Effectiveness Study of a Parkinson's Disease Management Model Led by Movement Disorder Specialists and Centered on Community Physicians (Postprint)

Authors: Cai-Xia Feng, Wang Zengshuai, Mu Hailin, Yang Hanxuan, Tamir, Wang Zengshuai

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Abstract

Background The incidence of Parkinson's disease (PD) is increasing annually, imposing a growing burden on healthcare insurance. Current chronic disease management models have proven ineffective for community-based PD patient management.

Objective To investigate the efficacy of a PD management model led by movement disorder specialists and centered on community physicians, with the aim of enhancing community physicians' comprehensive PD management capacity and improving patients' quality of life.

Methods A total of 102 PD patients who received diagnosis and treatment at the Department of Neurology, Second Affiliated Hospital of Baotou Medical College between January 2022 and May 2023 were enrolled. Using a random number table method, patients were assigned to either a control group or an active management group (n=51 each). The control group received conventional community management, while the active management group received proactive management by community physicians with PD as a subspecialty, encompassing medication adjustment, exercise rehabilitation, dietary nutrition, and management of cognitive and psychiatric dysfunctions. Evaluations were conducted within one week of patients returning to the community (baseline) and at 6 months, assessing daily levodopa equivalent dose, Unified Parkinson's Disease Rating Scale Part III (UPDRS-III), Unified Parkinson's Disease Rating Scale Part IV (UPDRS-IV), Hoehn-Yahr (H-Y) staging, and the 39-item Parkinson's Disease Quality of Life Questionnaire (PDQ-39).

Results At 6 months, the active management group demonstrated increased levodopa equivalent dose and decreased UPDRS-III scores, UPDRS-IV other

complications dimension scores, and PDQ-39 scores compared with baseline (P<0.05). Spearman rank correlation analysis revealed that changes in PDQ-39 scores in the active management group were positively correlated with changes in mental health, stigma, cognition, social support, communication, and bodily discomfort dimension scores (rs values ranging from 0.651 to 0.893, P<0.05), and positively correlated with changes in UPDRS-IV scores (rs=0.338, P<0.05), but not correlated with changes in UPDRS-III scores (P>0.05). Univariate logistic regression analysis indicated that, compared with the control group, patients in the active management group had 11.769 times higher odds of PDQ-39 reduction (95%CI=4.340~31.918, P<0.001).

Conclusion The PD management model led by movement disorder specialists and centered on community physicians can improve patient quality of life, providing a reference for community-based PD management.

Full Text

Effect of a Parkinson's Disease Management Model Led by Movement Disorder Specialists and Centered on Community Doctors

FENG Caixia[1], WANG Zengshuai[1]*, MU Hailin[2], YANG Hanxuan[3], TAMIR[3]

[1]Department of Neurology, the Second Affiliated Hospital of Baotou Medical College, Inner Mongolia University of Science and Technology, Baotou 014030, China
[2]Zhenhua Community Health Service Center, Wanqing Road Office, Baotou 014010, China
[3]Graduate School of Baotou Medical College, Inner Mongolia University of Science and Technology, Baotou 014040, China

Corresponding author: WANG Zengshuai, Chief Physician; E-mail: wzs1121@163.com

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Abstract

Background: The incidence of Parkinson's disease (PD) is increasing annually, imposing a growing burden on medical insurance systems. Current chronic disease management models have proven ineffective for community-based PD patient care.

Objective: To evaluate the effectiveness of a PD management model led by movement disorder specialists and centered on community doctors, aiming to enhance community physicians' comprehensive management capabilities and improve patients' quality of life.

Methods: A total of 102 PD patients treated at the Department of Neurology, Second Affiliated Hospital of Baotou Medical College between January 2022 and May 2023 were enrolled and randomly divided into a control group and an active intervention group (51 patients each). The control group received conventional community management, while the active management group received proactive care from community doctors with PD subspecialty training. Management encompassed medication adjustment, exercise rehabilitation, dietary nutrition, and management of cognitive and psychiatric dysfunction. Evaluations were conducted within one week of community re-entry (pre-management) and at six months (post-management), assessing daily levodopa equivalent dose, Unified Parkinson's Disease Rating Scale Part III (UPDRS-III), Unified Parkinson's Disease Rating Scale Part IV (UPDRS-IV), Hoehn-Yahr (H-Y) staging, and the 39-item Parkinson's Disease Questionnaire (PDQ-39).

Results: At six months, the active management group showed increased levodopa equivalent dose and decreased UPDRS-III scores, UPDRS-IV other complications dimension scores, and PDQ-39 scores compared to baseline ($P<0.05$). Spearman rank correlation analysis revealed that PDQ-39 score changes in the active management group positively correlated with changes in mental health, stigma, cognition, social support, communication, and bodily discomfort dimensions ($rs=0.651–0.893$, $P<0.05$), and with UPDRS-IV score changes ($rs=0.338$, $P<0.05$), but not with UPDRS-III score changes ($P>0.05$). Univariate logistic regression showed the probability of PDQ-39 reduction was 11.769 times higher in the active management group than in the control group (95%CI=4.340–31.918, $P<0.001$).

Conclusion: A PD management model led by movement disorder specialists and centered on community doctors can improve patients' quality of life, providing a valuable reference for community-based PD management.

Keywords: Parkinson's disease; Community management model; Quality of life; General practitioner-specialist integration; Movement disorder specialists; Community physicians; Cohort studies

Introduction

Parkinson's disease (PD) is a common chronic neurodegenerative disorder. Current treatments cannot halt disease progression, necessitating lifelong management. PD is not merely a motor disorder but a complex syndrome involving multiple organ systems and neurotransmitters. Non-motor symptoms—including autonomic dysfunction, neuropsychiatric manifestations, sleep-wake disorders, pain, fatigue, and olfactory/visual impairments—may emerge during preclinical and prodromal phases and persist throughout the disease course, causing significant distress yet often overlooked or misdiagnosed by community physicians. In mid-to-late stage PD, disease progression, medication side effects, motor complications, and non-motor symptoms such as depression, sleep disorders, pain, and

fatigue create complex therapeutic challenges, with some patients taking over ten medications without adequate symptom control. As PD advances, motor and non-motor symptoms intertwine, markedly increasing rates of malnutrition, infection, and falls. This stage requires collaboration between multiple specialists and movement disorder physicians. Thus, PD management necessitates both multidisciplinary involvement across systems and longitudinal, life-cycle treatment.

Multidisciplinary management centered on movement disorder specialists represents the ideal PD care model, but specialist scarcity and concentration in tertiary hospitals limit community accessibility. For PD patients returning to community care, specialist-centered multidisciplinary teams cannot provide detailed management. Our research group previously explored a PD management model led by movement disorder specialists and centered on community doctors, which improved PD patients' quality of life in community settings. This study aims to detail this model's processes and effectiveness to inform community PD management.

Methods

1.1 Study Participants This randomized controlled trial compared PD patients receiving conventional community management (control group) with those receiving proactive management from community doctors with PD subspecialty training (active management group). Sample size was calculated using the formula $N=[2(Z\alpha+Z\beta)^2\sigma^2]/\delta^2$, where α=0.05, β=0.10, $Z\alpha$=1.96, and $Z\beta$=1.28. In a pilot study of 8 patients (4 per group), PDQ-39 scores at six months were 49.2$\pm$14.7*inthecontrolgroupand*39.5$\pm$\$12.4 in the active management group. Using σ=13.55 and δ=9.7 from pilot data, the calculated sample size was 41 per group. Accounting for 20% attrition, the final required sample was 49 per group.

We enrolled 102 PD patients treated at the Department of Neurology, Second Affiliated Hospital of Baotou Medical College from January 2022 to May 2023, randomly assigning 51 to each group. Inclusion criteria were: (1) meeting the 2015 International Parkinson and Movement Disorder Society clinical diagnostic criteria for PD; (2) age \$ \$55 years; (3) signed informed consent from patients or relatives; and (4) inclusion of dependent patients if family members could cooperate with follow-up. Exclusion criteria were: (1) severe cardiopulmonary, hepatic, renal, or thyroid dysfunction; (2) severe infection, connective tissue disease, or malignancy; (3) post-deep brain stimulation surgery; and (4) secondary parkinsonism or Parkinson-plus syndromes. The study was approved by the Ethics Committee of the Second Affiliated Hospital of Baotou Medical College.

1.2 Management Protocols **1.2.1 Control Group:** Patients followed their usual care patterns, freely choosing to visit tertiary hospitals or community health centers without proactive guidance or treatment from community doctors.

1.2.2 Active Management Group: Patients received management led by movement disorder specialists and centered on community doctors. Specialists provided: (1) comprehensive PD training for community doctors with ongoing treatment guidance; (2) diagnosis and treatment for complex cases; and (3) quality control throughout the active management process. Community PD subspecialty doctors served as the central hub, responsible for establishing patient records, continuous follow-up, proactive guidance on medication, rehabilitation, nutrition, cognitive and mood management, and referring complex cases to tertiary hospitals. Community doctors maintained close communication with specialists through continuous learning.

Community Physician Training: Movement disorder specialists from tertiary hospitals, trained at Beijing Tiantan Hospital, provided specialized training to community doctors interested in PD management. Training included: (1) four weeks of centralized offline instruction covering PD guidelines, treatment protocols, non-motor symptom management, early-onset PD, rehabilitation, and psychiatric disorders; (2) participation in specialist clinics, ward rounds, and case discussions; and (3) formation of PD management teams (one specialist guiding two community doctors). This study operated through two PD teams at Zhenhua Community Health Service Center in Qingshan District, Baotou. Community doctors received systematic training, continued learning through practice, participated in intermittent online training, and discussed cases with specialists via WeChat and Tencent Meetings to establish a mentor-mentee relationship ensuring standardized PD care.

Community Management Process: (1) PD patients with confirmed diagnoses and treatment plans from tertiary hospitals returned to community centers with detailed medical records. Community doctors established files within one week and determined follow-up frequency: weekly for unstable patients, biweekly to quarterly for stable patients, monthly for home care patients, and semiannually for high-risk patients. (2) Active guidance was provided through $ $30-minute consultations, home visits for mobility-impaired patients, covering medication adjustment, timing, exercise rehabilitation, nursing care, nutrition, swallowing difficulties, bowel/bladder dysfunction, pain, and cognitive/psychiatric management. Patients could consult via phone or WeChat, with community doctors seeking specialist input for complex issues. (3) A two-way referral green channel connected community centers with tertiary hospitals, enabling seamless transfers and waived registration fees for referred patients.

1.3 Follow-up and Outcome Evaluation Two trained assessors evaluated patients at baseline (within one week of enrollment) and six months, with specialists and community doctors blinded to assessments. One assessor calculated daily levodopa equivalent dose and administered PDQ-39; the other evaluated UPDRS-III, UPDRS-IV, and H-Y staging.

Outcome Measures: (1) *Levodopa equivalent dose*: calculated relative to 100 mg immediate-release levodopa (100 mg levodopa = 100 mg piribedil = 1.0 mg

pramipexole = 1 mg rasagiline = 100 mg amantadine = 2 mg trihexyphenidyl). (2) *UPDRS-III*: 14 items assessing motor symptoms, with higher scores indicating greater severity. (3) *UPDRS-IV*: 11 items across three dimensions (dyskinesia, motor fluctuations, other complications), with higher scores indicating more severe treatment complications. (4) *H-Y staging*: 5-level scale assessing disease severity. (5) *PDQ-39*: 39 items across 8 dimensions (mobility, activities of daily living, emotional well-being, stigma, social support, cognition, communication, bodily discomfort), scored 0–100, with higher scores indicating poorer quality of life.

1.4 Statistical Analysis SPSS 22.0 was used for analysis. Normally distributed data were expressed as mean±SD, compared between groups using t-tests and within groups using paired t-tests. Non-normally distributed data were expressed as median (interquartile range), compared using Mann-Whitney U test and Wilcoxon signed-rank test. Categorical data were analyzed using ^{2} or Fisher's exact test. Spearman rank correlation examined relationships between PDQ-39 change scores and dimension changes, UPDRS-III, and UPDRS-IV. Univariate logistic regression analyzed the management model's effect on PDQ-39 scores. $P<0.05$ was considered statistically significant.

Results

2.1 Baseline Characteristics Nine patients in the control group and two in the active management group were lost to follow-up, leaving 91 completers. No significant differences existed between groups in gender distribution, mean age, proportion with low education (<9 years), proportion with fixed caregivers, or mean BMI ($P>0.05$) .

2.2 Treatment and Symptom Management Indicators No significant between-group differences were observed at baseline or six months in daily levodopa equivalent dose, UPDRS-III scores, UPDRS-IV total or dimension scores, or H-Y staging ($P>0.05$). However, within the active management group, levodopa equivalent dose increased while UPDRS-III and UPDRS-IV other complications dimension scores decreased significantly at six months ($P<0.05$) .

2.3 Quality of Life Comparison Post-management, the active management group showed significantly lower scores than the control group in mental health and cognition dimensions ($P<0.05$). Within-group comparisons revealed the control group's mobility dimension scores increased (worsened) from baseline, while the active management group's PDQ-39 total scores and all dimension scores except mobility significantly decreased (improved) ($P<0.05$) .

2.4 Correlation Analysis In the active management group, PDQ-39 score changes positively correlated with changes in mental health (rs=0.893), stigma (rs=0.712), cognition (rs=0.844), social support (rs=0.651), communication

(rs=0.736), and bodily discomfort (rs=0.718) dimensions (all P<0.05), and with UPDRS-IV score changes (rs=0.338, P<0.05), but not with UPDRS-III changes (rs=0.115, P>0.05).

2.5 Effect of Management Model on PDQ-39 Scores Univariate logistic regression with PDQ-39 reduction as the dependent variable (no reduction=0, reduction=1) and group as the independent variable (control=0, active management=1) showed the active management group had 11.769 times higher odds of PDQ-39 reduction [b=2.465, Wald ^{2}=23.459, OR (95%CI)=11.769 (4.340–31.918), P<0.001].

Discussion

Life-cycle management is recognized as an effective PD management approach, yet real-world implementation faces constraints, including limited community physician knowledge. Our center developed a PD management model led by movement disorder specialists and centered on community doctors, which improved patient quality of life and demonstrated favorable outcomes.

In this model, community doctors serve as the central hub connecting specialists and patients, ensuring standardized care. Just as neurologists in tertiary hospitals develop subspecialties, community general practitioners can choose PD as a focus area. We provided systematic PD training to interested community doctors, developing their diagnostic and management capabilities across staging, assessment, pharmacotherapy, and non-motor symptom management. Standardized training enables community doctors to identify preclinical and prodromal PD patients during routine examinations, facilitating early intervention.

The "14th Five-Year Plan" for national health encourages health promotion and education, advocating comprehensive, life-cycle health services and chronic disease management systems. As PD incidence rises with population aging, integrated management and continuous post-discharge care become increasingly important. Our model, building upon medical alliance infrastructure and leveraging WeChat for convenient consultation and referral, enables standardized management for patients across all H-Y stages in community or home settings. Trained community PD subspecialty doctors function as movement disorder specialists, general practitioners, rehabilitation therapists, nutritionists, and nurses, supporting multidisciplinary, full-cycle management.

Our findings demonstrate this model improves quality of life by addressing non-motor symptoms, reducing medication side effects, and slowing motor symptom progression, offering a new direction for PD management.

Limitations include small sample size and short follow-up duration. Future plans involve standardizing processes and expanding this model to additional communities. Implementation challenges include inadequate supervision, compensation, and collaboration issues. Integration of PD management platforms

and wearable monitoring systems may address financial and human resource constraints while motivating community physicians.

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Note: Figure translations are in progress. See original paper for figures.