

How medical technology can support health care management – Introduction of a telemedicine-based integrated care management, for improved diagnosis and treatment in Parkinson's disease through intersectoral and interdisciplinary collaboration.

Droeschel D^{1,2,3*}, Walzer S^{1,4}, Wilpshaar G⁵, Lynch P⁵,

- ¹ MARs Market Access & Pricing Strategy GmbH, Weil am Rhein, Germany
² The Mobile University, SRH FernHochschule, Riedlingen, Germany
³ School of Health and Related Research (SchARR), The University of Sheffield, United Kingdom
⁴ University of Applied Sciences Baden-Württemberg, Loerrach, Germany
⁵ Global Kinetics Corporation, Melbourne, Australia

Corresponding author:

Daniel Dröschel
 MARs Market Access & Pricing Strategy GmbH
 Geffelbachstr. 6
 79576 Weil am Rhein, Germany



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INTRODUCTION:

EPIDEMIOLOGY

- Prevalence of patients with Parkinson's disease in Germany is reported with 220:100.000 (1,2,3).
- In more than 75 % of cases the Parkinson syndrome is idiopathic Morbus Parkinson, meaning without a known cause so far (1).
- The begin of the Parkinson disease in working age is not uncommon.
- According to the German Institute of Medical Documentation and Information (DIMDI) ca. 250.000 people in Germany suffering from Parkinson's disease. Moreover, there is probable a high estimated number of diseased (1).
- Annually ca. 12.500 – 12.800 new Parkinson diseased; the incidence rate increases especially after the 65. life year and decreases beyond the 84. life year (4).
- In light of the increasing life expectancy of the population in the future a growing number of Parkinson patients can be expected.

Table 1+2: Incidence and Prevalence of Parkinson disease in Germany

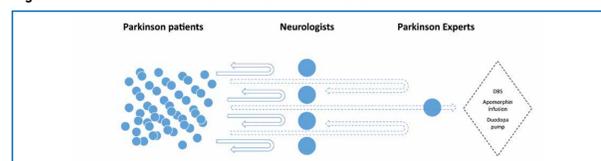
	Incidence rate in %		40 to 60 years	60 to 70 years	over 70 years
Up to 40 years	10	Prevalence in %	0,1-0,2	1,0	1,5-2,0
Up to 50 years	30				
50 to 60 years	40				
Over 60 years	20				

Source: Own representation according to DIMDI 2016 (1)

CURRENT CARE STRUCTURE FOR PARKINSON'S DISEASE

- The specialist care of Parkinson patients nowadays takes place predominantly in larger cities, while in many rural regions in Germany there is an under-supply (5,6).
- Office-based Neurologist have to cover the broad spectrum of Neurological diseases among these Parkinson disease.
- They have a limited time budget of ca. 5-15 min (in specialized offices 30 min) (7).
- The procedure is:
 - Only a short anamnesis of the patient possible
 - At best short symptom orientated examination of the superficial Parkinson symptoms (Rigor, Bradykinesia, Tremor)
 - Preparation of a new medication plan
 - Prescription of medication and if necessary Physio-, Logo- and/or Ergotherapy
- Typical Invitation interval:
 - Every three month (Settlement takes place quarterly)
- A frequent problem in advanced stages of the disease are motor fluctuations, which are often only recognized by neurologists at a late stage (see Infobox 1) (7).
- The lack of specialised Parkinson treatment from office-based Neurologists, frequently leads to suboptimal treatment and unnecessary handicaps in daily life (see figure 1) (7).
- Due to insufficient capacity at office-based Neurologist, they shift the buck to Neurological clinics where patients are usually hospitalized for multi-modal complex treatment which often is unnecessary (8).
- This wrong admissions block capacities at expert centres, leading to long waitinglists and patients with advanced Parkinson disease do not receive access to advanced therapie options in an appropriate timeframe (Deep Brain Stimulation, Apomorphin infusion, Duodopa pumps) (9).

Figure 1 – Current care structure for Parkinsons disease



Source: Own representation according to DIMDI 2016 (1)

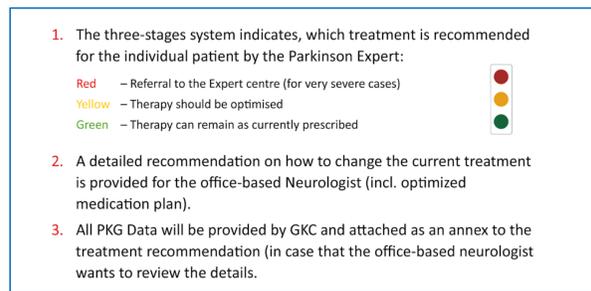
„Thank you very much. By the way you're the first Neurologist, that has examined me at all.“
 (Parkinson patient after her first consultation at the Parkinson specialised centre but which has been treated by office-based Neurologist for two years already)

„Actually, I have not seen my Neurologist. His treatment room was crowded with paperwork and he remained seating behind his stack of files“
 (Parkinson patient when she asks „if there has been any doubts of the diagnosis with Parkinson's disease by the office-based Neurologist“)

„I didn't know that for me such options exist“
 (Patient with long standing, severe cervical dystonia and secondary treatment failure with Brudapomorphin, after the Parkinson Expert has made him aware that this disorder can as be treated with a deep brain stimulation.)

Infobox 1: Patients views and experience in current care
 Source: Quotes collected and provided by Dr. med Matthias Löhle, Parkinson Expert and Neurologist, University Hospital Rostock, Specialized Centre for Movement Disorders

Figure 3: Content of the treatment recommendation



Source: Own representation (Dröschel D., Löhle M., 2016)

PARTNERS AND THEIR TASKS IN THE NETWORK (FIGURE 4)

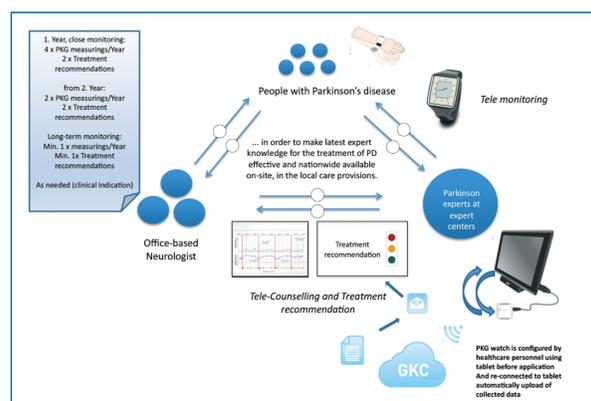
Office-based Neurologist:

- Identification of eligible PD patients (1)
- Registration of patients for PKG service via Fax or Website form (2)
- Clinical examination of participating patients (1)
- Implementation of the treatment recommendation on a voluntary basis (6)
- Referral of selected patients to (need for advanced therapeutic intervention) the Expert centre (participative counselling with PD Expert) (6)

Parkinson experts in specialised centres

- Distribution of PKG devices to eligible patients (3+4)
- Development of optimised medication plan and treatment recommendation based on PKG data returned from patients (5)
- Communication of treatment recommendation to office-based neurologists (summarized in a traffic light system)
- Data evaluation and statistical analysis
- Regular case counselling with the treating office-based neurologist

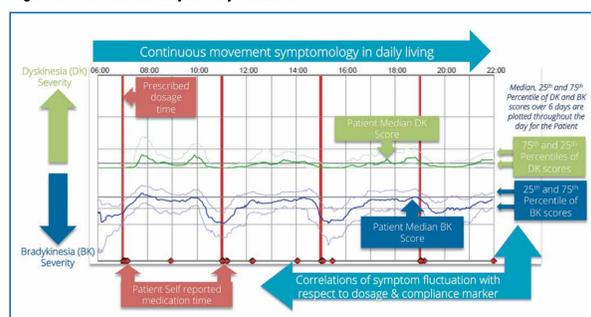
Figure 4: Telemedicine based, intersectoral cooperation for optimized care for those with Parkinson's disease



Source: Own representation adopted from GKC 2016

- The PKG Data Logger is a wrist-worn device
 - Precision: digital accelerometer collects movement data
 - Vibration based reminder to register medication dose
 - Proprietary mathematical algorithm translates raw data
 - Shows PD patients symptoms in relation to controls (non-PD patients)

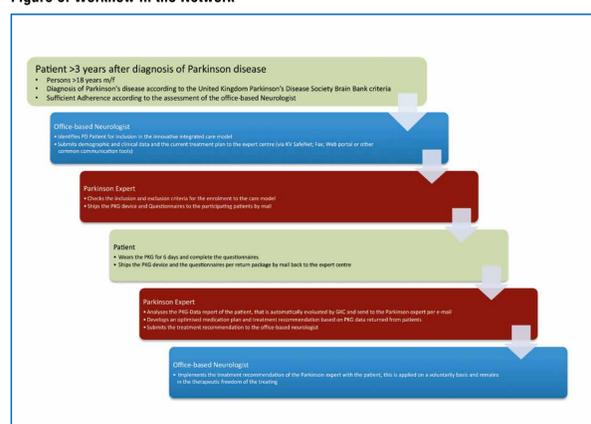
Figure 5: The PKG can objectively measure...



Source: GKC 2016

- The telemedicine-based integrated care management model follows a clear and agreed workflow within the network (Figure 6).

Figure 6: Workflow in the Network



Source: Own representation (Dröschel D., Löhle M., 2016)

- PKG Driving Parkinson's Disease Management and can lead to an improvement of the treatment according to the treatment guidelines (protocol, Table 3) across all levels of care (intersectoral and interdisciplinary) due to a consistently structured and controlled care process (Table 3).

Table 3: Proposed treatment protocol and quality measures

Visit	0	1	2	3
Time (months)	-1	0	6	12
Identification of eligible patients	X			
Submission of demographic and clinical data to UMR	X			
Submission of current medication plans to UMR	X			
Shipment of PKG devices and questionnaires to PD patients with return envelope		X	X	X
Evaluation of PKG data after return from patients		X	X	X
Submission of individual treatment recommendations to local neurologists		X	X	X
Questionnaires:				
- Patient Global Impression of Severity (PGI-S)		X	X	X
- Patient Global Impression of Improvement (PGI-I)			X	X
- Wearing-off questionnaire (WOOQ-32)		X	X	X
- Non-motor symptoms scale (NMSS)		X	X	X
- Parkinson's Disease Quality of Life Questionnaire (PDQ-39)		X	X	X
- Hospital Anxiety and Depression Scale (HADS)		X	X	X
- Scale of Quality of Life of Care-Givers (SQLC)		X	X	X
- Caregiver-burden Inventory (CBI)		X	X	X
Health-economic measures (e.g. emergencies, admissions, falls, fractures within last 6 months)		X	X	X
Clinical assessments:				
- Modified Hoehn and Yahr stage in on stage		X	X	X
- Clinical Global Impression of Severity (CGI-S)		X	X	X
- Clinical Global Impression of Improvement (CGI-I)			X	X
- Clinical Global Impression Efficacy Index (CGI-EI)			X	X
Implementation of recommended treatment plan		X	X	X

Source: Own representation (Dröschel D., Löhle M., 2016)

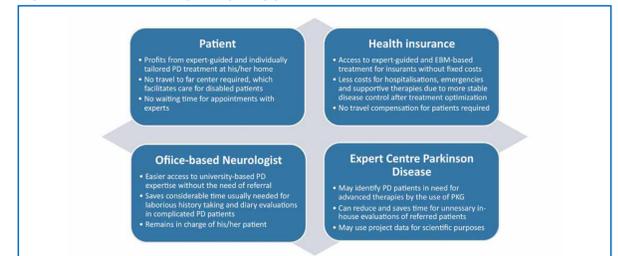
POTENTIALS FOR QUALITY IMPROVEMENT AND COST SAVINGS

- By intergration of the specialized expertise of experts for movement disorders, the diagnostic accuracy can be improved. This can be improved in particular, if this is validated in later years of the disease as this becomes better over time (10)
- Improvement of treatment according to guidelines at all levels of care (Intersectoral und Interdisciplinary) through a consistent structured and controlled care process (11).
- Non-optimally adjusted Idiopathic Parkinson's Syndrome IPS (i.e. dyskinesia, fluctuations) is associated with significantly higher overall costs than optimally adjusted IPS (12)
- The objective measurement by means of the PKG, can improve the therapy management of an IPS patient permanently, as fluctuations can be better controlled and due to the optimization of the drug therapy, the time until more invasive therapies (i.e. deep-brain stimulation, dudopa pump, apomorphine infusion) are required, can be extended.
- This also ensures, that the specialist centers and clinics treat only those patients who actually have the need for advanced treatment (i.e., patients with complex fluctuations) and then they can do so in a timely and professionally optimized manner.
- For the patient, this can improve the quality of life with the disease, it increases the safety, as unwanted events, such as fractures caused by fall, are prevented and consequently costs can be avoided.
- The cost savings (based on example population in Baden-Wuerttemberg) through the new Intervention of approximately 41.723.882,34 € allows an economical provision of care for Parkinson patients!
- Case shifts from inpatient to outpatient care –30% (13)
 - ~33.703.230,78 € savings due to avoidable hospitalizations (over the total 3 years project timeframe).
 - ~7.611.814,58 € savings in non-pharmaceutical and non-medical cost due to avoided hospitalizations (over the total 3 years project timeframe).
- The objective Measuring by means of the PKG, can improve the therapy management of an IPS-Patient sustainably:
 - Because the fluctuations can be better controlled and an optimized IPS-medication or newly treatment procedures can be achieved. (11, 13-16)
 - ±10% ~408.836,99 € savings in medication costs all patients (over the total 3 years project timeframe).
 - Because the pharmaceutical therapy can be prolonged until more invasive therapies become necessary:
- Dudopa-Pump (intrajejunale Levodopa/Carbidopa-Infusion); continous subcutaneous Apomorphin-Infusion; Deep-Brain Stimulation (bilateral electrical stimulation of the Nucleus subthalamicus)

CONCLUSIONS:

- Through this approach, the latest knowledge on the treatment of Parkinson's disease can be made available in local care and the therapy can be optimized.
- This leads to a quality improvement in health care and to significant cost savings through a case shift from inpatient to outpatient.
- The intersectoral and interdisciplinary cooperation will be changed sustainably, particularly in regions with limited supply, due to the telemedicine-based integrated care management.

Figure 7: Benefits for the participating parties



Source: Own representation (Dröschel D., Löhle M., 2016)

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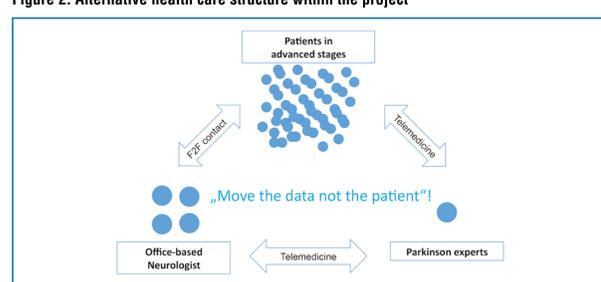
METHOD:

- A telemedicine-based integrated care management model for the improvement of diagnosis and treatment of the Parkinson's disease was developed and conceptualized for some pilot target regions (Mecklenburg-Western Pomerania; Saxonia; Baden-Wuerttemberg).
- Measures to improve the intersectoral (out- and inpatient) and interdisciplinary (Neurologist and Parkinson Expert) cooperation, particularly in the healthcare-poor regions, have been included.
- The approach is conceptualized to modify sustainably the current care through improved integration of both outpatient Neurologist and inpatient specialists.

RESULTS:

- In order to meet the challenges of everyday clinical practice in the area of office-based neurologists, particularly in the healthcare-poor regions, the authors propose a conceptual new form of integrated care.
- The approach uses four core principles:
 - No longer the patient has to be moved, but only the data (Figure 2).
 - In addition to the currently used diagnostic possibilities, the use of an objective measurement method (Parkinson Kinetigraph PKG™) shall improve the ambulatory and inpatient Parkinson therapy.
 - This approach can improve the diagnostic accuracy, since due to the integration of the experts for movement disorders, the knowledge is transferred into the outpatient care.
 - A three-stage traffic system indicates, which action is recommended to the office-based neurologist for the individual patient by the Parkinson expert (Figure 3).

Figure 2: Alternative health care structure within the project



Source: Own representation (Dröschel D., Löhle M., 2016)