Movement Disorders
CLINICAL PRACTICE

BRIEF REPORT

Long-Lasting Impact of the COVID-19 Pandemic on Patients with Parkinson's Disease and Their Relatives

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Abstract: Background: The coronavirus disease 2019 (COVID-19) pandemic has heavily impacted medical care of patients with Parkinson's disease (PwP).
Objective: To assess the longitudinal impact of the COVID-19 pandemic on PwP and their relatives in Germany.
Methods: Two online, nationwide, cross-sectional surveys were conducted from December 2020 to March 2021 and from July to September 2021.
Results: A total of 342 PwP and 113 relatives participated. Despite partial resumption of social and group activities, healthcare was continuously disrupted during times of loosened restrictions. Respondents' willingness to use telehealth infrastructure increased, yet the availability remained low. PwP reported worsened symptoms and further deterioration during the pandemic, resulting in an increase in new symptoms and relatives' burden. We identified patients at particular risk: young patients and those with long disease duration.
Conclusions: The COVID-19 pandemic persistently disrupts the care and quality of life of PwP. Although willingness to use telemedicine services has increased, its availability needs to be improved.

Since onset of the global coronavirus disease 2019 (COVID-19) pandemic, patients with Parkinson's disease (PwP) reduced their physical activity[1] and faced cancelations of healthcare appointments[2–4]. Disruptions in medical care accompanied by an increase in distress[5] and social isolation[6] have contributed to a rising disease burden for PwP. Telemedicine approaches have been shown to provide appropriate medical care for PwP while complying with pandemic-related contact restrictions.[7,8] However, this technology has not been universally implemented and may therefore, not be available to all PwP.[3,9]

High resolution longitudinal data covering the effect of the pandemic on PwP over time are lacking. Therefore, two consecutive nationwide online surveys of PwP and their relatives in Germany covering lockdown periods (first survey) and periods of less restrictions (second survey) sought to examine changes in medical care and symptom burden during this dynamic time.

Methods

PwP and relatives were invited during routine visits to 67 specialist centers for the first survey (accessible December 15, 2020 to March 31, 2021), and additionally through newsletters of the German Parkinson's disease patient association (4891 e-mail accounts) for the second survey (accessible July 07, 2021 to September 20, 2021). Respondents of the first survey, who provided their e-mail address, were invited to participate in the second. Questionnaires for PwP contained 51 and 54 items,

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respectively, and 15 and 24 for relatives (detailed description as Data **S1**). All data were obtained using the electronic data capture system secuTrial by self-assessment of the respondent. Data were analyzed using R Version 4.1.0 (R Core Team, Vienna, Austria). Two-sample *t* tests or paired Wilcoxon tests were performed for comparison of metric variables between groups, whereas Fisher's exact tests were performed for the analysis of categorical data. Associations between binary and ordinal variables were analyzed by performing Cochran-Armitage tests. Risk ratios with 95% confidence intervals were estimated for variables and categories with more than five observations and conceivable influence on medical care and symptom burden.

Results

A total of 142 patients and 75 relatives participated in the first survey, whereas 242 patients and 47 relatives participated in the second. A total of 42 patients and nine relatives participated in both surveys. Participants displayed comparable demographics in both surveys. PwP were predominantly self-sufficient, received drug-based treatment, and supplementary physio- and occupational therapy (Tables **S1** and S2). However, PwP of the first survey had a longer disease duration (10 vs. 6 years, $P < 0.001$) and participated less in support groups (21.6% vs. 43.1%, $P < 0.001$). Advanced therapies were used by few PwP, but deep brain stimulation was more common in the first survey (11.1% vs. 6.4%, $P < 0.001$).

The number of PwP who reported an overall worsening of symptoms since pandemic onset increased between both surveys (45.3% vs. 59.2%, $P = 0.010$). Most patients observed a worsening of at least one parkinsonian symptom compared to pre-pandemic times, with reports increasing from the first to the second survey (77.5% vs. 86.9%, $P = 0.022$). Simultaneously, the number of PwP who reported developing at least one new symptom since the pandemic's onset also increased between both surveys (10.6% vs. 25.4%, $P < 0.001$). Specifically, the most commonly present and affected symptoms were rigidity, gait problems, and bradykinesia. If present pre-pandemic, especially *off* time, depression, poor motivation, cognitive impairment, and sleepiness deteriorated since pandemic onset (Fig. 1A).

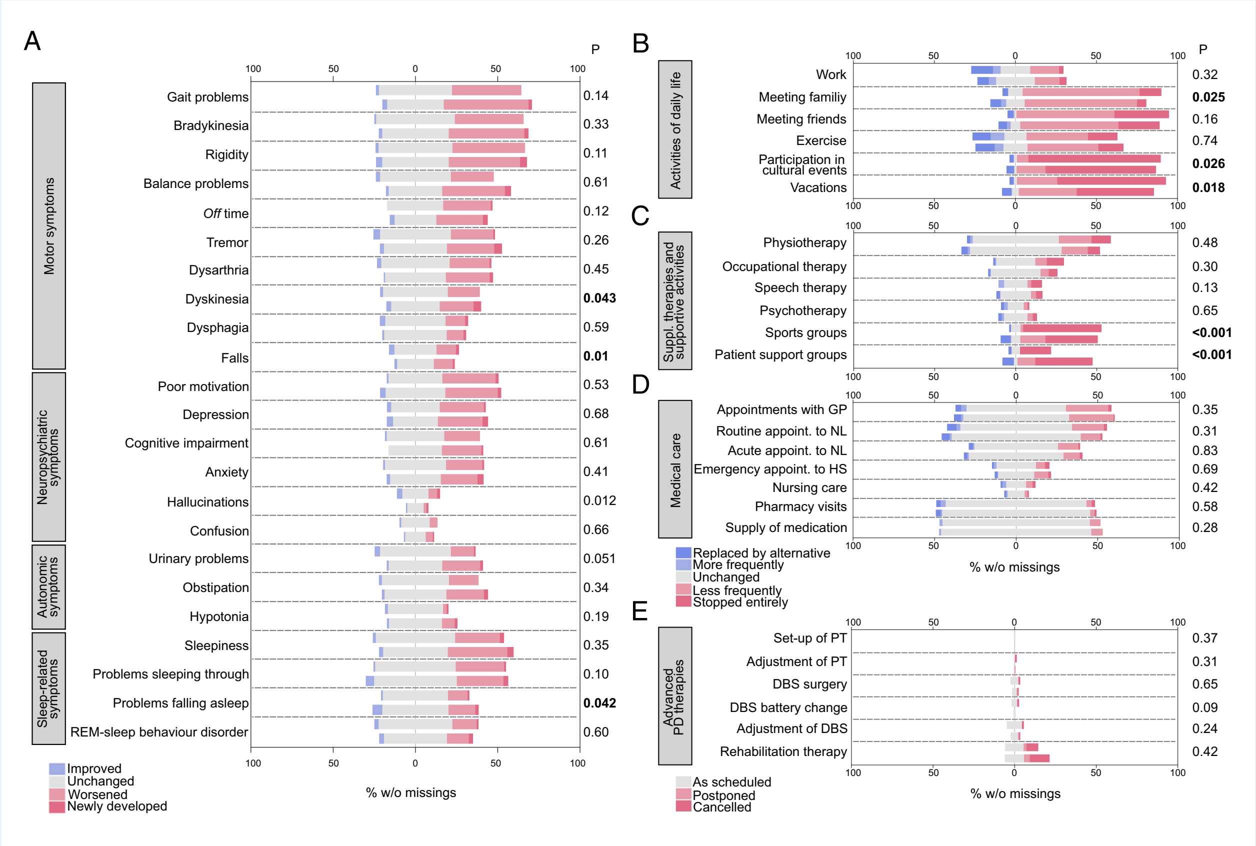

FIG. 1. (**A**) Impact of the coronavirus disease 2019 pandemic on parkinsonian symptoms. (**B**) Impact on activities of daily life. (**C**) Impact on supplementary therapies and supportive activities. (**D**) Impact on medical care. (**E**) Impact on advanced therapies. PD, Parkinson's disease; GP, general practitioner; NL, neurologist; HS, hospital; PT, pump therapy (eg, LCIG, CSAI); DBS, deep brain stimulation. For each symptom/activity, upper bars: first survey (December 15, 2020 to March 31, 2021), lower bars: second survey (July 07, 2021 to September 20, 2021). Results are given as percentage of the whole without missing values. *P*-values refer to comparisons of first versus second survey (Fisher's exact tests).

Overall, two thirds of PwP claimed that the pandemic had a negative impact on their lives. Patients cut down their social contacts and reduced or entirely stopped exercise (Fig. 1B). However, less PwP from the second survey reported a worsening of their medical care compared to pre-pandemic times than from the first (35.7% vs. 23.4%; $P = 0.018$). For most patients, support or sport group meetings stopped entirely before the first survey, yet the proportion of patients who continued these activities—albeit less frequently compared to pre-pandemic times—increased between the first and the second survey (Fig. 1C). Visits to general practitioners and neurologists, advance therapy set-ups or adjustments, and rehabilitation therapy continuously occurred less frequently without significant change between both surveys (Fig. 1D,E).

Reported worsening of medical care correlated positively with perceived worsening of symptoms ($P = 0.002$ and $P < 0.001$, respectively). Furthermore, longer disease duration, pre-pandemic use of occupational therapy, lower monthly income per family member, and younger age were associated with a worsening of symptoms. Risk factors for a deterioration in medical care were pre-pandemic treatment with deep brain stimulation, participation in a support group, diagnosis of COVID-19, as well as longer disease duration, and smaller hometown size (Table S3).

PwP reported new usage of digital media after the onset of the pandemic, which further increased before the second survey. Still, except for video calling software, most PwP indicated knowledge, but not actual usage of digital services (Table S4). In both surveys, PwP expressed willingness to use alternative and/or digital healthcare tools, foremost digital prescriptions, video or telephone calls, and e-mails with their neurologists. Additionally, the number of patients willing to use a subset of digital applications—wearables and digital tools for Supplementary therapy—increased further between both surveys (Table S5). However, only printed information (24.4% and 41.3%) and e-mail contact with neurologists (33.6% and 33.6%) were already implemented in healthcare of a substantial number of PwP.

During the recruitment period for the first survey, vaccinations against severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) became available in Germany. The willingness to be vaccinated against SARS-CoV-2 was high in both surveys, but further increased in the second survey (90.2% vs. 96.2%, $P = 0.032$). "Lack of trust", "fear of side-effects", and "vaccines are generally not useful" were reported as rare reasons for a refusal to be vaccinated. After the vaccine was broadly available in Germany, 91.7% of patients reported having been vaccinated twice, 4.6% having been vaccinated once, and 3.7% having not been vaccinated. Regarding other vaccinations, 38.8% and 38.0% reported being vaccinated against *Streptococcus pneumoniae* and 56.5% and 66.5% against influenza. In total, 14 of 344 patients reported having been infected with SARS-CoV-2 (Table S6). Of those who received treatment, five were treated as outpatients, four were hospitalized, and one was treated in the intensive care unit. Fever/chills, cough, shortness of breath, headache, and sore throat were reported significantly more frequently in COVID-19 positive patients.

Relatives of both surveys were mostly spouses and most were directly involved in caregiving. Relatives observed a deterioration in parkinsonian symptoms (71.0% and 69.6%) and medical care (58.0% and 43.4%) for their relative. Simultaneously, relatives reported a significant increase in their own financial, physical, psychological, and time burden and spent significantly more time on caregiving during compared to before the pandemic (2.8 vs. 3.5 h, $P = 0.001$; 5.1 vs. 5.9 h, $P < 0.001$) (Tables S7 and S8).

Discussion

We present an extensive analysis, spanning multiple phases of the pandemic and provide a comprehensive overview of the changes and challenges PwP and their relatives faced during this dynamic time. Although social and group activities were resumed, disruptions of medical care continued during times of loosened restrictions. Cross-sectional studies from the United States,[2,6,10–12] Europe,[3,5,13–21] and other global regions[22–29] have demonstrated pronounced worsening of motor and non-motor symptoms. The number of affected PwP increased over the development of the pandemic: reports ranged from no worsening[26] to over 69%[20,21,29] during the first global COVID-19 wave (March 2020–May 2020) to 60% to 83%[3,10,14] in later stages of the pandemic. Although our data support previous reports on increasing symptom burden, it also documents the long-lasting deterioration that spans periods of low SARS-CoV-2 incidence rates and minimum disease control restrictions. Similar to patient-reported worsening, trend analyses of motor symptoms (Movement Disorder Society-Sponsored Revision of the Unified Parkinson's Disease Rating Scale [MDS-UPDRS] part III) revealed a worsening for 40% of PwP[23] since pandemic onset and doubled disease progression rates (MDS-UPDRS part III points/year) compared to pre-pandemic[15]. However, PwP in this study were mostly self-sufficient with few comorbidities and represent a less severely affected subgroup within the spectrum of PwP in Germany.[30] Despite the high self-sufficiency, time spent on caregiving increased for relatives in both surveys since pandemic onset, accompanied by higher financial, physical, and psychological burden. The latter is attributed to the pandemic, because data from Germany before the pandemic's onset found no significant change in burden over a comparable timespan.[31]

The use of digital media (eg, online fitness, cultural, or educational programs) increased between both surveys. Nevertheless, the number of patients contacting their neurologist by telephone or video call did not significantly increase. Globally, the pandemic catalyzed the implementation of telehealth.[7,32] Although usage drastically increased up to >90% in the United States,[8,11,12,33,34] implementation in Europe is lagging behind. Less than 15% of PwP in Italy[35] and Germany[9,36] were acquainted with video-based consultations and less than two-thirds of neurologists offered these services.[3,35] In contrast, ~50% of PwP in Germany[9] express demand for teleconsultations, with rising numbers over the development of the pandemic, as shown in this study.

Low socioeconomic status has been associated with higher all-cause mortality in PwP[37] and a negative impact on healthcare since pandemic onset[2] while increasing age[38] and social isolation[6] has been associated with a worsening of psychiatric symptoms during the pandemic. Among other risk factors, we depict a strong intercorrelation of symptom worsening and worsening of medical care and identified younger age and longer disease duration to correlate with healthcare disruption and symptom worsening. We, therefore, hypothesize, that the two ends of the spectrum—young patients, who presumably led active lives, and more advanced patients, who need intensified therapy—were especially burdened by limitations in social activity and medical care.

Because participants had to be able to fill out a lengthy online survey, there is a bias toward a more self-sufficient and therefore, less affected patient population. Therefore, the impact on the entirety of ∼180.000 PwP in Germany—including older and more advanced patients—may be even more substantial.[39] Because few patients participated in both surveys, a complete longitudinal assessment of individual data was not possible. However, the very similar patterns in responses to many questions suggest an accurate representation of the pandemic's influence. Our study reveals the long-lasting impact on PwP during the COVID-19 pandemic. Telehealth applications may represent satisfactory substitutes for in-person visits in selected settings.[8,40] Here, the documented readiness of PwP for digital services in contrast to substantial deficits in the digital infrastructure in the German healthcare system offers guidance to telehealth implementation, to the adoption of legal regulations for its use, and to the establishment of an adequate reimbursement system for the providers.

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Author Roles

(1) Research project: A. Conception, B. Organization, C. Execution; (2) Statistical Analysis: A. Design, B. Execution, C. Review and Critique; (3) Manuscript Preparation: A. Writing of the First Draft, B. Review and Critique.

A.W.: 1A, 1B, 1C, 2A, 2B, 2C, 3A, 3B.
B.H.: 2A, 2B, 3B
A.D.: 1A, 1C, 2C, 3B
D.P.: 1C, 2C, 3B
J.N.: 1C, 2C, 3B
I.C.: 1C, 2C, 3B
E.W.: 2C, 3B
P.L.: 1A, 1B, 2A, 2C, 3B

Disclosures

Ethical Compliance Statement: The study was approved by the ethics commission of the Technical University of Munich (TUM), Germany under the number 746/20 S-EB, and informed consent was obtained online from all participants. We confirm that we have read the Journal's position on issues involved in ethical publication and affirm that this work is consistent with those guidelines.

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Supporting Information

Supporting information may be found in the online version of this article.

Data S1. Supporting Information