

Home Visits and Caregivers: Associations and Outcomes  
among Homebound Individuals with Parkinson's Disease (PD)

Maya Goldheim  
Briarcliff High School

*Acknowledgements:*

I would like to thank my mentor, Jori Fleisher for her time and dedication for guiding me throughout my project. Our work together for the past two years has given me unique opportunities that I could have not experience without her. I would also like to thank my teacher, Ms. Melissa Carnahan and Mr. Michael Inglis for helping me finalize my project in the past three years even when obstacles occurred. I would also like to thank my parents for supporting me throughout my entire research process.

*Table of Contents*

*List of*

*Tables*.....3

*Abstract*.....4

*Introduction*.....5

*Research Question and*

*Hypothesis*.....8

*Method*.....8

*Results*.....10

*Conclusion*.....12

*Tables and Charts*.....13

*References*.....18

*List of Tables*

1. UPDRS
  - a. UPDRS Parts 1-4
  - b. Speech Symptoms Rating on UPDRS Scale
2. 2: Inclusion and Exclusion Criteria
3. 3:Codebook
4. Interquartile Range of Patients that Missed Neurology Appointments Between Visits
5. The Rate of Missed Neurology Appointments Based on Presence or Absence of a Caregiver- Total Visits
6. The Rate of Missed Neurology Appointments Based on Presence of Absence of a Caregiver at Visit 2
7. The Rate of Missed Neurology Appointments Based on Type of Caregiver at Visit 1
8. The Rate of Missed Neurology Appointments Based on Type of Caregiver at Visit 1
9. The Number of ER Visits Based on the Presence or Absence of a Caregiver- total visits
10. The Number of ER Visits Based on Presence or Absence of a Caregiver at Visit 2
11. The Number of ER Visits Based on Presence or Absence of a Caregiver at Visit 3
12. The Number of ER Visits based on Presence or Absence of a Caregiver at Visit 4
13. The Number of ER Visits Based on Type of Caregiver at Visit 1

*Abstract*

Parkinson's Disease is a neurodegenerative disease that affects the cognitive and physical function of over one million Americans. The purpose of this study was to examine the rate of missed neurology appointments and emergency room visits among patients with advanced Parkinson's Disease based on the presence and type of their caregivers. All patients were enrolled in a novel home visit program. Data was collected from patient files. During home visits, caregiver presence, caregiver type, missed neurology appointments, and number of emergency room visits were recorded. Two-sample t-tests with unequal variances were conducted to analyze relationships between the variables. There was no significant difference in the rate of missed neurology appointments and number of emergency room visits based on presence of caregiver and type of caregiver for patients with advanced Parkinson's Disease. It can be hypothesized that caregiver burden can explain why patients with caregivers tended to have more ER visits and more missed neurology appointments.

## *1.0 Introduction*

### *1.1 Review of Literature*

Parkinson's Disease (PD) is the second most common neurodegenerative disease in the U.S., affecting about 1 million people (Parkinson's Association of the Carolinas , 2017). The disease is typically found in the elderly population (about 60 years or older) but symptoms can start as young as 40 years old. PD symptoms arise from the deterioration of dopamine-producing neurons in the brain (Saleeby, 2014). The continued loss of dopamine and other neurotransmitters in the brain causes motor and nonmotor symptoms of PD to appear. Non-motor symptoms include neuropsychiatric symptoms, sleep disorders, cognitive dysfunctions, autonomic symptoms, and sensory symptoms (Ou et. al., 2015). Motor symptoms include rest tremors, slowness of movement (bradykinesia), muscle stiffness (rigidity), postural instability, and loss of balance (Saleeby, 2014 and Ou et. al., 2015).

As the disease progresses, the severity of symptoms becomes worse (Ou et. al., 2015). This is why symptoms, especially motor symptoms, are used for classification and stage of illness diagnoses (Miyasaki et.al., 2012). A common scale to rate the motor severity and functional disability experienced by PD patients is the Unified Parkinson's Disease Rating Scale (UPDRS). The UPDRS, a four-part questionnaire, rates the patient's mental state, daily life, motor examination, and motor fluctuations. The Hoehn and Yahr Scale, a scale from 1-5 based on symptom progress and relative level of disability is also used to classify the stage of PD. In the Hoehn and Yahr Scale stage 1 indicates affecting only one side of the body, stage 2 indicates bilateral involvement, and stage 3 indicates bilateral involvement and impaired balance. At stage 4, patients have severe disease but can stand unassisted. When the patient is at stage 5 patients are bed bound or wheelchair-bound unless they have assistance (Miyasaki et.al., 2012).

These homebound PD patients require a lot of attention and energy to get through each day. Symptoms can make daily tasks, such as walking, eating, and dressing very difficult. Typically, patients with advanced PD require a caregiver to help the patient live their day-to-day lives. A primary caregiver is typically is an unpaid individual, either family or friend. As the patient's symptoms worsen, especially motor symptoms, their caregiver experiences more global strain (Carter et. Al., 2008). Worsening symptoms, caregiver strain, and age negatively correlate

with the quality of life (QOL) of a patient (Nutt et. Al., 2014) When QOL decreases, symptoms become harder to manage, leading to more patients with PD being hospitalized.

Patients with PD are hospitalized 50 percent more than their peers (Aimnoff et. al., 2011). Hospitalization for these individuals primarily consist of acute care problems which can become very expensive (Hassan et. Al., 2013). Patients with PD are hospitalized frequently and have longer hospital stays. When patients are hospitalized, it can negatively affect mental health and mobility (Oertel et. al., 2011). Total cumulative effects of PD hospital encounters increases burden of care, hospital costs and rates of mortality (Hassan et. Al., 2013).

Furthermore, new medical complications may appear when a patient stays in the hospital for too long. These issues can be hospital-related and not directly related to the reason for admission. Patients with PD have a strict medication regimen; therefore, any changes including time the medication is taken, dosage change, and the addition or subtraction of certain medications can negatively affect the patient and worsen symptoms. Miscommunication between doctors and nurses in hospitals and the patient's primary caregiver and/or primary doctor can lead to mishandling medication. Also, patients who stay at a hospital tend to have a decrease in daily physical activity which can also worsen symptoms (Oertel et. al., 2011). There is an urgent need to create programs to reduce the number of patients with advanced PD who are admitted to hospitals (Hassan et. al., 2013).

### *1.2 Home Visit Program*

Policies to improve in-home support and caregiver support will be crucial in efforts aimed at maintaining patients in a home setting and keep them out of hospitals (Hassan et. al., 2012). This is where the home visit program is introduced. The home visit program is a unique, grant-funded program at an institution offered to patients with advanced PD based on principles of movement disorders, geriatrics, and palliative care, with an interdisciplinary and holistic approach to symptom management. The goal for the home visit program is to improve quality of life and prevent hospitalization for patients with advanced Parkinson's Disease. A team consisting of a doctor, nurse, and social worker visit the patient at their residence to assess quality of life and try to improve care. The home visit program is in addition to or a replacement for regular check-ups with the patient's movement disorders neurologist. This interdisciplinary approach is aimed to create better communication between therapists, hospitals and neurologists.

At a home assessment, patients are examined in a similar way to their usual visit with their movement disorders neurologist, including a physical exam with UPDRS. The home (or residence area) is examined to find any obstacles that must be fixed before an accident could occur. For example, if there are many throw rugs around the house, the team of professionals would recommend to take them away or safely secure them to the ground to prevent falls. Then the team of professionals ask for the patient and their caregiver to go through daily tasks to see how they function. Also, the patient and caregiver are asked about the patient's medications, and the nurse performs a detailed medication reconciliation, checking for medication errors or expired prescriptions. The information gathered at each home visits can help assess quality of life for the patient with advanced PD and their caregiver by conducting surveys. Conducting surveys, reviewing of medication, performing physical examinations, and conducting safety and needs assessments can help create a plan aimed at improving the patient's quality of life.

To improve the quality of life for the patient, the team will recommend various types of interventions. Interventions may include medication changes, addition of assisted devices, recommendations for physical therapies, speech therapy, and psychotherapy. Other recommendations can include the team connecting the patient to a meal delivery services, assistiveransportation services, and in-home supportive counseling

The home visit program is a new approach to treating patients with advanced PD, though it has been previously studied in other non-PD populations. In other studies, participating in a home visit program has been shown to reduce subsequent institutionalization in geriatric patients (Perles, 2000). In each of these models, each team member brings different skill sets to the home visits to affect quality of life and minimize hospitalization. Social workers are key to help transition from hospitals to home in order to prevent readmission. In a study performed in 2000 by Watkins et. al., found that in the home visit program for frail older adults, hospital readmissions for patients with other medical problems decreased by 61%. It is vital for patients to remain home instead of in the hospital, and to do this there needs to be extensive social support and health education into the home after discharge from their hospital (Watkins et. al., 2012).

The home visit program this study is focused on is first-of-its kind because it focuses on a population that did not previously have this option- patients with advanced PD. Prior to the

establishment of this home visit program there have not been ways for patients with advanced PD to improve QOL and prevent hospitalization. This home visit program explores an under researched population.

## *2.0 Research Questions and Hypothesis*

Research Question: What are the associations and outcomes of patients with advanced PD who have or do not have caregivers and the type of caregiver that are enrolled in the home visit program?

Hypothesis 1: The rate of missed neurology appointments in between home visits for patients with advanced PD will be higher if the patient does not have a caregiver compared to those with caregivers.

Hypothesis 2: The rate of missed neurology appointments in between home visits for patients with advanced PD will be lower if the patient's caregiver is a spouse, partner, or significant other, compared with patients that do not.

Hypothesis 3: The number of emergency room (ER) visits in between home visits for patients with advanced PD will be greater if the patient does not have a caregiver than among patients with caregivers.

Hypothesis 4: ER visits in between home visits in patients with advanced PD will be minimal if the patient's caregiver is a spouse, partner, or significant other compared with those who do not.

## *3.0 Methods*

### *3.1 Home Visit Program and Patients*

Patients were enrolled in the Home Visit Program (HVP) for Advanced Parkinson's Disease, staffed by a team that consists of a social worker, nurse, and movement disorders-specialized neurologist. The team of professionals travel to the patient's home to examine the patient, their surroundings, and daily activities to get a better perspective on the patient's daily life. Home visits follow similar procedures from patient to patient which includes: obtaining the patient's history in detail, completing the UPDRS (Table1), asking patients to do certain tasks such as those done in daily life, reviewing medications and home safety, and performing a

psychosocial evaluation of the patient and caregiver. Recommendations, such as medications, over-the-counter treatments, physical or occupational therapies, community resources, and home safety, differ from patient to patient based on the results of the patient's evaluation. Please see Table 2 for inclusion and exclusion criteria. There were a total of 86 subjects in the program at the time of data analysis.

### *3.2 Protection of Patients and Risk Assessments*

All patients of the HVP program were prior patients of the institution that ran the HVP. Patients that qualified for the HVP were recommended to join. Basic demographic information was collected directly from the patient, caregiver, and from the electronic medical record. Each patient was assigned a unique ID number to keep confidentiality. De-identified data was then entered into a secure, electronic database (REDCap). A codebook was created to help organize the information obtained during each visit (Table 3). At each home visit, over 60 items were assessed recorded in REDCap. Only members of the HVP and the research team had access to the data.

### *3.3 Assessments*

Data was collected throughout the visits and stored in the REDCap database, which was then exported for analysis in Microsoft Excel and STATA 14. Data were assessed for normal distributions; if normally distributed, then the mean and standard deviation were reported. If the data were skewed, then the median and interquartile range were reported (Table 4).

First, the total number of visits and divided it into two groups- those who have caregivers and those who do not- and analyzed if there is a difference among the rate of missed neurology appointments when all the visits were accounted for (Results 4.1). Next, each individual visit was analyzed to see if there was a difference in the rate of missed neurology appointments between patients with caregivers and those who do not have caregivers (Results 4.1). Next, the rate of missed neurology appointments of patients that have a spouse or partner as a caregiver versus those who do not was compared for each visit (Results 4.2).

To test the last two hypotheses, data was analyzed based on the number of emergency room visits (ER) a patient reported between home visits. The statistical analysis was done in a similar way as mentioned in the paragraph above. Similarly to the analysis of missed neurology appointments, the data of ER visits was not normally distributed, so the median and interquartile

range was checked (Table 5). The total number of visits was split again into two groups- those who have caregivers and those who do not and analyzed if there is a difference among the number of ER visits when all the visits were considered (Results 4.3). Each individual visit was then analyzed to see the number of ER visits between each visit (Result 4.3) of patients with and without caregivers. Lastly, the number of ER visits of patients that have a spouse or partner (cgidentitiy\_\_1) as a caregiver versus those who do not was compared for each visit (Results 4.4).

#### *4.0 Results*

##### *4.1 Demographics*

The average mean age of the 86 patients at visit one was 78.33 years old. There were 41 males and 45 females. The mean UPDRS score at visit 1 was 78.42. The races of patients included Caucasian, African American, and Asian.

##### *4.2 Rate of Missed Neurology Appointments for Patients with and without Caregivers*

To test the first hypothesis, the number of missed neurology appointments was calculated throughout all visits with all patients. There was a total of 272 visits throughout the study. Table 6 shows patients with caregivers (group 1) and patients without caregivers (group 0) and the rate of missed neurology appointments. Results showed that there was no significant difference ( $p > .05$ ) among the number of missed visits by presence or absence of caregivers when all visits were considered.

To look more in depth at the first hypothesis, each visit was analyzed. The majority of visits contained the same results of no significant difference in the number of missed neurology appointments of patients with caregivers and patients without caregivers. But, table 7 below shows that at visit 2, there was a trend towards individuals with caregivers missing more neurology appointments than those without caregivers.

Overall, the rate of missed neurology appointments is not affected if a patient does or does not have a caregiver. But, at visit two there was a trend that showed patients with caregivers will have a higher rate of missed neurology appointments. It is not unusual for patients to miss appointments once in awhile, but the reason that patients without caregivers were less likely to miss their neurology appointments could be that these patients are not scheduling appointments

in the first place. If a patient does not have a scheduled appointment, then they cannot miss it, thus the rate of missed neurology appointments does not increase.

#### *4.3 Comparing the presence of a spouse or partner caregiver versus not on missed neurology appointments*

To test the second hypothesis, the number of missed neurology appointments was analyzed to see if there was a difference between the number of missed neurology appointments of patients that had a spouse or partner as a caregiver versus patients who do not. Each visit was analyzed separately. Throughout all visits there was no significant difference in missed neurology appointments of patients with spouses or partners as caregivers and those who do not. Table 8 in the appendix shows the rate of missed neurology appointments of patients with spouses or partner as a caregiver (group 1) and the patients that do not (group 0) at visit 1.

#### *4.4 Rate of Emergency Room Visits for Patients with and without Caregivers*

To test the third hypothesis the number of ER visits was calculated throughout all visits with all patients. Table 9 shows patients with caregivers (group 1) and patients without caregivers (group 0) and the rate of missed neurology appointments. There was no significant difference among the number of ER visits by presence or absence of caregivers when all visits were considered.

When each visit was analyzed, half of the visits showed a significant difference between the number of ER visits a patient encounters if the patient does or does not have a caregiver. Visits 2-4 showed a statistically significant difference, with individuals with caregivers having more ER visits than individuals without caregivers (Table 10-12). Visits 1,5, and 6 showed so significant difference in the number of ER visits.

#### *4.5 Comparing the presence of a spouse or partner caregiver versus not on ER Visits*

To test the last hypothesis the number of ER visits was analyzed to see if there was a difference between the number of ER visits of patients that had a spouse or partner as a caregiver versus patients who do not. Each visit was analyzed separately. The majority of visits there was no significant difference in missed neurology appointments of patients with spouses or partners as caregivers and those who do not. But, in Visit 4 there was a statistically significant difference so that individuals with spouses, partners, or significant others as a caregiver have more ER

visits than individuals who do not (Table 13). Patients with spouses or partner as a caregiver is represented by group 1 and the patients that do not are represented in group 0).

## *5.0 Conclusion*

### *5.1 Major Findings*

In this study of an advanced, homebound PD population, neither the presence nor the identity of a caregiver significantly impacted the rate of missed neurology appointments and the number of ER visits.

### *5.2 Discussion*

In reference to the results 4.2, rate of missed neurology appointments for patients with and without caregivers, the overall rate of missed neurology appointments was not affected if a patient does or does not have a caregiver. But, at visit two there was a trend that showed patients with caregivers will have a higher rate of missed neurology appointments. It is not unusual for patients to miss appointments once in awhile, but it can be hypothesized that the reason that patients without caregivers were less likely to miss their neurology appointments could be that these patients are not scheduling appointments in the first place. If a patient does not have a scheduled appointment, then they cannot miss it, thus the rate of missed neurology appointments does not increase.

In reference to results 4.4, rate of emergency room visits for patients with and without caregivers, as Parkinson's disease progresses there is an increase in caregiver burden . Caregiver burden could be the reason for the missed neurology appointments and visits to the ER for patients with any of type of caregiver. To improve the rate of missed neurology visits and decrease the number of ER visits, relief of caregiver burden through improvements in access to in-home support is needed (Hassan et. al., 2012). With about one third of Parkinson's disease patients hospitalized throughout a year it becomes vital to make sure patients are being well taken care of (Hassan et. al., 2012).

### *5.2 Limitations*

The HVP has limited resources and time per visit and a considerable amount of time was spent traveling. The program is relatively new and has rolling admission, many patients had had

one visit by the time of data analysis, but few had been in the program long enough to have multiple visits, particularly when analyzing fifth or sixth visit data.

### 5.3 Future Research

Future research can include more patients. Also, future research can include more visits and see the difference of the rate of missed of neurology appointments and the number of ER visits between each home visit over the course of many years.

### Tables and Charts

**Table 1: UPDRS (Martinez et. al., 1994)**

The Unified Parkinson's Disease Rating Scale helps doctors measure each possible symptom a patient with PD can have and rate the level of severity on a 1-4 scale. Total points will add up to give a UPDRS score. The higher the score, the more severe a patient's PD symptoms are.

**Table 1.A: UPDRS Parts 1-4**

This list of symptoms is what a doctor would test/ ask about during an examination Part 1 asks the patient to rate their symptoms of mentation, behavior and mood. Part 2 asks the patient to rate the difficulty of performing daily tasks. Part 3 is a motor examination. Lastly, Part 4 asks about the patient's complications of therapy.

Part 1	Part 3 Continued
Mentation	Rigidity: neck
Thought Disorder	Upper extremity: right
Depression	left
Motivation/ Initiative	Lower extremity: right
Subtotal Part 1 (maximum=16)	left
Part 2	Finger taps: right
Speech	left
Salivation	Hand pronate/supinate: right
Swallowing	left
Handwriting	Leg agility: right
Cutting Food	left
Dressing	Arise from chair
Hygiene	Posture
Turning in bed	Gait
Falling	Postural stability
Freezing	Body bradykinesia
Walking	Subtotal Part 3 (maximum 108)
Tremor	Part 4
Sensory Symptoms	Dyskinesia (duration)
Subtotal Part 2 (maximum=52)	Dyskinesia (disability)
Part 3	Dyskinesia (pain)
Speech	Early Morning dystonia
Facial Expressions	"Offs" (predictable)
Tremor at rest: face, lips, chin	"Offs" (unpredictable)
Hands: right	"Offs" (sudden)
left	"Offs" (duration)
Feet: right	Anorexia, nausea, vomiting
left	Sleep disturbance
Action tremor: right	Symptomatic orthostasis
left	Total of 4 parts ( maximum= 199)

**Table 1.B**

The image below shows an example of how the UPDRS would rate how symptoms would affect speech. The higher the score the more severe the symptom is.

#### 18. Speech

0 = Normal.

1 = Slight loss of expression, diction and/or volume.

2 = Monotone, slurred but understandable; moderately impaired.

3 = Marked impairment, difficult to understand.

4 = Unintelligible.

**Table 2: Inclusion and Exclusion Criteria (Sweeney et al., 2017)**

This was the criteria used to select the patients included in the study.

Inclusion Criteria	Exclusion Criteria
<ol style="list-style-type: none"> <li>1. PD diagnosis by neurologist</li> <li>2. Reside in New York City</li> <li>3. Patient is enrolled in (HVP)</li> <li>4. Meet Medicare Criteria for homebound                             <ol style="list-style-type: none"> <li>a. A patient is classified as homebound if the patient cannot leave their home due to their medical condition without “considerable and taxing effort” and requires the assistance of either assistive devices, special transportation, or the assistance of another person.</li> </ol> </li> <li>5. <math>\geq 1</math> high risk criteria                             <ol style="list-style-type: none"> <li>a. Fluctuations, multi-morbidity, medication mismanagement, depression, anxiety, high risk for hospitalization or institutionalization, suspected elder abuse or caregiver burnout, increased falls at home</li> </ol> </li> </ol>	<ol style="list-style-type: none"> <li>1. Age &lt;21 years</li> <li>2. Active psychosis</li> </ol>

**Table 3: Codebook**

The codebook was used to convert information to be able to analyze the observations statistically. The codes used below were used in the research to test the research question.

variable/ field name	Field label/ field note	Field Attributions (Field Type, Validation, Choices, Calculations, etc.)																					
cgpresent_v#	Was a caregiver present for the visit?	Yes or no 1=yes 0=no																					
cgidentity_v	Who is the caregiver?	<table border="1"> <tbody> <tr> <td>1</td> <td>cgidentity_v#_1</td> <td>Spouse, partner, or significant other</td> </tr> <tr> <td>2</td> <td>cgidentity_v#_2</td> <td>Adult child</td> </tr> <tr> <td>3</td> <td>cgidentity_v#_3</td> <td>Other family member</td> </tr> <tr> <td>4</td> <td>cgidentity_v#_4</td> <td>Friend or neighbor</td> </tr> <tr> <td>5</td> <td>cgidentity_v#_5</td> <td>Part-time home health aide</td> </tr> <tr> <td>6</td> <td>cgidentity_v#_6</td> <td>24 hour Home health aide</td> </tr> <tr> <td>7</td> <td>cgidentity_v#_6</td> <td>other</td> </tr> </tbody> </table>	1	cgidentity_v#_1	Spouse, partner, or significant other	2	cgidentity_v#_2	Adult child	3	cgidentity_v#_3	Other family member	4	cgidentity_v#_4	Friend or neighbor	5	cgidentity_v#_5	Part-time home health aide	6	cgidentity_v#_6	24 hour Home health aide	7	cgidentity_v#_6	other
1	cgidentity_v#_1	Spouse, partner, or significant other																					
2	cgidentity_v#_2	Adult child																					
3	cgidentity_v#_3	Other family member																					
4	cgidentity_v#_4	Friend or neighbor																					
5	cgidentity_v#_5	Part-time home health aide																					
6	cgidentity_v#_6	24 hour Home health aide																					
7	cgidentity_v#_6	other																					
neuromissed_v#	How many neurology appointments did the patient miss or cancel since the last visit?																						
er_v#	How many times did the patient visit emergency room, urgent care facility or after-hours clinic (not leading to																						

	hospitalizations) since the last visit?	
--	---	--

Table 4: Interquartile Range of Patients that Missed Neurology Appointments Between Visits

Percentiles	
1%	0
5%	0
10%	0
25%	0
50%	0
75%	0
90%	1
95%	2
99%	4

Table 5: Interquartile Range of ER Visits of Patients

Percentiles	
1%	0
5%	0
10%	0
25%	0
50%	1
75%	2
90%	3
95%	5
99%	10

Table 6: The Rate of Missed Neurology Appointments Based on Presence or Absence of a Caregiver- Total Visits

Group	Obs	Mean	Std. Err.	Std. Dev.	[95% Conf. Interval]	
0	30	1.566667	.4975419	2.725149	.5490793	2.584254
1	242	1.202479	.1077465	1.676143	.9902342	1.414725
combined	272	1.242647	.1102507	1.818301	1.02559	1.459704
diff		.3641873	.5090749		-.6730517	1.401426
diff = mean(0) - mean(1)					t =	0.7154
Ho: diff = 0					Satterthwaite's degrees of freedom =	31.7754
	Ha: diff < 0		Ha: diff != 0		Ha: diff > 0	
	Pr(T < t) = 0.7602		Pr( T  >  t ) = 0.4796		Pr(T > t) = 0.2398	

Table 7: The Rate of Missed Neurology Appointments Based on Presence or Absence of a Caregiver at Visit 2

Group	Obs	Mean	Std. Err.	Std. Dev.	[95% Conf. Interval]	
0	6	.3333333	.2108185	.5163978	-.2085929	.8752596
1	54	.9259259	.2347395	1.724976	.4550982	1.396754
combined	60	.8666667	.2132168	1.65157	.4400209	1.293312
diff		-.5925926	.3155108		-1.247083	.0618979
diff = mean(0) - mean(1)					t =	-1.8782
Ho: diff = 0					Satterthwaite's degrees of freedom =	21.907
	Ha: diff < 0		Ha: diff != 0		Ha: diff > 0	
	Pr(T < t) = 0.0369		Pr( T  >  t ) = 0.0737		Pr(T > t) = 0.9631	

Table 8: The Rate of Missed Neurology Appointments Based on Type of Caregiver at Visit 1

Group	Obs	Mean	Std. Err.	Std. Dev.	[95% Conf. Interval]	
0	32	.8125	.2477215	1.401324	.3072687	1.317731
1	28	.9285714	.3634366	1.923126	.1828611	1.674282
combined	60	.8666667	.2132168	1.65157	.4400209	1.293312

ratio = sd(0) / sd(1) f = 0.5310  
Ho: ratio = 1 degrees of freedom = 31, 27

Ha: ratio < 1 Pr(F < f) = 0.0452      Ha: ratio != 1 2\*Pr(F < f) = 0.0905      Ha: ratio > 1 Pr(F > f) = 0.9548

Table 9: The Number of ER Visits Based on the Presence or Absence of a Caregiver- total visits

Group	Obs	Mean	Std. Err.	Std. Dev.	[95% Conf. Interval]	
0	29	.2068966	.0912328	.4913037	.0200146	.3937785
1	242	.3057851	.0481779	.7494726	.2108815	.4006887
combined	271	.295203	.0441127	.7261868	.2083543	.3820516
diff		-.0988886	.1031724		-.3066399	.1088627

diff = mean(0) - mean(1) t = -0.9585  
Ho: diff = 0 Satterthwaite's degrees of freedom = 45.3838

Ha: diff < 0 Pr(T < t) = 0.1714      Ha: diff != 0 Pr(|T| > |t|) = 0.3429      Ha: diff > 0 Pr(T > t) = 0.8286

Table 10: The Number of ER Visits Based on Presence or Absence of a Caregiver at Visit 2

Group	Obs	Mean	Std. Err.	Std. Dev.	[95% Conf. Interval]	
0	5	0	0	0	0	0
1	54	.1666667	.0576139	.4233737	.0511079	.2822254
combined	59	.1525424	.0530406	.4074123	.0463701	.2587146
diff		-.1666667	.0576139		-.2822254	-.0511079

diff = mean(0) - mean(1) t = -2.8928  
Ho: diff = 0 Satterthwaite's degrees of freedom = 53

Ha: diff < 0 Pr(T < t) = 0.0028      Ha: diff != 0 Pr(|T| > |t|) = 0.0055      Ha: diff > 0 Pr(T > t) = 0.9972

Table 11: The Number of ER Visits Based on Presence or Absence of a Caregiver at Visit 3

Group	Obs	Mean	Std. Err.	Std. Dev.	[95% Conf. Interval]	
0	5	0	0	0	0	0
1	54	.1666667	.0576139	.4233737	.0511079	.2822254
combined	59	.1525424	.0530406	.4074123	.0463701	.2587146
diff		-.1666667	.0576139		-.2822254	-.0511079

diff = mean(0) - mean(1) t = -2.8928  
Ho: diff = 0 Satterthwaite's degrees of freedom = 53

Ha: diff < 0 Pr(T < t) = 0.0028      Ha: diff != 0 Pr(|T| > |t|) = 0.0055      Ha: diff > 0 Pr(T > t) = 0.9972

Table 12: The Number of ER Visits based on Presence or Absence of a Caregiver at Visit 4

Group	Obs	Mean	Std. Err.	Std. Dev.	[95% Conf. Interval]	
0	23	.0434783	.0434783	.2085144	-.0466901	.1336467
1	18	.3333333	.1143324	.4850713	.0921131	.5745536
combined	41	.1707317	.0594942	.3809488	.0504894	.290974
diff		-.2898551	.1223203		-.5435868	-.0361234
diff = mean(0) - mean(1)					t = -2.3696	
Ho: diff = 0				Satterthwaite's degrees of freedom = 21.9181		
Ha: diff < 0		Ha: diff != 0		Ha: diff > 0		
Pr(T < t) = 0.0135		Pr( T  >  t ) = 0.0270		Pr(T > t) = 0.9865		

Table 13: The Number of ER Visits Based on Type of Caregiver at Visit 1

Group	Obs	Mean	Std. Err.	Std. Dev.	[95% Conf. Interval]	
0	4	0	0	0	0	0
1	37	.1891892	.0652765	.3970613	.0568024	.321576
combined	41	.1707317	.0594942	.3809488	.0504894	.290974
diff		-.1891892	.0652765		-.321576	-.0568024
diff = mean(0) - mean(1)					t = -2.8983	
Ho: diff = 0				Satterthwaite's degrees of freedom = 36		
Ha: diff < 0		Ha: diff != 0		Ha: diff > 0		
Pr(T < t) = 0.0032		Pr( T  >  t ) = 0.0064		Pr(T > t) = 0.9968		

## References

Aminoff, Michael J., Chad W. Christine, Joseph H. Friedman, Kelvin L. Chou, Kelly E. Lyons, Rajesh Pahwa, Bastian R. Bloem, Sotirios A. Parashos, Catherine C. Price, Irene A. Malaty, Robert Iansek, Ivan Bodis-Wollner, Oksana Suchowersky, Wolfgang H. Oertel, Jorge Zamudio, Joyce Oberdorf, Peter Schmidt, and Michael S. Okun. "Management of the Hospitalized Patient with Parkinson's Disease: Current State of the Field and Need for Guidelines." *Parkinsonism & Related Disorders* 17.3 (2011): 139-45. Web.

Carter, Julie H., Barbara J. Stewart, Karen S. Lyons, and Patricia G. Archbold. "Do Motor and Nonmotor Symptoms in PD Patients Predict Caregiver Strain and Depression?" *Movement Disorders* 23.9 (2008): 1211-216. Web.

Chou, Kelvin L., Jorge Zamudio, Peter Schmidt, Catherine C. Price, Sotirios A. Parashos, Bastiaan R. Bloem, Kelly E. Lyons, Chadwick W. Christine, Rajesh Pahwa, Ivan Bodis-Wollner, Wolfgang H. Oertel, Oksana Suchowersky, Michael J. Aminoff, Irene A. Malaty, Joseph H. Friedman, and Michael S. Okun. "Hospitalization in Parkinson Disease: A Survey of National Parkinson Foundation Centers." *Parkinsonism & Related Disorders* 17.6 (2011): 440-45. Web.

Hassan, Anhar, Samuel S. Wu, Peter Schmidt, Yunfeng Dai, Tanya Simuni, Nir Giladi, Bastiaan R. Bloem, Irene A. Malaty, and Michael S. Okun. "High Rates and the Risk Factors for Emergency Room Visits and Hospitalization in Parkinson's Disease." *Parkinsonism & Related Disorders* 19.11 (2013): 949-54. Web.

Hassan, Anhar, Samuel S. Wu, Peter Schmidt, Irene A. Malaty, Yun Feng Dai, Janis M. Miyasaki, and Michael S. Okun. "What Are the Issues Facing Parkinson's Disease Patients at Ten Years of Disease and Beyond?: Data from the NPF-QII Study." *Parkinsonism & Related Disorders* 18 (2012): n. pag. Web.

Lanoix, M. "Palliative Care and Parkinson's Disease: Managing the Chronic-palliative Interface." *Chronic Illness* 5.1 (2009): 46-55. Web.

Martínez-Martín, P., Gil-Nagel, A., Gracia, L. M., Gómez, J. B., Martínez-Sarriés, J. and Bermejo, F. (1994), Unified Parkinson's disease rating scale characteristics and structure. *Mov. Disord.*, 9: 76–83. doi: 10.1002/mds.870090112

Miyasaki, Janis M., J. Long, D. Mancini, E. Moro, S.h. Fox, A.e. Lang, C. Marras, R. Chen, A. Strafella, R. Arshinoff, R. Ghoche, and J. Hui. "Palliative Care for Advanced Parkinson Disease: An Interdisciplinary Clinic and New Scale, the ESAS-PD." *Parkinsonism & Related Disorders* 18 (2012): n. pag. Web.

Ornstein, Katherine, Cameron R. Hernandez, Linda V. Decherrie, and Theresa A. Soriano. "The Mount Sinai (New York) Visiting Doctors Program: Meeting the Needs of the Urban Homebound Population." *Care Management Journals* 12.4 (2011): 139-43. Web.

Ou, Ruwei, Jing Yang, Bei Cao, Qianqian Wei, Ke Chen, Xueping Chen, Bi Zhao, Ying Wu, Wei Song, and Huifang Shang. "Progression of Non-motor Symptoms in Parkinson's Disease among Different Age Populations: A Two-year Follow-up Study." *Journal of the Neurological Science* 360 (2015): 72-77. Web.

*Parkinson Association of the Carolinas*, [www.parkinsonassociation.org/facts-about-parkinsons-disease/](http://www.parkinsonassociation.org/facts-about-parkinsons-disease/).

Pereles, Laurie. "Home Visits: An Access to Care Issue for the 21st Century." *Canadian Family Physician* 46 (2000): 2044-048. Web.

Saleeby, Yusuf. "Parkinson's Disease." *American Fitness* (2014)..

Sweeney, Meghan M, et al. "Assessment and Connection to Care: The Vital Role of Social Worker in an Interdisciplinary Home Visit Program for Advanced Parkinson's Disease Patients." 3 June 2016.

Sorocco, Kristen H., Kristi L. Bratkovich, Rita Wingo, Saleem M. Qureshi, and Patrick J. Mason. "Integrating Care Coordination Home Telehealth and Home Based Primary Care in Rural Oklahoma: A Pilot Study." *Psychological Services* 10.3 (2013): 350-52. Web.

Watkins, Lynn, Carol Hall, and Daria Kring. "Hospital to Home." *Professional Case Management* 17.3 (2012): 117-23. Web.

"What homebound means." *Medicare Interactive*, [www.medicareinteractive.org/get-answers/medicare-covered-services/home-health-care-benefit-part-a-and-b/what-homebound-means](http://www.medicareinteractive.org/get-answers/medicare-covered-services/home-health-care-benefit-part-a-and-b/what-homebound-means).