Smaller values of chi-square, AIC, and RMSEA (particularly values below .06) indicate better model fit. Values of CFI and TLI that are close to 1 indicate better fit. Fit between nested models was compared statistically using the chi-square test. The relationships between the 3 depression components and general psychological disturbance were examined via standardized factor loadings on a single, second-order factor. Relationships between the 3 components and DSM-IV defined depressive episodes were examined via regression paths between the 3 first-order factors and a dichotomous variable representing the presence or absence of a depressive episode.

Results

Characteristics of Depressed Patients

Of the 95 patients surveyed, 27 (28%) met DSM-IV criteria for either a major (24 patients) or minor (3 patients) depressive episode. Of these 27 patients, 13 reported both sad mood and loss of interest/pleasure, 12 reported loss of interest/pleasure in the absence of sad mood, and 2 reported sad mood in the absence of loss of interest/pleasure. Additional depressive symptoms were as follows: weight/appetite changes (59%), sleep changes (81%), psychomotor agitation/retardation (74%), fatigue (93%), worthlessness/guilt (56%), concentration difficulties/indisiveness (85%), and thoughts of death (19%).

Table 3 compares demographic and clinical characteristics between depressed and nondepressed groups. Inferential tests revealed that groups did not differ in age, sex, disease duration, or global cognition (MMSE). On average, depressed patients exhibited lower education, greater motor severity, and greater psychopathology across most instruments. Twenty-three depressed (85%) and 21 nondepressed (31%) patients exhibited clinically significant apathy, as defined by a score greater than 13 on the Apathy Scale.²⁹

Twelve of the 29 patients (41%) on an antidepressant were taking a selective serotonin reuptake inhibitor (SSRI). Among the 29 patients taking an antidepressant, there were no differences either in the proportion of patients meeting criteria for a current depressive

episode or in the scores on any of the psychological measures, between those taking a SSRI versus a non-SSRI antidepressant.

First-Order Confirmatory Factor Analysis

Results from 3 nested Confirmatory Factor Analysis (CFA) models of increasing complexity are shown in Table 4. In these models, the 11 psychological variables listed in Table 2 were forced to load onto 1, 2, or 3 factors, respectively. Model fit was significantly improved with each subsequent model allowing for an additional factor. Fit statistics of the final, 3-factor model met standard criteria for adequate fit, as suggested by the majority of indicators: $\chi^2(40) = 66.33$ ($P = .006$); AIC = 5276.89; CFI = .95; TLI = .93; RMSEA = .08 ($p = .07$); and standardized RMSEA = .09. In this model, all 3 factors were significantly correlated with one another (negative affect/apathy: $r = .70$, $p < .001$; negative affect/anhedonia: $r = .37$, $p < .001$; apathy/anhedonia: $r = .51$, $p < .001$). Note that the Apathy Scale was not used in these CFA models because including it in the second-order model (described below) resulted in negative residual variance in a latent factor. Specifically, the Apathy Scale loaded so highly onto the global psychological disturbance factor that the residual variance of the apathy factor could not be estimated.

Second-Order CFA

In order to examine the relative associations between the 3 depression components and overall psychological disturbance, a second-order model was built in which the 3 first-order factors (ie, negative affect, apathy, and anhedonia) were forced to load on a single, second-order factor (ie, global psychological disturbance). A schematic of this model with resultant factor loadings is shown in Figure 1. All 3 components exhibited significant associations with global psychological disturbance ($p < .001$ for all), with apathy exhibiting the highest loading.

Associating Components and DSM-IV Depressive Episodes

In order to evaluate the unique relationships between the 3 components and DSM-IV defined depressive episodes, regression paths between each of the 3 first-order factors and a dichotomous variable indexing the presence/absence of a depressive episode were estimated in the latent space (ie, psychological constructs were theoretically free of measurement error). The strongest relationship was found between DSM-IV depressive episode status and negative affect ($b = .71$; standard error [SE] = .06; $p < .001$), followed by apathy ($b = .69$; $SE = .08$; $p < .001$) and anhedonia ($b = .32$; $SE = .10$; $p = .001$).

Discussion

The results support the possibility of statistically separating the 3 depression components (negative affect, apathy, and anhedonia) in PD. Other major findings of this study were that apathy was most associated with global psychological disturbance in PD, while negative affect (ie, anxiety and dysphoria) was most associated with DSM-IV defined depression.

Characteristics of Depressed Patients

A quarter of the sample met DSM-IV criteria for a major depressive episode, while an additional 3% met criteria for a minor depressive episode. This prevalence rate for major depression is comparable with those previously described in the literature.³⁻⁷ The lower prevalence rate of minor depression may relate to our use of an inclusive approach to diagnose major depression in this study, which may have resulted in some symptoms common to PD (eg, sleep disturbance) being counted as symptoms of depression. Notably, a substantial proportion (31%) of patients with PD who did not meet criteria for a major or

minor depressive episode reported clinically significant levels of apathy, defined as a score above 13 on the Apathy Scale. This proportion is similar to those reported by other studies (12%-29%) that have differentiated apathy and depression in PD.^{29,37-39}

In this study, patients with PD currently experiencing a depressive episode were comparable to the rest of the sample in terms of age and sex, although depressed patients were slightly less educated (ie, approximately 2.5 years of college vs almost 4 years). Lower education has been associated with depression in previous studies.⁴⁰ Patients in a depressive episode also exhibited worse motor functioning, as defined by UPDRS scores obtained while patients were on their anti-Parkinsonian medications. These findings correspond to previous studies reporting greater disease severity in point comparisons of depressed and nondepressed patients with PD.⁴¹ Other studies have reported an association between cognitive impairment and depressive symptoms in PD.⁴² That depressed patients in the present study did not obtain lower scores on a cognitive screening instrument may be due to the fact that we excluded individuals with marked cognitive impairment (ie, MMSE <26).

Factor Structure of Psychological Symptoms in PD

Nested model comparisons confirmed that the test battery tapped 3 distinct psychological constructs: negative affect, apathy, and anhedonia. Importantly, while the constructs of apathy, anhedonia, and negative affect can be separated in PD (based on support for separate latent factors), they nevertheless overlapped (based on correlations among factor scores). That apathy loaded most highly on the global psychological disturbance factor is consistent with the view that apathy may be the core neuropsychiatric feature of PD. A similar view has previously been argued based on the higher prevalence rates of apathy compared to other mood symptoms in PD.³⁷

Relationships Between the Components and DSM-IV Depression

All 3 components were significantly associated with depression status. Importantly, negative affect exhibited the strongest unique association with current depressive episode status, followed by apathy and anhedonia. These findings have several implications. First, while apathy may be most associated with general psychological disturbance in PD, negative affect is most associated with depression per se. These findings are consistent with the contemporary conceptualization of a distinction between apathy and depression.^{25,37,43} Specifically, the symptomatic dysphoria seen in a depressive episode is absent in an apathy syndrome, while a lack of strong emotional responses, regardless of valence, is symptomatic of apathy.

Second, the factor most associated with depression (ie, negative affect) was composed most prominently of anxiety measures which is consistent with recent studies using latent class analysis to characterize depression in PD.^{44,45} Specifically, the 2 indicators that loaded most strongly onto the negative affect factor in this study were anxiety measures. It was recently suggested that in PD, anxiety and depression may represent overlapping rather than distinct, unitary constructs,⁴⁴ and anxiety may be useful as an additional diagnostic criterion for major depression.⁴⁵

Third, anhedonia was least discriminating of a depressive episode. This was based on the observation that the anhedonia factor exhibited the weakest unique association with depressive episode status, as compared to negative affect and apathy. This finding is consistent with studies reporting that anhedonia is less prominent in PD depression than among depressed individuals without PD.¹⁵ This finding does not support the recent NINDS recommendation that anhedonia may be more specific to PD depression than the loss of interest.⁷ It should be noted that the relatively smaller association involving the anhedonia

factor was not due to lower reliability of its indicators, as Cronbach's ranged from .72 for Temporal Experience of Pleasure Scale Anticipatory to .93 for Snaith-Hamilton Pleasure Scale in this study.

Limitations

Limitations of this study include the relatively small sample size. For example, only 27 patients met criteria for a current depressive episode. However, estimates of the fit of final CFA models were adequate, as determined by multiple, commonly used statistics. Another limitation relates to our choice to focus on aspects of depression rather than account for the full spectrum of psychiatric disorders in PD (eg, anxiety disorders). A recent study examining the interaction between symptoms of depression and anxiety in PD suggested that they may not be distinct, unitary conditions, which is an important area of further research. Finally, it should be noted that many patients who did not meet criteria for a current depressive episode were taking an antidepressant and/or reported experiencing depression in the past. Thus, it is possible that at least some of these individuals had major depression in partial or full remission. The lack of adequate psychiatric records precluded a more comprehensive exploration of how symptom profiles differed between individuals at different stages of depression. Such investigation would be an important avenue of future research.

Conclusions and Future Directions

This study supports the concept that psychological disturbance in PD is heterogeneous and can produce symptoms of negative affect, apathy, and anhedonia. Apathy appears to be the core neuropsychiatric feature of PD in general, while negative affect (eg, dysphoria and anxiety) is most pathognomonic of PD depression. Practically, these findings suggest that clinicians should be mindful of apathy among their patients with PD, as this symptom is likely to be the most sensitive indicator of general psychological disturbance, and it may be accompanied by other psychological symptoms. In addition, the presence of negative affect, not apathy, should be considered the strongest evidence for the presence of current depression. This latter point is particularly important given that antidepressant medications may ameliorate symptoms of depression related to negative affect, but not to apathy.⁴⁶

The understanding of the phenomenology of PD depression was enhanced by applying a componential approach. As the heterogeneity of PD depression is more systematically recognized and researched, better models of its pathophysiology can be developed and more effective treatments can be designed. Future studies should explore the specific neural correlates unique to each of the components identified, as well as how each may respond to different treatment approaches.

Acknowledgments

Funding

The author(s) disclosed receipt of the following financial support for the research, authorship and/or publication of this article: the National Institute on Aging (T32-AG020499), the Bryan W. Robinson Endowment for Neuroscience, the American Psychological Foundation, the American Psychological Association Divisions 20 and 40, and the AQ4 National Parkinson Foundation Center of Excellence (UF).

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Figure 1.

Schematic model of the second-order confirmatory factor analysis. Standardized factor loadings are shown for the second-order factor. LARS indicates Lille Apathy Rating Scale; TEPS, Temporal AQ1 Experience of Pleasure Scale; SHPS, Snaith-Hamilton Pleasure Scale, STAI: State-Trait Anxiety Inventory, BDI-II, Beck Depression Inventory, 2nd Edition; PANAS, Positive and Negative Affect Schedule.

Table 1**Sample Characteristics**

	Mean	Standard Deviation
Demographics		
Age	66.24	9.89
Sex (%male)	68.40	–
Education	15.53	2.99
Disease characteristics		
Years with symptoms	8.68	5.72
Years since diagnosis	6.53	4.96
UPDRS on medication	29.06	9.79
Cognitive		
MMSE	28.11	1.48
Psychiatric(% yes)		
Apathetic ^a	46.30	–
Antidepressant use ^b	31.60	–
History of depression ^c	53.68	–

Abbreviations: UPDRS, Unified Parkinson Disease Rating Scale; MMSE, Mini-Mental State Examination.

^aDefined as a score above 13 on the Apathy Scale.

^bAntidepressants included selective serotonin reuptake inhibitors, serotonin–norepinephrine reuptake inhibitors, bupropion, mirtazapine, trazodone, and tricyclic antidepressants.

^cHistory of depression was defined as the occurrence of a depressive episode either presently or at some point in the past.

Table 2

Psychological Measures

Construct	Instrument
Apathy	Apathy Scale ²⁹
	Lille Apathy Rating Scale (LARS) ³⁰
	Intellectual curiosity ^a
	Action initiation ^a
	Emotion ^a
Anhedonia	Self-awareness ^a
	Snaith-Hamilton Pleasure Scale ³¹ (SHPS) ^a
	Temporal Experience of Pleasure Scale ³² (TEPS) ^b
	Consummatory pleasure ^a
	Anticipatory pleasure ^a
Negative affect	Positive and Negative Affect Schedule ³³
	Negative affect ^a
	State-Trait Anxiety Inventory ³⁴
	State ^a
	Trait ^a
	Beck Depression Inventory-II (BDI-II) ³⁵
	Dysphoria ^a

^aThe 11 scales/subscales were used as variables in the confirmatory factor analyses.

^bBecause the TEPS was validated in college-aged samples, 3 of its 18 items were changed to ensure its relevance to older adults living in Florida. Specifically, items 9, 11, and 13 were changed from “I love it when people play with my hair;” “When I’m on my way to an amusement park, I can hardly wait to ride the roller coaster;” and “I appreciate the beauty of a fresh snowfall” to “I love it when people rub my back;” “When I’m on my way to my grandchildren’s house, I can hardly wait to see them;” and “I appreciate the beauty of a colorful sunset,” respectively.

Table 3**Comparisons Between Depressed and Nondepressed Participants**

	Depressed (N=27)	Non-depressed (N=68)	<i>p</i> ^a
Demographics			
Age	66.55 (10.12)	66.12 (9.87)	.73
Sex (%male)	63.0	71.0	.47
Education	14.42 (3.29)	15.96 (2.78)	.04
Disease characteristics			
Years with symptoms	8.97 (5.83)	8.56 (5.72)	.70
Years since diagnosis	6.70 (4.72)	6.46 (5.08)	.70
UPDRS on medication	33.59 (10.95)	27.37 (8.85)	.01
Cognitive			
MMSE	28.12 (1.66)	28.11 (1.42)	.82
Psychiatric (%yes)			
Apathetic ^b	85.2	30.9	<.001
Antidepressant use ^c	59.3	20.6	<.001
History of depression	77.8 ^d	35.3	<.001
Psychometric			
BDI-II	19.22 (7.31)	6.15 (4.66)	<.001
BDI-II dysphoria	7.74 (3.91)	1.57 (2.17)	<.001
AS	19.70 (4.73)	10.38 (5.35)	<.001
LARS total	12.69 (9.87)	22.42 (5.14)	<.001
LARS intellectual curiosity	0.93 (1.26)	2.47 (0.74)	<.001
LARS emotion	1.62 (1.77)	1.99 (1.10)	.551
LARS action initiation	1.48 (1.89)	2.79 (1.09)	.002
LARS self-awareness	2.77 (1.37)	2.97 (1.24)	.514
STAI state	44.78 (10.17)	32.15 (9.22)	<.001
STAI trait	47.73 (7.16)	31.31 (8.69)	<.001
TEPS Anticipatory ^e	42.81 (8.41)	46.44 (7.28)	.060
TEPS Consummatory ^e	34.85 (6.98)	39.53 (6.41)	.003
SHPS	25.58 (4.53)	22.03 (7.39)	<.001
PANAS positive ^e	30.77 (6.45)	38.87 (6.83)	<.001
PANAS negative	27.69 (6.71)	17.67 (6.94)	<.001

Abbreviations: PD, Parkinson disease; UPDRS, Unified Parkinson's Disease Rating Scale; MMSE, Mini-Mental State Examination; BDI-II, Beck Depression Inventory, 2nd Edition; AS, Apathy Scale; LARS, Lille Apathy Rating Scale; STAI, State-Trait Anxiety Inventory; TEPS, Temporal Experience of Pleasure Scale; SHPS, Snaith-Hamilton Pleasure Scale; PANAS, Positive and Negative Affect Schedule.

^a Comparison carried out using the chi-square test for categorical variables.

^b Defined as a score above 13 on the Apathy Scale.

^c Antidepressants included selective serotonin reuptake inhibitors, serotonin-norepinephrine reuptake inhibitors, bupropion, mirtazapine, trazodone, and tricyclic antidepressants.

^dFor currently depressed patients, history of depression was defined as the self-reported occurrence of a depressive episode prior to the present episode.

^eFor subscales, the lower scores indicate greater psychopathology. For all other scales, higher scores indicate greater psychopathology.

Table 4

Standardized Factor Loadings in the Nested First-Order Models

	Model 1: 1 factor		Model 2: 2 factors ^a		Model 3: 3 factors ^b		
	Global affective disturbance	Apathy / Anhedonia	Apathy / Anhedonia	Negative Affect	Apathy	Anhedonia	Negative Affect
Apathy							
LARS Intellectual curiosity	.644	.465		–	.861	–	–
LARS action initiation	.484	.387		–	.613	–	–
LARS emotion	–.060	.270		–	.242	–	–
LARS self-awareness	.092	.295		–	.213	–	–
Anhedonia							
TEPS consummatory	.400	–.923		–	–	–.962	–
TEPS anticipatory	.370	–.728		–	–	–.709	–
SHPS total	.318	.770		–	–	.762	–
Negative affect							
PANAS negative	.705	–		.704	–	–	.715
BDI-II dysphoria	.802	–		.813	–	–	.814
STAI state	.847	–		.838	–	–	.847
STAI trait	.961	–		.976	–	–	.968

Abbreviations: LARS, Lille Apathy Rating Scale; TEPS, Temporal Experience of Pleasure Scale; SHPS, Snaith-Hamilton Pleasure Scale; PANAS, Positive and Negative Affect Schedule; STAI, State-Trait Anxiety Inventory; BDI-II, Beck Depression Inventory, 2nd Edition.

^a $\Delta\chi^2(1) = 85.407; p < .001$.

^b $\Delta\chi^2(1) = 41.925; p < .001$.