High patient satisfaction with telehealth in Parkinson disease

A randomized controlled study

Jayne R. Wilkinson, MD, MSCE; Meredith Spindler, MD; Stephanie M. Wood, BS; Steven C. Marcus, PhD; Daniel Weintraub, MD; James F. Morley, MD, PhD; Margaret G. Stineman, MD; John E. Duda, MD

Abstract

Background: Parkinson disease (PD) is a complex neurodegenerative disorder that benefits from specialty care. Telehealth is an innovative resource that can enhance access to this care within a patient-centered framework. Research suggests that telehealth can lead to increased patient satisfaction, equal or better clinical outcomes, and cost savings, but these outcomes have not been well-studied in PD. **Methods:** We conducted a dual active-arm 12-month randomized controlled trial to assess patient satisfaction, clinical outcomes, travel burden, and health care utilization in PD using video telehealth for follow-up care with specialty providers. Telehealth visits took place either at a facility nearer to the patient (satellite clinic arm) or in the patient's home (home arm). Each control group received usual in-person care. Patient satisfaction, assessed by quantitative questionnaires, was the primary outcome. **Results:** Eighty-six men were enrolled (home arm: 18 active, 18 control; satellite clinic arm: 26 active, 24 control) with a mean age of 73 years (range 42–87). There were no differences in baseline characteristics between the active group and the controls in each arm ($p > 0.05$). A significant difference in overall patient satisfaction was not found; however, high levels of patient satisfaction were found in all groups. Greater satisfaction for the telehealth modality was found in assessments of convenience and accessibility/distance. Clinical outcomes were similar between groups, travel burden was reduced using telehealth, and health care utilization was largely similar in both groups. **Conclusions:** As the need for PD subspecialty care increases, innovative patient-centered solutions to overcoming barriers to access, such as video telehealth, will be invaluable to patients and may provide high patient satisfaction. *Neurol Clin Pract* 2016;6:241–251

Parkinson's Disease Research, Education and Clinical Center (PADRECC) (JRW, MS, SMW, DW, JFM, JED), Philadelphia Veterans Affairs Medical Center, Philadelphia, PA; Department of Neurology (JRW, MS, DW, JFM, JED), Department of Psychiatry (DW), and Department of Physical Medicine Rehabilitation (MGS), Perelman School of Medicine of the University of Pennsylvania, Philadelphia; and School of Social Policy and Practice (SCM), University of Pennsylvania, Philadelphia.

Funding information and disclosures are provided at the end of the article. Full disclosure form information provided by the authors is available with the **full text of this article at Neurology.org/cp**.

The views expressed in this article are those of the authors and do not necessarily reflect the position or policy of the Department of Veterans Affairs or the United States government.

Correspondence to: jayne.wilkinson@va.gov

Editorial, page 203

Parkinson disease (PD) is a chronic neurodegenerative disorder characterized by disabling motor and nonmotor symptoms. Studies have demonstrated the importance and value of specialty care, with superior clinical outcomes, improved survival, and enhanced quality of care.^{1–3} Obstacles to receiving specialty care are numerous and include geographical and financial obstacles as well as limitations in patients' physical ability to travel. Therefore, limited access to care is regarded as a major barrier facing those with PD, particularly given the burden the projected growth of the PD population is expected to place on health care systems.^{4,5}

Telehealth was developed as a means to provide accessible care to those in remote locations. In the United States, this modality is best developed in the Veterans Affairs (VA) Medical System. Active since 1968, Virtual Care, which includes video and other remote care modalities, provides care to more than 2 million veterans.⁶ Similarly, the clinical model of the patient-centered medical home was introduced in 1967 to provide quality health care to vulnerable patient populations via cost-effective, accessible means in a time when increasing health care costs and other resource limitations create obstacles to care.^{7,8} Incorporating telehealth resources while providing patient-centered care in a multidisciplinary PD clinic is the focus of this study.

Efforts to implement telehealth technologies in PD care were summarized by a task force of the International Parkinson and Movement Disorder Society.⁹ A number of feasibility trials are looking at video telehealth as an alternative to face-to-face care.^{10–13} Generally, these efforts have been successful, and implementing telehealth in PD treatment is a promising area of clinical development and research. Our objective was to determine whether patients with PD using video telehealth would be as satisfied as those who received face-to-face care and to assess clinical outcomes, travel burden, and health care utilization.

METHODS

Study design and protocol

We conducted a dual-arm randomized controlled trial focused on patient satisfaction as the primary endpoint, as well as clinical outcomes, patient travel burden, and health care utilization, using clinical video telehealth vs usual in-person care in a VA-based subspecialty PD clinic. This study included application of telehealth to local closer VA facilities (satellite clinic arm) as well as to the veteran's home (home arm). The facility equipment consisted of a Global Med Telehealth Specialty Carts and Cisco Webcams. The Intel Health Guide was deployed to the veterans' homes. These technologies provided live high-resolution audiovisual connections between the patient and provider. Within each study arm, individuals were randomized to either the telehealth group or the control group using a random number generator with blocks of 4 to ensure balance in this small sample size. Veterans were enrolled for a period of 12 months. Target enrollment was 50 veterans in each arm. Visits were similar to in-person visits in duration and aspects of interview and included a modified examination¹⁴ facilitated by a telehealth clinical technician at the remote VA site. The frequency of clinical visits was dictated by clinical needs, with a minimum of every 6 months (2 visits total) and no maximum.

Standard protocol approvals, registrations, and patient consents

The study's protocol was approved by the Philadelphia VA Medical Center Institutional Review Board and all participants provided written informed consent.

Study participants

All participants were recruited from one subspecialty clinic (Philadelphia Parkinson's Disease Research, Education and Clinical Center, Philadelphia, PA) and were established patients meeting diagnosis of PD according to UK Parkinson's Disease Society Brain Bank diagnostic criteria.¹⁵ Patients receiving primary care at a closer (to their home) outpatient VA facility

Secondary outcomes included clinical outcomes, patient travel burden and costs, and health care utilization.

were recruited for the satellite clinic arm, and the remaining patients were recruited for the home arm. Patients requiring in-person visits, as determined by their treating physician, were excluded. These patients were receiving botulinum toxin injections and/or deep brain stimulation adjustments, which required in-person care. For those patients recruited into the home arm, Internet access was required to support the video equipment and the patient and/or caregiver had to be able to operate the equipment. Fourteen patients did not have Internet access. Of the eligible patients, 62% agreed to participate.

Outcomes

Data collection took place via chart review and patient questionnaires. Baseline and demographic data included age, sex, race, and presence of caregiver (yes/no); baseline disease characteristics included the UPDRS Unified Parkinson's Disease Rating Scale (UPDRS),¹⁶ Hoehn and Yahr stage,¹⁷ and the 15-item Geriatric Depression Scale (GDS).¹⁸ Outcomes were collected at 6- and 12-month visits ± 1 month. The primary outcome measure was patient satisfaction assessed using the aggregate score of the Patient Assessment of Communication of Telehealth (PACT) questionnaire. This validated 33-item (Likert scale) instrument has been used in a number of telehealth studies to assess the quality of the communication between the provider and patient^{19,20} and is useful for its ability to be administered to both intervention and control groups. In addition to the aggregate score, 2 specific domain scores were evaluated: convenience/satisfaction with the type of visit (referred to as PACT, convenience subscore) and convenience/satisfaction with respect to distance traveled (referred to as PACT, distance subscore). Patient satisfaction was also assessed using a patient clinical survey (figure e-1 at Neurology.org/cp). This 6-question assessment tool was developed specifically for this study to evaluate the respondents' assessment of their experience compared with prior in-person visit(s), as no existing tools were available to study this patient preference. The first 5 questions were prefaced with "Compared with your last visit to the clinic, today's visit...", and the questions addressed travel time, convenience, overall communication, adequate addressing of clinical concerns, and overall quality of the visit. Responses were worded as "much less," "slightly less," "same," "slightly more," and "much more" to determine how telehealth compared subjectively with usual in-person care. The final question (yes/no) asked respondents whether they would prefer the alternative care modality; 2 versions of this question existed (one designed for the control group and one for the intervention group).

Secondary outcomes included clinical outcomes, patient travel burden and costs, and health care utilization. The clinical outcomes were measured using reliable and validated scales, namely the UPDRS and Hoehn and Yahr stage for disease severity, the Parkinson's Disease Questionnaire (PDQ-8) for quality of life,²¹ and the GDS for mood. Patient travel burden and costs were gathered from self-reported questionnaires designed to capture both financial and time investments of clinical visits. Wait time from arrival to scheduled appointment time was also self-reported. Googlemaps.com was used to calculate the distance traveled. Health care utilization data included hospital admissions, emergency department visits, routine and nonroutine PD provider visits, provider phone calls, and number of referrals made by PD clinicians to other health care providers or services. These outcomes were collected from self-reported questionnaires and the VA electronic medical record system. "No-show" and patient-initiated cancellations were measured using the VA electronic medical record system.

Supplemental Data

Neurology.org/cp

Figure 1 Study enrollment flow chart

Data analysis

Statistical analysis was completed with STATA version 12. Descriptive statistics are reported for baseline demographic and clinical information for each study arm. Within each study arm, the telehealth intervention group was compared with a control group, and mean differences between groups were tested using Fisher exact tests for categorical variables and *t* tests for continuous variables. All tests were 2-sided with a significance level set at ≤ 0.05 . Given the relatively small sample size of this pilot study, we did not adjust for multiple comparisons because, per the recommendation of Rothman,²² we preferred to explore leads that may turn out to be incorrect rather than miss potentially important findings. An intention-to-treat analysis was completed on the outcome variables at 6- and 12-month time points; individuals were analyzed in the group to which they were randomized. No item nonresponses were noted. Questionnaire aggregate scores were used for the PACT, GDS, and PDQ-8. Patient clinical survey questions were analyzed individually and reported as the percentages of responses based on group assignment. Similarly, the 2 questions on the PACT specifically addressing patient satisfaction regarding convenience (#32, #33) were analyzed individually. Our primary outcome for the study was the aggregate PACT score. At the time of the study, no prior work was available to inform our power calculations. Our financial and other constraints permitted recruitment of only 100 individuals for the entire study. Therefore, to maximize power, we divided equally between the telehealth and control groups for each study arm (i.e., 4 groups with $n = 25$ each). Before initiation of the study, we calculated that

Table 1 Baseline characteristics of study participants

Baseline characteristics	Satellite clinic arm		Home arm	
	Telehealth (n = 26)	Control (n = 24)	Telehealth (n = 18)	Control (n = 18)
Demographics				
Age, y (SD)	76.1 (8.4)	76.1 (7.9)	67.2 (9.8)	70.9 (8.4)
Race, n (% white)	26 (100)	24 (100)	18 (100)	15 (83.3)
Distance from home to clinic (VA-based subspecialty clinic), miles (SD)	26.9 (15.6)	27.2 (15.0)	54.2 (50.6)	35.9 (40.0)
Parkinson disease characteristics				
Hoehn and Yahr stage (0–5) (SD)	2.5 (0.7)	2.5 (0.6)	2.5 (1.1)	2.3 (0.4)
Unified Parkinson's Disease Rating Scale score, Section III (0–108) (SD)	23.4 (12.8)	25.9 (11.8)	25.3 (17.6)	19.2 (11.5)
mUPDRS III score (0–84) (SD)	17.9 (9.8)	19.5 (8.3)	19.9 (12.9)	13.4 (9.2)
GDS score (0–15) (SD)	5.7 (4.7)	5.7 (4.9)	3.8 (4.3)	4.9 (4.2)
Abbreviations: GDS = Geriatric Depression Scale; mUPDRS = modified Unified Parkinson's Disease Rating Scale; UPDRS = Unified Parkinson's Disease Rating Scale; VA = Veterans Affairs. p > 0.05 for differences between control and telehealth groups for all characteristics.				

with $\alpha = 0.05$ and 25 participants per group we would have 80% power to detect Cohen $d = 0.8$ for the standardized mean difference between the control/intervention of each study arm. This is considered to be a “large effect size.”²³

RESULTS

Eighty-six men (50 in the satellite clinic arm and 36 in the home arm) were recruited from June 2011 to March 2013, representing 62% of eligible veterans. Figure 1 outlines participant enrollment. There were no significant demographic differences at baseline between control and intervention individuals in either arm (table 1). In the satellite clinic arm, 17 veterans lived between 0 and 20 miles of the subspecialty clinic, 26 lived 21–40 miles, and 7 lived greater than 40 miles. In the home arm, 11 veterans lived 0–20 miles from the subspecialty clinic, 13 lived 21–40 miles, and 12 lived greater than 40 miles. At the conclusion of the study, 30 individuals had dropped out: 11 had died and 19 withdrew. However, the majority (19/30 = 63%) of attrition occurred before the first study visit: 9 had died and 10 withdrew. Reasons for withdrawal in the telehealth groups related to technical issues (unable to establish connection) (2), relocation of clinical care (2), change in frequency of visits to annually (1), and preference for in-person care (3, one of which stemmed from concerns about paying the Internet bill). Of the 11 that dropped out after the intervention was started, 2 died and 9 withdrew. Reasons for withdrawal in the telehealth arm related to technical issues (poor connection; degraded video) (4), relocation of clinical care (1), change in frequency of visits to annually (1), and preference for face-to-face visit (1). Attrition in the satellite clinic arm was largely similar between controls and telehealth; in the home arm, most withdrawals occurred in the active arm (figure 1). The average number of visits was 4.1 and 4.2 (telehealth vs control) in the satellite arm and 2.7 and 3.4 (telehealth vs control) in the home arm. A total of 87 telehealth visits were completed. A provider requested an in-person visit on only one occasion, in order to include an additional provider who did not participate in telehealth.

There were no significant differences in overall (aggregate) patient satisfaction, with average PACT total scores demonstrating a high level of patient satisfaction in all groups. In the domain related to convenience of the type of visit, the PACT questionnaire showed significantly higher

Telehealth has been shown to be a promising modality to extend care to closer medical facilities as well as directly to the patient's home.

satisfaction for both telehealth interventions compared with usual treatment at 6 months; and for the satellite clinic group compared with usual treatment at 12 months (table 2; figure 2). For convenience related to distance to travel, satisfaction was significantly higher in both telehealth intervention groups at 12 months and in the home arm at 6 months. The patient clinical survey confirmed a significantly higher level of satisfaction at both time points in the 2 telehealth arms based on answers to items related to travel time and general convenience. Telehealth patients also reported equal or improved overall communication, addressing of clinical concerns, and overall quality of visit compared with in-person visits (both telehealth arms at 6 months and the satellite clinic arm at 12 months [figure 2; table e-1]). In the satellite clinic arm, 40% of controls stated that they would have preferred telehealth at a close facility (vs 25.8% of telehealth participants who would have preferred an in-person visit). In the home arm, 14.4% of controls stated that they would have preferred a telehealth visit (vs 33.3% of telehealth participants who would have preferred an in-person visit).

There were no between-group differences in secondary endpoints related to clinical outcomes, including the GDS, UPDRS, and quality of life measures (table 3). As expected, travel burden was decreased for telehealth participants in both arms of the study, with savings of 17.1 miles per visit in the satellite clinic arm and 58.2 miles per visit in the home arm. In addition, in the satellite clinic arm, patient-reported wait time (from time of scheduled appointment) was decreased at 12 months for the telehealth group vs controls (table 3). Health care utilization patterns were largely similar between groups, with the exception of a lower proportion of appointment “no-shows” and patient-initiated cancellations (for scheduled appointments) in the satellite arm telehealth group compared to the control group (6.9% [$\pm 10.5\%$] vs 19.6% [$\pm 12.6\%$], $p = 0.0045$).

DISCUSSION

Although there was no difference between groups in overall patient satisfaction, this study suggests that using telehealth to treat patients with PD results in high patient satisfaction, reduced travel burden, equal clinical outcomes, and perhaps improved health care utilization. Managing PD is a challenge requiring numerous medical providers, often a devoted caregiver, and expenditure of significant health care and personal resources. Evidence has shown the benefits of including neurologic specialists in the care of PD.^{1,2} However, many patients do not have access to this level of care, so providing avenues to access appropriate care will not only improve patient outcomes and satisfaction but also allow more effective management of this chronic disease and benefit the health care system at large. Telehealth has been shown to be a promising modality to extend care to closer medical facilities as well as directly to the patient's home. There have been a few studies supporting the feasibility of telehealth in PD^{10–13}; this study reports a randomized controlled trial designed to look at specific outcomes over 6 and 12 months. Despite moderate dropout rates, we found outcomes at 6 and 12 months to be generally similar and provided ample data to evaluate the outcomes of this study.

Specifically, overall patient satisfaction for telehealth was equal to that for in-person care. Aggregate patient satisfaction scores were high, even in the control group, and a ceiling effect likely explains the absence of significant differences between groups in aggregate scores. On those items specifically addressing patient satisfaction regarding convenience of the type of visit

Table 2 Study endpoints: Patient satisfaction

Patient satisfaction	Satellite clinic arm				Home arm			
	Telehealth	Control	Absolute difference	p Value	Telehealth	Control	Absolute difference	p Value
PACT, total (0-165), mean (SD)								
6 mo	139.3 (16.8)	142.9 (21.3)	3.6	0.57	152.4 (12.8)	146.2 (14.5)	6.2	0.25
12 mo	141.5 (13.8)	143.4 (21.6)	1.9	0.77	154.0 (5.1)	152.2 (13.7)	1.8	0.75
PACT, convenience (0-5), mean (SD)								
6 mo	4.6 (0.8)	3.9 (1.1)	0.7	0.04	4.8 (0.6)	3.9 (1.2)	0.9	0.004
12 mo	4.9 (0.3)	3.6 (1.4)	1.3	0.002	5.0 (0)	4.3 (1.1)	0.7	0.12
PACT, distance (0-5), mean (SD)								
6 mo	4.1 (1.4)	3.2 (1.5)	0.9	0.08	4.7 (0.9)	3.5 (1.3)	1.2	0.009
12 mo	4.5 (0.8)	3.5 (1.5)	1.0	0.03	5.0 (0)	4.1 (1.1)	0.9	0.043

Abbreviation: PACT = Patient Assessment of Communication of Telehealth.

and the accessibility/distance, a significant difference was noted in most comparisons, favoring telehealth over in-person care. In addition, elements of patient satisfaction related to communication, addressing of clinical concerns, and overall quality were largely similar between telehealth and in-person visits. This is an important finding, because it is essential that the benefits

Figure 2 Patient satisfaction outcomes (PACT questionnaire and patient clinical survey)

(A) Patient Assessment of Communication of Telehealth (PACT) questionnaire, satellite clinic arm; (B) PACT questionnaire, home arm; (C) patient survey, satellite clinic arm; (D) patient survey, home arm.

Table 3 Secondary study endpoints: Patient clinical outcomes, health care utilization, and travel burden

	Satellite clinic arm			Home arm		
	Telehealth	Control	p Value	Telehealth	Control	p Value
Clinical outcomes						
mUPDRS III score (0–84), mean (SD)						
6 mo	18.3 (9.7)	21.7 (8.9)	0.28	11.1 (6.7)	12.8 (6.7)	0.64
12 mo	18.1 (11.2)	21.6 (7.9)	0.34	8.0 (4.7)	13.5 (10.8)	0.33
Hoehn and Yahr stage (0–5), mean (SD)						
6 mo	2.5 (0.6)	2.5 (0.5)	0.89	2.1 (0.5)	2.3 (0.4)	0.25
12 mo	2.5 (0.9)	2.5 (0.7)	0.92	2.1 (0.2)	2.3 (0.4)	0.28
GDS score (0–15), mean (SD)						
6 mo	4.1 (4.1)	5.3 (4.3)	0.38	3.1 (3.9)	5.3 (4.1)	0.17
12 mo	4.3 (4.5)	3.9 (2.4)	0.79	3.3 (4.0)	4.2 (3.5)	0.57
PDQ-8 score (0–32), mean (SD)						
6 mo	11.4 (6.4)	11.9 (6.0)	0.77	8.7 (6.5)	8.4 (6.1)	0.88
12 mo	11.9 (6.9)	12.5 (6.1)	0.79	8.6 (7.2)	9.8 (6.8)	0.69
Health care utilization						
Hospitalizations, mean (range)	0.13 (0–2)	0.18 (0–2)	0.82	0.18 (0–2)	0	0.22
Emergency room visits	0.13 (0–1)	0.59 (0–3)	0.09	0.27 (0–3)	0.18 (0–2)	0.72
Phone calls	1.9 (0–12)	2.3 (0–8)	0.49	2.8 (0–16)	2.2 (0–10)	0.69
Clinical visits	4.1 (3–6)	4.2 (2–7)	0.67	2.7 (1–5)	3.4 (3–5)	0.08
Interdepartmental referrals	2.1 (0–6)	3.3 (0–9)	0.19	2.5 (0–6)	1.8 (0–6)	0.34
Patient cancellations/no-shows, % of scheduled visits (SD)	6.9 (10.5)	19.6 (12.6)	0.005	5.9 (13.6)	10.2 (17.6)	0.50
Travel burden						
Distance saved, miles, mean (SD)						
6 mo	379.4 (20.0)			651.4 (59.2)		
12 mo	203.4 (13.6)			396.8 (56.6)		
Total	582.8			1,048.2		
Per patient visit	17.1			58.2		
Wait time (from scheduled appointment), min, mean (SD)						
6 mo	12.6 (7.7)	22.6 (25.3)	0.11	15.4 (8.5)	21.2 (20.9)	0.40
12 mo	13.3 (6.2)	21.5 (10.4)	0.01	12.1 (8.6)	13.2 (6.1)	0.73

Abbreviations: GDS = Geriatric Depression Scale; mUPDRS = modified Unified Parkinson's Disease Rating Scale; PDQ-8 = Parkinson's Disease Questionnaire; UPDRS = Unified Parkinson's Disease Rating Scale.

of telehealth do not come at the cost of patients' perceptions of overall quality of communication and visit goals.

This study showed that remote care resulted in similar clinical outcomes. Although certain aspects of the neurologic examination cannot be completed remotely (e.g., pull test and muscle tone assessment), the majority of the movement disorder–related exam is conducive to an audiovisual approach using the modified version of the UPDRS as a validated proxy for the full motor UPDRS.¹⁴ In addition, the treating clinician requested that a patient come to the

clinic for an in-person evaluation in only one instance (out of 87 telehealth visits). The most informative and reliable data collected regarding travel burden in our study were quantitative data on miles saved, as travel distance and burden is a frequent barrier to accessing care. More formal cost-benefit analysis is needed to quantify the magnitude of this benefit and to consistently capture expenses. In addition to travel cost benefits, more accessible care may have downstream effects on health care utilization patterns, with reduced visits to emergency rooms and clinics and fewer phone calls, although these were not borne out in this study, likely because of the small sample size. Examining health care utilization patterns may ultimately provide the most useful data to support telehealth and other innovative health care applications that increase access. Although patterns were largely similar between telehealth and in-person visits in this study, some data suggested fewer unplanned contacts with the health care system. For example, in the satellite clinic arm, there was a significant reduction in the proportion of appointments cancelled or “no-showed” in the telehealth group. As managed-care companies and government entities (Medicare and Medicaid) consider reimbursement for these newer technologies, this type of evidence will be critical.

Remote care delivery models have been used in treating neurologic conditions within the VA medical system. There are emerging general neurology, multiple sclerosis, cognitive, pain/headache, epilepsy, stroke, traumatic brain injury, and other telehealth programs throughout the nation. The VA has deemed telehealth and other remote care modalities (collectively termed Virtual Care) a national priority by funding these programs and setting annual goals. FY15 marked more than 2.3 million veterans (~40%) using some type of Virtual Care modality, and 2.1 million telehealth encounters took place.⁶ As telehealth programs expand and eventually become funded and more accessible outside of the VA, research studies will guide providers in successful development.

There are study limitations to note. The small sample size may have decreased power to detect more between-group differences, particularly in the home arm because enrollment did not reach the goal of 50 participants. We also acknowledge that without correction for multiple comparisons, false-positive results may have occurred. The newness of this resource posed logistical challenges regarding scheduling and technical aspects, particularly in the home arm, resulting in dropouts and some reduction in overall quality at 12 months (home arm only). This likely explained the 33% of home telehealth patients who would have preferred an in-person visit. However, of the 19 patients who withdrew, only 3 cited a preference for face-to-face visits as the reason. The cohort comprised existing patients in a multidisciplinary veteran-based specialty center and may not be generalizable to the patient population at large. This study did not examine the effectiveness of telehealth for initial evaluations. Recall bias may have affected patient questionnaire responses. Thus, although the evidence is encouraging, larger long-term studies will be needed to guide program development and growth, with emphasis on cost-effectiveness, quality, and utilization. As remote video technologies are developed and evolve, the opportunities to access care will increase. As PD providers strive to develop more accessible patient-centered practices, it will be important to understand the advantages, limitations, and issues involved with remote delivery of care.

REFERENCES

1. Willis AW, Schootman M, Evanoff BA, Perlmutter JS, Racette BA. Neurologist care in Parkinson disease: a utilization, outcomes, and survival study. *Neurology* 2011;77:851–857.
2. Willis AW, Schootman M, Tran R, et al. Neurologist-associated reduction in PD-related hospitalizations and health care expenditures. *Neurology* 2012;79:1774–1780.
3. Cheng EM, Swartztrauber K, Siderowf AD, et al. Association of specialist involvement and quality of care for Parkinson's disease. *Mov Disord* 2007;22:515–522.
4. Dorsey ER, Constantinescu R, Thompson JP, et al. Projected number of people with Parkinson disease in the most populous nations, 2005 through 2030. *Neurology* 2007;68:384–386.
5. Dorsey ER, George BP, Leff B, Willis AW. The coming crisis: obtaining care for the growing burden of neurodegenerative conditions. *Neurology* 2013;80:1989–1996.

6. U.S. Department of Veterans Affairs. The National Veterans Affairs Telehealth Services Website. Available at: <http://www.telehealth.va.gov/>. Accessed May 19, 2015.
7. Stange KC, Nutting PA, Miller WL, et al. Defining and measuring the patient-centered medical home. *J Gen Intern Med* 2010;25:601–612.
8. Levine ME. This I believe... about patient-centered care. *Nurs Outlook* 1967;15:53–55.
9. Achey M, Aldred JL, Aljehani N, et al; International Parkinson and Movement Disorder Society Telemedicine Task Force. The past, present, and future of telemedicine for Parkinson's disease. *Mov Disord* 2014;29:871–883.
10. Samii A, Ryan-Dykes P, Tsukuda RA, Zink C, Franks R, Nichol WP. Telemedicine for delivery of health care in Parkinson's disease. *J Telemed Telecare* 2006;12:16–18.
11. Venkataraman V, Donohue SJ, Biglan KM, Wicks P, Dorsey ER. Virtual visits for Parkinson disease: a case series. *Neurol Clin Pract* 2014;4:146–152.
12. Dorsey ER, Deuel LM, Voss TS, et al. Increasing access to specialty care: a pilot, randomized controlled trial of telemedicine for Parkinson's disease. *Mov Disord* 2010;25:1652–1659.
13. Dorsey ER, Venkataraman V, Grana MJ, et al. Randomized controlled clinical trial of “virtual house calls” for Parkinson disease. *JAMA Neurol* 2013;70:565–570.
14. Abdolahi A, Scoglio N, Killoran A, Dorsey ER, Biglan KM. Potential reliability and validity of a modified version of the Unified Parkinson's Disease Rating Scale that could be administered remotely. *Parkinsonism Relat Disord* 2013;19:218–221.
15. Hughes AJ, Daniel SE, Kilford L, Lees AJ. The accuracy of clinical diagnosis of idiopathic Parkinson's disease: a clinicopathological study. *J Neurol Neurosurg Psychiatry* 1992;55:181–184.
16. Martínez-Martín P, Gil-Nagel A, Gracia LM, Gómez JB, Martínez-Sarriés J, Bermejo F. Unified Parkinson's Disease Rating Scale characteristics and structure. The Cooperative Multicentric Group. *Mov Disord* 1994;9:76–83.
17. Hoehn MM, Yahr MD. Parkinsonism: onset, progression and mortality. *Neurology* 1967;17:427–442.
18. Sheikh JI, Yesavage JA. Geriatric Depression Scale (GDS): recent evidence and development of a shorter version. In: Brink TL, editor. *Clinical Gerontology: A Guide to Assessment and Intervention*. New York: The Haworth Press; 1986:165–173.
19. Agha Z, Schapira RM, Laud PW, McNutt G, Roter DL. Patient satisfaction with physician-patient communication during telemedicine. *Telemed J E Health* 2009;15:830–839.
20. Hall JA, Irish JT, Roter DL, Ehrlich CM, Miller LH. Satisfaction, gender, and communication in medical visits. *Med Care* 1994;32:1216–1231.
21. Peto V, Jenkinson C, Fitzpatrick R. PDQ-39: a review of the development, validation and application of a Parkinson's disease quality of life questionnaire and its associated measures. *J Neurol* 1998;245 (suppl 1):S10–S14.
22. Rothman KJ. No adjustments needed for multiple comparisons. *Epidemiology* 1990;1:43–46.
23. Cohen J. *Statistical Power Analysis for the Behavioral Sciences*, 2nd ed. Hillsdale, NJ: Lawrence Erlbaum Associates; 1988.

Received October 28, 2015. Accepted in final form March 8, 2016.

AUTHOR CONTRIBUTIONS

Jayne R. Wilkinson: involved in all aspects of the study. Meredith Spindler: revising the manuscript, study concept and design, obtaining funding. Stephanie M. Wood: revising the manuscript, study concept or design, acquisition of data, study coordination. Steven C. Marcus: drafting and revising the manuscript, study concept or design, analysis or interpretation of data, statistical analysis. Daniel Weintraub: revising the manuscript, study concept, obtaining funding. James F. Morley: revising the manuscript, acquisition of data. Margaret G. Stineman: revising of manuscript, study concept and design, analysis and interpretation of data, study supervision. John E. Duda: drafting and revising of manuscript, study concept or design, interpretation of data, study supervision, obtaining funding.

ACKNOWLEDGMENT

This material is based on work supported by the Department of Veterans Affairs, the Center for the Evaluation of the Patient-Aligned Care Team (CEPACT), Philadelphia, PA, with additional infrastructure support through the facility's research program. Jayne Wilkinson was also supported by the Philadelphia VAMC and PADRECC.

STUDY FUNDING

Funding was provided by a VA grant issued by the Center for the Evaluation of the Patient-Aligned Care Team (CEPACT) based out of the Philadelphia VAMC.

DISCLOSURES

J. Wilkinson receives research support from Veterans Affairs Medical Center (Philadelphia, PA) Center for the Evaluation of the Patient-Aligned Care Team (CEPACT). M. Spindler serves on a scientific advisory board for and receives research support from US WorldMeds. S. Wood and S. Marcus report no disclosures. D. Weintraub serves on scientific advisory boards for Pfizer, Teva Pharmaceuticals, Avanir Pharmaceuticals, Merck & Co., Lundbeck Inc., UCB, Bristol-Myers Squibb Company, Novartis, Clintrex, Theravance, Medivation, CHDI, and ADCS; serves on the editorial boards of *Movement Disorders Journal* and *Journal of Parkinson's Disease*; receives licensing fees from the University of Pennsylvania for the QUIP and QUIP-RS; receives research support from Novartis, NIH (NINDS/NIA), Department of Veterans Affairs, and Michael J. Fox Foundation; and has participated in medico-legal cases. J. Morley receives research support from GE Healthcare and the Department of Veterans Affairs. M. Stineman has received research support from NIH and Agency for Healthcare Research and Quality. J. Duda serves as Academic Editor for PLoS One and on the editorial boards of *Movement Disorders* and *npj Parkinson's Disease*; and receives research support from the Department of Veterans Affairs, NIH/NINDS, and Michael J. Fox Foundation. Full disclosure form information provided by the authors is available with the **full text of this article at Neurology.org/cp**.

Related articles from AAN physician and patient resources

Neurology® Clinical Practice

Virtual visits for Parkinson disease: A case series

April 2014;4:146-152.

Neurology® ● Neurology.org

Telemedicine training during stroke fellowship

Published online before print March 25, 2016.

A call for formal telemedicine training during stroke fellowship

Published online before print March 25, 2016.

Teleneurology applications: Report of the Telemedicine Work Group of the American Academy of Neurology

February 12, 2013;80:670-676.

Neurology Now® ● Neurologynow.com

This Way In: Caucusing for Cures: A legislator's personal history fuels his commitment to raising funds for medical innovation

February/March 2015;11:12-13.

Neurology Today® ● Neurotodayonline.com

IN PRACTICE: More Neurologists Transition to Concierge-Type Practices — What They're Doing to Make it Work

April 2, 2015;15:14-16.

Can Telemedicine End the "Neurologist Gap" in Parkinson's Disease?

September 5, 2013;13:36-41.