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Self-Reported Symptoms of Parkinson's Disease by Sex and Disease Duration

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Abstract

Parkinson's disease (PD) is a neurodegenerative disease with a wide range of symptom presentations. The purpose of this research was to compare self-reported motor and non-motor symptoms of PD by sex and disease duration. This study was a cross-sectional descriptive survey in community-dwelling people with PD. A total of 141 participants (64.6% response rate; 59.6% men; $M_{age} = 69.7$ years) were included. Males reported more rigidity, speech problems, sexual dysfunction, memory problems, and socializing problems than females. The number of motor symptoms in three groups divided by increments of 5 years was significantly increased. Postural instability, freezing, off periods, dyskinesia, speech problems, and hallucinations/psychosis were significantly increased as the disease duration increased. Thorough assessment of motor and non-motor symptoms could decrease the risk of inadequate symptom management. Provision of information regarding PD symptoms at each stage may help people with PD and their caregivers in planning their future care and life.

Keywords

Parkinson's disease; symptoms; sex; disease duration

People with Parkinson's disease (PD) may experience various symptoms due to neurodegenerative processes in the brain. The progression of PD is well explained by Hoehn and Yahr's (1967) stages of disease. Symptom presentations are based on the part of the brain where degeneration occurs (Braak et al., 2003). Cardinal motor symptoms of PD, such as bradykinesia, rigidity, resting tremor, and postural instability, are presented as a result of the loss of dopamine in the brain (Chaudhuri et al., 2007; Hughes, Ben-Shlomo, Daniel, & Lees, 1992). Traditionally, PD treatment has focused on managing motor symptoms, whereas non-motor symptoms have received less attention until recently (Gallagher, Lees, & Schrag, 2010). Neurodegeneration in other neurotransmitter systems in the brain presents various non-motor symptoms. Those symptoms could be grouped into several categories: neuropsychiatric symptoms (e.g., depression, anxiety, cognitive impairment, dementia, and hallucination), sleep disorders (e.g., excessive daytime sleepiness, insomnia, restless leg

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syndrome, and rapid eye movement symptoms), autonomic nervous symptoms (e.g., urinary symptoms, gastrointestinal symptoms, orthostatic hypotension, sexual dysfunction, sweating, and thermoregulation), sensory symptoms (e.g., pain, diplopia, blurred vision, and olfactory changes), and other symptoms (e.g., fatigue and weight loss; Chaudhuri et al., 2006; Pfeiffer, 2016; Sauerbier, Jenner, Todorova, & Chaudhuri, 2016).

Motor symptoms are usually assessed by the Movement Disorder Society Unified Parkinson's Disease Rating Scale (MDS UPDRS), which needs to be rated by trained health care professionals (Goetz et al., 2008). Chaudhuri and colleagues developed a screening tool titled "the Non-motor Symptom Questionnaire (NMSQuest)," a self-report measure with dichotomous (yes/no) answers, and a rating scale titled, "Non-Motor Symptom Scale (NMSS)." Both measures included 30 questions in nine domains, including cardiovascular, sleep/fatigue, mood/cognition, perceptual problems/hallucinations, attention/memory, gastrointestinal, urinary, sexual dysfunction, and other miscellaneous symptoms (Chaudhuri et al., 2007; Chaudhuri et al., 2006). The scores of the NMSS are to be rated by health professionals via interview and they are based on a multiple of severity and frequency (Chaudhuri et al., 2007).

Participants with PD responding to the NMSS reported several non-motor symptoms with the range 7.7 to 11 (Bronner et al., 2014; Gallagher et al., 2010). The most commonly reported non-motor symptoms on the NMSS included autonomic nervous symptoms (e.g., nocturia, urinary urgency, and changed libido), sleep symptoms (e.g., restless leg syndrome), and neuropsychiatric symptoms (e.g., memory difficulties, impaired concentration, low mood, and anxiety). Fatigue and autonomic symptoms (e.g., nocturia) were reported as the most prevalent non-motor symptoms (Barone et al., 2009; Gallagher et al., 2010; Martinez-Martin et al., 2012). Frequently reported autonomic symptoms in patients with PD included urinary symptoms (83%), gastrointestinal dysfunction (84%), orthostatic hypotension (51%), thermoregulatory dysfunction (43%), sexual dysfunction (30%), and pupilometer dysfunction (26.2%; Arnao et al., 2015). People with PD also reported various bothersome symptoms, including motor symptoms (e.g., tremors, lack of mobility, imbalance, and dysarthria), non-motor symptoms (e.g., pain, lack of energy/fatigue, anxiety, and depression), and having to give up previously enjoyed activities (Uebelacker, Epstein-Lubow, Lewis, Broughton, & Friedman, 2014). Autonomic dysfunction, neuropsychiatric complications, memory problems, pain, fatigue, and sleep problems are major correlates of poor health-related quality of life (Gallagher et al., 2010).

PD Symptoms by Sex and Disease Duration

Given the wide range of PD symptoms, potential sex differences in symptom presentation have been studied. Males had a higher incidence rate of PD in comparison with females in a meta-analysis (Wooten, Currie, Bovbjerg, Lee, & Patrie, 2004). The neuroprotective role of estrogen and selective estrogen receptor modulators are believed to be a reason why females have a lower incidence rate of PD (Smith & Dahodwala, 2014). Males reported more motor symptoms and higher motor scores indicative of higher disability (UPDRS-III) and required a significantly higher daily levodopa equivalent dose even after controlling for age and disease duration (Lubomski, Louise Rushworth, Lee, Bertram, & Williams, 2014; Scott,

Borgman, Engler, Johnels, & Aquilonius, 2000). Males reported greater difficulties with activities of daily living (ADL), cognition, and communication (Lubomski et al., 2014). Males also reported more daytime sleepiness and autonomic nervous symptoms (e.g., dribbling saliva, decreased interest in sex, and problems having sex) in comparison with females (Martinez-Martin et al., 2012).

Although females reported fewer motor symptoms (Scott et al., 2000), they reported more dyskinesia after taking levodopa than males (Pavon, Whitson, & Okun, 2010). They also reported more fatigue, sleep problems (e.g., restless leg), neuropsychiatric problems (e.g., nervousness and feeling of sadness), autonomic nervous symptoms (e.g., constipation and excessive sweating), and sensory problems (e.g., pain) in comparison with males (Martinez-Martin et al., 2012). Females had better cognition than males in early treated PD populations (Augustine et al., 2015).

As the disease has progressed, the increases of the number and severity of PD symptoms have been documented (Ou et al., 2016; Scott et al., 2000). The number of non-motor symptoms increased with onset of PD after age 50, longer duration of disease, and Hoehn and Yahr Stage of PD (Martinez-Martin et al., 2007). There was also a significant increase in the number of PD non-motor symptoms broken down by the duration of disease in 5 years (Martinez-Martin et al., 2007). There was also a significant difference in autonomic nervous symptom scores between the groups with shorter than 5 years of PD and the group with equal to or longer than 5 years of PD (Gallagher et al., 2010).

Purpose

Only a few studies have examined sex differences in the concurrent presentation of motor and non-motor symptoms in PD. Even less literature exists that examines the presentation of symptoms by disease duration. In addition, the social aspects of PD-related symptoms, such as work and leisure activities, were not fully explored in the literature yet. The purpose of this research was to further explore these relationships comparing self-reported motor and non-motor symptoms of PD by sex and the duration of PD. In this study, the duration of PD was divided into three groups in 5-year intervals.

Method

Study Design

This study was part of a cross-sectional descriptive survey. Institutional review board approval was obtained from the study sites and the authors' institution.

Sample and Setting

Participants were community-dwelling people with PD in the United States. The following characteristics were the inclusion criteria of this study: an individual who (a) was diagnosed with PD, (b) lived at home, (c) did not have a known dementia, and (d) was able to read, write, and converse in English.

Contents of the Survey

A demographic section of the questionnaire included items for age, sex, race/ethnicity, marital status, years of education, and annual household income. General health was also documented, including difficulty of performing daily activities (e.g., bathing and showering, dressing, eating/feeding, functional mobility, personal hygiene and grooming, and toilet hygiene), most common chronic diseases in older adults (e.g., diabetes, cancers, coronary artery disease, myocardial infarction, hypertension, hyperlipidemia, depression, and anxiety), health care spending/costs per month, health insurance, and the time to visit an emergency room in the past 12 months.

A disease-specific section of the questionnaire asked for information about PD, including duration of PD, age at onset, motor and non-motor symptoms, PD treatment such as prescription medications and surgeries, and other non-PD health-related issues. Specifically, a list of 32 PD symptoms was included and reviewed by a group of five PD experts. The contents of this list included motor and non-motor symptoms and other social problems. Each question was answered with a dichotomous (yes/no) answer. Eight motor symptoms were resting tremor, bradykinesia, rigidity, postural instability, off periods, dyskinesia, freezing, and dystonia. Non-motor symptoms included 24 items covering problems in various domains, such as autonomic nervous symptoms (e.g., orthostatic hypotension, urological, gastrointestinal problems, sexual dysfunction, and excessive sweating), neuropsychiatric symptoms (e.g., cognition, emotion, depression, anxiety, and memory problems), sensory problems (e.g., pain and decreased sense of smell), work-related problems, leisure/hobby-related problems, and socializing problems. Several symptoms were explained in lay language, such as bradykinesia (slowness of movement), dyskinesia (abnormal involuntary movement of muscles), and orthostatic hypotension (lightheadedness and low blood pressure when standing).

The data were collected from March 2015 to February 2016 using a mailed survey. Participants of this study were recruited via a recruitment flyer, advertisement on the Michael J. Fox Foundation's Fox Trial Matching, and presentations to PD support groups in the mid-Atlantic area and a Midwestern state in the United States. Interested individuals contacted the investigators in person, or via phone or email. The survey questionnaire, informed consent forms, and directions of the survey were provided in person, via U.S. mail or email depending on participant's preference once they agreed to participate in the study. Participants returned the self-administered, completed survey and a consent form using an addressed, postage-paid envelope. A gift card of a small amount was offered and provided as a thank-you.

Data Analysis

Data from the survey were analyzed using IBM SPSS Statistics version 23. Descriptive statistics described participant characteristics and symptom presentations. A series of *t* tests, chi-square tests, and simple one-way ANOVAs were used to for mean comparisons; *t* tests were used for comparing males with females, and ANOVAs for comparing duration groups. Alpha was set at $p < .05$.

Results

Total Sample Characteristics

A total of 141 participants (84 males and 57 females) were included in this study (Table 1). Response rate was 64.6%. All respondents were from eight states/districts in the United States: Delaware (41.1%), Indiana (23.4%), Maryland (19.1%), and Pennsylvania (9.2%). The following states/districts had less than five respondents: New Jersey (3.5%); Washington, D.C. (0.7%); Texas (0.7%); and Virginia (1.4%). The mean age of participants was 69.7 years ($SD = 8.21$, range = 42–89 years). There was no significant age difference between males ($M_{age} = 70.57$, $SD = 8.64$) and females ($M_{age} = 68.53$, $SD = 7.45$), $t(1, 139) = 1.457$, $p = .147$. Participants were mostly Caucasian/White (95.03%), currently married (87.2%), and not working (86.7%). The mean years of education were 15.8 years ($SD = 3.15$). There was no significant difference in years of education between males ($M_{education} = 16.17$ years, $SD = 2.97$) and females ($M_{education} = 15.14$ years, $SD = 3.32$), $t(1, 138) = 1.930$, $p = .056$. There was no significant difference in annual household income between males and females ($p = .765$). A total of 62.2% of participants reported their general health as excellent (11.3%) or good (51.8%). The mean of the number of difficulties in ADL was 1.48 ($SD = 1.72$) of six activities. Males ($M_{ADL} = 1.74$, $SD = 1.82$) reported more difficulties in ADL in comparison with females ($M_{ADL} = 1.09$, $SD = 1.47$), $t(1, 136) = 2.340$, $p = .022$. Difficulty with functional mobility was reported in 45.0% of participants. Participants had an average of 1.91 ($SD = 1.38$) of eight listed diseases, which were the most common chronic diseases in older adults. Males ($M_{diseases} = 2.22$, $SD = 1.48$) reported more chronic diseases than females ($M_{diseases} = 1.46$, $SD = 1.09$), $t(1, 138) = 3.311$, $p = .001$. The mean years of being diagnosed with PD was 6.34 years ($SD = 4.84$). There was no significant difference in PD duration between males ($M_{duration} = 6.17$, $SD = 5.19$) and females ($M_{duration} = 6.57$, $SD = 4.32$), $t(1, 135) = -0.473$, $p = .637$. All participants had at least one health care insurance policy and were taking at least one antiparkinsonian medicine. Most participants (86.5%) were taking various forms of levodopa. Notably, eight participants were prescribed new formulations of carbidopa and levodopa: a carbidopa and levodopa enteral suspension (Duopa, $n = 1$) and an extended release carbidopa and levodopa capsule (Rytary, $n = 7$).

The mean of the number of symptoms reported was 12.86 of a possible 32 ($SD = 1.98$). The mean of motor symptoms reported was 3.81 ($SD = 1.98$). The mean of non-motor symptoms reported was 9.05 ($SD = 4.80$). Top five motor symptoms reported were four cardinal symptoms and freezing: bradykinesia (70.7%), rigidity (65.0%), resting tremor (60.7%), postural instability (55.7%), and freezing (38.6%; Table 2). Top 10 non-motor symptoms reported included sleep problems (66.4%), fatigue/excessive tiredness (65.7%), autonomic nervous symptoms (e.g., bladder urgency [62.1%], decreased sense of smell [59.3%], constipation [57.1%], and excessive salivation and/or drooling [50.7%]), neuropsychiatric symptoms (e.g., memory problems [55.0%], difficulty with concentration [44.3%], and anxiety [40.7%]), and speech problems (47.9%). Less than 20% of participants reported excessive sweating, hallucinations/psychosis, self-care problems, work-related problems, and impulsive behaviors.

Comparison by Sex

There were no sex differences between males ($n = 84$, 59.6%) and females ($n = 57$, 40.4%) in the demographic variables (see Table 1). However, there were no sex differences in PD-specific characteristics, including duration and PD health care providers. There were a few significant sex differences in ADL such as difficulties in dressing and eating/feeding.

There was no significant sex difference in the number of motor symptoms reported between males ($M_{\text{motor}} = 4.04$, $SD = 1.95$) and females ($M_{\text{motor}} = 3.49$, $SD = 1.99$), $t(1, 138) = 1.609$, $p = .110$. In contrast, males ($M_{\text{nonmotor}} = 9.71$, $SD = 4.81$) reported more non-motor symptoms than females ($M_{\text{nonmotor}} = 8.09$, $SD = 4.68$), $t(1, 138) = 1.985$, $p = .049$. There were significant sex differences in type of motor and non-motor symptoms reported (Table 2). Despite more rigidity reported in males, other motor symptoms did not demonstrate sex differences. Males also reported more non-motor symptoms (e.g., speech problems, sexual dysfunction, memory problems, and socializing problems) in comparison with females.

There were sex differences in the top five motor symptoms reported. Males reported four cardinal symptoms (e.g., bradykinesia, rigidity, resting tremor, postural instability) and freezing as the top five motor symptoms. However, females reported off periods rather than freezing as one of their top five symptoms reported along with four cardinal symptoms. Despite the differences in the order of rank, the top 10 non-motor symptoms reported between males and females were similar except for one symptom for each sex (e.g., sexual dysfunction for males and bladder incontinence for females).

Comparison by Disease Duration

The duration of PD in participants was divided into three groups: Group I (5 years or less, $n = 73$), Group II (6–10 years, $n = 42$), and Group III (longer than 10 years, $n = 22$; see Table 3). ANOVAs were used to test group differences. The mean years of being diagnosed with PD were 6.34 years ($SD = 4.84$, range 1–24 years) at the time of the survey. The mean age of each group was not statistically significantly different, $F(2, 134) = 0.503$, $p = .61$: Group I ($M_{\text{age}} = 68.96$, $SD = 8.87$), Group II ($M_{\text{age}} = 70.55$, $SD = 7.44$), and Group III ($M_{\text{age}} = 69.36$, $SD = 7.25$).

The number of motor symptoms reported among the three groups increased with the duration of disease, $F(2, 133) = 3.464$, $p = .034$: Group I ($M_{\text{motor}} = 3.49$, $SD = 2.04$), Group II ($M_{\text{motor}} = 4.05$, $SD = 1.89$), and Group III ($M_{\text{motor}} = 4.68$, $SD = 1.76$). There were significant increases in postural instability, freezing, off periods, and dyskinesia in three groups. However, there were no group differences in the number of non-motor symptoms, $F(2, 133) = 0.910$, $p = .405$: Group I ($M_{\text{nonmotor}} = 8.50$, $SD = 4.77$), Group II ($M_{\text{nonmotor}} = 9.67$, $SD = 4.65$), and Group III ($M_{\text{nonmotor}} = 9.55$, $SD = 5.56$). Two symptoms reported (e.g., speech problems and hallucinations/psychosis) showed significant group differences. Speech problems showed significant group differences, which was 61.9% in Group II (6 < PD ≤ 10 years, $p = .022$). Participants in Group III (PD > 10 years) reported more hallucinations/psychosis in comparison with those in Group I (PD ≤ 5 years) and Group II (6 < PD ≤ 10 years, $p = .018$).

Participants in Group I (PD $\leq$ 5 years) reported four cardinal symptoms (e.g., resting tremor, bradykinesia, rigidity, postural instability), freezing (21.9%), and off periods (21.9%) as top five motor symptoms. Top 10 non-motor symptoms reported included sleep problems, autonomic nervous symptoms (e.g., bladder urgency, constipation, and excessive salivation/drooling), fatigue/excessive tiredness, neuropsychiatric symptoms (e.g., memory problems, difficulty with concentration, and anxiety), speech problems, decreased sense of smell, and sensory problems. Leisure/hobby-related problems, excessive sweating, self-care problems, work-related problems, and impulsive behaviors were reported in less than 20% of participants in Group I.

Participants in Group II (6 < PD $\leq$ 10 years) also reported four cardinal symptoms, freezing, and off periods as the top six motor symptoms. The top 10 non-motor symptoms reported were fatigue/excessive tiredness, sleep problems, decreased sense of smell, autonomic symptoms (e.g., bladder urgency, constipation, excessive salivation and/or drooling, and sexual dysfunction), speech problems, and neuropsychiatric symptoms (e.g., memory problems, difficulty with concentration, and anxiety). Less than 20% of participants in Group II reported excessive sweating, hallucinations, self-care problems, work-related problems, and impulsive behaviors.

In participants who had PD for longer than 10 years (Group III), the top five motor symptoms reported included postural instability, bradykinesia, rigidity, freezing, and off periods. Resting tremor, one of the cardinal symptoms, was not included in the top five motor symptoms in Group III. The top 10 non-motor symptoms reported included sleep problems, fatigue/excessive tiredness, autonomic symptoms (e.g., bladder urgency, excessive salivation/drooling, and constipation), neuropsychiatric symptoms (e.g., memory problems, difficulty with concentration, anxiety, and apathy), speech problems, sensory problems, and decreased sense of smell. Work-related problems were the only non-motor symptoms that were reported by less than 20% of participants in Group III.

Discussion

Characteristics of participants in this study were similar to those of previous studies in terms of the ratios of males and females, mean age, and disease duration (Barone et al., 2009; Chaudhuri et al., 2006, 2007; Martinez-Martin et al., 2007). Findings from this study are consistent with previous research studies; however, this study also suggests new findings that warrant further investigation. Consistent with findings of previous studies, four cardinal motor symptoms were commonly reported in both males and females and all groups divided by disease durations (Scott et al., 2000; Uebelacker et al., 2014). Rigidity was the only motor symptom that showed sex differences in this study. Males in this study reported greater difficulties with some ADL functions, which were also reported in a previous study (Lubomski et al., 2014).

Several non-motor symptoms such as sleep problems, fatigue/excessive tiredness, and autonomic dysfunction (e.g., bladder urgency, constipation, and excessive salivation and/or drooling) were also common in both sexes and in all groups. Sleep problems (e.g., excessive daytime sleepiness) were the most commonly reported symptoms in this study, which was

similar to findings of previous studies (Barone et al., 2009; Chaudhuri et al., 2006; Martinez-Martin et al., 2012; Uebelacker et al., 2014). Fatigue/tired-ness showed worsening over time and they were associated with other non-motor symptoms such as apathy, depression, sleep disorder, and cognitive dysfunction (Lou, 2015). Despite the increased attention to fatigue, its mechanism and management are not available yet (Elbers, Verhoef, van Wegen, Berendse, & Kwakkel, 2015). Autonomic symptoms develop as the disease progresses. Decreased sense of smell was also reported in this study, which is considered as a strong preclinical characteristic and eventually affects up to 90% of people with PD (Chaudhuri et al., 2006). Gastrointestinal problems such as constipation and excessive salivation/drooling were also prevalent in this study. Bladder urgency was reported in up to 35% and nocturia was in up to 62% of previous studies (Chaudhuri et al., 2007; Gallagher et al., 2010; Martinez-Martin et al., 2012). Memory problems were reported in this study despite excluding individuals with diagnosed dementia. Of note, aging processes may play a role in some symptom presentations (e.g., nocturia, constipation, and memory problems). Thus, more attention to the baseline symptom profile would help health care providers evaluate and manage non-motor symptoms in people with PD. Males reported more non-motor symptoms (e.g., speech, memory, socializing problems, and sexual dysfunction) in comparison with females, which were partially supportive of findings from a previous study (Martinez-Martin et al., 2012). Consistent with findings of previous studies, changes in interest in sex and problems having sex in males were also reported in this study (Martinez-Martin et al., 2012). Sexual dysfunction was often reported among males (Adler, 2005; Gallagher et al., 2010) although it presents in both sexes (Bronner et al., 2014). Females may possibly consider sexual dysfunction as embarrassing or unrelated to PD, which could support Gallagher and colleague's point of view (Gallagher et al., 2010). In contrast, some symptoms that showed sex difference in previous studies did not show sex difference in this study such as excessive sweating, fatigue, nervousness, feeling of sadness, constipation, and pain (Martinez-Martin et al., 2012). It may have been due to the small sample size of this study.

Findings of this study supported differences in PD symptoms reported by the duration of PD. Participants in Group III (PD > 10 years) reported more motor symptoms. Along with four cardinal motor symptoms, participants reported more postural instability, freezing, off periods, and dyskinesia across the groups. The increase of these motor symptoms could increase safety issues, including falls and functional limitations in the advanced stages of PD. Speech problems and hallucination/psychosis were also increased in Group III (PD > 10 years). Hallucinations/psychosis is the strongest predictor of nursing home placement in people with PD (Pfeiffer, 2016).

Early detection of motor and non-motor symptoms of PD might be beneficial for people with PD and their family members to avoid the risk of being misdiagnosed with other chronic diseases with similar symptoms. Changes of symptom presentation at each stage of PD need to be considered to prepare for patient-centered, tailored care plans in clinical settings. At the advanced stages of PD, safety issues such as falls need to be included in the plan of care due to increased motor symptoms (e.g., freezing, off periods, and dyskinesia) and hallucinations/psychosis. Walking difficulties, orthostatic hypotension, and fatigue were

also known associated factors of falls. Thus, these factors need to be managed and reduced to prevent falls and consequent complications.

Due to the chronicity of the disease and multifaceted symptoms, people with PD utilize various self-management strategies, including medications, physical activity/exercise, speech therapy, complementary health approaches, and instrumental or practical support and emotional support (Shin, Habermann, & Pretzer-Aboff, 2015; Uebelacker et al., 2014). Thus, interprofessional approaches are needed to assist people with PD in managing their PD symptoms. Education and support for caregivers of people with PD need to include symptom presentations by sex and duration of PD. In doing so, people with PD and their caregivers may understand symptom profiles at each stage and plan their future life according to their symptoms and function level.

The survey needs to be retested with a different sample to validate the comprehensiveness of its contents. Measuring symptoms with frequency and severity could strengthen the accuracy of symptom assessment. In addition, presenting a time frame as to when these symptoms were experienced (e.g., in the last year) might yield a better understanding of symptom presentation in PD. Findings relative to sex differences in PD symptoms are less distinct as some previous differences that have been reported in the literature were not replicated in this study. However, this warrants further investigation in larger samples to better understand the sex differences to ensure tailored care delivery to both males and females with PD. Work, leisure/hobby-related problems, and socializing problems could be elaborated on in future studies to better understand the impact of symptoms on the specific aspects of these activities. This could lead to an area of research where targeted symptom management interventions could be developed. Given the array of symptoms experienced in PD, identifying which symptoms are interfering with work, leisure, or social functioning could serve as a foundation for tailored symptom management intervention research in PD.

This study has limitations as follows. First, the study sample size was a small convenience sample. Although data were collected in different U.S. regions, the predominant area was the mid-Atlantic region. Participants in the study were homogeneous in terms of race/ethnicity and educational attainment. The survey was developed by the research team and this was its initial usage. Symptoms were also self-reported by a dichotomous response and were not validated by health care professionals. Thus, further studies are needed to elaborate and validate the survey questions. The analyses conducted were exploratory and there are not many significant differences in the demographic and clinical variables by sex. However, there were limitations as possible confounding variables such as age, marital status, and the duration of PD were not considered in the data analyses. The findings of the study have limited generalizability to people with PD who have different demographic and symptom characteristics.

In conclusion, PD is a neurodegenerative disease that has a wide range of symptoms. Findings from this study showed differences in PD symptom reports by sex and duration of the disease. Given the multifaceted feature of symptoms, thorough assessment of motor and non-motor symptoms could decrease the risk of inadequate symptom management. Ongoing symptom assessment and treatment could improve function and quality of life in people with

PD. Finally, provision of information regarding PD symptoms at each stage may help people with PD and their caregivers in planning their future care and life.

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Table 1

Sample Characteristics by Sex ($N = 141$).

Characteristics	Total n (%)	Male ($n = 84$) n (%)	Female ($n = 57$) n (%)	χ^2	p
Race/ethnicity				0.157	.692
Caucasian/White	134 (95.03)	81 (96.43)	53 (92.9)		
African American/Black	2 (1.42)	1 (1.19)	1 (1.75)		
Asian	2 (1.42)	1 (1.19)	1 (1.75)		
Multiracial	3 (2.13)	1 (1.19)	2 (3.6)		
Marital status				6.183	.186
Married	123 (87.2)	75 (89.3)	48 (84.2)		
Widowed	9 (6.4)	3 (3.6)	6 (10.5)		
Divorced	5 (3.6)	2 (2.4)	3 (5.3)		
Single	4 (2.8)	4 (4.8)	0 (0.0)		
Employment				0.738	.390
Working	18 (13.3)	9 (11.3)	9 (16.4)		
Not working	117 (86.7)	71 (88.8)	46 (83.6)		
Annual household income				2.577	.765
>US\$20,000	8 (5.84)	3 (3.6)	5 (9.4)		
US\$20,000–US\$39,999	10 (7.3)	7 (8.3)	3 (5.7)		
US\$40,000–US\$59,999	23 (16.8)	15 (17.9)	8 (15.1)		
US\$60,000–US\$99,999	25 (18.24)	16 (19.0)	9 (17.0)		
More than US\$100,000	44 (32.11)	26 (31.0)	18 (34.0)		
Do not wish to respond	27 (19.7)	17 (20.2)	10 (18.9)		
Global health				5.341	.148
Excellent	16 (11.3)	7 (8.3)	9 (15.8)		
Good	73 (51.8)	43 (51.2)	30 (52.6)		
Fair	48 (34.0)	33 (39.3)	15 (26.3)		
Poor	4 (2.8)	1 (1.2)	3 (5.3)		
Difficulty in activities of daily living					
Bathing and showering	22 (13.7)	16 (19.0)	6 (10.7)	1.762	.184
Dressing	50 (35.7)	38 (45.2)	12 (21.4)	8.296	.004

Characteristics	Total n (%)	Male (n = 84) n (%)	Female (n = 57) n (%)	χ^2	p
Eating/feeding (including chewing and swallowing)	33 (23.6)	26 (31.0)	7 (12.5)	6.350	.012
Functional mobility	63 (45.0)	40 (47.6)	23 (41.1)	0.582	.446
Personal hygiene and grooming (brushing/combing/styling hair)	15 (10.7)	9 (10.7)	6 (10.7)	0.000	1.00
Toilet hygiene (completing the act of urinating/defecating)	24 (17.1)	17 (20.2)	7 (12.5)	1.416	.234
Chronic disease					
Diabetes	12 (8.6)	8 (9.6)	4 (7.0)	0.296	.586
Cancer	26 (18.6)	19 (22.9)	7 (12.3)	2.516	.113
Coronary artery disease	17 (12.1)	15 (18.1)	2 (3.5)	6.718	.010
Myocardial infarction	4 (2.9)	4 (4.8)	0 (0)	2.828	.093
Hypertension	54 (38.6)	37 (44.6)	17 (29.8)	3.105	.078
Hyperlipidemia	49 (35)	32 (38.6)	17 (29.8)	1.132	.287
Depression	49 (35)	32 (38.6)	17 (29.8)	1.132	.287
Anxiety	56 (40)	37 (44.6)	19 (33.3)	1.780	.182

Table 2

PD Symptom Reported by Sex ($N = 141$).

Symptoms	Total n (%)	Male ($n = 84$) n (%)	Female ($n = 57$) n (%)	χ^2	p
Motor symptoms					
Bradykinesia	99 (70.7)	60 (72.3)	39 (68.4)	0.244	.706
Rigidity	91 (65.0)	60 (72.3)	31 (54.4)	4.761	.032
Resting tremor	85 (60.7)	54 (65.1)	31 (54.4)	1.614	.222
Postural instability	78 (55.7)	51 (61.4)	27 (47.4)	2.714	.120
Freezing	54 (38.6)	36 (43.4)	18 (31.6)	1.894	.216
Off periods	52 (37.1)	29 (34.9)	23 (40.4)	0.424	.594
Dyskinesia	47 (33.6)	28 (33.7)	19 (33.3)	0.002	1.00
Dystonia	28 (20.0)	17 (20.5)	11 (19.3)	0.030	1.00
Non-motor symptoms					
Sleep problems	98 (66.4)	50 (60.2)	43 (75.4)	3.500	.07
Fatigue/excessive tiredness	92 (65.7)	55 (66.3)	37 (64.9)	0.027	1.00
Bladder urgency	87 (62.1)	51 (61.4)	36 (63.2)	0.042	.861
Decreased sense of smell	83 (59.3)	49 (59.0)	34 (59.6)	0.005	1.00
Constipation	80 (57.1)	47 (56.6)	33 (59.6)	0.022	1.00
Memory problems	77 (55.0)	52 (62.7)	25 (43.9)	4.821	.038
Excessive salivation and/or drooling	71 (50.7)	48 (57.8)	23 (40.4)	4.131	.058
Speech problems	67 (47.9)	46 (55.4)	21 (36.8)	4.675	.039
Difficulty with concentration	62 (44.3)	39 (47.0)	23 (40.4)	0.603	.491
Anxiety	57 (40.7)	37 (44.6)	20 (35.1)	1.261	.296
Sexual dysfunction	53 (37.9)	49 (59.0)	4 (7.0)	38.869	<.001
Bladder incontinence	51 (36.4)	27 (32.5)	24 (42.1)	1.338	.285
Sensory problems: pain, tightness, tingling, burning	48 (34.3)	29 (34.9)	19 (33.3)	0.039	.859
Swallowing problems	48 (34.3)	33 (39.8)	15 (26.3)	2.711	.107
Apathy	48 (34.3)	33 (39.8)	15 (26.3)	2.711	.107
Mood changes (depression)	46 (32.9)	30 (36.1)	16 (32.9)	0.999	.363
Orthostatic hypertension	38 (27.1)	27 (32.5)	11 (19.3)	2.992	.121
Socializing problems	38 (27.1)	30 (34.1)	8 (14.0)	8.353	.004

Symptoms	Total <i>n</i> (%)	Male (<i>n</i> = 84) <i>n</i> (%)	Female (<i>n</i> = 57) <i>n</i> (%)	χ^2	<i>p</i>
Leisure/hobby-related problems	33 (23.6)	24 (28.9)	9 (15.8)	3.232	.104
Hallucinations/psychosis	24 (17.1)	14 (16.9)	10 (17.5)	0.011	1.00
Excessive sweating	24 (17.1)	12 (14.5)	12 (21.1)	1.035	.364
Self-care problems	17 (12.1)	9 (10.8)	8 (14.0)	0.323	.606
Work-related problems	16 (11.4)	9 (10.8)	7 (12.3)	0.069	.793
Impulsive behaviors	14 (10.0)	6 (7.2)	8 (14.0)	1.739	.252

Note. PD = Parkinson's disease.

Table 3

PD Symptom Reported by Disease Duration ($n = 137$).

Symptoms	PD	5 years ($n = 73$) n (%)	6 < PD	10 years ($n = 42$) n (%)	PD > 10 years ($n = 22$) n (%)	χ^2	p
Motor symptoms							
Resting tremor		49 (68.1)		24 (57.1)	10 (45.5)	4.005	.135
Bradykinesia		48 (66.7)		34 (81.0)	16 (72.7)	2.695	.260
Rigidity		43 (59.7)		32 (76.2)	14 (63.6)	3.219	.200
Postural instability		34 (47.2)		23 (54.8)	19 (86.4)	10.503	.005
Freezing		21 (29.2)		18 (42.9)	13 (59.1)	6.939	.031
Off periods		21 (29.2)		18 (42.9)	13 (59.1)	6.939	.031
Dyskinesia		19 (26.4)		15 (35.7)	12 (54.5)	6.066	.048
Dystonia		16 (22.2)		6 (14.3)	6 (27.3)	1.739	.419
Non-motor symptoms							
Sleep problems		50 (69.4)		28 (66.7)	14 (63.8)	0.286	.867
Bladder urgency		45 (62.5)		27 (64.3)	13 (59.1)	0.166	.920
Fatigue/excessive tiredness		44 (61.1)		32 (76.2)	13 (59.1)	3.135	.209
Decreased sense of smell		43 (59.7)		28 (66.7)	9 (40.9)	4.006	.135
Memory problems		42 (58.3)		20 (47.6)	12 (54.5)	1.228	.541
Constipation		40 (55.6)		26 (61.9)	11 (50.0)	0.903	.637
Excessive salivation and/or drooling		32 (44.4)		25 (59.5)	11 (50.0)	2.413	.299
Difficulty with concentration		29 (40.3)		18 (42.9)	12 (54.5)	1.403	.496
Anxiety		28 (38.9)		18 (42.9)	9 (40.9)	0.176	.916
Speech problems		26 (36.1)		26 (61.9)	12 (54.5)	7.674	.022
Sensory problems: pain, tightness, tingling, burning		26 (36.1)		11 (26.2)	10 (45.5)	2.532	.282
Bladder incontinence		25 (34.7)		17 (40.5)	7 (31.8)	0.583	.747
Swallowing problems		24 (33.3)		16 (38.1)	6 (27.3)	0.772	.680
Apathy		23 (31.9)		16 (38.1)	9 (40.9)	0.802	.670
Mood changes (depression)		22 (30.6)		15 (35.7)	8 (36.4)	0.446	.800
Orthostatic hypertension		22 (30.6)		10 (23.8)	5 (22.7)	0.875	.646
Sexual dysfunction		22 (30.6)		21 (50.0)	8 (36.4)	4.294	.117
Socializing problems		17 (23.6)		14 (33.3)	7 (31.8)	1.144	.486

Symptoms	PD	5 years (<i>n</i> = 73) <i>n</i> (%)	6 < PD	10 years (<i>n</i> = 42) <i>n</i> (%)	PD > 10 years (<i>n</i> = 22) <i>n</i> (%)	χ^2	<i>p</i>
Leisure/hobby-related problems		14 (19.4)		13 (31.0)	6 (27.3)	2.041	.360
Excessive sweating		10 (13.9)		7 (16.7)	6 (27.3)	2.151	.341
Hallucinations/psychosis		8 (11.1)		6 (14.3)	8 (36.4)	8.085	.018
Self-care problems		7 (9.7)		4 (9.5)	5 (22.7)	3.039	.219
Work-related problems		7 (9.7)		5 (11.9)	4 (18.2)	1.163	.559
Impulsive behaviors		6 (8.3)		3 (7.1)	5 (22.7)	4.434	.109

Note. PD = Parkinson's disease.