



# Enhancing medication therapy in Parkinson's disease by establishing an interprofessional network including pharmacists

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## Abstract

**Background** Optimizing therapy regimens through collaboration and combination of available resources is a promising approach to improve quality of life for patients with Parkinson's disease (PD). **Aim** The aim of this project was to enhance patient-oriented therapy and interprofessional collaboration by establishing a regional PD network. **Setting** The network is located in a rural area in Germany. It covers primary, secondary and tertiary care facilities across professional boundaries. **Development** Recruitment of PD specialists and patient support groups was done by the local newspaper to spread the word. The network was initially open to all healthcare professionals, who stated a focus or special interest in PD. A working group for medication was founded within the network by asking for interested participants. Problems in the medication process were discussed within the group. As a consequence, therapy recommendations (quickcards) and a specific medication plan were developed and a certified education curriculum for pharmacists was developed. **Implementation** The network grew to > 150 participants across all disciplines and sectors. Quickcards were adjusted, approved and implemented by the network during interquartile meetings. Certified education was implemented and became a requirement for participating pharmacists. **Evaluation** The quickcards on medication plan and drug-drug-interactions were approved to be useful and feasible by the network by unanimous assent. Overall satisfaction with certified education was high (mean of 1.4 on a scale between 1 = high and 6 = low). **Conclusion** A regional interprofessional PD network with pharmacists was established and new standards were established. Future research needs to measure the effects on patient outcomes.

**Keywords** Clinical pharmacy · Interprofessional · Integrated care · Network · Neurology · Parkinson's disease · Pharmacist

## Facilitators of best practice

- Building a large interprofessional network was facilitated based on the domains of the Consolidated Framework for Implementation Research (CFIR) with input from an existing Dutch network and patient support groups
- Providing small memory cards (quickcards), which depict elaborated clinical practice standards, was found to be a feasible approach as they were small enough to fit into a pocket and helped to establish standards
- Certified interprofessional education was a core element to enhance the clinical skills of the participating pharmacists

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## Barriers to best practice

- A basic network structure needed to be created, before routine work could be replaced by standardized best practice processes
- As the medication process was just a small part of the network activities, it was difficult to draw attention on clinical pharmacy services
- A significant barrier was the current lack of direct patient care provided by pharmacists at all levels and a lack of provided data on hospital discharge

## Background

Parkinson's disease (PD) is a complex neurological disorder, which progressively affects patients' lives. Therapy is based on medication as well as on non-pharmacological treatments such as physical therapy, and, primarily in patients with advanced stage disease, deep brain stimulation. While neuroprotective pharmacologic therapies did not reach clinical practice during the past decades, creating regional interprofessional networks has shown to be a promising approach, which can improve patients' quality of life [1–3]. These networks usually consist of (a) emphasis on integrated care with coordination and collaboration of the different healthcare professions and sectors and (b) a focus on best practice, with increased guideline adherence and continuous education [4]. A PD network in the Netherlands, which was based on these principles, has shown a reduced number of hip fractures, hospital admissions and cost savings, compared to standard care [5]. Although studies on medication review have been conducted in PD [6, 7] and clinical pharmacy services are well established in many countries [8–11], interprofessional and intersectoral PD networks have emerged only recently.

## Aim

The aim of the project was to incorporate pharmacists into a PD network by establishing a working group for the medication process, developing a certified education program for pharmacists and initiating a quickcard guided best practice approach. The ultimate aim of the network is to provide patient-oriented care for patients with PD through enhanced collaboration.

## Development

After an inauguration phase of 12 months, the Parkinson's network Münsterland+ (PNM+) was officially established in May 2018 under the lead of the Department of Neurology, University of Münster. It was designed as a multidisciplinary network of all medical and non-medical professions, patients, carers and families engaged in PD. Initially, all professionals and patient groups with a focus or special interest in PD could enter. As members grew rapidly after a newspaper article and word-of-mouth recommendation, no specific recruitment was done. The network is located in a rural area of North Rhine-Westphalia, Germany, with a population of 1.8 million and estimated 7000 PD patients. The steering committee (currently 15 members) and the plenum (currently 162 members) meet at least at an interquartile range, the working groups (between 4 and 19 participants) additionally on demand. The PNM+ covers primary, secondary and tertiary care facilities across all professional boundaries. It focuses on:

- Multidisciplinary collaboration of all relevant professions and patients
- Best practice by developing evidence-based quickcards to set and implement standards of care in clinical practice beyond guidelines
- Continuous medical education (for all participants) and board-certified education (for pharmacists)
- Integrated patient care (currently without formal acknowledgment or reimbursement)
- An analog patient file, which is owned by the patient and should be taken to each appointment with a healthcare professional to provide an overview on the patient history and the current therapy

The approach of the PNM+ can be described by the Consolidated Framework for Implementation Research (CFIR) [12], with an internally developed intervention based on the experience of other networks in PD, meeting local needs of the Münsterland area and testing on a small scale (intervention characteristics). In particular, the PNM+ plenum invited researchers from a Dutch PD network and discussed the role model. Statutes were elaborated in moderated sessions of the plenum, denominating collaborative care for the sake of the patient as the superior goal of the network. Goals were defined as collaboration to reach a patient-oriented therapy, interprofessional teambuilding to create expertise and continuous education and learning from other professions. Patient's needs, barriers and facilitators were addressed by participating patients in the whole network and, more specific by working groups (outer setting). Norms and values have been defined by a

network charter and leaders were motivated by participation in the steering committee (inner setting). Within the network there was a specialized team in human resources and efficient team work (characteristics of individuals). A steering committee was in charge to design a strategy to advancement and plans future processes (process). Working groups were doing the substantial work. They could consult other working groups or the steering committee. Results of the working groups were introduced to the plenary, modified if needed, and approved by voting. Minutes of all meetings of the steering committee were provided to the plenary. The plenary could vote for new working groups and assign the steering committee to handle certain aspects. The steering committee could provide suggestions to the plenary (Fig. 1). Communication was facilitated by the software teamspace 5.8 (5 POINT AG, Darmstadt, Germany). Financial planning was done by the steering committee. The network was supported by the University of Münster, which provided meeting rooms and hosted the website. The network otherwise depended on the commitment of the participants, who took part voluntarily and in their free time. No member fee was taken from the participants. Donations were used to print the quickcards and patient files. Participation at a convention was supported by AbbVie. After 18 months of growing, candidates for new membership needed to send an application to the PNM+, which explained their focus and expertise in PD. The application was discussed and granted or denied by the steering committee.

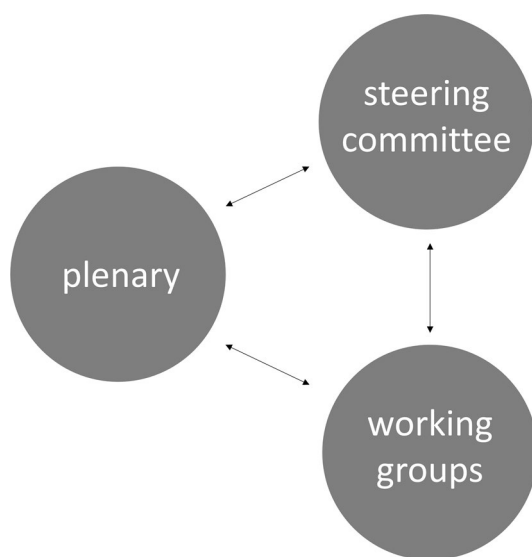
General aspects of the network were addressed during the plenary meetings. New projects (for example: new working groups, conventions, publications) and standards (for example: new proposed quickcards from the working

groups) were introduced and medical education was provided (for example: new studies or guidelines were presented by members or external specialists). An overview and update on the network's activities were given and decisions were made. The steering committee was working on more specific and detailed aspects, which might not have been relevant for the whole plenary. For example, applications of new members were discussed, the region's border was determined, collaboration with other networks was arranged and contributions to conventions were conceived. Working groups were founded in a plenary meeting upon suggestion of the participants. The participants were asked to assign for one working group, which meets their expertise and interest best. Working groups elaborated standards and defined best practice approaches by developing evidence-based quickcards as a core element of the network. The draft quickcard was introduced to the plenary, which could discuss, modify and finally approve the standards. These quickcards specified and standardized a single step in patient care, which usually involved multiple professions and sectors. They were provided to all network members and contained valuable information on decision making, practical work, network standards, intersectoral aid and expertise. As an example, a quickcard on management of dysphagia was designed, which defined the different approaches of therapy and connected hospital neurologists to community neurologists and speech therapists. A quickcard on non-pharmacological treatment was implemented and has been published by the PNM+ [13]. As a network rule, quickcards needed to be based on available evidence and facilitate intersectoral care. After approval by the plenary, they were integrated into standard care of the network participants and were not evaluated further. Feedback was collected by the responsible working group.

The working group on the medication process was founded by the plenary by asking for specialized and interested participants. The group developed quickcards on the medication process and a PD specific education program for pharmacists. The education program was requested by members of the PNM+ and the national patient support group deutsche Parkinson Vereinigung (dPV) and transferred to the working group.

## Implementation

A matrix table for quickcards was created by the steering group and provided to all working groups. The working group on the medication process grew from 6 members in 2018 to 9 members in 2021. It consisted of 4 pharmacists, 4 neurologists and 1 patient. Problems in the medication process were reviewed and identified. As a consequence, quickcards on a standardized medication plan (Table 1) and



**Fig. 1** Organization plan of the PNM+

**Table 1** Page 1 of the quickcard for issuing a network specific medication plan, addressing the needs of PD

User	Recommendations on handling the national medication plan in the PNM+ :
Patient	<p>The national medication plan is part of each patient file. It should be actively shown to every physician and pharmacist at each contact or appointment</p> <p>The goal of using the national medication plan is</p> <ul style="list-style-type: none"> <li>to reduce discrepancies between the medication actually in use and the documented medication</li> <li>to optimize the important application intervals</li> <li>to inform the patient on the medication and it's indication</li> <li>to increase medication safety</li> </ul>
Physician and pharmacist	<ul style="list-style-type: none"> <li>presentation of the national medication plan at each contact, demand to see the plan otherwise</li> <li>update the medication plan according to the recommendations and standards of the PNM+ (see box below and flip side)</li> <li>update reciprocally by network physicians and pharmacists, optionally add handwritten information</li> <li>recommendations to others</li> <li>reason for a change</li> <li>recommendations for implementation</li> <li>Authorize updates by signature/stamp and add date of update. Keep older versions in the patient file to make changes traceable</li> </ul>

References to fill the national medication plan in Parkinson's disease in the PNM+ for physicians and pharmacists

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Filling the national medication plan for patients in the PNM+  
 the rows morning, noon and evening are not to be used for application time but for information on administration with meal or without meals (30–60 min before or 2 h after meal)  
 don't fill the row for units with tab/caps for tablets and capsules but write 1 tab / caps or ½ tab where appropriate  
 fill the row recommendations with the specific point of time, separated by a dash  
 insert additional line for additional administration times under special administration  
 After filling the medication plan, it should be:  
 printed and signed  
 in special cases complemented with handwritten information to other healthcare providers

on drug-drug interactions (Table 2) were developed. The need for specifications in the medication plan was mentioned by the pharmacists, whereas the interactions were addressed by the physicians. The standardized German national medication plan (BNP) was mandatory for all patients with 3 or more drugs in use [14]. Unfortunately, it was not designed for most PD medications and other complex diseases, as it supported only 4 administration times per day. After an initial discussion with the plenum, the working group decided to keep the BNP and adjusted it to the needs of the network instead of developing a new format. The group specified the administration times and the field for administration was used to provide additional information on the right timing in relation to meals, as this is an important issue in PD medication. The quickcard was introduced to the plenum, discussed and enforced after unanimous consent. It was added to the patient file and all physicians and pharmacists of the network were instructed to issue the medication plan in this way.

Physicians did not have permanent access to a licensed drug-drug interaction checker software. The request for a quickcard on interactions was transferred to the working group and a first draft was developed (CM, TH). All drugs

and interactions were analyzed by the network pharmacists (OR, SE) using different software. As the freely available online interaction checkers at [www.drugs.com](http://www.drugs.com) and [www.wechselwirkungscheck.de](http://www.wechselwirkungscheck.de) failed to detect several interactions, which were rated clinically relevant by the working group, the final version of the quickcard was elaborated engaging the drug-drug interaction database ABDA-Datenbank (Version Nr. 454). Each interaction was rated to one of seven categories. The two most severe categories were appraised clinically relevant and displayed in a red field, the next, third ranking category in a yellow field. Interactions of lower relevance were not regarded in this quickcard. As relevancy can change dramatically with more than 2 drugs involved in a similar mechanism, there is a warning on the card saying that complex regimens and drugs in HIV or oncology, which are heavily metabolized via CYP-450 isoenzymes should be analyzed in detail by a network pharmacist. The second draft was edited by all working group members and the final version was approved by all working group members (Table 2).

Members of the PNM+ and of the dPV and regional patient support group Parkinson-Forum outlined the current

**Table 2** Page 1 of the quickcard on drug-drug interactions with frequent PD drugs

Ingredient name i.e. brand name	Precautions/contraindications	Interacting drugs	References on medication
<i>Levodopa</i>			
<b>Levodopa + Benserazide</b> Madopar (-T, -LT, -Depot)® Levopar® Levodopa Comp. ®	<i>closed-angle glaucoma, severe hypothyroidism, pheochromocytoma</i>	<i>all antipsychotics (except for Clozapine and Quetiapine) Linezolid Metoclopramide (MCP) Alfuzosin</i>	Vitamin B12/folic acid deficiency by levodopa, can lead to polyneuropathy Before initiation of Duodopa: baseline levels of folic acid, Vitamin B1, B6, B12, Holotranscobalamin, Methyl malonic acid TSH decrease by levodopa Entacapon: orange coloring of urine Keep interval to meals
<b>Levodopa + Carbidopa</b> Isicom, Isicom retard® Nacom, Nacom retard® Sinemet® Duodopa intestinal®	severe renal and hepatic impairment, gastrointestinal bleeding, tachycardia, melanoma	Ferrum (all salts and formulations) ↓	
<b>Levodopa + Carbidopa + Entacapon</b> Stalevo® LCE®			
<i>Non-ergot dopamine agonists</i>			
<b>Pramipexole</b> Sifrol® Opryma® Mirapexin®	severe renal impairment, severe cardiac indications (increasing risk for hypotension)	<i>Alfuzosin</i> all antipsychotics ↓ MCP ↓	Renal excretion 90%, dosing adjustment in renal impairment
<b>Rotigotin transdermal</b> Neupro® Leganto®	<i>severe hepatic impairment</i>	<i>Alfuzosin</i> all antipsychotics ↓ MCP ↓	Detach before MRI or cardioversion (contains aluminium)
<b>Ropinirol</b> Requip® Ralnea® Adartre®l	<i>renal impairment (GFR &lt; 30 ml/min)</i> <i>severe hepatic impairment</i>	<i>Alfuzosin</i> all antipsychotics ↓ MCP ↓ Estrogens ↑ Fluvoxamine ↑	Nicotine (CYP1A2-inductor): ↓ Control INR more frequently if coadministered with Phenprocoumon
<b>Piribedil</b> Clarium® Trivastal®	<i>acute coronary syndrom</i>	<i>Alfuzosin</i> all antipsychotics ↓ MCP ↓	
<b>Apomorphin s.c</b> APO-go® (Pen, Pumpe) SO-CONNECT PAR® (Pumpe)	<i>long QT syndrome</i> renal impairment	<i>Alfuzosin</i> <i>Ranolazine</i> all antipsychotics ↓ MCP ↓	Take QTc baseline Monitor total blood count (hemolytic anemia in rare cases)

Overview on the most important drug-drug interactions of medication, usually engaged in the therapy of patients with Parkinson's disease. For a comprehensive interaction check in patients with poly medication and especially in patients with HIV or oncologic therapies, please consult network pharmacists

Italics denote "Severe precautions", Relative contraindications

↑ = Increasing effect or plasma concentration of Parkinson medication

↓ = Increasing effect or plasma concentration of Parkinson medication

QTc-time: normal < 450 ms, high risk for severe cardiac arrhythmias, if > 500 ms or increase > 50 ms from baseline

pharmaceutical care situation of patients with PD as rather insufficient. A particular complaint was the restricted access to remote mail-order pharmacies and unspecialized information by community pharmacies. A discussion round with the presidents of the regional and national boards of pharmacy, the secretary of the dPV and members of the PNM+ working group lead to the decision to initiate a PD specific board-certified education for pharmacists. The curriculum was developed by the medical association German Parkinson Society (DPG), the Board of Pharmacy for Westphalia-Lippe (AKWL) and the dPV. In accordance with other existing board-certified education programs by the national board

of pharmacy, it was decided to offer 16 h of education in a seminar, followed by a longitudinal medication therapy management over 6 months, which has to be completed, documented and finally be submitted to the AKWL to reach individual certification. The AKWL approved all submitted medication therapy managements, which were properly done and seemed reasonable. There was no formal test. The seminar content was elaborated and presented by the DPG (6 h), AKWL (8 h) and dPV (2 h). It was implemented by the AKWL as a 2-day seminar. The certification was decided to be a compulsory requirement for applying pharmacists to reach membership in the PNM+ by the steering group

**Table 3** Curriculum of the certified education

Content	Provider	Duration (h)
Patient expectations, interprofessional collaboration	dPV	1
Pathophysiology, diagnostics	DPG	2
Pharmacotherapy, general approach, guidelines, therapy of motor and non-motor symptoms	AKWL	2
Collaborative medication management in PD	AKWL	2
Patient case discussions	AKWL	1
Case scenarios and patient-oriented therapies	DPG	1
Social aspects in therapy	DPG	0,5
Therapy approaches in non-motor symptoms	DPG	1,5
Developing a therapy plan, clinical reasoning, prioritizing	DPG	1
Background in medication management	AKWL	0,5
Conducting medication reviews	AKWL	2
Reflection of the content, discussing ways to establish patient care in PD in individual settings and clinical practice	AKWL	0,5
Discussion and networking for further collaboration	dPV	1

AKWL Board of Pharmacy for Westphalia-Lippe, dPV Deutsche Parkinson Vereinigung, DPG German Parkinson Society

in 2020. The curriculum of the certified education is shown in Table 3.

## Evaluation

The quickcard on the medication plan was approved to be useful and feasible by the network by unanimous assent at a plenary meeting in September 2019. The quickcard on drug-drug interactions was approved by all members of the working group for the medication process in January 2021. The certified education was conducted and evaluated by the AKWL. It was completed by 108 pharmacists between 2018 and 2020 and served as a blueprint for national distribution. The course was evaluated by 9 out of 29 participants in March 2018 and with a new questionnaire by 24 out of 31 participants of a course in May 2019 on a Likert scale between 1 and 6, with 1 implicating best and 6 implicating worst performance. Overall satisfaction with the education was very high (mean 1.4, n=33). Some difficulties existed with integrating the course into the work schedule of the

participants. Further results of the evaluation are displayed in Table 4.

Qualitative evaluation by free-text of the raters provided more details. It was stated that the patient case videos could only be seen at the meetings but were not provided in a way, that they could be watched at home. Other stated that “*patient videos were plenty, more would have been too much*” or that “*the mixture of web-based seminars and face to face seminars was very good*”. One rater expressed difficulties with access to the internet-based platform, where the presentations were provided for download.

## Discussion

To the best of our understanding, the project describes integration of pharmacists into an interprofessional and intersectoral specialized network for PD for the first time. Pharmacists were engaged in steering and clinical practice of the network. Collaboration with pharmacists lead to set quickcard supported standards. Pharmacists have participated

**Table 4** Results of the two evaluation rounds (mean, n=33)

Evaluated Item	Rating	Number of raters
The course provided useful additional knowledge	1.1	24
The course provided skills, which I can transfer to clinical practice	1.2	24
Satisfaction with the organization of the course	1.8	24
The course was easy to combine with my work schedule	2.0	24
The content of the course was just right	1.4	33
Overall satisfaction with the course	1.4	33



in all network decisions and were involved in many other processes within the network. Further collaborative projects are under development. Prior experiences of the existing Dutch network helped to start the PNM+ [4]. Researchers were contacted several times and were present to introduce their experiences at one of the first meetings. This helped very much to get the network started. Testing on a small scale came by itself. The first quickcards, new standards and cooperations were immediately tested with a few patients out of curiosity. At a certain stage of development, it was very helpful to elaborate statutes to have guidance and a clear vision. In this particular case, patient-oriented care and collaboration of the healthcare professionals were defined as the network goals. Patients' needs and demands were explored by integrating local, regional and national support groups. Recommendations by these groups contributed greatly and led to the specialized education for pharmacists. Another important step was the formation of the steering committee. As plenary meetings were overloaded with content, the steering committee could deal with aspects, which were not of general interest.

Implementation of a board-certified certification for pharmacists in PD faced many barriers. These were seen mainly among the different boards of pharmacy of the 17 states and provinces and then again on the federal level. Many boards did not see the special demands of the patients with PD. In contrast, collaboration with the medical society and the national patient support group on the curriculum was smooth and constructive. As participants stated some problems with integration of the program into daily life, the curriculum was partly changed to web seminars, to allow for more flexibility. Although a specific PD guideline for pharmacists was published in Canada [15] and studies demonstrated a patient benefit from pharmacist-led medication management [6, 7], the vast majority of most PD network members are usually neurologists, occupational therapists, physical therapists and speech therapists. Even though new aspects on the medication process could be elaborated and pharmaceutical expertise led to a fruitful collaboration, the representative main focus of networks on non-pharmacological therapies can be a barrier to multidisciplinary collaboration. This barrier was overcome only by the persistence of the pharmacists, who are outnumbered by the therapists and physicians by far. An easy and simple facilitator to successful collaboration on the other hand is to take a proactive role and to deliver indispensable content. A result of this project was that a lot of work, energy and time needed to be invested to establish a fundamental network structure, before substantive work could begin and routine care could be replaced by best practice standards. This seemed to be especially true for multidisciplinary and intersectoral networks.

The board-certified education was well accepted by pharmacists and all courses were booked out. In contrast to a

similar education program developed by the Hackensack University Medical Center in New Jersey for a hospital setting [16], this education program was designed to enable the participating community pharmacists to efficiently collaborate in a network. For national distribution, the education program was recently introduced to secretaries of further regional chambers of pharmacy. Discussion resulted in a modified curriculum, partly offered as a web-based seminar. The PNM+ and the related regional board-certified education program however have shown resilient to fluctuations and are very likely to sustain. The PNM+ recently has gained funding by a national program and was already introduced at several conventions. It has inspired and associated further neighboring networks in Germany. Future activities of the working group for the medication process include the implementation of medication safety and optimizing therapy standards.

## Limitations

Even though first projects on the medication process could be initiated and implemented, the patient benefit has not been evaluated so far. As the network offers a multiple and complex intervention, defining endpoints to determine the contribution of the pharmacists is challenging. The PNM+ is still at an initial stage and collaboration needs to intensify over the next years. The board-certified education is open to all pharmacists, inside and outside of the PNM+ area. It is unclear, whether the successful integration of pharmacists into the PNM+ is related to individual efforts and whether it can be transferred into other networks. An evaluation of the pharmacists' effects on the quality of life of the patients is still pending. The quickcards were the result of a small group of specialists in PD only. External validity is uncertain.

## Conclusion

A sustainable PD network was developed, based on the CFIR domains. Integration of pharmacists into a PD network could broaden the perspective of the network and originated new aspects in best practice. Created standards could smooth the way for interprofessional collaboration and be regarded as an additional value to guidelines. A certified education for pharmacists in PD was well accepted to prepare pharmacists in this highly specialized field. However, cooperation in a PD network should not be practiced to reach individual benefits of the participants. It should ultimately result in a benefit in the quality of life of the patients and the relatives. These effects remain to be evaluated in further studies.

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**Availability of data and material** All data and materials are available from the corresponding author upon reasonable request.

## Declarations

**Conflicts of interest** Susanne Erzkamp has received a speaker honorarium from MSD Sharp & Dohme, Svenja Happe has received lecturer honoraria from Bial, Bioprojet and Bayer Vital, Tessa Huchtemann declares that she has no competing interests, Constanze Mönig declares that she has no competing interests, Michael Ohms declares that he has no competing interests, Oliver Schwalbe declares that he has no competing interests, Olaf Rose has received a speaker honorarium from AbbVie, MSD Sharp & Dohme, Novartis and Omnicell, Tobias Warnecke has received lecturer and consulting honoraria from AbbVie, UCB Pharma, Archimedes, Bayer, Bial, Biogen, Desitin, Licher, Phagenesis, Pfizer, Teva, and Zambon.

**Consent to participate and for publication** The study was not obtained as no patient data was used in this publication.

**Ethical approval** was not obtained as no patient data were used in this publication

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