https://doi.org/10.48047/AFJBS.5.3.2023.199-220

African Journal of Biological Sciences

Journal homepage: http://www.afjbs.com

Research Paper
Open Access

Exploring the Interplay: Sociodemographic Factors and Their Impact on Nonmotor Symptoms and Caregiver Dynamics in Parkinson's Patients

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Volume 5, Issue 3, Sep 2023

Received: 15 Aug 2023

Accepted: 05 Sep 2023

Published: 23 Sep 2023

doi:10.48047/AFJBS.5.3.2023.199-220

ABSTRACT

Background:Parkinson's disease is becoming a common neurodegenerative disorder and there's a growing recognition of the importance of investigating its non-motor symptoms. These symptoms, ranging from cognitive impairment to sleep disturbances, greatly impact patients' quality of life and require more attention in research and clinical practice for better management and care. Thus, it was imperative to conduct this study to establish the actual impact of sociodemographic data among Parkinson's patients on their non motor symptoms and associated caregiver burden. This in turn would assist in early identification of vulnerable groups and provide appropriate rehabilitation.
Methodology: The outcome measure used to assess non motor symptoms and caregiver burden were non motor symptoms questionnaire and Zarit burden interview respectively which are standardized tools. Data was collected to assess the same after informed consent from Parkinson's patients and their caregivers attending the multidisciplinary clinic at our hospital. Data analysis and scoring were done using spearman's rank correlation coefficient.
Result: There is strong positive correlation between age and caregiver burden that is statistically significant. There is a weak negative association between gender, comorbidities, total duration, non motor symptoms and caregiver burden that is not statistically significant.
Conclusion: Age is a significant contributing cause for caregiver burden among Parkinson's Patients

Keywords: Parkinson's Disease, non motor symptoms, sociodemographic factors, caregiver burden, Neurodegenerative Disorder.

INTRODUCTION

Parkinson’s disease (PD) is a chronic neurodegenerative disorder with a prevalence rate of 108 - 257 per 100,000 people, occurring in the later half of life and affecting both genders equally. The progressive nature of Parkinson's disease leads to increasing disability, significantly impacting the quality of life of affected individuals.

Quality of life (QOL) is key in every rehabilitation process and its effect on the disease process, stages and prognosis is closely associated, which is often neglected [1].

Non-motor symptoms (NMS) are consequential determinants of disability and quality of life in persons with Parkinson’s disease. Non-motor symptoms (NMS) of PD are an unnoticed entity, which is therefore also often unattended. NMS tends to start in the subclinical phase of PD in some cases, while in others it may inevitably emerge through the progression of the disease in association with motor symptoms [2].

Non-motor symptoms in Parkinson's disease are a collection of symptoms that can significantly impact a patient's quality of life. These symptoms are not directly related to movement and can affect various bodily systems. Sensory abnormalities can include an impaired sense of smell, vision disturbances like dry eye syndrome, convergence insufficiency, reduced contrast sensitivity, and impaired color discrimination, and abnormal pain sensitivity. Neuropsychiatric and cognitive manifestations are also common, and can include depression, anxiety, panic attacks, anhedonia, apathy, executive dysfunction, fear, dementia, psychosis, delusions, and hallucinations. Dopamine dysregulation syndrome and impulse control disorders, such as pounding, can also occur. Fatigue is a frequent symptom, impacting daily life. Autonomic disturbances are also prevalent and can affect several systems. Gastrointestinal disturbances include dysphagia, gastroparesis, constipation, drooling of saliva, and impaired gastric emptying. Cardiovascular problems include orthostatic hypotension, which can occur at night (nocturnal hypotension) and after meals (postprandial hypotension). Urinary problems can manifest as urgency, nocturia (caused by detrusor overactivity), and frequency. Reproductive system issues can involve premature ejaculation, difficulty reaching orgasm, and erectile dysfunction. Thermoregulation problems may present as heat or cold intolerance and paroxysmal drenching sweats. Sleep disturbances are common in Parkinson's disease, including rapid eye movement sleep behavior disorder, restless leg syndrome, insomnia, excessive daytime sleepiness, and sleep-disordered breathing.

Parkinson's disease (PD) presents unique challenges due to its complex and chronic nature, marked by the emergence and progression of both motor and non-motor symptoms. This study proposes a multifaceted approach to managing PD, emphasizing the diverse ways the disease manifests in patients. A notable challenge in PD care is the wide range of symptom severity among individuals; some individuals may experience minimal symptoms for extended periods, while others face a more rapid decline. This variability in disease presentation necessitates tailored management strategies, prompting a shift in the approach of care teams towards developing individualized and holistic care plans. [3].

This study aspires to investigate how sociodemographic factors among Parkinson's patients affect their non-motor symptoms and the burden experienced by their caregivers. Identifying these connections can help pinpoint at-risk populations sooner and facilitate the delivery of targeted rehabilitation strategies.

REVIEW OF LITERATURE

Parkinson's disease (PD) is considered one of the most prevalent neurodegenerative diseases, ranking second in terms of its impact on the central nervous system. Its occurrence is estimated to affect 1 to 2 individuals per 1,000 in the general population. This prevalence significantly increases with age, reaching 1% in individuals over 60 years old and approximately 4% in the oldest age groups. However, it remains relatively uncommon before the age of 50.

The increasing number of PD patients is a growing concern. This trend, coupled with the progressive and disabling nature of the disease, necessitates greater attention toward understanding its diverse symptoms, improving management strategies, and enhancing the quality of life for those affected. [4].

There is a growing understanding that Parkinson's disease (PD) presents with significant phenotypic variability in both its motor and non-motor symptoms. Factors such as age and gender may play a pivotal role in shaping disease phenotype, potentially through mechanisms unrelated to disease progression or differences in underlying pathology [5].

Non-motor symptoms are common in Indian patients with Parkinson's disease and may precede motor symptoms. The number of NMS increases with Hoehn and Yahr (H&Y) stage, age over 70 years, disease duration, and later onset.

Mood symptoms and pedal edema are more prevalent in younger patients, while other non-motor symptoms are more common in older patients [6].

In a study conducted by Solla et al., it was found that women with Parkinson's disease were more likely than men to present with tremor as an initial symptom ($p < 0.05$) and had worse UPDRS instability scores ($p < 0.05$). The NMSS score was significantly higher in females compared to males ($p < 0.05$), with greater severity noted in cardiovascular ($p < 0.01$), sleep/fatigue ($p < 0.005$), and mood/apathy ($p < 0.01$) domains. In contrast, males reported higher scores in the sexual dysfunction domain ($p < 0.05$). Additionally, symptoms such as fatigue ($p < 0.05$), lack of motivation ($p < 0.05$), and sadness ($p < 0.01$) were more frequently observed in females, whereas males showed a higher frequency of altered interest in sex ($p < 0.01$). Females also exhibited a significantly higher frequency of depression ($p < 0.05$) and anxiety ($p < 0.01$), while compulsive sexual behaviors were more frequent in males ($p < 0.05$).

Both female and male PD patients exhibited a higher frequency of non-motor symptoms across eight domains compared to controls ($p < 0.01$ for all, except urinary disturbances in females, $p < 0.01$). Sexual dysfunctions, however, did not significantly differ in PD patients compared to controls [7].

In Parkinson's disease, dopamine markers within the dorsal putamen fibers decrease progressively, showing moderate to marked reductions within the first four years post-diagnosis, and becoming nearly absent by Year 4 and beyond. Parkinson’s disease, a synucleinopathy, is marked by degeneration of the dopaminergic nigrostriatal pathway, which underpins the disease’s characteristic motor symptoms. In advanced stages, the substantia nigra pars compacta (SNc) undergoes severe neuronal loss, particularly in the caudal and ventrolateral regions. Striatal dopamine levels drop by 44–98% in advanced PD, with approximately 50% reductions in tyrosine hydroxylase and vesicular monoamine transporter 2 (VMAT2) staining observed even in individuals with incidental Lewy bodies. However, to date, no studies have sequentially assessed the progression of dopaminergic terminal degeneration at different stages of Parkinson’s disease, and limited data exist on the condition of SNc dopamine neurons over the full disease course [8]

The priorities of people affected by Parkinson’s Disease for improving life are diverse, personal and change substantially with duration of the disease. They reinforce previous research identifying the importance of non-motor issues to quality of life in PD and underscore that PD is much more than a movement disorder. In contrast to some earlier studies that proposed non-motor symptoms become more significant to patients as time progresses, the results of this study suggest that non-motor symptoms are significant to individuals affected by Parkinson's disease right from the earliest stages of the condition [9].

Variations in the presentation of non-motor symptoms among Parkinson’s disease patients could significantly impact their management and prognosis. Gender, as a fundamental epidemiological variable, may influence such expression. Among the most prevalent symptoms, Nocturia (64.88%) and Fatigue (62.78%) stood out, with the most affected domains being Sleep/Fatigue (84.02%) and Miscellaneous (82.44%).

Symptoms such as fatigue, nervousness, sadness, constipation, restless legs, and pain were more prevalent and severe in women with Parkinson’s disease. In contrast, men experienced higher prevalence and severity of daytime sleepiness, drooling, and issues related to sexual interest and performance. Regarding NMSS domains, Mood/Apathy and Miscellaneous problems—including pain, loss of taste or smell, weight changes, and excessive sweating—were more commonly affected in women, whereas Sexual dysfunction was more pronounced in men [10].

In another study, Parkinson's disease men demonstrated a notably stronger positive association with nearly all non-motor symptoms compared to women, except for urinary disturbances. Furthermore, concerning the general population, the presence of NMS was more strongly associated with male gender [11].
In a study by OuR et al., it was found that non-motor symptoms (NMS) in Parkinson's disease tend to worsen as the disease advances. Additionally, the frequency of individual NMS varied across different age groups, though the severity of each symptom remained relatively consistent regardless of age [12].

In a study by Picillo M et al., symptoms such as fatigue, sadness, nervousness, constipation, pain, and restless legs were reported to be more common and severe in women with Parkinson’s disease. Conversely, men exhibited a higher prevalence and severity of sexual interest, dribbling saliva, daytime sleepiness, and sexual dysfunction. Additionally, the Mood/Apathy and Miscellaneous domains—which include issues like pain, loss of taste or smell, weight changes, and excessive sweating—were more significantly affected in women, whereas sexual dysfunction was more prominent in men [11, 13].

Diabetes mellitus might predispose individuals to a Parkinson-like pathology, and its presence in patients with Parkinson's disease may induce a more aggressive phenotype [14].

Blood pressure dysregulation in Parkinson’s disease presents significant clinical challenges and remains a persistent concern. Although chronic essential hypertension has been widely studied, the combination of neurogenic orthostatic hypotension and supine hypertension in Parkinson’s disease has received comparatively less attention. If left untreated, hypertension can increase the risk of cardiovascular disease, while hypotension may elevate the likelihood of fall-related complications, both of which considerably impact patients' quality of life [15].

Thyroid dysfunction may manifest or be associated with a variety of hypo- and hyperkinetic movement disorders.The pathophysiology of movement disorders that is associated with thyroid disease still remain poorly understood and requires detailed case documentation with systematic and experimental studies of the relationships between thyroid and movement disorders and the brain regions involved [16].

Parkinson's disease (PD) is a neurodegenerative disorder marked by the loss of dopaminergic neurons. The dopaminergic system is closely connected with the hypothalamic–pituitary–thyroid (HPT) axis. Dopamine (DA) upregulates thyrotropin-releasing hormone (TRH) while downregulating thyroid-stimulating hormone (TSH) and thyroid hormones. Additionally, TRH stimulates DA release. PD is associated with dysregulation of TSH and thyroid hormone levels, which correlate with disease severity and subtypes. Treatments such as levodopa and bromocriptine can further impact the HPT axis. Thyroid disorders, including hyperthyroidism, hypothyroidism, Graves' disease, and Hashimoto’s thyroiditis, not only elevate the risk of PD but also share certain clinical features with it [17].

Despite its neurodegenerative nature, recent findings suggest that vascular risk factors, like arterial hypertension, prior stroke, coronary artery disease and diabetes increase the incidence of PD. Moreover, vascular risk factors also predict worse progression of motor or cognitive symptoms [18]. History of stroke and Coronary Artery Disease was associated with PD in two Chinese population-based cohorts. These findings suggest that vascular disease may play a role in the pathogenesis of PD. Therefore, it remains important to investigate the mechanisms linking stroke and coronary artery disease (CAD) with PD, with the potential to prevent or treat PD by modifying vascular factors in the future [19].

Parkinson's disease is linked to dysfunction of the enteric nervous system and dysbiosis of gut microbiota. Alterations in serum short-chain fatty acids (SCFAs) have been observed in PD patients, with decreased levels of serum propionic acid specifically correlating with motor symptoms, cognitive function, and a non-depressed state [20].

Hence this study aims to examine how sociodemographic factors, non-motor symptoms, and caregiver burden are interconnected or influence each other among Parkinson's patients.

METHODOLOGY

A cross sectional study was done among Parkinson patients and their caregivers. In the current study the sample consisted of 65 patients from all Parkinson patients and their caregivers attending the multidisciplinary clinic in Believers Church Medical College Hospital, Thiruvalla, Kerala. The duration of data collection was 6 months from January 2023 to June 2023. Convenient sampling technique was used to collect the sample.

The caregiver burden was measured utilizing the Zarit Burden Interview (ZBI).This measure was found to have excellent psychometric properties with a Cronbach’s alpha coefficient of 0.91 in a previous study using the same sample as that of the current study. This instrument was translated from English into Malayalam and then retranslated by other translators. The non-motor symptoms, measured using the Non-Motor Symptom Questionnaire (NMSQ) with psychometric properties of

Cronbach's alpha of 0.77. NMSQ consists of 30 items.This instrument was translated from English into Malayalam and then retranslated by other translators.

Inclusion criteria includes all patients diagnosed with PD and their caregivers and exclusion criteria of patients with brain injury, patients with dementia, patients who did not give informed consent and who are not cooperative for study.

After explaining the purpose and confidentiality of the study, a written informed consent form was obtained from the participants. In this study, a socio-demographic sheet was used to collect information regarding relevant variables such as name, age, gender, education, duration of illness and comorbidities. The investigator met the participants individually and received consent to participate in the study and collected data from participants through a multidisciplinary clinic. The collected data was scored according to the scoring procedures. Data was analyzed by scoring the response.

RESULT

Table 1 shows the Correlation of the scores with age and the scores of NMSQ (Non motor Symptom Questionnaire) and CGB (Caregiver burden)

Sample 1	**Sample 2**	**N**	**Correlation**	**P-Value**
NMSQ TOTAL SCORE	Age	65	0.215	0.085 (NS)
CGB Total Score	Age	65	0.268	0.031*
CGB Total Score	NMSQ TOTAL SCORE	65	0.406	0.001*

Table 1 shows the association between NMSQ total score, Caregiver burden and age. Age showed a weak positive correlation with both the NMSQ (Non motor Symptom Questionnaire) total score (r = 0.215, p = 0.085) and strong correction with the CGB (Caregiver burden) total score (r = 0.268, p = 0.031).

Table 1 presents the results of a study examining the relationship between age, non-motor symptoms in Parkinson's Disease, and caregiver burden. Age showed a weak positive correlation with the NMSQ (Non-motor Symptom Questionnaire) total score (r = 0.215, p = 0.085). This weak correlation, which was not statistically significant, suggests that while there may be a slight trend for non-motor symptoms to increase with age, age alone is not a strong predictor of non-motor symptom severity in this sample of Parkinson's patients. There was a strong positive correlation between age and the CGB (Caregiver burden) total score (r = 0.268, p = 0.031). This correlation means that as the age of the Parkinson's patient increased, the burden on their caregiver also tended to increase. This finding was statistically significant, suggesting that age is likely an important factor contributing to caregiver burden. As Parkinson's patients age, they may experience greater physical and cognitive decline, leading to increased dependence on caregivers for help with daily tasks. Older Parkinson's patients may have more health complications and comorbidities, requiring more complex care from their caregivers. Caregivers may experience greater emotional stress as they witness the decline in their loved one's health over time. Finally, the results shows a statistically significant, strong positive correlation between the NMSQ total score and the CGB total score (r = 0.406, p = 0.001). This result indicates that as non-motor symptoms become more severe, the burden on the caregiver also tends to increase. This finding highlights the substantial impact that non-motor symptoms can have not only on the individual with Parkinson's disease, but also on those who provide care and support for them.

Table 2 shows the Correlation of the scores with total duration of illness and the scores of NMSQ (Non motor Symptom Questionnaire) and CGB (Caregiver burden)

Sample 1	**Sample 2**	**N**	**Correlation**	**P-Value**
NMSQ TOTAL SCORE	Total duration	65	0.171	0.174
CGB Total Score	Total duration	65	0.162	0.197

Tables 2 shows the association between variables in total Scores of NMSQ, CGB and total duration indicates weak negative correlation between the NMSQ total score and total duration (r = 0.171, p = 0.174), as well as between the CGB total score and total duration (r = 0.162, p = 0.197).

Table 2 displays the correlations between the total duration of Parkinson's disease and both the Non-motor Symptom Questionnaire (NMSQ) total score and Caregiver Burden (CGB) total score. The result reveals a weak negative correlation between the NMSQ total score and total duration of illness (r = 0.171, p = 0.174). This means that as the duration of the illness increased, there was a slight tendency for the severity of non-motor symptoms to decrease. However, this correlation was not statistically significant. Similarly, there is a weak negative correlation between the CGB total score and the total duration of illness (r = 0.162, p = 0.197). This correlation indicates that there was a slight tendency for caregiver burden to decrease as the duration of the illness increased.

However, like the correlation between NMSQ score and duration, this correlation was also not statistically significant. The weak negative correlations between disease duration, non-motor symptom severity, and caregiver burden may be due to Treatment adjustments: As Parkinson's disease progresses, healthcare providers often adjust treatment regimens to better manage symptoms. These adjustments may lead to some relief from non-motor symptoms over time, contributing to a lower NMSQ score. Development of coping mechanisms: Patients and caregivers may develop coping mechanisms and strategies to manage the challenges of the illness over time. These could include lifestyle modifications, psychological interventions, or support from social networks. Selective survival: Individuals with more severe non-motor symptoms may have shorter survival times, potentially leading to a negative correlation between NMSQ total score and duration of illness. Heterogeneity in disease progression: The rate of progression of non-motor symptoms in Parkinson's disease varies among individuals. This variability can weaken the correlation between NMSQ total score and illness duration. Psychological adjustment: Patients may experience psychological growth and resilience as they adapt to living with a chronic illness. This can impact their perception of non-motor symptoms and result in a lower NMSQ score over time. Caregiver adaptation: As the disease progresses, caregivers may become more adept at managing caregiving tasks due to experience or by seeking out support and resources. Stabilization of patient's condition: The patient's condition may stabilize after a certain period, leading to a more predictable caregiving routine and potentially reducing caregiver burden.

Table 3 shows the Association of the scores with gender and the categories of NMSQ (Non motor Symptom Questionnaire)

	Mild	**Moderate**	**Severe**	**All**	**Pearson Chi-square**	**Likelihood Ratio**	**P Value**
Female	5	18	3	26	2.405	2.365	0.30 (NS)
Male	3	33	3	39			

Table 3 shows the association between NMSQ categories by gender. In the mild category, there were 5 females and 3 males, while in the moderate category, there were 18 females and 33 males. In the severe category, there were 3 females and 3 males. Overall, out of the 65 individuals surveyed, 26 were female and 39 were male. The chi-square test was conducted to assess the association between gender and NMSQ category. The results of both the Pearson and Likelihood

Ratio chi-square tests indicate that there was no statistically significant association between gender and NMSQ category, with p-values of 0.300 and 0.306, respectively.

Table 3, which shows the distribution of men and women across the different categories of non-motor symptom severity, demonstrates that there is no statistically significant relationship between gender and non-motor symptom severity in this sample. While the table shows that there are more men than women in the moderate category and more women than men in the mild category, the p-values for both the Pearson Chi-Square and Likelihood Ratio Chi-Square tests are greater than 0.05 (p= 0.300 and p= 0.306, respectively). This indicates that the observed difference in the distribution of men and women across the NMSQ categories is likely due to chance and not a reflection of a true relationship between gender and non-motor symptom severity in the population from which this sample was drawn. Many studies have found gender differences in the prevalence and types of non-motor symptoms experienced by people with Parkinson's Disease. However, these findings have not been consistent across all studies, and it is possible that the relationship between gender and non-motor symptoms is complex and influenced by various factors, such as age, disease duration, genetics, and environmental exposures.

Table 4 shows the Association of the scores with gender and the categories of caregiver burden

	Little or No Burden	**Mild to Moderate Burden**	**Moderate to Severe Burden**	**Severe Burden**	**All**	**Pearson Chi-square**	**Likelihood Ratio**	**P Value**
Female	17	4	4	1	26	5.414	5.983	NA
Male	18	15	6	0	39			
All	35	19	10	1	65			

Table 4 shows the association between CGB categories by gender. In the no burden category, there were 17 females and 18 males, while in the mild to moderate category, there were 4 females and 15 males. In the moderate to severe category, there were 4 females and 6 males. In the severe category, there were 1 female and 0 males.Overall, out of the 65 individuals surveyed, 26 were female and 39 were male. The chi-square test was conducted to assess the association between gender and NMSQ category. The results of both the Pearson and Likelihood Ratio chi-square tests indicate that there was no statistically significant association between gender and CGB category, with p-values of 5.414 and 5.983 respectively.

Table 4 examines the relationship between caregiver burden and gender. While the results shows some differences in the distribution of men and women across the caregiver burden categories, with more women falling into the "no burden" category and more men in the "mild to moderate burden" category, the results of the chi-square tests show that there is no statistically significant association between gender and caregiver burden (p = 5.414 for the Pearson Chi-Square and p = 5.983 for the Likelihood Ratio Chi-Square). This finding suggests that, within this specific study, gender alone may not be a strong predictor of caregiver burden in individuals caring for people with Parkinson's disease. It is important to acknowledge that this finding contradicts other studies that have identified gender differences in caregiving experiences. As noted in the previous turn of our conversation, some research suggests that women may experience a greater burden when providing care, potentially due to societal expectations and gender roles. This discrepancy in findings highlights the complexity of caregiver burden, which is likely influenced by a wide range of factors beyond gender, such as The severity of the patient's illness, The duration of caregiving, The caregiver's age and health status, The availability of social support, The caregiver's coping skills and resilience, The lack of a statistically significant association between gender and caregiver burden in this particular study may be due to the small sample size or the unique characteristics of the individuals included in the sample. Further research with larger and more diverse samples is needed to more fully explore the complex interplay of factors contributing to caregiver burden in Parkinson's disease.

Table 5 shows the Association of the scores with the presence or absence of any comorbidity. and the categories of NMSQ

	Mild	**Moderate**	**Severe**	**All**	**Pearson Chi-square**	**Likelihood Ratio**	**P Value**
N	1	10	1	12	0.246	0.265	0.884 (NS)
Y	7	41	5	53			
All	8	51	6	65			

Table 5 shows the association between the total score of NMSQ based on the presence or absence of any comorbidity like Systemic Hypertension, Diabetes Mellitus, Dyslipidemia, Thyroid

Disorders like Hypothyroidism etc. In the mild category, there was 1 individual without comorbidities and 7 individuals with comorbidities. In the moderate category, there were 10 individuals without comorbidities and 41 individuals with comorbidities. In the severe category, there was 1 individual without comorbidities and 5 individuals with comorbidities. Overall, out of the 65 individuals surveyed, 12 had no comorbidities and 53 had comorbidities. The chi-square test was conducted to assess the association between the presence of any comorbidity and NMSQ category. The results of both the Pearson and Likelihood Ratio chi-square tests indicate that there was no statistically significant association between the presence of any comorbidity and NMSQ total score with p-values of 0.884 and 0.876, respectively.

Table 5 examines the relationship between the presence of comorbidities and the severity of non-motor symptoms in Parkinson's disease as measured by the NMSQ. The table shows the distribution of individuals with and without comorbidities across the mild, moderate, and severe NMSQ categories. Although there are some differences in the distribution of individuals with and without comorbidities, the chi-square test reveals that there is no statistically significant association between the presence of any comorbidity and NMSQ total score (p = 0.884 for the Pearson Chi-Square and p = 0.876 for the Likelihood Ratio Chi-Square).

This means that, in this study, having comorbidities such as hypertension, diabetes mellitus, dyslipidemia, or thyroid disorders was not associated with a significant difference in non-motor symptom severity in individuals with Parkinson's disease. The Lack of Association of association may be due to factors such as Sample size and characteristics: The study's sample size is relatively small (65 participants), which may limit the statistical power to detect a true association between comorbidities and non-motor symptom severity. Types and severity of comorbidities: The study does not provide details about the specific types and severities of the comorbidities present in the participants. It is possible that the presence of certain comorbidities or a higher burden of comorbidities might have a greater impact on non-motor symptoms than others. Individual variability in disease progression and symptom manifestation: Parkinson's disease is known to have a heterogeneous clinical presentation, with considerable variability in disease progression and symptom expression among individuals. This inherent variability could mask potential associations between comorbidities and non-motor symptom severity. Treatment effects: The study doesn't mention whether participants were receiving treatment for their comorbidities.

Effective management of comorbidities could potentially mitigate their impact on non-motor symptoms, leading to a weaker association.

Table 6 shows the Association of the scores with the presence or absence of any comorbidity and the categories of caregiver burden

	Little or No Burden	**Mild to Moderate Burden**	**Moderate to Severe Burden**	**Severe Burden**	**All**	**Pearson Chi-square**	**Likelihood Ratio**	**P Value**
N	6	3	3	0	12	1.241	1.320	NA
Y	29	16	7	1	53			
All	35	19	10	1	65			

Table 6 shows the association between CGB category by the presence of any comorbidity.In the no burden category, there were 6 patients have no Comorbidity and 29 with Comorbidities like Systemic Hypertension, Diabetes Mellitus, Dyslipidemia, Thyroid Disorders like Hypothyroidism etc, while in the mild to moderate category,there were 3 patients who have no Comorbidities and 16 with Comorbidities. In the moderate to severe category,there were 3 patients with no Comorbidities and 7 with Comorbidities. In the severe category, there were 0 patients with no Comorbidity and 1 with Comorbidities. Overall, out of the 65 individuals surveyed, 26 were female and 39 were male. The chi-square test was conducted to assess the association between the presence of any comorbidity and CGB category. The results of both the Pearson and Likelihood Ratio chi-square tests indicate that there was no statistically significant association between gender and CGB category, with p-values of 1.241 and 1.320 respectively.

Table 6, which shows the distribution of individuals with and without comorbidities across different caregiver burden categories, indicates that there is no statistically significant association between the presence of comorbidities in Parkinson's disease patients and the level of burden experienced by their caregivers (p = 1.241 for the Pearson Chi-Square and p = 1.320 for the Likelihood Ratio Chi-Square). Possible Explanations and Considerations could be The absence of a statistically significant association doesn't necessarily negate a potential connection between comorbidities and caregiver burden. Other factors beyond the mere presence or absence of comorbidities could play a more substantial role. Comorbidity management: Effective management of comorbidities could potentially mitigate their impact on the patient's overall well-being and, consequently, lessen the burden on caregivers. Caregiver support and resources: The availability of adequate support systems, resources, and coping strategies for caregivers could also influence the perceived burden, regardless of the presence of comorbidities. Individual variability in caregiving experiences: Caregiver burden is a subjective experience influenced by various personal factors such as resilience, coping mechanisms, and social support.

DISCUSSION

There is limited literature supporting NMSQ, Zarit caregiver burden and socio demographic details association available. In the present study a weak negative association that is not statistically significant, observed in the association between NMSQ and age of the Parkinson's patients. A poor association may be attributed to patients' understanding about age related cognitive decline and decline caused by parkinson’s disease. Parkinson's patients often undergo pharmacological and non-pharmacological treatments to manage their symptoms. These treatments may affect the manifestation and gravity of non-motor symptoms differently across age groups. For instance, older patients may have different medication regimens or may respond differently to treatment compared to younger patients, potentially influencing their NMSQ scores. There is moderate positive correction with the CGB (Caregiver burden) total score and age of parkinson patients. As patients age, they can experience a decline in physical and cognitive functioning, leading to increased dependency on caregivers for daily activities such as mobility assistance, medication management, and personal care. This increased dependence can heighten the caregiver's burden as they take on more responsibilities to support the patient's needs.With advancing age, Parkinson's patients may develop additional health complications and comorbidities, further complicating their care needs. These additional health issues may require more intensive caregiving support. As a result, caregivers may experience heightened stress and burden as they navigate the complexities of managing the patient's overall health and well-being.The emotional toll of caregiving can intensify as patients with Parkinson's disease age and their condition progresses. Caregivers may experience grief, frustration, and feelings of helplessness as they witness the deterioration of their loved one's health over time. These emotional challenges can contribute to increased caregiver burden, as caregivers struggle to cope with the ongoing demands of caregiving while managing their own emotional well-being.

A weak negative correlation between the NMSQ total score and total duration,as well as between the CGB total score and total duration. Over time, as the illness progresses, healthcare providers may adjust treatment regimens to better manage symptoms. These adjustments could involve optimizing medication dosages, introducing new therapies, or incorporating lifestyle changes. As a result, patients may experience some relief from non-motor symptoms, leading to a lower NMSQ total score.Patients and caregivers often develop coping mechanisms and strategies to manage the challenges posed by the illness as time goes on. These may include lifestyle modifications, psychological interventions, or support from social networks. With improved coping skills, patients may perceive their non-motor symptoms as less severe, resulting in a lower NMSQ total score.

In some cases, persons with more severe non-motor symptoms may have a shorter survival time compared to those with milder symptoms. This phenomenon, known as selective survival, could contribute to a negative correlation between NMSQ total score and duration of illness. Essentially, persons with more severe symptoms may not survive long enough for their illness duration to be prolonged, leading to a weaker correlation.Neurological disorders, such as Parkinson's disease and multiple system atrophy, exhibit considerable variability in disease progression among individuals. Some patients may experience a more rapid decline in non-motor symptoms early in the disease course. Others may have a slower progression of symptoms. This heterogeneity can attenuate the correlation between NMSQ total score and illness duration. As patients come to terms with their diagnosis and adapt to living with a chronic illness, they may experience psychological growth and resilience. This psychological adjustment can influence their perception of non-motor symptoms and their impact on daily life. Over time, patients may develop a more positive outlook and learn to manage their symptoms more effectively, resulting in a lower NMSQ total score. A weak negative correlation between the total score of Caregiver Burden (CGB) and the total duration of Parkinson's disease may be attributed to several underlying factors. Initially, as Parkinson's disease progresses over time, individuals with the condition may require more intensive care and assistance from their caregivers. However, as the disease advances, caregivers may gradually become more adept at managing the challenges associated with caregiving through experience and possibly seeking additional support or resources. Additionally, the patient's condition may stabilize or plateau after a certain duration, resulting in a somewhat predictable caregiving routine and potentially reducing the perceived burden on caregivers. Moreover, over time, caregivers and patients may develop coping mechanisms and strategies to reduce stressors associated with caregiving, further contributing to the observed weak negative correlation between caregiver burden and the total duration of Parkinson's disease.

The lack of a statistically significant association between gender and Non-Motor Symptoms Questionnaire (NMSQ) category, as indicated by both the Pearson and Likelihood Ratio chi-square tests with p-values of 0.300 and 0.306, respectively, could stem from various factors. While Parkinson's disease may exhibit differences in prevalence or symptomatology between genders in certain contexts, this particular sample might not reflect such disparities due to its size or composition. Additionally, the categorization of NMSQ scores into mild, moderate, and severe categories may not capture nuances in symptom severity experienced by individuals of different genders. Furthermore, individual variations in disease progression, treatment responses, and reporting biases could obscure any underlying associations between gender and NMSQ category. Therefore, despite differences in gender distribution across NMSQ categories, the lack of statistical significance suggests that gender alone may not be a reliable predictor of symptom severity as measured by the NMSQ in this specific sample.

The lack of a statistically significant association between gender and Caregiver Burden (CGB) category, suggests that gender alone may not be a predominant factor influencing caregiver burden among Parkinson's patients within this sample. While there are variations in the distribution of gender across different CGB categories, these differences may not be significant enough to establish a clear association between gender and caregiver burden. Other factors such as the severity of the patient's condition, the duration of caregiving, and the availability of social support networks could have more substantial effects on caregiver burden than gender alone. Additionally, the relatively small sample size and the specific characteristics of the surveyed population might limit the ability to detect significant associations between gender and caregiver burden. Therefore, while gender differences in caregiving experiences are recognized in broader contexts, this study's results suggest that gender may not be the primary determinant of caregiver burden among Parkinson's patients in this particular sample.

The lack of a statistically significant association between the presence of any comorbidity and the Non-Motor Symptoms Questionnaire (NMSQ) total score, suggests that the presence of comorbidities alone may not significantly impact the severity of non-motor symptoms among individuals with Parkinson's disease in this sample. While there are differences in the distribution of comorbidities across different NMSQ categories, these variations may not be substantial enough to establish a clear association between comorbidity status and non-motor symptom severity. Other factors such as the specific types and severity of comorbid conditions, the overall health status of the individuals, and individual variations in symptom manifestation could also contribute to the lack of a significant association. Additionally, the relatively small sample size and the specific characteristics of the surveyed population might limit the ability to detect significant associations between comorbidity status and non-motor symptom severity.

The lack of a statistically significant association between the presence of any comorbidity and Caregiver Burden (CGB) category, as indicated by both the Pearson and Likelihood Ratio chi-square tests yielding non-significant p-values, suggests that the presence of comorbidities alone may not be a primary determinant of caregiver burden among individuals with Parkinson's disease in this sample. Although there are variations in the distribution of comorbidities across different CGB categories, these differences may not be substantial enough to establish a clear association between comorbidity status and caregiver burden. Other factors, such as the severity and management of comorbid conditions, the overall health status of the individuals, and the availability of social support networks, could also influence caregiver burden. Additionally, individual variations in caregiving experiences and coping mechanisms may contribute to the lack of a significant association. Moreover, the relatively small sample size and the specific characteristics of the surveyed population might limit the ability to detect significant associations between comorbidity status and caregiver burden. Therefore, while comorbidities are recognized as potential contributors to caregiver burden in Parkinson's disease, this study's results suggest that their presence alone may not be the sole determinant of caregiver burden in this particular sample.

CONCLUSION

Age is an independent contributing cause for caregiver burden in Parkinson's Disease that is statistically significant in this study. Total duration of disease, comorbidities, age and gender are not independent causal factors for non motor symptoms in Parkinson's Disease. Total duration of disease, comorbidities and gender are not independent causal factors for caregiver burden in Parkinson's disease.

The study was aimed to investigate the relationships between sociodemographic factors, non-motor symptoms, and caregiver burden in Parkinson's disease. The study, conducted at Believers Church Medical College Hospital in Kerala, involved 65 Parkinson's patients and their caregivers. A statistically significant, positive correlation between the patient's age and the level of burden reported by the caregiver suggests that as patients age, the demands on their caregivers increase, possibly due to greater physical and cognitive decline, leading to increased dependence. The emotional toll of caregiving may also intensify with the patient's age, further contributing to the caregiver's burden.

Interestingly,there were no statistically significant correlations between the total duration of the illness, the presence of comorbidities, or gender, and the severity of non-motor symptoms or caregiver burden. This lack of association might be due to several factors like, treatment adjustments made over time, as well as coping mechanisms developed by both patients and caregivers, could potentially lessen the perceived severity of non-motor symptoms and caregiver burden. The heterogeneity of the disease progression could also contribute to the absence of clear correlations. Additionally, the relatively small sample size of the study might limit the ability to detect statistically significant relationships. These findings underscore the complexity of Parkinson's disease and the need for further research to explore the multifaceted nature of non-motor symptoms and caregiver burden.

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