Co-occurring chronic conditions and healthcare expenditures associated with Parkinson's disease: A propensity score matched analysis

Sandipan Bhattacharjee*, Usha Sambamoorthi

Department of Pharmaceutical Systems and Policy, School of Pharmacy, West Virginia University, Morgantown, WV, USA

ABSTRACT

Background: The objective of this study was to ascertain co-occurring chronic conditions and expenditures associated with Parkinson's disease among elderly individuals (age $\geq$ 65 years).
Methods: A retrospective, cross-sectional matched case–control design with data from Medical Expenditure Panel Survey (MEPS), a nationally representative survey of households in the United States was used. Elderly with Parkinson's disease ($N = 350$) were compared to a matched control group ($N = 1050$) based on propensity scores. Ordinary Least Squares regressions on logged dollars were performed to understand the association between Parkinson's disease and expenditures. All analyses accounted for the complex survey design of the MEPS and were conducted in SAS 9.3.
Results: Among elderly, the average total expenditures were $15,404 for those with Parkinson's disease and $13,333 for those without Parkinson's disease. Results from regressions revealed that elderly with Parkinson's disease had 109% greater total expenditure compared to those without Parkinson's disease, when only demographic and socioeconomic variables were entered in the model. When co-occurring chronic conditions were additionally included in the model, those with Parkinson's disease had 84% greater expenditures compared to those without Parkinson's disease.
Conclusions: Excess expenditures associated with Parkinson's disease are partially driven by co-occurring conditions among individuals with Parkinson's disease.

1. Introduction

The prevalence of Parkinson's disease (PD) has been found to be highly variable with worldwide standardized prevalence (across all ages) of 57–230 per 100,000 [1]. In the United States, an estimated 2% of elderly individuals over the age of 65 years have PD [2]. Existing literature suggests that compared to matched controls, individuals with PD experience higher comorbidity burden [3,4]. Using data from one county in Minnesota, it has been found that compared to gender and age matched controls without PD, individuals with PD had higher scores on Charlson Comorbidity Index (CCI) [3]. Using the same data, another study comparing the prevalence of mental health conditions found that the odds of anxiety and depression were approximately twice as high as among individuals with PD compared to their matched controls [4]. However, in a study of Medicare beneficiaries it was found that

cardiovascular, renal, metabolic, and gastrointestinal conditions were not significantly different between beneficiaries with and without PD [5], suggesting that prevalence rates of some chronic conditions are comparable between the two groups.

Co-occurring conditions in individuals with PD can severely compromise their Health-Related Quality of Life (HRQoL) and can also lead to increased healthcare utilization and expenditures [6,7]. Although several studies have been conducted in European settings [8–10], only a handful of studies in the US have examined direct healthcare expenditures associated with PD [5,11–13]. Using commercial insurance claims, it has been estimated that average annual direct medical per-capita expenditures (in 2002 dollars) with PD ($23,101) was more than double compared to the individuals without PD ($11,247), with a projected annual direct healthcare expenditures of $23 billion for individuals with PD in the U.S. [11]. Among Medicare long-term care users, Medicare beneficiaries with PD had higher comorbidity cost ratios (ratio of average per person per year charges for PD alone vs. with comorbid conditions) compared to individuals without PD (adjusted to 2000 US dollars) [12]. Among nationally representative elderly Medicare beneficiaries, those with PD had approximately twice the total

* Corresponding author. Department of Pharmaceutical Systems and Policy, West Virginia University School of Pharmacy, PO Box 9510, Medical Center Drive, Morgantown, WV 26506, USA. Tel.: +1 304 293 6991.

E-mail address: sbhattacharjee@hsc.wvu.edu (S. Bhattacharjee).

expenditures (expressed in 2002 dollars) compared to beneficiaries without PD [5].

Studies that examined the relationship between PD and direct healthcare expenditures have highlighted excess expenditures associated with PD. However, these studies have not examined the extent to which co-occurring conditions contribute to these excess expenditures. Therefore, the primary objective of this study is to examine incremental expenditures associated with PD and the role of co-occurring conditions in contributing to these excess expenditures. In addition, the present study builds on and improves existing research by including a nationally representative sample, recent data, use of a matched case–control design derived through rigorous statistical matching technique (i.e. propensity score matching).

2. Methods

2.1. Study design

A retrospective, cross-sectional matched case–control design was adopted for this study, matching individuals with PD to those without PD using a propensity score approach. A matched case–control design was adopted because individuals with PD may differ from individuals without PD in demographic characteristics, as well as physical and mental health status. To control for these systematic differences, we selected individuals with and without PD who were comparable on their demographic characteristics and health status.

Propensity score matching was performed using gender (male, female), race (white and other), perceived physical and mental health status (excellent/very good, good, fair/poor) and body mass index (BMI) [under weight or normal (BMI < 25 kg/m²) and overweight or obese (BMI ≥ 25 kg/m²)]. In addition, as our study pooled data from 10 years, two successive years were used to match, for e.g. 2000 and 2001, 2002 and 2003, 2004 and 2005, 2006 and 2007, 2008 and 2009 in order to avoid the matching of individuals with and without PD from distant years. Since the number of PD cases was low, for each individual with PD, 3 individuals without PD were selected in order to improve the power of the analysis [14].

2.2. Data source

We used data from annual releases of the Medical Expenditure Panel Survey (MEPS), a nationally representative survey of households and families. A wide array of information in terms of physical and mental health conditions, treatment, healthcare utilization and expenditures of non-institutionalized civilians in the United States are available in the MEPS. The household files from the MEPS provide information on the demographics, socio-economic status, employment, access to care, health status, and healthcare utilization and expenditures. Telephone interviews enquiring about the diagnosis (primary and other diagnoses) are conducted among a sample of physician offices and hospitals which rendered care to the MEPS sample population constituting the Medical Provider Component, which is often used to add and/or substitute the data on expenditures reported in the household component [15]. Medical conditions recorded in MEPS are self-reported. Studies conducted to demonstrate the accuracy of survey participants reported conditions have shown that household reports were consistent with provider reports for most of the salient conditions such as diabetes, mental health, and hypertension along with other conditions with a median sensitivity of approximately 70% [16].

2.3. Analytic sample

Our analytic sample consisted of elderly individuals aged 65 years or older and alive during the calendar years. We identified elderly individuals with PD using *International Classification of Diseases, Ninth Revision, Clinical Modification* (ICD-9-CM) codes of 332.xx. In addition, we required that those without PD to have positive direct healthcare expenditures as all individuals with PD had positive direct healthcare expenditures. Matched controls were selected using the GREEDY 8 to 1 matching technique of propensity score [17].

The distribution of gender, race, health status, mental health status, and BMI categories, the matching variables, before and after propensity score matching are summarized in Table 1. Chi-square tests were used to determine the statistically significant differences between PD and no PD groups before and after propensity score matching. Before matching, all the characteristics except race were statistically significantly different between the two groups. Before matching, individuals with PD had a higher proportion of men (54.5%), whereas, the individuals without PD had higher proportion of women (57.8%). Overall, both the groups with and without PD comprised mostly whites (86.0% and 81.5% respectively). There were also statistically significant differences in physical health status between the two groups. A higher proportion of individuals with PD reported fair/poor health (53.9%) as compared to those without PD (23.7%). In terms of mental health status, 33% of the individuals with PD reported fair/poor mental health, while only 11.1% individuals without PD reported fair/poor mental health. With respect

Table 1
Description of sample before and after propensity score matching. Medical Expenditure Panel Survey (2000–2009).

	Before matching			After matching		
	PD	Non-PD	Sig	PD	Non-PD	Sig
	Wt% 100.0	Wt% 100.0		Wt% 100.0	Wt% 100.0	
Gender			**			
Women	45.5	57.8		45.5	48.7	
Men	54.5	42.2		54.5	51.3	
Race						
White	86.0	81.5		86.0	86.6	
Others	14.0	18.5		14.0	13.4	
Health status			***			
Excellent/very good	16.0	43.3		16.0	16.2	
Good	30.1	33.0		30.1	27.1	
Fair/poor	53.9	23.7		53.9	56.7	
Mental health status			***			
Excellent/very good	28.7	57.6		28.7	31.4	
Good	38.0	31.4		38.1	34.6	
Fair/poor	33.2	11.1		33.2	34.0	
Body mass index[a]			*			
Under or normal weight	45.5	37.3		45.5	43.7	
Overweight or obese	54.5	62.7		54.5	56.3	

Note: Based on 351 individuals with PD and 33,474 individuals without PD before matching; and 350 individuals with PD and 1050 individuals without PD after matching among elderly people aged 65 or older. Matching was conducted on gender, race/ethnicity, health status, mental health status, and body mass index. Asterisks represent statistical significance between women and men based on chi-square tests.
Wt%: Weighted percentage, HS: High School.
***p < 0.001; ** 0.001 ≤ p < 0.01.
[a] Numbers do not add up to total numbers due to missing data.

to BMI, a lower proportion of individuals with PD (54.5%) were in overweight/obese group compared to 62.7% of individuals without PD. From Table 1, it can be observed that, after propensity score matching, none of the characteristics were statistically significant, and the distributions of individuals with and without PD were balanced.

2.4. Measures

2.4.1. Dependent variables

Dependent variables for this study consisted of total, inpatient, outpatient, emergency room, prescription drugs, home health agency and other expenditures (which included dental care vision care and other expenditures). Direct expenditures are defined as payments for different types of services (example: inpatient, outpatient) and from different sources (out-of-pocket or direct payments from the individuals, payments from private insurance, Medicaid, Medicare, Workers' Compensation, and others) [18]. As our data spanned across 10 years, we also expressed expenditures in real dollars. Medical care services part of the annual consumer price index (CPI) was utilized to transform/convert all expenditures to 2009 constant dollars. The CPI was obtained from the Bureau of Labor Statistics [19]. In addition, expenditure data were skewed to the right; logarithmic transformations of the expenditure data were conducted in order to fit a linear model.

2.5. Co-occurring conditions

Co-occurring conditions were identified using ICD-9-CM codes and Clinical Classification codes. We included the following co-occurring physical conditions: arthritis, asthma, cancer, diabetes, eye, gastro esophageal reflux disorder (GERD), heart disease, hypertension, osteoporosis, stroke, and thyroid disorders and mental health conditions: anxiety and depression. We also used total number of chronic physical conditions as an independent variable in multivariable models.

2.6. Other independent variables

Other independent variables consisted of marital status (married and other), area of residence (metro and non-metro), education (less than high school, high school, and more than high school education), and poverty status (poor, near poor, middle income, and high income).

2.7. Statistical analyses

T-tests were used to examine the differences in average total, inpatient, outpatient, emergency room, pharmacy, home healthcare, and other expenditures