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# Prevalence and Influencing Factors of Depression in Patients with Parkinson's Disease

## ABSTRACT

**Objective:** The aim was to explore the prevalence and influencing factors of depression in patients with Parkinson's disease (PD).

**Methods:** This was a cross-sectional study of the clinical data of 179 PD patients for retrospective analysis. Using the self-rating depression scale (SDS) and the Hamilton depression scale-21 (HAMD-21), we evaluated the prevalence of depression and analyzed the factors influencing depression in PD.

**Results:** The prevalence of depression in PD patients was 45.25%, and the degree of depression was mainly mild to moderate. Sleep status, daily use of levodopa, a high Hoehn and Yahr stage, a high unified Parkinson's disease rating scale (UPDRS) II score, and a high UPDRS III score were all risk factors for depression in PD patients.

**Conclusion:** The prevalence of depression in PD patients is high, and the degree of depression is closely related to many factors, which should receive close attention in clinical work.

**Keywords:** Parkinson's disease, depression, prevalence, influencing factors

## Introduction

Parkinson's disease (PD) is a neurodegenerative disease that mostly occurs in the elderly; it has a prevalence in people aged 65 and above of about 1.7%.[1-2] In recent years, the number of PD patients in China has been increasing, and PD shows a trend of being diagnosed at younger and younger ages. One study has predicted that by 2030, the number of PD patients will reach 4.94 million in China, accounting for about 50% of the global incidence. China is becoming the country with the highest number of PD patients.[3] Parkinson's disease patients have a selective loss of dopaminergic neurons in the substantia nigra. As dopamine (DA) released from the nerve ending of the corpus striatum becomes depleted, patients experience motor symptoms, such as static tremor and bradykinesia.[4] Some patients' symptoms also include non-motor symptoms such as neurocognitive disorders, cardiovascular dysfunction, and sleep disorders. The current clinical treatment for PD only delays its progression; there are no complete cures. Serotonin (5-hydroxytryptamine) in the brain decreases with the decrease in DA as the disease progresses. Patients eventually show changes such as emotional indifference and reduced will activity, as well as differing degrees of emotional disorders.[5]

Parkinson's disease with depression is found quite often in clinical practice.[6,7,8] According to 1 report,[9] the prevalence of PD with depression is about 20%-30%, is a primary factor affecting the mental health and quality of life of PD patients, and may appear before motor symptoms.[10] Because the overlap exists between depression and PD symptoms, the problem of depression in PD patients is easily ignored in the clinical treatment process, resulting in a lack of timely and effective intervention and thereby aggravating the depression and increasing the familial and social burden.[11] At present, there are controversies in China about the incidence and related factors of PD that are complicated by depression. Because of these

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controversies, the present study retrospectively analyzed the clinical data of 179 PD patients from January 2018 to March 2023, with the aim of providing a reference for clinical screening of PD patients with a high risk of depression.

## Material and Methods

### Study Subjects

The present study initially included 187 PD patients at the Jiangsu Taizhou People's Hospital, from January 2018 to March 2023. The inclusion criteria were as follows: (1) patients met the clinical diagnostic criteria of PD;[12] (2) patients had normal cognitive function and could cooperate to fill out the questionnaires; (3) patients could provide real and detailed clinical data; and (4) patients did not take anti-depressant or anxiolytic medications before entering the group. Exclusion criteria were as follows: (1) patients with secondary PD caused by cerebral hemorrhage, encephalitis, or other factors; (2) patients with parkinsonism-plus syndrome; (3) patients with essential tremor; and (4) patients with other mental illness or medical history.

The present study conformed to the Declaration of Helsinki (2013)[13] and was approved by the ethics committee of Jiangsu Taizhou People's Hospital (Approval No: 2018-KY048). All patients signed informed consent forms.

### Procedures

Each patient's medical history and clinical manifestations were recorded, and in order to assess the prevalence and intensity of depression, the PD patient was instructed by professionals to fill in a self-rating depression scale[14] (SDS) and a Hamilton depression scale-21[15] (HAMD-21). The SDS scale consists of 20 items and uses a 4-level score (1-4 points), with a total score of 20-80 points. Based on the Chinese norms, the evaluation criteria were divided into depression (≥41 points), mild depression (53-62 points), moderate depression (63-72 points), and severe depression (73-80 points). The HAMD-21 scale is composed of 21 items, with a total score of 64 points. In order to improve the accuracy and reduce missed diagnoses, this study used an SDS score of ≥ 40 points and an HAMD-21 score of >21 points as the evaluation criteria for depression.

Cognitive function was assessed by having the patient fill in the brief screening scale for dementia (BSSD). The BSSD consists of 30 items, with a correct answer of 1 point and an error of 0 points, and a score range of 0-30 points. Patients with a total score of < 16, or who did not have the ability to cooperate in any aspect of the assessment, were determined to have cognitive dysfunction. The clinical and demographic data for all patients were collected, including gender, age, course of disease, initial symptoms, education level, marital status, smoking status, family monthly income, sleep status, nature of work, place of residence, daily use of levodopa, Hoehn and Yahr stages, and unified Parkinson's disease rating scale (UPDRS) II and UPDRS III scores, for univariate analysis. Sleep status was assessed by the Parkinson's disease sleep scale (PDSS), which includes 15 items. The score on each item could range from 0 (severe and persistent symptoms) to 10 points (no symptoms), with a maximum score of 150 points. The lower the score, the worse the sleep status. The UPDRS II score is a daily life score that includes 13 items such as writing, dressing, and personal hygiene, with a total score of 0-52 points. The higher the score, the worse the daily living ability. The UPDRS III score is a motor score that includes 14 items such as facial expressions, tremor, and movement retardation, with a total score of 0-56 points. The higher the score, the more serious the movement disorder.

### Statistical Methods

The present study used the Statistical Package for Social Science Statistics software, version 26.0 (IBM SPSS Corp.; Armonk, NY, USA), to process the data and GraphPad Prism 7 (GraphPad Software, San Diego, California, USA) to graph the data. The enumeration data were tested by the $\chi^2$ test, expressed as [*n* (%)]. The Shapiro–Wilk normality test was performed on the measurement data (SDS scores, HAMD-21 scores, course of disease, sleep status, UPDRS II score, and UPDRS III score). A Mann–Whitney *U*-test was used if the data did not conform to the normal distribution and were therefore expressed as medians (minimum–maximum). Univariate analysis, Spearman rank correlation coefficient, and multiple logistic regression analysis were used to analyze the influencing factors. When $P < .05$, the difference was considered to be statistically significant.

## Results

### Research Subjects

The present study initially included 187 Parkinson's disease (PD) patients in the Jiangsu Taizhou People's Hospital from January 2018 to March 2023. After vetting, 179 patients met the inclusion criteria and were included in the study (Figure 1). There were 123 males (68.72%) and 56 females (31.28%).

### MAIN POINTS

- *In this study, 179 Parkinson's disease (PD) patients were investigated for depression. The prevalence of depression in PD patients was as high as 45.25%, mainly mild and moderate depressions.*
- *Univariate analysis and multiple logistic regression analysis showed that the degree of depression was closely related to the patient's sleep status, daily use of levodopa, Hoehn and Yahr stages, unified Parkinson's disease rating scale (UPDRS) II score, and UPDRS III score.*
- *This study can provide scientific and reliable guidance for clinical prevention, identification, and antidepressant intervention of high-risk PD patients. In clinical practice, it is necessary to pay close attention to high-risk PD patients with depression, increase the strength of education on PD, give more encouragement and care to the patients, and effectively protect their mental health.*

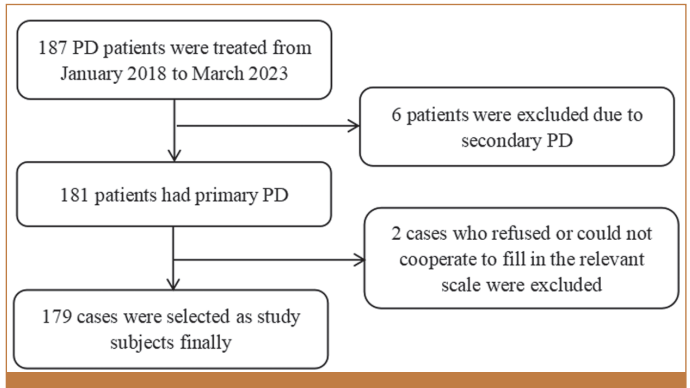


**Figure 1. Flowchart of selection of Parkinson's disease patients.**

**Table 1.** Univariate Analysis of Depression

| Items | Depressed Group ($n=81$) | Non-Depressed Group ($n=98$) | *P* |
|---|---|---|---|
| Gender [n (%)] | | | .013 |
| Male | 48 (59.26) | 75 (76.53) | |
| Female | 33 (40.74) | 23 (23.47) | |
| Age (years) [n (%)] | | | .032 |
| ≥60 years | 55 (67.90) | 51 (52.04) | |
| <60 years | 26 (32.10) | 47 (47.96) | |
| Course of disease [years, median (minimum–maximum)] | 7.00 (1.00-14.00) | 7.00 (1.00-14.00) | .919 |
| Primary symptoms [n (%)] | | | .950 |
| Movement retardation | 32 (39.51) | 41 (41.84) | |
| Tremor | 44 (54.32) | 51 (52.04) | |
| Others | 5 (6.17) | 6 (6.12) | |
| Education levels [n (%)] | | | .038 |
| Middle school and above | 32 (39.51) | 54 (55.10) | |
| Primary school and below | 49 (60.49) | 44 (44.90) | |
| Marital status | | | .021 |
| Married | 56 (69.14) | 82 (83.67) | |
| Widowed/divorced | 25 (30.86) | 16 (16.33) | |
| Smoking [n (%)] | | | .872 |
| Yes | 42 (51.85) | 52 (53.06) | |
| No | 39 (48.15) | 46 (46.94) | |
| Family monthly income [n (%)] | | | .022 |
| ≤CNY 3000 | 28 (34.57) | 19 (19.39) | |
| >CNY 3000 | 53 (65.43) | 79 (80.61) | |
| Sleep status [points, median (minimum–maximum)] | 67.00 (18.00-135.00) | 96.00 (21.00-136.00) | <.001 |
| Nature of work [n (%)] | | | .025 |
| Physical labor | 45 (55.56) | 38 (38.78) | |
| Mental work | 36 (44.44) | 60 (61.22) | |
| Place of residence [n (%)] | | | .980 |
| City | 39 (48.15) | 47 (47.96) | |
| Countryside | 42 (51.85) | 51 (52.04) | |
| Daily use of levodopa [n (%)] | | | <.001 |
| <300 mg | 47 (58.02) | 25 (25.51) | |
| 300-500 mg | 24 (29.63) | 40 (40.82) | |
| >500 mg | 10 (12.35) | 33 (33.67) | |
| Hoehn and Yahr staging [n (%)] | | | <.001 |
| Stage I | 9 (11.11) | 29 (29.59) | |
| Stage II-III | 28 (34.57) | 50 (51.02) | |
| Stage IV-VIV-V | 44 (54.32) | 19 (19.39) | |
| UPDRS II score [points, median (minimum–maximum)] | 13.00 (5.00-22.00) | 8.00 (3.00-14.00) | <.001 |
| UPDRS III score [points, median (minimum–maximum)] | 28.00 (10.00-46.00) | 18.00 (6.00-31.00) | <.001 |

CNY, Chinese Yuan; UPDRS, unified Parkinson's disease rating scale.

### Prevalence Investigation and Analysis of Depression

The median SDS and HAMD-21 scores of the 179 PD patients were 36.00 (19.00-75.00) and 20.00 (4.00-55.00), respectively. Among them, 81 patients had depression, with a prevalence of 45.25%, and the statistical results showed that the incidence of mild depression, moderate depression, and severe depression were 27.37%, 16.76%, and 1.12%, respectively, as shown in Table 1.

### Univariate Analysis of Depression

According to the presence or absence of depression, the patients were divided into a depression group (n = 81) and a non-depression group (n = 98) to carry out a univariate analysis. Table 1 shows females and patients with age ≥60 years, low education level, widowed and divorced states, family monthly income ≤CNY 3000, poor sleep status, physical labor, low daily use of levodopa, high Hoehn and Yahr stages, high UPDRS II score, and high UPDRS III score as the influencing factors of depression in PD patients ($P < .05$).

### Spearman Rank Correlation Coefficient of Depression

The age, education level, marital status, Hoehn and Yahr stage, UPDRS II score, and UPDRS III score were positively correlated with the occurrence of depression ($r = 0.185, 0.155, 0.172, 0.366, 0.421, 0.469$, $P < .05$), respectively. Gender, monthly income, sleep status, nature of work, and daily use of levodopa were negatively correlated with

**Table 2.** Spearman Rank Correlation Coefficient of Depression

| Factors | *r* | *P* |
|---|---|---|
| Age | 0.185 | .013 |
| Gender | −0.161 | .032 |
| Education level | 0.155 | .038 |
| Marital status | 0.172 | .021 |
| Family monthly income | −0.172 | .022 |
| Sleep status | −0.339 | <.001 |
| Nature of work | −0.167 | .025 |
| Daily use of levodopa | −0.345 | <.001 |
| Hoehn and Yahr stage | 0.366 | <.001 |
| UPDRS II score | 0.421 | <.001 |
| UPDRS III score | 0.469 | <.001 |

UPDRS, unified Parkinson's disease rating scale.

the occurrence of depression ($r = -0.161$, $-0.172$, $-0.339$, $-0.167$, $-0.345$, $P < .05$), respectively, as shown in Table 2.

### Multiple Logistic Regression Analysis of Depression

Using the prevalence of depression as the dependent variable of multiple logistic regression analysis and age, gender, education level, marital status, family monthly income, sleep status, nature of work, daily use of levodopa, Hoehn and Yahr stage, UPDRS II score, and UPDRS III score as independent variables, it was determined that sleep status ($P = .003$), daily use of levodopa ($P = .008$), high Hoehn and Yahr stage ($P = .011$), high UPDRS II score, and high UPDRS III score were all risk factors for depression in PD patients ($P < .05$), as detailed in Table 3.

## Discussion

Parkinson's disease is one of the most common neurodegenerative diseases, with a prevalence that is second only to Alzheimer's disease.[16] The etiology and pathogenesis of PD are not yet entirely clear; the known reasons mainly include environmental toxins, genetic inheritance, and abnormalities in brain iron metabolism.[17] The motor symptoms eventually directly affect the normal life of patients and cause great harm to their physical and mental health. Parkinson's disease patients often also suffer from obvious depression, which is closely related to the lack of clinical radical measures, reduced self-care ability, and lack of social support, based on multiple studies.[18-20]

The early stage of PD is the peak period for depression; clinical manifestations of patients showed persistent depression, difficulty in focusing attention, and reduced interest in life.[21] Parkinson's disease patients with depression often cannot get long-term targeted intervention; this promotes the progress of the disease, forms a vicious circle, and threatens the life and safety of patients. Many scholars[22-23] have suggested that there are 2 main reasons why depression in PD patients is not easily diagnosed in time. (1) Depressive symptoms lack specificity, as do the symptoms of PD. (2) There is a lack of clinical awareness of the risk factors of PD with depression and effective targeted intervention. Therefore, it is necessary to analyze the risk factors of depression in PD patients in order to alleviate the physical and mental pain of patients.

In the present study, the prevalence and influencing factors of depression in PD were analyzed. The results showed that 81 of 179 PD patients also showed depression (45.25%), and the degree of depression was mainly mild and moderate.

Low sleep status score, daily use of levodopa, high Hoehn and Yahr stage, high UPDRS II score, and high UPDRS III score were risk factors for depression in these PD patients. Clinical research[24] has found that 67%-98% of PD patients have a sleep disorder, and sleep disorders are the main cause of daytime sleepiness and cognitive impairment, which have significant adverse effects on a patient's daily life and psychological state. Therefore, sleep disorders are speculated to be associated with depression in PD patients, and a later study confirmed that sleep status scores are negatively correlated with depression. An Asian study has shown that the UPDRS II and UPDRS III scores of a depressed group were significantly higher than those of a non-depressed group.[25] That finding is consistent with the results of the present study, fully confirming that disease severity is related to depression severity in PD patients. From the perspective of disease and treatment, motor symptoms and depression in PD patients have the same pathophysiological basis and are closely related to the dysfunction of the 5-hydroxytryptamine (serotonin) system. The occurrence of movement disorders can be used as a warning of depression, and the symptoms of static tremor and movement retardation also cause great problems for the patient, so patients with movement disorders are more likely to suffer from depression, and the more serious the disorder, the higher the probability of depression.[26] Levodopa and related drugs have a good effect on PD-induced

**Table 3.** Multiple Logistic Regression Analysis of Depression

| Variables | *B* | Standard Error | Wald | *P* | Odds Ratio | 95% CI | |
|---|---|---|---|---|---|---|---|
| | | | | | | Lower | Upper |
| Gender (ref.: male) | 0.554 | 0.524 | 1.117 | .291 | 1.740 | 0.623 | 4.859 |
| Age (ref.: ≥ 60 years) | −0.384 | 0.503 | 0.582 | .446 | 0.681 | 0.254 | 1.827 |
| Education level (ref.: low education level) | 0.443 | 0.491 | 0.814 | .367 | 1.557 | 0.595 | 4.077 |
| Marital status (ref.: widowed/divorced) | 0.291 | 0.563 | 0.266 | .606 | 1.337 | 0.444 | 4.032 |
| Family monthly income (ref.: ≤ CNY 3000) | −1.016 | 0.551 | 3.399 | .065 | 0.362 | 0.123 | 1.066 |
| Sleep status | −0.024 | 0.008 | 9.019 | .003 | 0.976 | 0.961 | 0.992 |
| Nature of work (ref.: physical labor) | −0.342 | 0.481 | 0.505 | .477 | 0.710 | 0.277 | 1.824 |
| Daily use of levodopa (ref.: < 300 mg) | 0.923 | 0.347 | 7.076 | .008 | 2.517 | 1.275 | 4.968 |
| Hoehn and Yahr stage (ref.: stage I) | 0.854 | 0.336 | 6.447 | .011 | 2.349 | 1.215 | 4.541 |
| UPDRS II score | 0.254 | 0.062 | 16.991 | < .001 | 1.289 | 1.143 | 1.455 |
| UPDRS III score | 0.143 | 0.03 | 23.448 | < .001 | 1.154 | 1.089 | 1.223 |

CNY, Chinese Yuan; UPDRS, unified Parkinson's disease rating scale.

movement disorders; they can enter the central nervous system through the blood–brain barrier and be converted into DA by dopa decarboxylase to achieve the improvement. of symptoms. However, clinical results have shown that some patients have an inability to metabolize levodopa efficiently, and this poor therapeutic effect is more likely to produce depression.[27]

In summary, the prevalence of depression in PD patients is high, and the degree of depression is closely related to a low sleep status score, daily use of levodopa, a high Hoehn and Yahr stage, a high UPDRS II score, and a high UPDRS III score. Therefore, in clinical practice, it is necessary to increase attention to emotional changes of high-risk patients and implement psychological intervention treatment early in order to provide protection for the mental health of PD patients.

*Ethics Committee Approval:* *This study was approved by Ethics Committee of Jiangsu Taizhou People's Hospital (Approval No: 2018-KY048, Date: January 18, 2018).*

*Informed Consent:* *Written informed consent was obtained from the patients who agreed to take part in the study.*

*Peer-review:* *Externally peer-reviewed.*

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