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Depression in Parkinson's disease: a quantitative and qualitative analysis

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SUMMARY Depression is a common feature of Parkinson's disease, a fact of both clinical and theoretical significance. Assessment of depression in Parkinson's disease is complicated by overlapping symptomatology in the two conditions, making global assessments based on observer or self-ratings of doubtful validity. The present study aimed to provide both a quantitative and qualitative description of the nature of the depressive changes found in Parkinson's disease as compared with normal elderly subjects and arthritis patients. As with previous studies, the patients with Parkinson's disease scored significantly higher than normal controls on various self-ratings of depression and anxiety but, in this study, did not differ from those with arthritis. Qualitatively, both the Parkinson's disease and the arthritis groups had depression characterised by pessimism and hopelessness, decreased motivation and drive, and increased concern with health. In contrast, the negative affective feelings of guilt, self-blame and worthlessness were absent in both patient groups. This pattern of depression was significantly associated with severity of illness and functional disability. However, these factors account for only a modest proportion of the variability in test scores. Probable unexplored factors are individual differences in coping style and availability of support.

The association between Parkinson's disease and depression is known, but the exact prevalence of the depression, its nature and aetiology remain uncertain. This is the result of difficulties both in the methods of studying depression in patients with Parkinson's disease, and in the way in which depression itself is conceptualised.

Table 1 summarises the major studies[1-14] which have been conducted on depression in Parkinson's disease. Considerable variability is found between studies in the number of subjects, the nature of the samples, the methods of assessment, the criteria for diagnosis and the use of control groups. Comparison between studies is difficult because of this variability. However, a consistent finding in all of the studies which give figures, is a high rate of "depression" ranging from 20%[1] to 90%,[4] with a mean estimate of 46%. The validity and meaning of this estimate needs to be assessed because of its importance both to the patient and to the clinician.

One practical consideration is the population from which the patient sample was drawn. A hospitalised sample might contain patients who have suffered a sudden worsening or complication of symptoms. This may lead to a deterioration in mood that is unrepresentative of the normal mood state of the patient, or of patients not requiring hospitalisation. A direct estimation of the importance of sample selection on prevalence rates can be found from two studies which used the same diagnostic criteria on different populations. Warburton[3] studied 140 hospitalised patients and found some degree of depression in 63%. Celesia and Wanamaker[6] studied 153 patients at first presentation to a Parkinson's disease clinic. Some degree of depression was found, or reported for the preceding year in 37% of the cases. Furthermore, as the Celesia and Wanamaker figure was based on occurrence of depression within a 12 month period, it would have picked up many more cases than those actually depressed at the time of assessment, making the difference in depression ratio for the two studies more extreme. How many patients in these two studies would be considered to be significantly depressed by criteria such as DSM III?[15] In both studies, grade 1 depression was described as "fleeting symptoms of depression never lasting more than 2 or 3 weeks and not severe enough to interfere with life in general". Such symptoms accounted for 7% of the Warburton sample and 12% of the Celesia

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Table 1 *Summary of studies on depression in Parkinson's disease*

Study	*No of patients*	*Method of assessment*	*% Depressed*	*Comparison groups*
Patrick & Levy[1]	100	Clinical assessment	20	None
Mjones[2]	238	Clinical assessment	40	None
Warburton[3]	140	Clinical assessment	63	Hospitalised (Medical, Surgical and Gynecological)
Mindham[4]	89	Retrospective case examination	90	Psychiatric patients
Brown & Wilson[5]	111	Retrospective HRS	52	None
Celesia & Wanamaker[6]	153	Clinical assessment	37	None
Marsh *et al*[7]	27	MMPI	—	Healthy volunteers and physiotherapy patients
Horn *et al*[8]	24	MMPI	—	Healthy volunteers and Paraplegics
Robins[9]	45	HRS	—	Hemiplegic, spinal cord disease, C.V. disorder, and amputation patients
Mindham *et al*[10]	50	GPRUIS	48	None
Lieberman *et al*[11]	520	Clinical assessment	29	None
Mayeux *et al*[12]	55	Clinical assessment (DSM III criteria, and BDI)	49	Spouses
Vogel *et al*[13]	20	HRS, AMP—"apathetic" —"inhibited" —"somatic"	—	None
Mayeux *et al*[14]	31	Clinical assessment (DSM III criteria) "major depression" "dysthymic disorder" HRS	27 14	None

MMPI: Minnesota Multiphasic Personality Inventory. HRS: Hamilton Rating Scale. BDI: Beck Depression Inventory. DSM–III: Diagnostic Systems Manual (III). GPRUIS: General Practice Research Unit Interview Schedule. AMP: Arbeitsgemeinschaft fur Methodik und Documentation in der Psychiatrie.

and Wanamaker sample. Such symptoms would be unlikely to warrant a psychiatric diagnosis of depression.

A further source of bias, is where psychiatric disturbance forms the main reason for hospitalisation. Such selection bias was present in the study of Mindham[4] where the patients being assessed had been referred to the hospital for psychiatric problems. As depression is the most common cause of psychiatric referral, it is not surprising that a high prevalence rate (90%) was obtained. Another important source of variability between studies may be the method by which depression was assessed. A psychiatric diagnosis of depression is based not just upon mood changes, but also upon physical and behavioural features such as disturbances in posture, motor activity, facial expression, tone of voice, bowel function, sleep pattern, appetite and libido. However, many of these features are common in Parkinson's disease, without their presence necessarily being suggestive of depression. This makes the issue of diagnosis in Parkinson's disease particularly difficult, especially when the depression is mild.

Clinical assessment has been the most common method used in the studies under consideration. The degree to which the assessments emphasise different facets of depressive symptomatology is not always clear. A typical example of a semi-standardised psychiatric depression assessment is the Hamilton Rating scale (HRS)[16] which has been used in four studies.[5 9 13 14] The scale consists of 17 variables, each graded for severity or scored for presence/absence. Information is elicited using a non-standard interview. The scales cover a wide range of areas from depressed mood and guilt to psychological and motor retardation, work and interests, and somatic complaints such as loss of energy and fatiguability. Unfortunately, individual scales are not differentially weighted making the global score a poor diagnostic indicator of depression in Parkinson's disease.

In contrast to interviewer-rated scales such as the HRS, there are those scales which the patients fill out themselves. These include the Minnesota Multiphasic Personality Inventory (MMPI),[17] which contains a depression scale, and the Beck Depression Inventory (BDI).[18] The MMPI has been used twice, on both occasions with small samples, by Marsh *et al*[7] and Horn,[8] and the BDI once by Mayeux *et al.*[12] Such scales are not ideal as they also contain items which confound the physical features of depression and Parkinson's disease. Large samples are needed to allow the separate analysis of individual items on the scales.

In studies which give a prevalence figure for depression (by whatever criteria) the result is meaningful only when compared to some standard or to a control population. Which standard is chosen will depend

ble 1 *(continued)*

ients sig. e depressed	*Association with Depression*						
	Age	*Symptom severity*	*Tremor*	*Rigidity*	*Akinesia*	*Disability*	*Duration of illness*
s	No	No	—	—	—	No	No
	—	—	—	—	—	—	—
	—	—	No	?	No	—	—
	No	No	—	—	—	—	No
s	—	No	—	—	—	—	—
s	No	—	—	—	—	—	—
s	—	—	—	—	—	No	—
	—	Yes	—	—	—	Yes	—
	—	—	—	—	—	—	—
s	—	Yes	—	—	—	No	No
	—	No	No	No	No	No	—
		Yes	Yes	No	No	No	—
		Yes	No	No	No	No	—
		No	No	No	No	No	—
	No	No	—	—	—	—	No

—" indicates that no information is available.
?" indicates that the result was equivocal.

upon the nature of the enquiry. If the question is the degree to which Parkinson's disease leads to an increased risk of depression for whatever reason, the patients might be compared to a sample of normal healthy individuals.[7 8 12] If however, the question is the degree to which Parkinson's disease leads to depression beyond that attributable to the chronic, progressive physical handicap then a handicapped comparison group is needed, either acute[3 7] or chronic.[8 9] It is notable that in all of these controlled studies, whatever the criteria or method of assessment used, "depression" was significantly higher in the Parkinson's disease group than in the control group(s). This is of course different from saying that the Parkinson's disease groups were significantly depressed.

One of the most controversial issues in the relationship between Parkinson's disease and depression is the question of cause. It has been common to draw a diagnostic distinction between reactive and endogenous depression. Many studies have found high rates of depression in patients with chronic illness. Katon[19] has reviewed this matter, and reports figures of 12–25% for primary care outpatients, and 20–33% of hospital inpatients. Parkinson's disease, being a chronic and progressively disabling illness, is likely to lead to some degree of depressive reaction in a proportion of patients. However, the disease is also associated with a widespread disturbance of various neurotransmitter levels, especially dopamine but also noradrenaline and 5-hydroxytryptamine,[20 21] all of which have been implicated in models of depression.[22] Therefore, a patient with Parkinson's disease may be depressed because of (1) disturbances in brain amine levels, (2) as a reaction to the disabling qualities of the illness, (3) both, or (4) other factors unrelated to the illness.

Some studies have sought to explore these issues by looking for associations between severity of depression and factors such as duration of illness, degree of functional disability, symptom severity and response to medication. Of the five studies which looked at duration of Parkinson's disease[3 6 8 12] none found significant associations with rate or severity of depression. These studies also failed to find a significant association between age and depression in Parkinson's disease. With functional disability, only one study[10] has found a significant association with depression. No association was found in the studies of Warburton,[3] Horn *et al*,[8] Robins,[9] Mayeux *et al*[12] and Vogel *et al.*[13] With symptom severity the situation is more equivocal. Three studies[10 12 13] found small but significant associations between symptom severity and depression, compared with four studies which did not.[3 6 8 14]

What are the implications of these findings for the causal models of depression in Parkinson's disease? It

should be noted that both the biochemical and the reactive models predict an inverse relationship between the level of dopamine (and other monoamines) and the severity of depression. In one case this would be as a direct result of the biochemical imbalance, and in the other, this would be a response to increased symptom severity and functional disability. However, the evidence does not seem to fit either model. First, neither symptom severity, functional disability or disease duration are consistently or strongly associated with depression, arguing against a simple reactive model or a biochemical model based upon dopamine levels. Second, levodopa seems to have little, if any, antidepressant action when given to depressives.[23] Third, when levodopa is given to Parkinsonians, improvement in mood does not consistently accompany the significant improvement in physical symptoms.[10] Fourth, traditional antidepressants which have been shown to improve the mood of patients with Parkinson's disease, have no marked effect on the patients motor state.[24] Combined, this evidence suggests a dissociation between the role of dopamine and other neurotransmitters in the aetiology of depression in Parkinson's disease, and lends little weight to a simple reactive model.

The present study does not propose to answer the question of aetiology of depression in Parkinson's disease, even if a simple answer were possible. A difficulty, until now, has been the lack of detailed description on the nature of the "depressive" changes seen in Parkinson's disease. The present study aims to provide such a description. Three self-report scales were used: the Beck Depression Inventory (BDI),[18] the Beck Hopelessness Scale (HS),[25] and the trait form of the Speilberger Anxiety Inventory.[26] These three scales have been widely used in other clinical settings and provide detailed and reliable information on the individuals affective state. To date, only one of the scales, the BDI has been applied to Parkinson's disease[12] and only then with a small sample. The present study aims to provide some detailed information in a large sample, on the nature of any depressive type changes in Parkinson's disease. Two comparison groups were used, a normal healthy age matched group and a sample of patients suffering from arthritis, a non-neurological but chronic and disabling illness.

Method

SUBJECT GROUPS

1 Parkinson's disease

Two groups of patients with Parkinson's disease were selected. The first (PD1) (n = 200) comprised patients on the records of a Parkinson's disease out-patient clinic at a local general hospital, with a diagnosis of idiopathic Parkinson's disease. The second group (PD2) (n = 67) were volunteers who responded to an advertisement placed in the national newsletter of the Parkinson's Disease society. Completed questionnaires were received from 122 (61%) of the clinic group. Of the remaining 78 patients, 43 (21·5%) were accounted for by death or change of address, leaving 35 patients (17·5%) unaccounted for by the survey. The total sample of Parkinson's disease patients from both sources was 189. Information on the separate and combined groups is given in table 2.

2 Arthritis Group

This group (n = 121) comprised all patients registered under one consultant, on the records of the arthritis out-patient clinic at the same general hospital. Completed questionnaires were received from 57 (47%) of patients. Information on this group is given in table 2.

3 Elderly control group

This group (n = 100) was obtained from a university subject panel consisting of individuals who had volunteered to participate in psychological studies. The age stratification and sex ratios of this group was matched to that of the Parkinson's disease group. In accordance with standard practice for the subject panel, each subject received a standard, nominal payment for completing the questionnaire. All subjects returned completed questionnaires.

MEASURES

All subjects completed the following:

1 Beck Depression Inventory[18] This is a 21 item, self-rated inventory covering a wide variety of cognitive, behavioural and somatic aspects of depression. Each item consists of four statements ordered for severity. The subject responds by indicating the statement which best describes how he/she has felt in general over the past week. Total scores range from 0 (no depression), to 63 (severe depression).

2 Beck Hopelessness Scale[26] This is a 20 item self-rated scale. It focuses on the patient's sense of optimism/pessimism and their expectations for the future. Each item is a statement (10 positive valence, for example "I look forward to the future with hope and enthusiasm", and 10 negative valence, for example "My future looks dark to me"), which the subject rates as "true" or "false" depending on whether the statement applies to themselves. Scores range from 0 (low hopelessness) to 20 (high hopelessness).

3 Speilberger Anxiety Index, Trait form[27] This is a 20 item self-rated scale. The items are descriptive statements relating to anxiety for example "I worry too much over something that doesn't really matter". The subject is asked to rate how well the statement describes how they feel in general. Each item is rated on a four point scale from 1—"almost never" to 4—"almost always". Scores range from 20 (low anxiety) to 80 (high anxiety).

4 Activities of Daily Living Questionnaire (See appendix). This is a 24 item self-rated scale, covering various aspects of everyday life likely to be influenced by a chronic illness such as Parkinson's disease or arthritis. The questionnaire was assembled from several in general clinical use. Items cover activities involving manual dexterity for example "cut food

with a knife and fork" to mobility for example "get up from a chair". Subjects were asked to rate their ability to perform each activity on a 5 point scale from 1—"alone without difficulty" to 5—"unable to do". To take into account fluctuations in functional ability, patients were asked to rate according to how they performed in general.

Clinical information was obtained from hospital notes for the two hospital based groups (PD1 and arthritis) regarding age, sex, age of onset of illness and medication. Severity of illness for the PD1 group was assessed from the notes as being mild (only minimal restriction of physical activity, unilateral or bilateral), equivalent to Hoehn and Yahr[27] grades I–II; moderate, corresponding to Hoehn and Yahr grade III (bilateral impairment of physical functioning with restricted ability to carry out everyday tasks such as walking, and usually in need of some form of assistance); or severe, corresponding to Hoehn and Yahr grades IV and V (patient is unable to walk and is confined to wheelchair, or is mainly bedridden and requires constant care and attention). For the PD2 group, a form was enclosed with the questionnaires covering basic biographical and clinical information. In addition, subjects were asked to rate their Parkinson's disease as mild, moderate or severe. In addition, all subjects were asked to state whether they had ever required treatment for a depressive illness, and whether they were currently suffering from any other illness.

Results

The mean ages and the sex ratios for each group are given in table 2. In addition, for the patient groups, the table shows mean their duration of illness. As the two Parkinson's disease groups were obtained from different populations, separate values are given for each subgroup (PD1 and PD2) as well as for the combined group (PD).

Initially, the characteristics of groups PD1 and PD2 were compared. No difference was found for age ($t = 1{\cdot}35$, df = 182, $p = 0{\cdot}18$) or sex ratio (Chi-square = 2·18, df = 1, $p = 0{\cdot}14$). No difference was found between the subgroups for any of the dependant variables: ADL ($t = 0{\cdot}38$, df = 187, $p = 0{\cdot}70$); HS ($t = 0{\cdot}32$, df = 183, $p = 0{\cdot}75$); BDI ($t = -0{\cdot}12$, df = 187, $p = 0{\cdot}90$) or STAI ($t = -0{\cdot}11$, df = 186, $p = 0{\cdot}91$). The only variable to show a significant difference was duration of illness ($t = 3{\cdot}68$, df = 175, $p < 0{\cdot}001$). However, as this variable was found to be unrelated to any of the dependant variables (see below), the two groups were considered to be equivalent. All subsequent analyses are based on the combined group, PD.

One way analysis of variance (ANOVA) revealed a difference between the ages of the groups ($F = 10{\cdot}56$, $p = < 0{\cdot}001$). Planned comparisons using Scheffe's procedure (significance level set to 0·05) revealed that this overall effect was due to differences between the arthritis group and the two other groups (Parkinson's disease and normal). No significant difference was shown between these two latter groups.

Analysis also revealed a difference in the sex ratios in the three groups (Chi-square = 6·49, df = 2, $p < 0{\cdot}05$). This difference seems to be due to a higher proportion of females in the arthritis group. No difference was found between mean disease duration for the two patient groups (Parkinson's disease and arthritis) ($t = 0{\cdot}70$, df = 219, $p = 0{\cdot}48$).

Mean scores for the BDI, HS, and STAI and median score for the ADL are given in table 3. One way ANOVA's revealed differences between the groups for the BDI ($F = 37{\cdot}6$, $p = < 0{\cdot}001$), HS ($F = 17{\cdot}9$, $p = 0{\cdot}001$) and STAI ($F = 18{\cdot}9$, $p = < 0{\cdot}001$). In all cases, planned comparisons revealed that the significant omnibus F was due to a difference between the normal controls and the two patient groups. No difference was found between the Parkinson's disease and arthritis groups. Because of skewness in the distributions of the mean ADL scores, a non-parametric ANOVA (Kruskal-Wallis) was performed, revealing a significant difference between the three groups (Chi-square = 153·6, df, = 2, $p = 0{\cdot}001$). Further analysis (Kolmorgorov-

Table 2 *Group characteristics*

Group	*N*	*Age (yr) mean (SD)*	*Sex ratio m/f (%)*	*Duration (yr) mean (SD)*
Control	100	64 (9·5)	46/54	—
Arthritis	57	57 (13)	32/68	9·9 (7·6)
Parkinson's disease 1 (PD1)	120	65 (9·9)	55/45	12·5 (8·7)
Parkinson's disease 2 (PD2)	67	63 (8·7)	43/57	8·1 (5·8)
Parkinson's disease 1 + 2 (PD)	187	64 (9·6)	51/49	10·1 (8·1)

Table 3 *Group scores on questionnaires*

Group	*BDI mean (SD)*	*HS mean (SD)*	*STAI mean (SD)*	*ADL median.*
Controls	6·4 (5·8)	5·8 (3·5)	35·0 (9·5)	25·6
Arthritis	14·3 (8·7)	8·7 (4·8)	42·6 (12·3)	53·0
Parkinson's disease	14·1 (7·7)	9·2 (5·2)	43·8 (12·5)	46·8

Smirnoff) comparing ADL scores for the Parkinson's disease and arthritis groups revealed that the arthritis group were more impaired than the Parkinson's disease group ($z = 1{\cdot}46$, $p = < 0{\cdot}05$).

Because the two patient groups differed in terms of age, sex ratio and ADL score, an analysis of coveriance was conducted, comparing the two groups on BDI, HS and STAI, using age, sex, and log-transformed ADL scores as co-variates. These analyses revealed that for all three scales, ADL score was the only significant co-variate. However, after covarying out this factor, no difference was found between the Parkinson's disease and arthritis groups for BDI, HS or STAI scores.

Tables 4, 5 and 6 show the intercorrelations between subject data, and performance on the measures for the three groups. The first fact to note is the high correlations between performance on the BDI, HS and STAI, particularly for the two patient groups. This would suggest that the tests are tapping some common feature and that use of separate terms such as depression, hopelessness or anxiety may be misleading. Age did not appear to be an important factor in determining the subject's responses on the three measures, showing weak or insignificant correlations in all cases. Similarly, in the two patient groups, neither duration of illness nor age of onset, were significantly associated with performance on the tests. In contrast, self-rated functional disability as measured by the ADL scale was consistently associated with the three measures, particularly for the Parkinson's disease group. Similarly, for this group, the self-rating or clinical rating of the severity of their Parkinson's disease, was significantly associated with the three measures.

Discussion

The present study provides self-report data on the affective state of an outpatient sample of patients with Parkinson's disease. On average, the Parkinson's disease group had scores indicating higher levels of

Table 4 *Correlations: Parkinson's disease group*

	BDI	*HS*	*STAI*	*ADL*	*Duration*	*Age onset*	*Severity (clin.)*	*Severity (self)*
Age	0·06	0·13*	0·02	0·21†	0·17*	0·71‡	0·11	0·13
BDI		0·67‡	0·72‡	0·43‡	0·00	0·08	0·23†	0·48‡
HS			0·62‡	0·38‡	0·03	0·12	0·29†	0·40‡
STAI				0·30‡	0·05	0·01	0·22†	0·31†
ADL					0·24†	0·08	0·52‡	0·40†
Duration						−0·57‡	0·38‡	0·17
Age of onset							−0·15	0·04

*p < 0·05
†p < 0·01
‡p < 0·001

Table 5 *Correlations: arthritis group*

	BDI	*HS*	*STAI*	*ADL*	*Duration*	*Age onset*
Age	−0·02	−0·04	−0·12	0·00	0·37†	0·84‡
BDI		0·71‡	0·76‡	0·27*	0·05	−0·08
HS			0·77‡	0·27*	−0·01	−0·05
STAI				0·20	0·06	−0·17
ADL					−0·16	0·07
Duration						−0·20

*p < 0·05
†p < 0·01
‡p < 0·001

Table 6 *Correlations: control group*

	BDI	*HS*	*STAI*	*ADL*
Age	0·22*	0·01	−0·03	0·06
BDI		0·56‡	0·61‡	0·35‡
HS			0·61‡	0·61‡
STAI				0·23†

*p < 0·05
†p < 0·01
‡p < 0·001

depression, hopelessness and anxiety, compared to an age matched, normal control group, but did not differ from a sample of patients with arthritis. The three measures employed (BDI, HS and STAI) showed high degrees of intercorrelation in all groups, so for simplicity, "depression" will be used to refer to a global affective state, including depression, anxiety and hopelessness.

Before discussing the results further, it is necessary to comment upon the response rates in the present study. The 100% response rate in the normal control group is in sharp contrast with the 47% obtained from the arthritis group. Because the normal controls were members of a volunteer subject panel, it might be argued that the high levels of motivation which this entails would bias the sample towards lower levels of depression. However, most subjects had been members of the panel for many years, so their possibly low levels of depression at the time of their registering, may no longer be representative of their current mental state. The high response rate is likely to be due to a continued interest in helping research, plus the financial incentive. In contrast, over 50% of the arthritis group were unaccounted for, introducing a potential source of bias into the results. However, it is unlikely that the present results overestimate the level of depression in this group. If anything, it is likely that those patients who did not reply were the more disabled and more depressed ones, making the results an underestimate. Finally, for the Parkinson's disease group, only 17·5% were unaccounted for. Once again, it is likely that the patients who failed to reply were more, rather than less likely to be depressed. Current results should therefore be considered as a possible underestimate of depression in the total sample.

That patients with Parkinson's disease were more depressed than normal controls is not surprising, and confirms previous studies.[7 8 12] However, the level of depression in the present sample of Parkinson's disease patients was no higher than that found in a group of patients with a non-neurological, chronic illness. This result is in contrast to some previous studies which found higher levels of depression in their Parkinson's disease group than in their patient controls, whether acute[3 7] or chronic.[9] However, it is in agreement with the study of Horn *et al*[8] which used paraplegic patients, matched with the Parkinson's group for age, sex, duration of illness and disability.

The relationship between chronic illness and depression is well documented.[29] The results from the present study suggest that Parkinson's disease is no exception, although methodological differences makes direct comparison between studies difficult. In particular, the nature of the depressive changes are often unclear. The remainder of the discussion will be addressed to this issue for the present sample of Parkinson's disease patients. Because of the high intercorrelations between the BDI, STAI and HS, particularly for the patient groups, the discussion will be limited to the most widely used measure, the BDI.

Some indication of the severity of depression can be gained by examining the distribution of scores in the three groups. Beck,[29] set cutoff scores for the BDI to describe different levels of depression. Table 7 shows the results for the present study classified in this way. Also shown, are the results of Mayeux *et al.*[12] The most obvious difference is between the patient samples and the normal controls. In the latter group, only 6% of control subjects in the present study fell into the moderate-to-severe depression categories. This figure is similar to that found in various community based studies, using a variety of assessment techniques.[30] In contrast, 17–30% of the patient samples in table 7 fall within this moderate-to-severe range. The two patient groups in the present study show a remarkably similar distribution of scores, although it is notable that the highest proportion of patients in the most severe depressive category is shown by the arthritis sample. Comparison of the two Parkinson's disease samples in table 7, reveals that the patients of the present study have generally higher levels of depression than in the Mayeux[12] study. The reason for this is uncertain. Differences in the severity of physical illness may have been important, but the data on this point in the two studies are not compara-

Table 7 *Classification of Beck Depression Inventory Scores*

BDI scores	*Present study*			*Mayeux et al*[12]	
	Parkinson's disease (%)	*Arthritis (%)*	*Control (%)*	*Parkinson's disease (%)*	*Control (%)*
0–9 (non depressed)	31	33	77	53	87
10–17 (mild depression)	40	37	17	31	13
18–24 (moderate depression)	17	14	5	13	0
25+ (severe depression)	12	16	1	4	0

ble. The patients in the two studies were similar in terms of age and duration of illness but the samples differed in the sex ratio, with proportionately more females in the present study (male:female = 1·03:1, compared to 3.6:1 for Mayeux.[12]) Given the known higher prevalence of depression amongst women in the general population,[31] this provides a parsimonious explanation for the observed differences. It is given some support by the differences in the present study for mean BDI scores for the male Parkinsonians (12·41) compared with that for the females (15·79) ($t = 2·98$, df = 171, $p < 0·01$).

Because the BDI covers a wide range of symptoms, involving both physical and cognitive features of depression, it was decided to examine which items differentiated the three groups, by looking at the proportion of patients in each group rating each question 0, 1, 2 or 3 (in each case 0 is "non-depressed" and 3 "most-depressed"). Because of the large number of separate analyses, a conservative significance level of 0·01 was adopted. Table 8 reveals that even with this criterion, the groups differed on a large number of scales (14/21). In all cases, the main difference was between the scores of the controls and those of the two patient groups; the latter did not differ. The patients with Parkinson's disease and arthritis clearly had features of depression; they rated themselves as being more sad, crying more frequently and of having suicidal thoughts. The severity of the depression can be judged by the fact that 27% of the Parkinson's disease patients have had thoughts of killing themselves (compared to 19·3% for the arthritis group and 5% of the normal elderly controls). The other items represent a range of physical and motivational factors, several of which may relate more to functional disability than to any depressive change, such as concern about physical appearance, work effort, sleep disturbance, tiredness and worry about health. However, it is noticeable that a key component of depression is missing from the list of items discriminating those with Parkinson's disease and arthritis from the control group, namely the negative view of self, which together with a negative view about the future and the world, comprise what Beck terms the "cognitive triad".[29] This negative, self-focused, cognitive component of depression was absent in both patient groups. There was no increased sense of guilt or failure, no increase self blame or self hate, and no sense of being punished. Neither was there any decreased interest in other people which commonly accompanies the egocentric cognitive schemata of depressed individuals.

To summarize, the patients, both those with Parkinson's disease and arthritis, feel sad and may occasionally have suicidal thoughts. They are less able to work and make decisions than control subjects. They sleep less, feel more tired and have a decreased appetite and interest in sex. They are discouraged about the future, dissatisfied with life and feel more irritable than control subjects. They are more concerned about their health, and are aware of possible physical unattractiveness in themselves. Such a pattern of depression seems to indicate a reactive sense of hopelessness and pessimism. This appears to be a feature of depression in the elderly. In perhaps the most important survey of depression in old people to date, Gurland *et al*,[32] took a random community sample of elderly subjects (65 years and above) from New York (n = 445) and from London (n = 396). Evidence of depression was found in 38·6% of the New York sample, and in 35·8% of the London sample. Within these depressed groups, roughly half comprised a syndrome of "demoralisation" or "situational depression", and half a more pervasive depression sufficient to warrant treatment.

If the changes are reactive, both in the present study and that of Gurland *et al*,[32] then the depression should show associations with such factors as func-

Table 8 *Analysis of individual BDI items*

Items showing differences between the groups ($p < 0·01$)	*Items not showing differences between the groups ($p > 0·01$)*
1. Feeling sad	3. Sense of failure
2. Discouraged about the future	5. Sense of guilt
4. Disatisfied and bored	6. Sense of being punished
9. Thoughts of suicide	7. Self hate
10. Crying	8. Self blame
11. Irritability	12. Interest in others
13. Decision making	19. Weight loss
14. Physical appearance	
15. Work effort	
16. Sleep disturbance	
17. Tiredness	
18. Appetite	
20. Worry about health	
21. Interest in sex	

Items in the left column are those in which patients differed from control subjects. There was no difference between patients with Parkinson's disease and arthritis in these items.

tional disability and symptom severity. Such was the case in the Gurland study. Correlations of 0·37–0·47 were found between severity of depression and physical illness. Similarly in the present study, but in contrast to many earlier studies on Parkinson's disease,[3 6 7 14] significant correlations were found between the Parkinsonian patient's self-ratings of depression, and their functional disability and symptom severity. However, as in the Gurland study, these associations accounted for less than 25% of the common variance. One possible explanation is that depression in these groups is a more complex phenomenon than simple reactive change. Other factors such as the personal and social resources which the patient may call upon, to help cope with the chronic handicap of their illness, may be crucial in determining which patients suffer depressive changes and which do not.[33] This is certainly the implication from the Gurland study. It is also likely to be the case in Parkinson's disease. Personal attitudes to Parkinson's disease and disability, both in patients and carers, as well as social factors such as access to services and support, need to be investigated before we can obtain a fuller understanding of depression in Parkinson's disease, with all of the implications which that has for practical management and theory.

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