Prevalence of Parkinson Disease in Hospitalized Patients With Congestive Heart Failure

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Abstract

Background: Parkinson's disease (PD) is the second most common neurodegenerative disease, after Alzheimer's disease, affecting approximately one million persons aged 65 years and above in the United States. Parkinson's disease represents a major medical concern for health professionals, national healthcare bodies and a heavy burden for caregivers. Heart failure occurred twice as frequently in elderly PD patients as in non-PD patients. There is paucity of information on the association of patient and hospital characteristics on the outcomes of inpatient with both congestive heart failure and Parkinson disease.

Congestive Heart Failure with PD as a comorbidity will increase the cost of care and health resources. We investigate on the current prevalence and factors that affect the inpatient with both CHF and PD conditions using a longitudinal datasets from National Inpatient Samples. The results obtained from this study will provide information that will reduce frequent readmission, length of stay, total charges and mortality rate in this population.

Methods: Data from the National Inpatient Samples (NIS) were extracted and analyzed using ICD 9 codes (CHF 428, PD 332) for the main diagnosis. For continuous variables, we calculated the mean and standard deviations and evaluated significant differences of these factors by Parkinson disease status using the t-test. For categorical variables, we obtained the counts (proportions) and evaluated significant differences using the Chi-square and Fisher's exact test Propensity score was utilized to match age, gender and race using logistic model for hospital death and generalized linear model for length of stay (LOS) and hospital charges.

Result: The overall frequency of Parkinson disease (PD) in congestive heart failure was 1.54 % (n = 10,748). PD patients with CHF were more likely to be males (53.13 %; 5462) and Caucasians (82.24 %; n=8454). The average age of inpatient was approximately 80 years (SD=8.05). Hospital admission, decreases with median household income. Patients with low income ($1 - $38,999) were admitted more with 3002 (29.70%) than those with higher income ($63,000 and more) with 2230 (22.06%). Length of stay (LOS) (p<0.0001) and total charge incurred during hospitalization were less in patients with PD (p< 0.005) (table 1). In these analyses, we found that patients with PD were discharged more from urban non-teaching hospital than urban teaching hospital (p<0.0001).

Conclusion: The general characteristics and frequency of the participant in this study are summarized in Table I. Accordingly, characteristics of patients with congestive heart failure with or without Parkinson's disease did not differ by age, gender, or ethnicity (P>1.000). Similarly, hospital death rates (%) were not different (P>1.000), although hospital length of stay (P<1.000) and total charge incurred during hospitalization were less in patients with PD (p < 0.005)

Keywords: Parkinson disease, congestive heart failure, national inpatient sample, health outcomes

1. Introduction

Parkinson's disease (PD) is the second most common neurodegenerative disease, after Alzheimer's disease (AD), affecting approximately one million persons aged 65 years and above in the United States (Chen et al, 2007). Parkinson's disease represents a major medical concern for health professionals, national healthcare bodies and a heavy burden for caregivers (Nance, 2015 and Cruickshank et al., 2015). It greatly affects the quality of life of patients (Zhang et al., 2016). Incidence of PD disease is approximately 1.8 times higher in men versus women (1.5–2.0) (Hirtz et al. 2007; Mhyre, et al., 2012). The study of Zhang et al, 2016 revealed that the incidence of PD is slightly higher in males than in females; the ratio was close to 1:1, the average age of PD patients was about 60 years, the education level of patients with PD was paralleled with that of age-matched (40–70 years old) (Ransmayr, 2015), and education is not an associated factor for PD. The socioeconomic burden of PD is great with estimates of both direct and indirect costs upward of about $23 billion every year in the US (Huse et al. 2005; Mhyre, et al., 2012). Age is the single greatest risk factor for PD with the number of world-wide cases increasing from an estimated 4.1 million (340,000 US cases) in 2005 to nearly 8.7 million (610,000 US cases) by 2030 (Dorsey et al. 2007; Mhyre, et al., 2012). Whites have a substantially higher prevalence and incidence of Parkinson disease than Blacks or Asians (Willis et al., 2010). The incidence and prevalence of Parkinson disease varied significantly across the United States (see fig 1, Willis et al., 2010). Disease rates were highest in the Midwest and Northeast regions, where the incidence and prevalence of PD were 2–10 times greater than the rates of many Western and Southern US counties (Willis et al., 2010). Parkinson disease prevalence for the most urban counties was significantly greater than that for the most rural counties. Similarly, PD incidence for the most urban counties was significantly greater than that for the most rural counties (Willis et al., 2010).

Parkinson Disease, is characterized by four major motor symptoms (MS) including resting tremor, bradykinesia, rigidity, and postural and gait instability, and numerous nonmotor symptoms (NMS), such as neuropsychiatric symptoms, sleep disorders, autonomic dysfunctions, and sensory disturbances (Zhang et al., 2016). Autonomic dysfunctions include the deregulations of sweat gland, body temperature, cardiovascular, gastrointestinal, and genitourinary systems, mainly relevant to appearance of Lewy bodies in sympathetic or parasympathetic cholinergic ganglion, and sympathetic adrenergic nerve ganglion. The Autonomic disorder, leads to major problems such as constipation, frequent urination at night, orthostatic hypotension, fatigue, polyhidrosis, and sexual dysfunction (Truong et al., 2008; Zhang et al., 2016).

Individuals with PD are also likely to suffer from a variety of other chronic diseases as a result of the disease process or medication management (Csoti et al., 2016). In various studies on comorbidity, up to 80 % of the patients had five or more concomitant diseases (Gorell et al. 1994; Leibson et al. 2006; Csoti et al., 2016). Comorbidity related to disease process include; diabetes mellitus (Miyake et al. 2010; Xu et al. 2011; Sun et al. 2012), dyslipidemia (Firoz et al. 2015); obesity (Hu et al. 2006); arterial hypertension(Pagano et al. 2014); Gastritis and gastroesophageal reflux (Maeda et al. 2013); In a cross-sectional study of a national Medicare database, heart failure occurred twice as frequently in elderly PD patients as in non-PD patients (Zesiewicz et al., 2004). People living with PD are twice as likely as the general population to develop Cardiac disease (CD), and they have a 50% greater chance of dying from it. Recent research suggests that people with PD who have a high or medium risk of CD tend to have more problems with walking and memory. While both CD and PD become more common with age, people with poorer cardiovascular health also have worse walking and memory problems, even in the early stages of PD, suggesting that assessment and treatment of vascular health may help improve these patients' PD symptoms as well(Parkinson's UK, 2016, Swallow et al.,2016). There is paucity of information on the association of patient and hospital characteristics on the outcomes of inpatient with both congestive heart failure and Parkinson disease. CHF with PD as comorbidity will increase the cost of care and health resources. The goal of this study is to determine the prevalence of CHF and PD, contributing factors including the costs of hospital stays in a National Inpatient Sample. The results obtained from this study will provide information that will reduce frequent readmission, length of stay, total charges and mortality rate in this population.

2. Research Designs and Method

This study is a secondary analysis that utilizes data from the HCUP Nationwide Inpatient Sample (NIS). The HCUP manages the health care datasets and related software tools and products developed through a Federal-State-Industry partnership and sponsored by the Agency for Healthcare Research and Quality (AHQR). HCUP aggregates the data collection efforts of State data organizations hospital associations, private data organizations and the Federal government to create a national information resource of patient-level health care data (HCUP Partners) > HCUP includes acute care hospital data in the United States, with all-payer (source of payment for the hospital length of stay).

2.1 Study Population

In this study, data of patients with CHF were selected from the 2012 hospital discharge information according to hospital and patients' characteristics such as age, gender, race insurance, family median income, comorbidities, hospital location and teaching status and hospital charge. This range was selected due to data availability. Selection of samples was aided by the exiting NIS database and ICD-9-CM.

2.2 Inclusion and Exclusion Criteria

The NIS data samples were selected and extracted on the basis of the following criteria: (a) inpatient diagnosed with CHF and related comorbidities (b) inpatient admitted to nonfederal hospitals, (c) age 55 years and above. The exclusions were (a) pediatric inpatients and age below 55 years and above. The exclusions were (a) pediatric inpatients and age below 55 years (b) discharges from federal and government hospitals.

2.3. Patient Measures

Measures were as follows: Age (55 years and above); gender (male, female); race (white, black, others); income ($1,000 – 38,999; $39,000-$47,999; $48,000-$62,999; $63,000 and above); insurance (Medicare, Medicaid, private including HMO, Others); primary diagnosis (CHF and Parkinson disease); comorbidities (diabetes, stoke, obstructive sleep apnea, morbid obesity, renal insufficiency); hospital characteristics (rural, urban non-teaching, urban-teaching).

2.4 Statistical Analysis

Descriptive statistics were computed to assess baseline clinical and demographic factors associated with PD among participants with CHF. For continuous variables, mean and standard deviations and evaluated significant differences of these factors by Parkinson Disease status were analyzed using the t-test. For categorical variables the counts (proportions) were obtained and evaluated for significant differences using the Chi-square and Fisher's exact test (table 1). The relationship between primary outcomes (Hospital charges, Length of Stay, Mortality Rates) and Parkinson Disease status were evaluated using multiple regression analysis. Propensity score was utilized to match participants with age, gender and race using logistic model for hospital death and generalized linear model for LOS and hospital charges. Univariate analysis was performed to assess potential confounders for the association between PD status and the outcome measures. The factors that were significantly associated with the primary outcome measures and PD status (primary independent) was included in the multivariate stepwise regression analysis (table 2). An interaction test and graphical plots were performed to assess the association between and diabetes and PD status with the outcome measures. P-value less than 0.05 were considered statistically significant and confidence intervals (CI) were calculated at the 95% level (Table 3). Data analysis was conducted using the statistical analysis system (SAS) software 9.3 (SAS Institute, Cary. NC) and statistical Analysis and Graphics (NCSS 9.07, Kaysville, UT) (Statistical Analysis System -SAS).

3. Results

The general characteristics and frequency of the participant in this study are summarized in Table I.

The overall frequency of Parkinson disease (PD) in congestive heart failure was 1.54 % (n = 10,748). PD patients with CHF were more likely to be males (53.13 %; 5462) and Caucasians (82.24 %; n=8454). The average age of inpatient was approximately 80 years (SD=8.05). Hospital admission, decreased with median household income. Patients with low income ($1 - $38,999) were admitted more with 3002 (29.70%) than those with higher income ($63,000 and more) with 2230 (22.06%). Length of stay (LOS) (p<0.0001) and total charge incurred during hospitalization were less in patients with PD (p < 0.005) (table 1). The discharge rate of patients with PD was more from urban non-teaching hospital than urban teaching hospital (p<0.0001)

3.1 Co-morbid Disorders in PD by CHF Diagnosis

Renal Insufficiency (3.30%), diabetes (27.85%), morbid obesity and obstructive sleep apnea were higher for inpatient without PD. Stroke was more prevalent in patient with PD. These differences were not significant except for morbid obesity which was significantly less common in patients with PD (p < 0.024 (table 1).

3.2 Mortality Rate, Length of Stay and Total Charge

These results showed differences between patient with PD and those without in both adjusted and unadjusted analysis of the outcomes when matched with age, gender and race as shown in table 2. Logistic analysis for hospital death showed Odds (0.994, p >0.917) for unadjusted and Odds (0.996, p = 0.940) for adjusted. For LOS unadjusted analysis showed Beta (0.189, p < 0.011) and adjusted Beta (0.225, p< 0.003). While hospital charge showed Beta (-4247, p <0.0001) and adjusted Beta (-3899.51, p <0.0001)

3.3 Patient and Hospital Characteristics by Outcomes

Age and gender significantly affected hospital death and total charge (p<0.0001). Gender did not affect length of stay (p = 0.283). Hospital charge, was affected by patients with high income $63000 and more (p < 0.0.0001). Diabetes and stroke, significantly affected total charge (p <0.0001). Diabetes, stroke and morbidity significantly affected length of stay. Stroke significantly affected hospital death (p< 0.0001). Obstructive sleep apnea, significantly affected hospital death (p < 0.001).

Table 1. General characteristics of patients with congestive heart failure with or without Parkinson's disease

Characteristics	Parkinson (N = 10,748)	No Parkinson (N = 20560)	P value
Age – yrs.	79.79 (8.05)	79.78 (8.05)	1.000
Gender (%)			
Male	5462 (53.13%)	10924 (53.13%)	1.000
Female	4818 (46.87)	9636 (46.87)	
Race (%)			
White (1)	8454 (82.24%)	16,908 (82.24%)	1.000
Black (2)	783 (7.62%)	1566 (7.62%)	
Hispanics (3)	617 (6.00%)	1234 (6.00%)	
Asian or Pacific Islander (4)	165 (1.61%)	330 (1.61%)	
Native Americans (5)	34 (0.33%)	68 (0.33%)	
Others (6)	227 (2.21%)	454 (2.21%)	
Hospital Death (%)			
Yes	568 (5.53%)	1142 (5.56%)	0.917
No	9709 (94.47%)	19,413 (94.44%)	
Length of Stay (IQR)	6.22 (3.00, 8.00)	6.04 (3.00, 7.00)	<.0001
Total Charge (IQR)	45,501 (15,438, 52,044)	49,748 (15,266, 56,179)	0.005
Median Household Income (%)			
1 ($1 – $38,999)	3002 (29.70%)	6043 (29.92%)	0.234
2 ($39,000 – $47,999)	2508 (24.81%)	5195 (25.72%)	
3 ($48,000 – $62,999)	2368 (23.43%)	4607 (22.81%)	
4 ($63,000 or More)	2230 (22.06%)	4350 (21.54%)	
Renal Insufficiency (%)	339 (3.30%)	736 (3.58%)	0.203
Diabetes (%)	2863 (27.85%)	5846 (28.43%)	0.283
Stroke (%)	169 (1.64%)	304 (1.48%)	0.265
Morbid Obesity (%)	457 (4.45%)	1034 (5.03%)	0.024
Obstructive Sleep Apnea (%)	806 (7.84%)	1681 (8.18%)	0.308
Hospital Characteristics			
Rural (1)	1676 (16.30%)	2983 (14.15%)	<.0001
Urban Non-Teaching (2)	4385 (42.66%)	8522 (41.45%)	
Urban Teaching (3)	4219 (41.04%)	9055 (44.04%)	

Values are Mean (SD) for Continuous Variables and Count (%) for Categorical Variables.

For normally distributed variables p values were computed with t-tests; Wilcoxon Rank-sum Test for non-normally distributed. Chi-square test for Categorical Variables.

PD=Parkinson's Disease; Participants are matched by Age, Gender and Race.

Table 2. Hospital death, length of stay and total charge for congestive heart failure patients with and without Parkinson's disease

	Parkinson' Disease Status (PD vs. No PD)							
	Unadjusted Analysis				Adjusted Analysis			
Logistic Model	Odds	95% C.I.		P	Odds	95% C.I.		P
Hospital Death	0.994	0.897	1.103	0.917	0.996	0.897	1.106	0.940
GLM Model	Beta	SE	T	P	Beta	SE	T	P
Length of Stay	0.189	0.074	2.550	0.011	0.225	0.074	3.020	0.003
Total Charge	-4247.44	881.55	-4.820	<0.0001	-3899.51	870.45	-4.480	<0.0001

Unadjusted and Adjusted Association of Outcomes and Parkinson's Disease Status

Hospital Death: Model = Logistic Regression Analysis; Odds, 95% Confidence Interval; P-values

Length of Stay and Total Charge: Model = Generalized Linear Model; Estimate, Standard Error, T-value, P-value

PD = Parkinson's Disease; Participants are matched by Age, Gender and Race;

Table 3. Logistic Regression Analysis of characteristics of patients based on Hospital Death, Length of Stay and Total Charge

Characteristics	Hospital Death				Length of Stay			Total Charge		
	Odds	95% C.I.		P	Beta	SE	P	Beta	SE	P
Age – yrs.	1.028	1.020	1.035	<.0001	-0.018	0.005	<.0001	-685.420	53.504	<.0001
Gender (Female vs. Male)	0.830	0.751	0.917	<.0001	-0.076	0.071	0.283	-4363.342	827.640	<.0001
Race										
Whites vs. Blacks	0.973	0.800	1.185	0.719	-0.247	0.137	0.071	-559.290	1608.965	0.728
Hispanics vs. Blacks	1.025	0.780	1.347	0.504	0.023	0.193	0.904	20517.087	2264.551	<.0001
Asians vs. Blacks	1.415	0.971	2.063	0.017	0.091	0.308	0.767	20690.417	3671.160	<.0001
Native Americans vs. Blacks	0.557	0.174	1.787	0.292	-0.405	0.634	0.523	-4473.239	7397.817	0.545
Others vs. Blacks	0.850	0.571	1.266	0.602	0.642	0.271	0.018	12636.182	3154.094	<.0001
Median Household Income										
1 ($1 – $38,999)	ref	ref	ref	ref	ref	ref	ref	ref	ref	ref
2 ($39,000 – $47,999)	0.975	0.848	1.121	0.245	-0.088	0.097	0.362	359.937	1128.688	0.750
3 ($48,000 – $62,999)	1.053	0.911	1.217	0.583	-0.217	0.103	0.034	2535.418	1198.146	0.034
4 ($63,000 or More)	1.083	0.934	1.256	0.247	-0.049	0.106	0.642	10478.002	1244.842	<.0001
Renal Insufficiency	0.960	0.732	1.261	0.772	-0.373	0.191	0.051	-1023.694	2227.501	0.646
Diabetes	0.927	0.828	1.039	0.194	-0.472	0.079	<.0001	-4454.506	916.142	<.0001
Stroke	1.861	1.366	2.535	<.0001	1.464	0.285	<.0001	18855.438	3315.552	<.0001
Morbid Obesity	0.970	0.728	1.291	0.834	0.709	0.173	<.0001	5655.796	2029.571	0.005
Obstructive Sleep Apnea	0.660	0.522	0.834	0.001	0.021	0.135	0.877	289.416	1580.117	0.855
Urban Non-Teaching vs. Rural	0.974	0.830	1.144	0.497	0.862	0.113	<.0001	22560.453	1307.922	<.0001
Urban Teaching vs. Rural	1.025	0.874	1.202	0.501	1.394	0.112	<.0001	23730.412	1304.881	<.0001

Hospital Death: Model = Logistic Regression Analysis; Odds, 95% Confidence Interval; P-values

Length of Stay and Total Charge: Model = Generalized Linear Regression Model; Estimate, Standard Error, T-value, P-value

PD = Parkinson's Disease; Participants are matched by Age, Gender and Race; ref = reference group
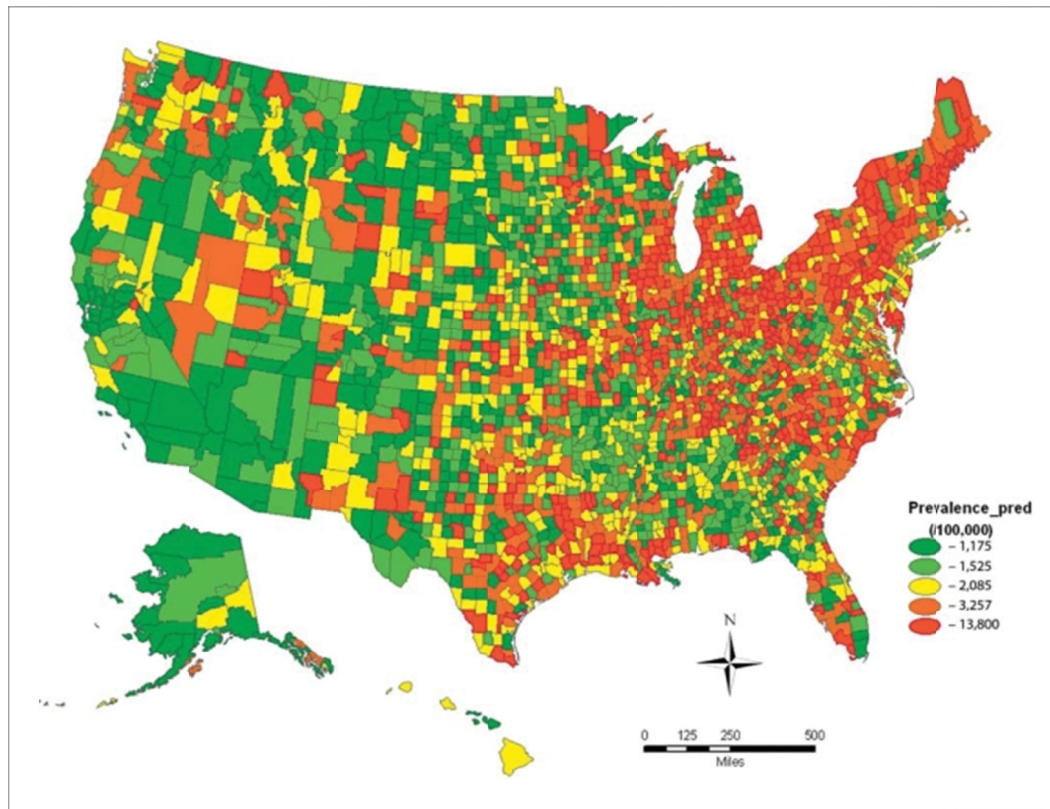
Figure 1. County level-age and race-standardized prevalence (per 100,000) of Parkinson disease among medicare beneficiaries in the United States (year = 2003) (Willis et al., 2010)

4. Discussion

The burden of chronic conditions such as PD is projected to grow substantially over the next few decades as the size of the elderly population grows (Mhyre, et al., 2012). In this study, we found that patients with CHF and Parkinson disease are more prevalent in Caucasian males compared to other races. The average age characteristic was 80 years. Hospital admission, decreases with median household income. Patients with low income were admitted more than those with higher income. Patients with Parkinson disease, stayed longer in the hospital than patients without Parkinson. Consequently, the total charge incurred during hospitalization was more in patients with PD. We also, found that patients with PD were discharged more from urban non-teaching hospital than urban teaching hospital. PD compared with non-PD patients had significantly less morbid obesity. Other less significant co-morbidities observed in all patients were diabetes, renal insufficiency, stroke and obstructive sleep apnea. After adjusting for age, gender and race the results showed that morbid obesity did not affect hospital death. However, length of stay and total charge were significantly affected. It is expected that as a patient stays longer in the hospital, the cost of staying will eventually affect total charge. Stroke increased hospital death, length of stay and total charge. Obstructive sleep apnea affected hospital death. Patients with CHF and PD contributed to the length of stay and total charge in urban and rural hospitals.

5. Conclusion

Parkinson is a neurodegenerative disorder that affects the elderly. Stroke increased hospital death, length of stay and total charge. Obstructive sleep apnea affected hospital death. All patients with CHF and PD contributed to the length of stay and total charge in urban and rural hospitals. In conclusion, comorbidities to CHF should be factored in to factors that could contribute readmission of CHF patients, within 90 days of discharge and to the high cost of CHF management. These results suggest that recognition, diagnosis and treatment of PD in CHF patients may reduce frequent readmissions, length of stay, total charges and mortality rates in this patient population.

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