ORIGINAL ARTICLE

INVESTIGACIÓN en DISCAPACIDAD

Vol. 11, No. 2
May-August 2025
pp 44-50
doi: 10.35366/121455

Demographic aspects of patients with Parkinson's disease at the National Rehabilitation Institute «Luis Guillermo Ibarra Ibarra» in Mexico City

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Keywords:
Parkinson's disease, hospital population, frequency, epidemiological study.

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Received: September 27th, 2024
Accepted: June 30th, 2025

Abstract

Introduction: Parkinson's disease (PD) is a highly disabling health problem that is clinically characterized by tremor at rest, bradykinesia, muscle stiffness and postural instability. **Objective:** to describe the demographic profile and health-related habits of patients with Parkinson's disease treated at the National Rehabilitation Institute «Luis Guillermo Ibarra Ibarra» (NRI-LGII) in Mexico City, in order to identify patterns relevant to disease understanding and prevention. **Material and methods:** the records of first-time patients with a diagnosis of PD who were seen in the Neurology Service of the NRI-LGII were reviewed. Sociodemographic information and medical histories were obtained through the Automated Hospital Information System (SAIH). A database was created, and statistical analysis was performed using SPSS version 17. **Results:** a total of 289 patients with PD were analyzed. The average age was 73.42 ± 11.34 years, with 118 (40.8%) men and 171 (59.2%) women. In the statistical analysis of habits such as smoking and alcohol consumption, both variables were statistically significant ($p < 0.001$), with χ^2 values of 42.3 and 41.1, respectively. Cross-tabulation by age, gender, smoking, and alcohol use revealed that women over 69 years of age who smoke ($p < 0.001$, $\chi^2 = 21.242$) had an odds ratio (OR) of 9.472 (95% confidence interval [95%CI]: 3.260-27.519) for alcohol consumption, compared to 4.0 for men. Finally, the Mantel-Haenszel test confirmed that the association between alcohol consumption and smoking differs significantly across strata ($\chi^2 = 33.84$, $p < 0.001$), with an odds ratio of 6.12 and a 95%CI of 3.25-11.52. **Conclusions:** the number of PD patients treated at the NRI-LGII is sufficient to support further research aimed at designing new preventive strategies and increasing access to care for this significant public health issue.

Abbreviations:
95% CI = 95% Confidence Interval
NRI-LGII = National Rehabilitation Institute «Luis Guillermo Ibarra Ibarra»
OR = Odds Ratio
PD = Parkinson's Disease

INTRODUCTION

Parkinson's disease (PD) is a highly disabling health problem is clinically manifested by motor symptoms such as tremor at rest, bradykinesia, muscle stiffness and

How to cite: Verduzco-Mendoza A, León-Hernández SR, Ávila-Luna AL, Bueno-Nava A, Olmos-Hernández AS, Gálvez-Rosas A. Demographic aspects of patients with Parkinson's disease at the National Rehabilitation Institute «Luis Guillermo Ibarra Ibarra» in Mexico City. Invest Discapacidad. 2025; 11 (2): 44-50. https://dx.doi.org/10.35366/121455

postural instability,[1,2] by the time PD is diagnosed, more than 70% of the dopaminergic neurons located in the basal ganglia of the patient's brain have already degenerated.[3,4] The PD is the second most common neurodegenerative pathology after Alzheimer's disease (AD), affecting more than 6.2 million people.[5-7]

Worldwide, the PD has an incidence of 14.2 cases per 100,000 inhabitants per year, and its prevalence increases with age, from 41 cases per 100,000 inhabitants (0.04%) in people aged 40 to 49 years and 1,903 cases (1.9%) in people over 80 years old.[8-10] Currently, in Mexico, there are few studies related to the prevalence and incidence of PD. The National Institute of Statistics and Geography (INEGI) reported that in 2015, PD could be found in 7.1% of the total population over age 65; so presumably, the prevalence in Mexico would be ~85,000 cases.[11,12] However, studies conducted in Mexican and Latin American populations with sufficient sample sizes allow for an approximation of the demographic and clinical profiles of individuals with PD in the country.[8,13,14]

Besides, tertiary care hospitals in Mexico face a significant challenge, as PD represents a highly complex condition that requires advanced specialized services and infrastructure. This complexity increases the healthcare burden, leading to substantial economic costs. Moreover, tertiary care institutions are often involved in cutting-edge research on PD, necessitating additional resource allocation for research projects and the development of specialized medical personnel through advanced training programs.[15]

Although few epidemiological studies have focused on knowledge of the disease at the national level, we consider it necessary to conduct such a study at the National Institute of Rehabilitation (NRI-LGII) in Mexico City. The objective was to describe the demographic profile and health-related habits of patients with Parkinson's disease treated at this institution, in order to identify patterns that may inform early diagnosis strategies and contribute to preventing disease progression.

MATERIAL AND METHODS

Patients diagnosed with PD for the first time were identified through the outpatient consultations of the Neurology Service at the NRI-LGII in Mexico City between 2019 and 2021. The information was obtained through the Automated Hospital Information System (SAIH), where patient data included name, age, sex, educational level, place of birth, occupation, alcohol consumption, and smoking status, among other variables. A database was created containing the patients' characteristics, and the data were coded to maintain confidentiality. All procedures were conducted in accordance with regulations for the protection of personal data, and the study was approved by the NRI-LGII Research and Ethics Committee under project number 06/22. The database is available upon request from the corresponding author.

Selection criteria

The inclusion criteria were as follows: male and female patients aged 35 years or older, with or without antiparkinsonian treatment, a neurological diagnosis of PD confirmed by the Neurology Service, complete clinical records, and records corresponding to the period from 2019 to 2021. The exclusion criteria included patients who did not sign the informed consent form, those without a confirmed neurological diagnosis, and those with incomplete clinical records.

Statistical analysis

Data were entered into a database created using Microsoft Excel and subsequently analyzed with the SPSS software package, version 17 for Windows. Descriptive statistics were performed using measures of central tendency. To assess possible associations, χ^2 tests, Student's t-tests, probability ratio and odds ratios (OR) were applied. A significance level of $p < 0.05$ was used in this study.

RESULTS

In the period from 2019 to 2021, a total of 650 patients were seen in the Neurology Service, of whom 289 had a diagnosis of PD. The mean Hoehn and Yahr functional stage was 2.5 ± 0.65,[16,17] and the mean time since diagnosis at the time of consultation for registry purposes was 4.4 ± 3.36 years. In the statistical analysis of habits such as smoking and alcohol consumption, both variables were statistically significant ($p < 0.001$), with a χ^2 of 42.3 and 41.1, respectively *(Table 1)*. The average age was 73.42 ± 11.34 years (range 34-103); the most frequent age groups were 60-69 years (23.2%, n = 67), 70-79 years (30.4%, n = 88) and 80-89 years (27.7%, n = 80). According to sex, 40.8% (n = 118) of the patients were male, and 59.26% (n = 171) were female *(Figure 1)*.

In relation to sociodemographic characteristics, such as marital status, the association analysis was

statistically significant ($p < 0.001$), with a probability ratio of 2.58 y 2.19 for single and widowed individuals, respectively. Regarding educational level, a statistically significant association was observed in women ($p = 0.002$), particularly at the levels of illiteracy, basic education, and elementary school, with a probability ratio of 2.41, 2.05, and 1.72, respectively. As expected, most women were homemakers, yielding a statistically significant result ($p < 0.001$) with a probability ratio of 28.52. Most participants were natives of Mexico City, with 60.2% of men and 46.2% of women, resulting in a statistically significant difference ($p = 0.01$, $\chi^2 = 5.459$; *Table 2)*.

PD is a highly heterogeneous condition, and the NRI-LGII is not a referral center for neurological disorders. Among the patients admitted to the Institute, the majority were referred through the Hip-Knee and Shoulder-Elbow Rehabilitation Services, accounting for 60% of cases due to back and shoulder pain, with back pain being the most prevalent (44.0%). After several years of clinical follow-up, these patients were referred to the Neurology Service due to emerging parkinsonian symptoms.

Other services involved in patient admission included the Audiology and Phoniatrics Department, which accounted for 8.0% of cases and addressed symptoms such as hearing loss and language impairments. Additionally, 8.0% of patients were admitted through the Geriatric Rehabilitation Service, initially presenting with cardiac symptoms. External institutions also contributed to the sample: 10.0% were referred by private physicians, 8.0% by public hospitals such as the Gea González

Table 1: Risk factors associated with gender.

	Male N = 118 n (%)	Female N = 171 n (%)	t-Student	p
Age (years)*,‡	72.5 ± 11.80	74.0 ± 11.01	1.10	0.144
			χ^2	
Smoking	59 (50.0)	25 (14.6)	42.3	< 0.001
Alcohol consumption	63 (53.4)	30 (17.5)	41.1	< 0.001
Hoehn & Yard Scale‡		2.5 ± 0.65		
Time since diagnosis (years)‡		4.4 ± 3.36		

*Age range: 34 to 103 years. ‡ Data indicate mean ± standard deviation.

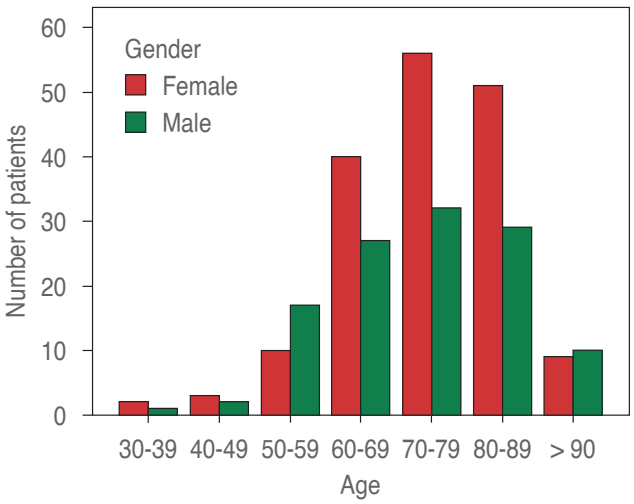

Figure 1: Prevalence of Parkinson's disease by gender and age.

Hospital, and 6.0% by the National Institute of Neurology and Neurosurgery (data not shown; *Supplementary Table S1* available at https://dsm.inr.gob.mx/indiscap/index.php/INDISCAP/article/view/363).

As antiparkinsonian treatment, 64.0% of patients were receiving levodopa/carbidopa, 30.0% were receiving the anticholinergic agent biperiden, 14.0% were being treated with the dopaminergic agonist pramipexole, and 12.0% were using another medication with dopaminergic and NMDA receptor antagonist effects, such as amantadine. Finally, 10.0% were managed with a monoamine oxidase inhibitor, such as rasagiline (data not shown, *Supplementary Table S2* available at https://dsm.inr.gob.mx/indiscap/index.php/INDISCAP/article/view/363).

When conducting the association analysis by age, sex, smoking, and alcohol use, male gender was statistically significant in both age groups (34-68 and 69-104 years), with p-values of 0.004 and 0.005, respectively. The risk was higher in men aged 34-68 years, with an OR of 8.400 (95% CI: 1.829-38.568), and in the 69-104 age group, the OR was 4.050 (95% CI: 1.502-10.920). In women, statistical and clinical significance was observed only in the 68–103 age group ($p < 0.001$, $\chi^2 = 21.242$), with an OR of 9.472 (95% CI: 3.260-27.519).

Based on these findings, the Mantel-Haenszel test was applied to assess the association between smoking and alcohol use, adjusting for age (34-68 vs 69-103 years) and sex as stratification variables. The results demonstrated a statistically significant association between these exposures, even after controlling for confounding variables (χ^2 MH = 33.844, $p < 0.001$).

The adjusted OR was 6.126 (95% CI: 3.256-11.523). This finding confirmed that the association between alcohol consumption and smoking differs across age strata, with the highest risk observed in the 69-103 age group, primarily driven by increased risk among women *(Table 3)*.

DISCUSSION

PD is a neurodegenerative disease of slow progression that is irreversible, and the clinical diagnosis is made when motor symptoms appear; therefore, it is delayed. When the clinical symptoms of tremor at rest, bradykinesia, muscular rigidity and postural instability are manifested, 70% of the dopaminergic neurons have degenerated in the substantia nigra compact part of the basal ganglia. PD is one of the diseases that leads to disability worldwide, mostly affecting the population over 50 years of age and limiting them in their daily activities.

When comparing the average age by gender, men had a mean age of 72.5 ± 11.80 years, and women had a mean age of 74.0 ± 11.01 years, with no statistically significant difference (p = 0.144). In this study, the female-to-male ratio was 1.5:1, despite PD generally being more prevalent in males,[18,19,20] our study found that females were more likely to suffer from PD than males. This difference is likely related to the fact that more women attended the NRI-LGII during the period evaluated.

In the demographic characteristics, the gender most affected was the female, there were differences between married and single people. Among patients who reported an occupation, the highest percentage identified as homemakers-an observation not widely supported in the literature, but possibly explained by the patients' age (over 65 years), as the vast majority are engaged in home-related activities.[21,22] The highest risk associated with educational level was observed in individuals with less than six years of

Table 2: Demographic data associated with patient gender.

	Male N = 118 n (%)	Female N = 171 n (%)	PR	p
Marital status				< 0.001
Single	11 (9.3)	41 (24.0)	2.58	
Married	80 (67.8)	67 (39.2)	0.57	
Divorced	11 (9.3)	12 (7.0)	0.75	
Widowed	16 (13.6)	51 (29.8)	2.19	
Scholarship				0.002
Illiterate	4 (3.4)	14 (8.2)	2.41	
Basic school	2 (1.7)	6 (3.5)	2.05	
Elementary school	26 (22.0)	65 (38.0)	1.72	
High school	26 (22.0)	25 (14.6)	0.66	
Undergraduate degree	25 (21.2)	39 (22.8)	1.07	
Graduate	30 (25.4)	19 (11.1)	0.43	
Postgraduate	5 (4.2)	3 (1.8)	0.42	
Employment				< 0.001
Unemployed	56 (47.5)	9 (5.3)	0.11	
Homemaker	3 (2.5)	122 (71.3)	28.52	
Retired	33 (28.0)	18 (10.5)	0.37	
Merchant	6 (5.1)	8 (4.7)	0.92	
Rural	1 (0.8)	1 (0.6)	0.75	
Worker	4 (3.4)	8 (4.7)	1.38	
Employee	12 (10.2)	3 (1.8)	0.17	
Professional	3 (2.5)	2 (1.2)	0.48	
Place of residence				0.01
Mexico City	71 (60.2)	79 (46.2)	$\chi^2 = 5.46$	

PR = Probability Ratio.

Table 3: Association between age, gender, smoking, and alcohol consumption.

Gender	Age group	Smoking	Alcohol		χ^2	p	OR [95% CI]
			Yes n (%)	No n (%)			
Male	34-68	Yes	14 (73.7)	2 (40.0)	**8.241**	**0.004**	**8.4 [1.8-38.5]**
Female		Yes	4 (25.0)	3 (10.7)	2.830	0.093	5.5 [0.6-47.8]
Male	69-103	Yes	27 (65.9)	10 (32.3)	**7.976**	**0.005**	**4.0 [1.5-10.9]**
Female		Yes	11 (47.8)	9 (8.8)	**21.242**	**< 0.001**	**9.4 [3.2-27.5]**
Stratified test							
Mantel-Haenszel					**33.844**	**< 0.001**	**6.1 [3.2-11.5]**

χ^2 = chi-squared test. OR = Odds Ratio. 95% CI = 95% Confidence Interval.

schooling, although all levels of education were.[23,24] Most participants were born in Mexico City, where a statistically significant difference between genders was found. This is likely explained by the proximity of Mexico City to the NRI-LGII. However, the distribution across other states was relatively homogeneous, suggesting that place of origin is not associated with the presence of PD.[12,25]

An increase in the frequency of PD was observed in adults over 60 years of age,[26,27] followed by those aged 60-69, with a peak among individuals aged 70-79. A slight decline was seen in those aged 80-89, and a substantial drop in individuals over 90. This trend may be related to the life expectancy of the Mexican population, which, according to the National Institute of Statistics and Geography, was 75.1 years in 2019. These data suggest that PD can occur beyond age 69; however, the lack of studies on the percentage of surviving individuals with the disease who exceed life expectancy limits further interpretation. Additionally, the frequency of PD increases with age, and individuals over 60 years of age are at higher risk of developing the condition. This age-related increase in PD frequency is consistent with the understanding that aging is a key risk factor for neurodegenerative diseases. As individuals grow older, a progressive decline in physiological functions is accompanied by increased vulnerability to chronic conditions, including PD.[28,29] Several biological mechanisms-such as oxidative stress, mitochondrial dysfunction, impaired protein degradation, chronic inflammation, and cellular senescence-have been proposed to explain this heightened susceptibility. These processes may contribute to the degeneration of neuronal structures involved in PD, supporting the observed trend in our findings.[30-34]

Another factor analyzed was smoking. As expected, only a few women patients were smokers; therefore, when comparing both sexes, a higher risk was found in the men. Although few studies have examined smoking in women, some have reported it as a weak protective factor for this group.[35-37] Regarding alcohol consumption, it was also identified as a risk factor for the men, with our findings aligning with previously reported studies.[38-40] When performing the association analysis of the four variables –age, sex, smoking, and alcohol consumption– it was found that women over 69 years of age had a significantly higher risk of alcohol consumption. The Mantel-Haenszel test confirmed that the risks associated with the relationship between alcohol consumption and smoking differ across age strata, with the highest risk observed in the 69-103 age group, primarily driven by an increased risk among women.

As previously mentioned, PD is a highly heterogeneous condition. Furthermore, before the onset of motor symptoms and neurological diagnosis, patients may present with various non-motor symptoms, including constipation, sleep disturbances, hyposmia, and depression.[41-43] These manifestations suggest that systems beyond the motor pathways of the basal ganglia are involved in disease progression. In our study, 60% of patients were admitted to the institute due to back, shoulder, and, to a lesser extent, knee pain. Joint pain may represent an additional non-motor symptom of PD that is not yet widely recognized as part of its clinical spectrum.[44-46] This represents a particularly meaningful contribution of our study.

It is also important to note that 64% of patients with PD were treated with levodopa, consistent with what has been reported in the literature.[47,48] Other

dopaminergic agonists used included pramipexole, a D2 receptor agonist, which accounted for 14% of cases-a lower percentage than previously reported.[49,50] Its lower frequency of use may be attributed to its higher cost compared to levodopa.

Finally, the main limitations of our study include the short duration of data collection and the limited number of variables analyzed. Moreover, the NRI-LGII is not a referral center for PD, which may affect the representativeness of the sample. Most patients initially sought care for other conditions –such as fractures, musculoskeletal stiffness, hearing loss, or cardiac issues–and were later referred to the Neurology Service after presenting motor symptoms. This referral pattern may introduce bias in patient selection. Additionally, the relatively small sample size and the lack of population-based studies in the local context limit the generalizability of our findings.

This study provided valuable insights into the clinical and demographic characteristics of patients with PD treated at the NRI-LGII. PD in older adults is a heterogeneous condition, and our findings underscore the need for strategies aimed at early and accurate diagnosis. Strengthening screening protocols and raising awareness among non-neurological health services –where many patients initially present– could help reduce diagnostic delays. These efforts may contribute to timely interventions that prevent functional decline, reduce disability, and ultimately improve quality of life and public health outcomes in aging populations.

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Funding: we declare that we have not received funding for this study.

Conflict of interest: we declare that there is no conflict of interest.

Use of artificial intelligence to generate texts: we declare that no artificial intelligence was used to generate the text of this manuscript or to create the tables.