Published in final edited form as:
Parkinsonism Relat Disord. 2011 February ; 17(2): 95–99. doi:10.1016/j.parkreldis.2010.10.014.

Clinical predictors of frequent patient telephone calls in Parkinson's disease☆

Anli A. Liu[a], **Christine E. Boxhorn**[a], **Michael A. Klufas**[a], **Paul J. Christos**[b], **Jeffrey T. Thorne**[a], **Angela Y. Shih**[a], **Nadejda M. Tsankova**[c], **Benjamin J. Dorfman**[a], **Claire Henchcliffe**[a], **Panida Piboolnurak**[a], and **Melissa J. Nirenberg**[a,*]

[a]Department of Neurology and Neuroscience, Weill Cornell Medical College, New York, NY, USA

[b]Departments of Biostatistics and Epidemiology, Weill Cornell Medical College, New York, NY, USA

[c]Department of Neuropathology, Columbia University Medical Center, New York, NY, USA

Abstract

Background—Patient telephone calls are a major form of unreimbursed healthcare utilization in Parkinson's disease (PD), yet little is known about potential risk factors for frequent calling behavior.

Methods—Prospective cohort study of 175 non-demented outpatients with PD. Our primary outcome measure was the frequency of patient telephone calls over a three-month period relative to baseline demographics, State-Trait Anxiety Index (STAI) and Beck Anxiety Inventory (BAI) scores, Unified Parkinson's Disease Rating Scale (UPDRS) motor scores, and medication use. Based on the median call rate (1 call/3 months), subjects were dichotomized into frequent (≥2 calls) and infrequent (≤1 call) caller groups.

Results—A total of 297 calls were received, of which 264 (89%) were from the frequent caller group ($n = 63$ subjects), and only 33 (11%) were from the infrequent caller group ($n = 112$ subjects). Compared with calls from infrequent callers, those from frequent callers more commonly related to somatic symptoms of PD (46.8% vs. 19.4%, $p = 0.007$). In multivariate logistic regression analysis, independent predictors of frequent calling were: anxiety (STAI ≥55; adjusted OR = 2.62, $p = 0.02$), sleep disorders (adjusted OR = 2.36, $p = 0.02$), dyskinesias (adjusted OR = 3.07, $p = 0.03$), and dopamine agonist use (adjusted OR = 2.27, $p = 0.03$). Baseline demographics, UPDRS motor scores, and levodopa use were similar in both groups.

Conclusions—Frequent patient telephone calls in PD are independently associated with anxiety, sleep disorders, dyskinesias, and dopamine agonist use, with a minority of patients accounting for the majority of calls. Aggressive treatment of these non-motor symptoms and motor complications might potentially reduce the burden of patient telephone calls in PD.

Keywords

Parkinson's disease; Telephone; Healthcare; Resource; Utilization; Non-motor; Anxiety; Sleep disorder; Motor complications; Dopamine agonist; Quality of care

☆The review of this paper was entirely handled by a Co-Editor-in-Chief, R. L. Rodnitzky.

*Corresponding author. Weill Cornell Medical College, 428 East 72nd Street, Suite 400, New York, NY 10021, USA. Tel.: +1 212 746 2584., mjnirenb@med.cornell.edu (M.J. Nirenberg). .

1. Introduction

As concerns grow over rising worldwide healthcare costs, there has been increasing interest in examining the economic burden of Parkinson's disease (PD). People with PD have significantly greater healthcare utilization than the general elderly population, resulting in excessive personal and societal expenditures. These are attributable to more frequent inpatient admissions, outpatient visits, medication usage, and need for long-term care [1-5]. Annual PD-related healthcare expenditures have been estimated at 23 billion dollars in the United States alone – a number that is expected to increase considerably as the population ages [1]. This has led to a growing interest in the identification of risk factors – particularly modifiable ones – for excess healthcare utilization in PD. In prior studies, clinical correlates of increased resource utilization and healthcare costs in PD have included advancing parkinsonism, trauma related to falls, dementia, and comorbid diabetes or cerebrovascular disease [4-8].

In addition to these direct causes of increased healthcare expenditures, PD is associated with a considerable burden of unreimbursed healthcare utilization, of which patient telephone calls represent a major component. In a recent study at a tertiary academic movement disorders center, clinical fellows spent an average of more than 1 h per day returning patient telephone calls, with a disproportionately high number of calls from patients with PD than from those with essential tremor or dystonia [8]. Reasons for these telephone calls vary, but commonly include disease symptoms, treatment questions, and medication side-effects [8], many of which reflect underlying distress on the part of the patient. Thus, identification and treatment of modifiable risk factors for telephone healthcare utilization in PD has the potential not only to reduce unreimbursed healthcare utilization, but also to improve patient quality of life.

The goal of the current study was to determine the clinical correlates of frequent telephone healthcare utilization in PD, and to identify potential modifiable risk factors thereof. Based on our clinical observations, preliminary research, [9,10] and prior findings in the primary care literature [11,12], we postulated that frequent telephone healthcare utilization in PD would more closely relate to non-motor symptoms – particularly anxiety – than to motor impairment.

2. Methods

2.1. Subjects

A convenience sample of patients with PD ($N = 175$) was recruited from the Weill Cornell Parkinson's disease and Movement Disorders Institute, an urban, academic movement disorders center, between June 2006 and November 2008. All subjects were part of a large, prospective cohort of non-motor and motor symptoms in PD, as previously described [13,14], and were therefore informed of numerous outcome measures that might be investigated in future studies; these included healthcare utilization in general terms, but not telephone calls in specific. Subjects were eligible for inclusion if they met United Kingdom Parkinson's Disease Society Brain Bank criteria [15] and were able both to provide informed consent and to complete the research questionnaires. Subjects were excluded from participation if they had a clinical history of dementia, a Folstein Mini-Mental State Examination (MMSE) score lower than 25, neurodegenerative disease other than PD, current dopamine receptor blocking agent usage, history of PD neurosurgery, or life expectancy of less than 12 months. The study was approved by and performed in accordance with the Weill Cornell Institutional Review Board. Written informed consent was obtained from all subjects prior to enrollment.

2.2. Assessments

A Unified Parkinson's Disease Rating Scale, modified Hoehn & Yahr staging, detailed medical and neurological history, and current medication list were completed by one of three movement disorders specialists (MJN, CH, or PP). Subjects subsequently completed a MMSE, Beck Anxiety Inventory (BAI), State-Trait Anxiety Inventory (STAI), Beck Depression Inventory (BDI), Obsessive-Compulsive Inventory–Revised (OCI-R), Schwab and England disability scale, and Parkinson's Disease Quality of Life Questionnaire (PDQL) under the supervision of a research assistant who was blinded to the motor assessments. Because there are no validated anxiety rating scales in PD, we used two complementary assessments – the STAI (which is more selective for sustained anxiety disorders such as generalized anxiety disorder), and the BAI (which is more specific for episodic anxiety disorders such panic disorder) [16]. All telephone calls from patients and caregivers were prospectively recorded in the paper chart or EpicCare Ambulatory© electronic medical record (Verona, WI) at the time that they were received. Treating physicians were blinded to the results of the non-motor assessments.

After study recruitment had been completed, a research assistant analyzed the total number of telephone calls that were received by physicians from subjects or caregivers within a predetermined time-period of three months after the baseline visit. This time-period was chosen to be long enough to allow for differentiation of subjects into high and low frequency caller groups, but short enough that no significant progression of PD would be expected to occur. The research assistant then assigned these patient-initiated telephone calls to one of the following categories based on the caller's chief complaint: (1) motor symptoms/side effects, (2) non-motor symptoms/side-effects, (3) questions or requests for information, and (4) requests for medication refills or completion of paperwork. Physician-initiated telephone calls and calls that did not involve a healthcare provider (e.g., those for appointment scheduling and confirmation) were excluded from analysis.

Data was recorded on paper case report forms and then entered into an electronic database (Microsoft Access; Microsoft Corp, Redmond, Washington). Dopaminergic medication usage was converted to levodopa equivalent daily doses (LEDD) as follows. The total dose of levodopa (levodopa-LEDD) was calculated as the sum of: the daily dose of regular levodopa + (0.75 times the daily dose of continuous-release levodopa) + (1.3 times the daily dose of levodopa/entacapone). The total dose of dopamine agonist (DA-LEDD) was calculated as the sum of: (100 times the daily dose of pramipexole or pergolide) + (30 times the daily dose of rotigotine) + (20 times the daily dose of ropinirole). Two research assistants independently reviewed all primary data and database entries to ensure that data collection was complete and accurate.

2.3. Statistical analysis

Frequent and infrequent caller groups were designated relative to the median number of phone calls in the 3-month period after baseline assessments. Descriptive statistics (including mean, median, standard deviation, and range for continuous variables; and frequencies and percentages for categorical variables) were calculated for demographic and clinical variables and stratified by high (≥2 calls/3 months) and low (≤1 call/3 months) frequency caller groups. Univariate relationships between frequency call group and (1) demographic variables, (2) motor scores, (3) non-motor scores, and (4) medication usage, were calculated using the two-sample t-test or Wilcoxon rank sum test for continuous variables and the chi-square test or Fisher's exact test for categorical variables. Differences in anxiety and depression symptoms were determined by comparing mean scores on the BAI, STAI, and BDI, respectively, and also by using previously recommended thresholds on each inventory. The thresholds used were STAI ≥55 [17], BAI ≥10 [18], and BDI ≥10 [18].

Specific patient characteristics were further assessed for a potential independent effect on high call frequency (≥2 calls/3 months) in a multivariate logistic regression model. These were chosen based on *a priori* assumptions and the results of the univariate analysis. Collinearity assessment between predictors was performed prior to the specification of the final multivariate model. If two predictive factors were collinear (kappa value > 0.40), then the one that more closely related to high call frequency in univariate analysis was explored in the multivariate model. The number of variables that could be explored in the multivariate model was limited by the number of subjects in the high call frequency group. All *p*-values are two-sided with statistical significance evaluated at the 0.05 alpha level. Ninety five percent confidence intervals (95% CI) for adjusted odds ratios (OR) were constructed to assess the precision of the obtained estimates. All analyses were performed in SPSS Version 18 (SPSS Inc, Chicago IL) and SAS Version 9.2 (SAS Institute, Inc., Cary NC).

Post hoc univariate analysis was also performed to examine the relationship between recommended medication changes at the baseline visit and the subsequent caller group. Recommended changes in: (1) any medications (PD or non-PD), (2) levodopa, and (3) DA at the baseline visit were tabulated and analyzed relative to subsequent caller group using the statistical methodology described above.

3. Results

One-hundred and seventy-five subjects were recruited into the study, with 297 total calls received in the three months after study enrollment. Based on the median number of calls (1 call per subject), the study population was dichotomized into frequent caller (≥2 calls/3 months) and infrequent caller (≤1 call/3 months) groups. The frequent caller group consisted of 63 subjects (36%), from whom a total of 264 calls were received, thus accounting for 89% of all calls. The infrequent caller group consisted of 112 subjects (64%), from whom a total of 33 calls were received, accounting for 11% of calls.

Table 1 shows baseline demographic and clinical characteristics of the study population. In univariate analysis, frequent callers had a longer disease duration than infrequent callers (median 5.5 vs 4.1 years, $p = 0.03$), but the two groups were similar with respect to other demographic features including age (67.7 ± 8.3 vs 66.6 ±11.5, $p = 0.47$), age of PD onset (61.4 ± 9.5 vs 61.6 ± 11.7; $p = 0.92$), female sex (47.6% vs 44.6%; $p = 0.70$), cumulative cigarette exposure (range 0.0–93.0 pack-years vs range 0.0–99.0 pack-years, $p = 0.40$), prevalence of married subjects (68.3% vs 60.7%, $p = 0.32$), and MMSE scores (29 ± 1.5 vs 29 ± 1.4, $p = 0.42$). Almost all subjects were either non-fluctuators or were in the “on” state at the time of examination (98.4% of frequent callers vs 98.2% of infrequent callers, $p = 1.0$).

The primary motor outcome, UPDRS motor score, was similar in frequent and infrequent callers (23.0 ± 11.0 vs 22.2 ± 10.8, $p = 0.65$), as were modified Hoehn & Yahr scores (median = 2 [range 1.0–3.0] vs median = 2 [range 1.0–4.0], $p = 0.05$) and Schwab and England Disability scores (85.8 ± 14.7 vs 88.9 ± 11.9, $p = 0.13$). Frequent callers had a greater prevalence of overall motor complications (52.4% vs 33.0%, $p = 0.01$); these included dyskinesias (25.4% vs 8.0%, $p = 0.002$) and off dystonia (31.7% vs 15.2%, $p = 0.01$), with a similar trend for end-of-dose wearing off (34.9% vs 21.4%, $p = 0.05$). There was also a trend towards higher UPDRS activities of daily living (ADL) scores in frequent than infrequent callers (9.6 ± 5.8 vs 8.3 ± 5.2, $p = 0.06$).

Frequent callers had a greater burden of anxiety symptoms, reflected in higher scores on both the STAI (76.1 ± 24.0 vs 66.5 ± 22.9, $p = 0.009$) and the BAI (14.0 ± 8.9 vs 11.3 ± 7.7, $p = 0.04$). Sleep disorders were also more common in frequent than infrequent callers (73%

vs 52.7%, $p < 0.01$). Compared with infrequent callers, frequent callers had a trend towards higher depression scores on the BDI (11.4 ± 8.0 vs 9.3 ± 7.2, $p = 0.08$), lower quality of life scores on the PDQL (140.3 ± 23.0 vs 147.1 ± 21.4, $p = 0.05$), and a greater prevalence of DA-related impulse control disorders (ICDs) (15.9% vs 7.1%, $p = 0.07$). In contrast, OCI-R scores and the prevalence of symptomatic orthostatic hypotension were comparable in both groups (Table 1)

The baseline prevalence of DA use was significantly higher among frequent versus infrequent callers (46.0% vs 25.9%, $p = 0.007$), but the prevalence of levodopa usagewas similar in both groups (58.7% vs 56.3%, $p = 0.75$). Among subjects who used DAs, the median baseline DA dosage was the same in both caller groups (median = 150.0 vs. median = 150.0 DA-LEDD, $p = 0.70$). In contrast, among subjects who used levodopa, the median levodopa dosage was higher in frequent than infrequent callers (median = 600.0 vs median = 450.0 levodopa-LEDD, $p = 0.02$). There was a trend towards usage of higher total dopamine replacement therapy (levodopa and/or DA) in frequent than infrequent callers (median = 400.0 vs median = 300.0 total LEDD, $p = 0.05$).

A multivariate logistic regression model for independent predictors of high call frequency (≥2 calls within 3 months following initial enrollment) was performed. The following variables were included, based on *a priori* considerations and the findings of univariate analysis: age, sex, disease duration, UPDRS motor score, dyskinesias, presence of a sleep disorder, STAI score ≥55, and prevalence of DA use. After multivariate analysis, frequent callers were more likely to: (1) have a STAI total score ≥55 (adjusted OR = 2.62, 95% CI = 1.20, 5.70; $p = 0.02$), (2) have a sleep disorder (adjusted OR = 2.36; 95% CI = 1.12, 4.95; $p = 0.02$), (3) have dyskinesias (adjusted OR = 3.07, 95% CI = 1.12, 8.43, $p = 0.03$), and (4) be taking a DA (adjusted OR = 2.27, 95% CI = 1.08, 4.76; $p = 0.03$). In contrast, after multivariate analysis, there was no observed relationship between caller group and age, sex, disease duration, or UPDRS motor score. Results of the multivariate analysis are shown in Table 2. Similar findings were observed when the multivariate analysis was repeated substituting BAI ≥10 instead of STAI ≥55 as a marker for high anxiety symptoms (data not shown).

An analysis of the types of telephone calls in the two groups is shown in Table 3. The majority of telephone calls were initiated by the subject (rather than a caregiver) in both frequent and infrequent caller groups (82.6% and 93.9%, respectively, $p = 0.15$). Calls related to PD symptoms (motor or non-motor) accounted for a higher percentage of the total calls initiated by frequent than infrequent callers (46.8% vs 19.4%, $p = 0.007$). In contrast, calls with questions, requests for information, and paperwork tended to account for a higher percentage of calls from subjects in the infrequent caller group. The percentage of calls about motor symptoms was similar in both groups (18.2% vs 12.1%, $p = 0.53$). In contrast, non-motor symptoms tended to account for a greater proportion of calls in frequent than infrequent callers (20.5% vs 6.0%, $p = 0.08$).

In *post hoc* analysis, we examined the relationship between caller group and the treatment recommendations that occurred at the baseline visit. Overall, study subjects were more commonly advised to increase rather than to decrease the dose of levodopa (26.9% vs 4%), and to decrease rather than increase the dose of DA (12.6% vs 10.3%), with no significant differences between the two caller groups. The recommendation to make one or more changes in the medication regimen at the baseline visit (including PD and non-PD meds) was more common in frequent than infrequent callers (76.2% vs 51.8%, $p = 0.002$). The recommendation to change the dosage of a DA was more prevalent (trend) in frequent than infrequent callers (31.7% vs 17.9%, $p = 0.06$), whereas the recommendation to change the dosage of levodopa was equally prevalent in both caller groups (31.7% vs 30.4%, $p = 0.99$).

4. Discussion

Telephone calls to healthcare providers represent a major cause of uncompensated healthcare utilization in PD [8], but to our knowledge there are no prior studies that have investigated the potential risk factors thereof. In this study, we examined the clinical predictors of frequent patient telephone calls in PD, postulating that they would correlate more closely with non-motor than motor impairment. The results of the study confirm that two major non-motor disease manifestations – anxiety symptoms and sleep disorders – are independent predictors of frequent telephone calls to healthcare providers. Motor complications – and dyskinesias in particular – were also predictive of frequent calling behavior. In contrast, we found no relationship between frequent calling and baseline demographic features, disease duration, UPDRS motor scores, or other measures of disease progression and physical impairment.

Although the prevalence of levodopa usage was similar in frequent and infrequent callers, frequent callers were more likely to have baseline dyskinesias and other motor complications, likely due the use of higher median dosages of levodopa observed in these subjects. Of interest, baseline usage of a DA was considerably more common in frequent than infrequent callers, perhaps reflecting the more prominent non-motor side-effects of these medications; these include sleep disorders and ICDs [19-23], both of which were more common in frequent than infrequent callers. Dopamine agonist withdrawal syndrome, which is associated with DA taper in the setting of baseline ICDs [13,24,25], might potentially have also contributed to increased telephone calls, as suggested by the greater prevalence of ICDs in the frequent caller group. Together, the study findings suggest that complications of dopaminergic therapy – both motor (such as levodopa-induced dyskinesias) and non-motor (such as DA-related ICDs) – may be risk factors for frequent patient telephone calls in PD.

The types of telephone calls also differed significantly between frequent and infrequent callers. Nearly half of the calls in the frequent caller group were related to somatic symptoms of PD, whereas the vast majority of calls in the infrequent caller group were related to more neutral factors (such as questions, prescription refills, and paperwork). The prevalence of calls related to motor symptoms was comparable in frequent and infrequent caller groups, consistent with the similar degree of motor impairment observed in the two groups. In contrast, the prevalence of calls related to non-motor symptoms tended to be greater in frequent callers, presumably reflecting greater burden of anxiety and other non-motor symptoms in this group. Quality of life scores also tended to be lower in frequent than infrequent callers, likely also due to the effects of these non-motor symptoms.

Study strengths include the large sample size, prospective cohort study design, use of two independent anxiety rating scales, and inclusion of subjects who were part of a large database study of PD (and thus unaware that the frequency of telephone calls was a specific focus). Limitations include the potential effects of enrolling in a research study on subsequent calling behavior, and the fact that subjects were recruited from a single tertiary care practice that may not be representative of the overall PD population.

In summary, we show that anxiety, sleep disorders, dyskinesias, and DA use are independent predictors of frequent patient telephone calls in PD. Increased recognition and treatment of these non-motor symptoms and complications of medical therapy might potentially reduce patient telephone calls – a major source of unreimbursed healthcare utilization in PD – while improving patient quality of life. Our findings also highlight the need for greater support of telephone medicine, which has been shown to reduce morbidity, mortality, and healthcare utilization in variety of medical disciplines [26-30], and appears to be of particular importance in the care of patients with PD.

Acknowledgments

We thank Malinka Velcheva and Bill Nikolov for technical assistance. This study was supported by the Parkinson's Disease Foundation. Dr. Paul J. Christos was partially supported by the Weill Cornell Clinical Translational Science Center (UL1-RR024996).

References

[1]. Noyes K, Liu H, Li Y, Holloway R, Dick A. Economic burden associated with Parkinson's disease on elderly medicare beneficiaries. Mov Disord. Mar; 2006 21(3):362–72. [PubMed: 16211621]

[2]. Huse D, Schulman K, Orsini L, Castelli-Haley J, Kennedy S, Lenhart G. Burden of illness in Parkinson's disease. Mov Disord. Nov; 2005 20(11):1449–54. [PubMed: 16007641]

[3]. Hagell P, Nordling S, Reimer J, Grabowski M, Persson U. Resource use and costs in a Swedish cohort of patients with Parkinson's disease. Mov Disord. Nov; 2002 17(6):1213–20. [PubMed: 12465059]

[4]. Pressley JC, Louis ED, Tang MX, Cote L, Cohen PD, Glied S, et al. The impact of comorbid disease and injuries on resource use and expenditures in parkinsonism. Neurology. Jan 14; 2003 60(1):87–93. [PubMed: 12525724]

[5]. Chrischilles EA, Rubenstein LM, Voelker MD, Wallace RB, Rodnitzky RL. The health burdens of Parkinson's disease. Mov Disord. May; 1998 13(3):406–13. [PubMed: 9613729]

[6]. Martignoni E, Godi L, Citterio A, Zangaglia R, Riboldazzi G, Calandrella D, et al. Comorbid disorders and hospitalisation in Parkinson's disease: a prospective study. Neurol Sci. Jun; 2004 25(2):66–71. [PubMed: 15221624]

[7]. Whetten-Goldstein K, Sloan F, Kulas E, Cutson T, Schenkman M. The burden of Parkinson's disease on society, family, and the individual. J Am Geriatr Soc. Jul; 1997 45(7):844–9. [PubMed: 9215336]

[8]. Adam OR, Ferrara JM, Aguilar Tabora LG, Nashatizadeh MM, Negoita M, Jankovic J. Education research: patient telephone calls in a movement disorders center: lessons in physician-trainee education. Neurology. Sep 8; 2009 73(10):e50–2. [PubMed: 19738167]

[9]. Nirenberg, MJ.; Boxhorn, CE.; Shih, AY.; Tsankova, NM.; Henchcliffe, C.; Savel, RH. Telephone healthcare utilization in Parkinson's disease is associated with non-motor symptoms but not with motor disability; American Academy of Neurology, 59th Annual Meeting; 2007;

[10]. Boxhorn, CE.; Shih, AY.; Tsankova, NM.; Henchcliffe, C.; Savel, RH.; Nirenberg, MJ. Telephone healthcare utilization and non-motor symptoms in Parkinson's disease; American Geriatrics Society, Annual Scientific Meeting; 2007;

[11]. Demertzis KH, Craske MG. Anxiety in primary care. Curr Psychiatry Rep. Aug; 2006 8(4):291–7. [PubMed: 16879793]

[12]. Evens S, Curtis P, Talbot A, Baer C, Smart A. Characteristics and perceptions of after-hours callers. Fam Pract. Mar; 1985 2(1):10–6. [PubMed: 3988010]

[13]. Rabinak CA, Nirenberg MJ. Dopamine agonist withdrawal syndrome in Parkinson disease. Arch Neurol. Jan; 2010 67(1):58–63. [PubMed: 20065130]

[14]. Khadem NR, Nirenberg MJ. Carbidopa/levodopa pharmacy errors in Parkinson's disease. Mov Disord. 2010 doi:10.1002/mds.23311.

[15]. Hughes A, Daniel S, Kilford L, Lees A. Accuracy of clinical diagnosis of idiopathic Parkinson's disease: a clinico-pathological study of 100 cases. J Neurol Neurosurg Psychiatr. Mar; 1992 55(3):181–4. [PubMed: 1564476]

[16]. Leentjens A, Dujardin K, Marsh L, Martinez-Martin P, Richard I, Starkstein S, et al. Anxiety rating scales in Parkinson's disease: critique and recommendations. Mov Disord. Oct; 2008 23(14):2015–25. [PubMed: 18792121]

[17]. Kvaal K, Ulstein I, Nordhus IH, Engedal K. The Spielberger State-Trait Anxiety Inventory (STAI): the state scale in detecting mental disorders in geriatric patients. Int J Geriatr Psychiatry. Jul; 2005 20(7):629–34. [PubMed: 16021666]

[18]. Shulman L, Taback R, Bean J, Weiner W. Comorbidity of the nonmotor symptoms of Parkinson's disease. Mov Disord. May; 2001 16(3):507–10. [PubMed: 11391746]

[19]. Driver-Dunckley E, Samanta J, Stacy M. Pathological gambling associated with dopamine agonist therapy in Parkinson's disease. Neurology. Aug 12; 2003 61(3):422–3. [PubMed: 12913220]

[20]. Nirenberg MJ, Waters C. Compulsive eating and weight gain related to dopamine agonist use. Mov Disord. Apr; 2006 21(4):524–9. [PubMed: 16261618]

[21]. Potenza MN, Voon V, Weintraub D. Drug insight: impulse control disorders and dopamine therapies in Parkinson's disease. Nat Clin Pract Neurol. Dec; 2007 3(12):664–72. [PubMed: 18046439]

[22]. Wood L. Clinical review and treatment of select adverse effects of dopamine receptor agonists in Parkinson's disease. Drugs Aging. Apr; 2010 27(4):295–310. [PubMed: 20359261]

[23]. Weintraub D, Koester J, Potenza MN, Siderowf AD, Stacy M, Voon V, et al. Impulse control disorders in Parkinson disease: a cross-sectional study of 3090 patients. Arch Neurol. May; 2010 67(5):589–95. [PubMed: 20457959]

[24]. Nirenberg MJ. Dopamine agonist withdrawal syndrome and non-motor symptoms after Parkinson's disease surgery. Brain. 2010 doi:10.1093/brain/awq165.

[25]. Nirenberg MJ, Rabinak CA. In reply: dopamine agonist withdrawal syndrome – the apomorphine solution. Arch Neurol. 2010; 67(9):1156. [PubMed: 20837869]

[26]. Tsuyuki RT. Periodic telephone counseling for polypharmacy improved compliance and reduced mortality. ACP J Club. Janefeb;2007 146(1):9. [PubMed: 17203929]

[27]. Kinkade S. An exercise and telephone follow-up programme reduced emergency readmissions and improved quality of life in older people. Evid Based Med. Aug.2009 14(4):120. [PubMed: 19648436]

[28]. Inglis SC, Clark RA, McAlister FA, Ball J, Lewinter C, Cullington D, et al. Structured telephone support or telemonitoring programmes for patients with chronic heart failure. Cochrane Database Syst Rev. 2010:8. CD007228.

[29]. Waterman AD, Banet G, Milligan PE, Frazier A, Verzino E, Walton B, et al. Patient and physician satisfaction with a telephone-based anticoagulation service. J Gen Intern Med. Jul; 2001 16(7):460–3. [PubMed: 11520383]

[30]. Stirewalt CF, Linn MW, Godoy G, Knopka F, Linn BS. Effectiveness of an ambulatory care telephone service in reducing drop-in visits and improving satisfaction with care. Med Care. Jul; 1982 20(7):739–48. [PubMed: 7121093]

Table 1

Baseline demographic and clinical characteristics of PD subjects by call frequency.

Subject characteristics	High frequency callers (≥2 calls/3 months) (*N* = 63)	Low frequency callers (≤1 call/3 months) (*N* = 112)	*P* value
Demographics			
Age (mean ± SD)	67.7 (±8.3)	66.6 (±11.5)	0.47
Age of PD onset (mean ± SD)	61.4 (±9.5)	61.6 (±11.7)	0.92
Disease duration (median, range)	5.5 (0.3–29.4)	4.1 (0.4–21.0)	0.03
Female sex (*N*, %)	30 (47.6%)	50 (44.6%)	0.70
Lifetime tobacco use (pack-years) (median, range)	0.0 (0.0–93.0)	0.0 (0.0–99.0)	0.40
Married (*N*, %)	43 (68.3%)	68 (60.7%)	0.32
MMSE (mean ± SD)	29 (±1.5)	29 (±1.4)	0.42
Motor and disability scores			
UPDRS motor score (mean ± SD)	23.0 (±11.0)	22.2 (±10.8)	0.65
Motor complications (*N*, %)[a]	33 (52.4%)	37 (33.0%)	0.01
Dyskinesias (*N*, %)	16 (25.4%)	9 (8%)	0.002
Wearing off (*N*, %)	22 (34.9%)	24 (21.4%)	0.05
Off dystonia (*N*, %)	20 (31.7%)	17 (15.2%)	0.01
Modified Hoehn & Yahr (median, range)	2 (1.0–3.0)	2 (1.0–4.0)	0.05
Schwab & England Disability (mean ± SD)	85.8 (±14.7)	88.9 (±11.9)	0.13
UPDRS ADL score (mean ± SD)	9.6 (±5.8)	8.3 (±5.2)	0.06
Non-motor scores			
STAI total (mean ± SD)	76.1 (±24.0)	66.5 (±22.9)	0.009
STAI state subset (mean ± SD)	37.2 (±13.0)	32.2 (±13.0)	0.02
STAI trait subset (mean ± SD)	38.9 (±12.0)	34.3 (±11.4)	0.01
STAI total ≥ 55 (*N*, %)	50 (79.4%)	67 (59.8%)	0.008
Beck Anxiety Inventory (mean ± SD)	14.0 (±8.9)	11.3 (±7.7)	0.04
Beck Anxiety Inventory ≥ 10	41 (65.1%)	56 (50.0%)	0.05
Beck Depression Inventory (mean ± SD)	11.4 (±8.0)	9.3 (±7.2)	0.08
Beck Depression Inventory ≥ 10 (*N*, %)	32 (50.8%)	48 (42.9%)	0.31
Presence of baseline ICDs	10 (15.9%)	8 (7.1%)	0.07
OCI-R score (median, range)	7.0 (0.0–51.0)	6.5 (0.0–43.0)	0.45
Symptomatic orthostatic hypotension (*N*, %)	11 (17.5%)	32 (28.6%)	0.10
Sleep disorder (*N*, %)	46 (73.0%)	59 (52.7%)	0.008
PDQL (mean ± SD)	140.3 (±23.0)	147.1 (±21.4)	0.05
PD medication use			
On levodopa (*N*, %)	37 (58.7%)	63 (56.3%)	0.75
L-dopa LEDD (median, range)[b]	600.0 (150.0–3500.0)	450.00 (100.0–1800.0)	0.02
On dopamine agonist (*N*, %)	29 (46.0%)	29 (25.9%)	0.007
DA LEDD (median, range)[c]	150.0 (10.0–450.0)	150.0 (60.0–450.0)	0.70
On PD levodopa and/or DA (*N*, %)	46 (73.0%)	71 (63.4%)	0.19

Subject characteristics	High frequency callers (≥2 calls/3 months) (*N* = 63)	Low frequency callers (≤1 call/3 months) (*N* = 112)	*P* value
Total LEDD (median, range)[d]	562.5 (62.5–3500.0)	450.0 (60.0–1860.0)	0.12
Total LEDD for all subjects (median, range)[e]	400.0 (0.0–3500.0)	300.0 (0.0–1860.0)	0.05

Abbreviations: ADL, Activities of Daily Living; DA, dopamine agonist; Hx, history; ICD, impulse control disorder; LEDD, levodopa equivalent daily dose; MMSE, Mini-Mental State Examination; OCI-R, Obsessive-Compulsive Inventory—Revised; PD, Parkinson's disease; PDQL, PD Quality of Life Questionnaire; STAI, State-Trait Anxiety Index; UPDRS, Unified Parkinson's Disease Rating Scale.

[a] Motor complications was defined as the presence of dyskinesias, wearing off, and/or off dystonia.

[b] L-Dopa LEDD based on all patients on levodopa.

[c] DA-LEDD based on all patients on dopamine agonist.

[d] Total LEDD for all subjects on levodopa and/or DA.

[e] Total LEDD based on all study subjects.

Table 2

Multivariate analysis of the baseline clinical features of high frequency callers. Patient characteristics that differed significantly in frequent and infrequent caller groups ($p < 0.05$) are shown in boldface.

Patient characteristic	Odds ratio (95% CI)	*P* value
Age (years)	1.01 (0.97–1.04)	0.66
Female sex	0.79 (0.39–1.59)	0.50
Disease duration (years)	1.01 (0.93, 1.10)	0.79
UPDRS motor score	0.99 (0.97–1.03)	0.96
Total STAI ≥55	**2.62 (1.20–5.70)**	**0.02**
UPDRS sleep disorder	**2.36 (1.12, 4.95)**	**0.02**
UPDRS dyskinesia	**3.07 (1.12, 8.43)**	**0.03**
On dopamine agonist	**2.27 (1.08–4.76)**	**0.03**

Abbreviations: UPDRS, Unified Parkinson's Disease Rating Scale; STAI, State-Trait Anxiety Index.

Table 3

Types of phone calls made by high frequency vs. low frequency callers.

Phone call type	**High frequency callers (≥2 calls/3 months) (*N* = 264 calls)**	**Low frequency callers (≤1 call/3 months) (*N* = 33 calls)**	***P* value**
Caregiver-initiated calls (*N*, %)	46 (17.4%)	2 (6.1%)	0.15
Patient-initiated calls (*N*, %)	218 (82.6%)	31 (93.9%)	0.15
Related to PD symptoms	**102 (46.8%)**	**6 (19.4%)**	**0.007**
Motor symptoms (*N*, %)	48 (18.2%)	4 (12.1%)	0.53
Non-motor symptoms (*N*, %)	54 (20.5%)	2 (6.0%)	0.08
Unrelated to PD symptoms	**116 (53.2%)**	**25 (80.6%)**	**0.007**
Questions/information (*N*, %)	79 (29.9%)	18 (54.5%)	0.008
Prescriptions/paperwork (*N*, %)	37 (14.0%)	7 (21.2%)	0.40

Abbreviation: PD, Parkinson's disease.