Practice recommendations for Parkinson's disease: Assessment and management by community pharmacists

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Clinical presentation

The hallmark of Parkinson's disease (PD) is the progressive loss of voluntary motor control over time.¹ Initial symptoms usually include asymmetrical tremor, stiffness of the body and a decrease in speed of movement and activity.¹ Pathologically, the loss of motor control is explained by the loss of nigrostriatal dopaminergic neurons in the basal ganglia of the affected individuals.^{1,2} Indeed, by the time symptoms present, approximately 60% to 70% of the nigrostriatal dopaminergic neurons have perished.² The loss of these neurons results in a deficit of dopamine, the neurotransmitter primarily responsible for initiating and controlling movement, hence the tremor, rigidity and akinesia or bradykinesia (Table 1).¹⁻⁴ Tremor presents as a characteristic "pill-rolling" movement, usually starting in one hand or foot and progressively affecting one side of the body and then the other.^{1,3,4} It usually presents at rest and dissipates with movement.^{1,3,4} Rigidity is not visually obvious, but a physical examination of the joints may reveal a resistance to movement, reported as "lead-pipe" (continuous) or "cog-wheeling" (ratchet-like) resistance.^{1,3} Bradykinesia (slowness of movement) can manifest as smaller handwriting (micrographia), decreased facial expression (hypomimia or "masked facies"), decreased blink rate, softer speech (hypophonia), decreased swallowing (dysphagia) and decreased arm swing.^{1,3,4} Finally, patients present with gait impairment (stooped posture, slow shuffling gait with small steps) and may ultimately develop postural instability (decreased ability to stabilize body in a balanced position).^{1,3,4}

Although motor symptoms are most noticeable and required for clinical diagnosis of PD, nonmotor symptoms are gaining recognition and may precede diagnosis by several years.⁵ Depression, fatigue, hyposmia (lack of smell), rapid eye movement sleep behaviour disorder and constipation are reported by 25% to 97% of patients, frequently prior to the actual diagnosis of PD.⁵ Other nonmotor symptoms such as anxiety, postural lightheadedness, drooling (sialorrhea), urinary urgency, sexual dysfunction, cognitive impairment and dementia are reported as the disease progresses, usually 5 years or more following the diagnosis of PD.⁵

Guidelines for management of PD for pharmacists

The Canadian guidelines on PD, published in 2012, provide guidance on several aspects of the management of PD, including communication, diagnosis and progression, treatment of motor symptoms and features and treatment of nonmotor symptoms.¹ From these guidelines, information and recommendations most relevant to pharmacists were summarized in the PD guidelines for pharmacists and addressed 4 areas: communication, diagnosis, prognosis and neuroprotection and treatment of both motor and nonmotor features of PD.^{1,6} The objective of the present article is to focus attention on those aspects of the treatment of PD that pharmacists can address in collaboration not only with patients' physicians but also with other providers involved in the circle of care. With this objective in mind, we also discuss drug-induced parkinsonism and provide additional details

TABLE 1 Symptoms of Parkinson's disease

Symptom	Description
Tremor	Asymmetrical presentation of pill-rolling, 4-6 Hz resting tremors initially, which may progress to bilateral resting tremors in all extremities.
Rigidity	Cogwheel or lead-pipe rigidity on clinical examination of joints.
Akinesia or bradykinesia	Slowing of movement, loss of dexterity, smaller handwriting (micrographia), decreased facial expression (masked facies) and/or decreased blinking rate. Speech may become softer (hypophonia). Patients may present with reduced arm swing.
Postural instability	Patients may have gait disturbance—shuffling gait, stooped posture. Patients may complain of a transient inability to initiate movement (freezing), although this typically occurs in the later stages of Parkinson's disease.

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TABLE 2 Selective list of drugs associated with drug-induced parkinsonism^{8,9}

High risk	Intermediate risk	Low risk
First-generation antipsychotics (chlorpromazine, prochlorperazine, thioridazine, haloperidol)	Second- and third-generation antipsychotics (quetiapine, clozapine)	Antiarrhythmics (amiodarone, procaine)
Second-generation antipsychotics (risperidone, olanzapine, ziprasidone, aripiprazole)	Calcium channel blockers (diltiazem, verapamil)	Antidepressants (fluoxetine, sertraline, moclobemide, phenelzine)
Calcium channel blockers (flunarizine)	Antiepileptics (phenytoin, valproate, levetiracetam)	Immunosuppressants (cyclosporine, tacrolimus)
Cardiovascular (reserpine)	Mood stabilizers (lithium)	Antivirals and antifungals (acyclovir, vidarabine, amphotericin B)
Antiemetics (metoclopramide)		Statins (lovastatin)
		Hormones (levothyroxine, medroxyprogesterone, epinephrine)

related to pharmacotherapy to complement the PD guidelines for pharmacists. Finally, we review 2 publications detailing the impact of community pharmacy on providing care to patients with PD.

Drug-induced parkinsonism (DIP)

Diagnosis of PD is guided by the presentation of clinical symptoms; there is no diagnostic test that clearly identifies PD.¹ Additionally, where diagnosis is difficult to ascertain from the clinical presentation, other forms of parkinsonism, such as multiple system atrophy, progressive supranuclear palsy and corticobasal degeneration, have to be ruled out. Therefore, patients who present to a community pharmacy with symptoms indicative of PD should be referred to their family physician for assessment and diagnosis and, usually, referral to a specialist.^{1,6} Community pharmacists can contribute to the assessment

and diagnosis of the patient by reviewing current medications to determine the likelihood of drug-induced parkinsonism (DIP) and reporting the potential relationship of presentation of PD symptoms with the initiation of any medications known to be likely causes of DIP to the family physician. Medications are the second most prevalent cause of parkinsonism (making up 20%-56% of all cases), with almost 7% of patients presenting with DIP misdiagnosed with PD.⁷⁻⁹ Drugs frequently associated with DIP include antipsychotics, both typical and atypical agents, some cardiovascular medications such as flunarizine and antiemetics such as metoclopramide or trifluoperazine (see Table 2 for drugs commonly associated with DIP). Review of the temporal relationship between symptom onset and initiation of an offending medication (onset of symptoms within 1-3 months) may guide

clinicians in the diagnosis of PD.^{7,9} Although not always a reliable indicator, the presentation of motor symptoms is usually asymmetric in idiopathic PD but symmetric in DIP.⁷⁻⁹ Additionally, clinical response to levodopa is usually excellent in idiopathic PD but poor in DIP.⁷⁻⁹ Finally, withdrawal of the causative agent may result in amelioration of motor symptoms in 75% to 80% of patients with DIP but not in idiopathic PD, although this may take several months.⁷⁻⁹ The use of these medications may also unmask the underlying PD.⁷⁻⁹

Treatment

The discovery of curative, neuroprotective or disease-modifying treatments with PD has been elusive, and currently the goal of treatment is to alleviate the symptoms of PD.^{1,5} A review of the results of clinical trials investigating pharmacological agents for neuroprotection in PD has led the authors of the Canadian PD guidelines to recommend against use of vitamin E, coenzyme Q10 and monoamine oxidase B inhibitors explicitly for neuroprotection.^{1,6} There is insufficient evidence to support or refute the use of amantadine, and no long-term evidence that indicates that levodopa is neuroprotective.^{1,6}

Several different modalities, including pharmacotherapy, surgery, physiotherapy, occupational therapy, speech therapy and exercise, may be used to produce therapeutic benefit in patients with PD.^{1,6} This article focuses on the use of pharmacotherapy for the treatment of PD and complements the information previously presented in the PD guidelines for pharmacists.⁶

The initiation of pharmacotherapy is guided by patients and usually is indicated when symptoms impair functionality, quality of life or employment or lead to embarrassment in social situations.^{1,5,6,10} The choice of drug used to initiate treatment should be based on the clinical characteristics (presenting PD symptoms, age, comorbid conditions, drug-drug interactions with other agents and adverse effects of medications) and lifestyle characteristics (impact of symptoms on quality of life and ability to work, affordability of medications) of the patient and should include the patient in the decision-making process once he or she has been informed of the short- and long-term consequences, both positive and negative.^{1,5,6,10}

Given the loss of dopaminergic neurons, key pharmacological options for the treatment of PD are related to 1 of 2 modalities¹⁰:

1. Replacing or increasing dopamine concentrations intracranially
2. Agonistic activity at dopamine receptors

Monoamine oxidase B inhibitors, levodopa with dopa decarboxylase inhibitors and dopamine agonists are the primary drugs of choice for initiating treatment. Amantadine may be used in early PD but is not a drug of choice, while anticholinergics are not drugs of choice but may be used in young patients with tremor-predominant early PD; the use of these agents in elderly patients is limited by the potential for detrimental cognitive effects.¹ Finally, although beta-blockers may be used to treat postural tremors in selected patients, these agents are not drugs of first choice.¹

Levodopa has been demonstrated to be a very effective drug for the treatment of PD.¹ It is metabolized in the periphery by dopamine decarboxylase to dopamine, resulting in gastrointestinal side effects (nausea and vomiting) and orthostatic hypotension.^{1,10} Additionally, dopamine does not penetrate the blood-brain barrier. To minimize side effects and increase the amount of dopamine in the brain, levodopa is formulated in combination with 1 of 2 decarboxylase inhibitors, carbidopa or benserazide. Levodopa/carbidopa is also available in combination with a catechol-O-methyl transferase inhibitor, entacapone, which decreases the metabolism of levodopa into another metabolite, 3-O-methyl dopa, through a different pathway.¹⁰ The coadministration of carbidopa or benserazide decreases the incidence of nausea and vomiting; however, in some patients, administration with food may provide further relief, although there are several caveats to consider in more advanced PD:

1. Dietary protein competes with levodopa for absorption from the intestine; therefore, if the patient is advised to administer levodopa with food, he or she should also be advised to avoid meals high in protein content when ingesting levodopa.
2. Absorption may be variable or delayed with meals, therefore, if the patient complains of delayed onset of effect or variability in effectiveness, he or she should be advised to take levodopa 1 hour before or after eating.¹⁰

Levodopa should also be initiated at a small dose and titrated up to an initial dose of 100/25

mg 3 times per day or lower for elderly patients, to mitigate these side effects. If these strategies do not prevent nausea and vomiting, domperidone 10 mg before meals, up to 3 times per day, may be suggested.¹⁰ Absorption of the sustained-release formulation of levodopa is highly variable, and this formulation is not recommended for management of gastrointestinal side effects.¹⁰

Long-term levodopa therapy may be associated with dyskinesias and motor fluctuations, such as “end-of-dose deterioration” or “wearing off,” unpredictable “on-off” and “delayed on,” which can significantly worsen patients’ quality of life.^{1,5,10} Suggestions for the management of these side effects are provided in Table 3. Other side effects include orthostatic hypotension, neuropsychiatric side effects such as hallucinations, confusion, impulse control disorders (e.g., hypersexuality, gambling) and somnolence, although these are more common with dopamine agonists.^{1,6,5,10}

Dopamine agonists are not as potent as levodopa but are more effective than the other agents used to treat PD.¹ Ergot-derived dopamine agonists, such as bromocriptine, have fallen out of favour due to the potential for serious side effects such as serosal membrane fibrosis and erythromelalgia. Non-ergot-derived dopamine agonists, pramipexole and ropinirole, are used with greater frequency, typically in younger patients given the higher frequency of side effects in older patients.^{1,10} Dopamine agonists activate specific types of dopamine receptors and have some theoretical advantages over levodopa: they do not require conversion to dopamine for activity, do not compete with dietary protein for absorption and have longer half-lives than levodopa.^{1,10} Adverse effects include gastrointestinal side effects, orthostatic hypotension, hallucinations, impulse control disorders (especially in younger patients), leg edema and sleepiness.^{1,5,10} Initiation of either dopamine agonist at a small dose with gradual titration should minimize peripheral side effects and allow tolerance to develop.^{1,10} Both dopamine agonists and levodopa have been associated with reports of “sudden sleep” attacks; however, they occur more frequently with dopamine agonists. These attacks, which occur without warning, are likely related to excessive daytime sleepiness.¹⁰

Monoamine oxidase B inhibitors, selegiline and rasagiline, irreversibly inhibit the metabolism of dopamine, thereby increasing

the concentrations of dopamine in the brain.^{1,10} Both agents are effective for mild symptoms in early PD and are generally well tolerated.^{1,10} Selegiline is metabolized to amphetamine and methamphetamine and can produce insomnia if taken later in the day. Rasagiline appears to be the more potent of the 2 agents and is not metabolized to amphetamine or methamphetamine. Both agents may be used as monotherapy for symptom relief earlier in the disease process, but rasagiline may be used as an adjunct to levodopa in the later stages of PD to reduce off time.^{1,10} However, patients should be monitored for dyskinesias and neuropsychiatric side effects when these agents are used as adjunctive treatment.^{1,10}

The use of anticholinergic agents, trihexyphenidyl and benztropine, is limited to cognitively intact patients younger than 60 years of age who present with tremor-predominant PD.^{1,5,10} As with other agents, a small dose should be initiated and the dose should be gradually titrated to an effective level.¹⁰ As expected with any anticholinergic, patients may present with side effects such as confusion, memory impairment, hallucinations, sedation, dry mouth, blurred vision, constipation and orthostatic hypotension.¹⁰ While some patients may tolerate sedation, dry mouth and blurred vision, the appearance of cognitive impairment should deter the use of these agents. Orthostatic hypotension may be responsive to treatment with fludrocortisone or midodrine.¹⁰ Anticholinergics should be withdrawn slowly to prevent acute exacerbation of parkinsonian symptoms.¹⁰

The mechanism of action of amantadine in PD is not known. It is an *N*-methyl-D-aspartate (NMDA) antagonist and likely has dopamine agonist as well as anticholinergic effects.^{1,10} It may be used in early PD but is not the drug of first choice and is generally used in the later stages of PD for the treatment of levodopa-induced dyskinesias.^{1,5,10} Similar to other agents with dopamine agonist activity, it has side effects including nausea, hallucinations, confusion and orthostatic hypotension.¹⁰ Patients may also report dry mouth, blurred vision and sedation as well as other anticholinergic side effects. As amantadine is renally cleared, the dose should be limited in elderly patients and the drug should be avoided or used only with great caution in others with renal impairment. Additionally, patients should be closely monitored for livedo reticularis. Ankle edema can limit treatment.¹⁰

TABLE 3 Management of selected motor complications and selected side effects

Motor complications/side effects		Description	Current treatment	Options
Motor complications				
Motor fluctuations	Delayed on	Delay in response to onset of effect from levodopa or dopamine agonist	Levodopa	<ul style="list-style-type: none"> • Increase dose. • Change time of administration. • Limit, redistribute or eliminate coadministration of protein.
			DA	<ul style="list-style-type: none"> • Increase dose. • Change time of administration.
	End of dose or wearing off	Duration of the effect or symptomatic relief from levodopa or DA decreases to <4 hours. With progression of PD, duration of action of doses is progressively shorter.	Levodopa	<ul style="list-style-type: none"> • Increase frequency of dosing. • Increase dose. • Add COMT inhibitor (entacapone, lower dose of levodopa by 20% if dyskinesias emerge). • Add MAO B inhibitor (rasagiline). • Add DA (pramipexole or ropinirole). • Modified-release levodopa may be useful for some patients but is not the first choice.
			DA	<ul style="list-style-type: none"> • Add levodopa.
Dyskinesias	Peak-dose dyskinesias	Uncontrolled choreiform movements resulting at times of peak plasma concentrations of levodopa. Other types of dyskinesias will not be addressed.	Levodopa	<ul style="list-style-type: none"> • Decrease each dose by small amount. • Decrease dose of levodopa, but add dopamine agonist or increase dose of concurrent dopamine agonist. • If on modified-release levodopa, change to immediate-release levodopa. • If on concurrent MAO B inhibitor, gradually decrease MAO B inhibitor and discontinue. • If recent addition of COMT inhibitor, decrease dose of levodopa by 15%-30%. • Add amantadine.
Side effects				
Neuropsychiatric/psychotic side effects	Hallucinations	<ul style="list-style-type: none"> • Mild symptoms, if tolerated by patient and/or caregiver, do not need to be treated. • Gradually reduce/discontinue offending nonparkinsonian medications (anticholinergics, anxiolytics, sedatives, antidepressants, etc.). • Gradually reduce/discontinue offending antiparkinsonian medications (amantadine, MAO B inhibitor, COMT inhibitor, DA). • If on levodopa, decrease dose. • Do not use antipsychotics, except for clozapine or quetiapine, in patients with PD. 		
Autonomic	Constipation	<ul style="list-style-type: none"> • Improve dietary fiber and fluid intake. • Improve physical activity. • If on anticholinergic agents, discontinue. • Initiate stool softeners, bulk-forming laxatives or enemas; limit use of bisacodyl. • Consider domperidone if constipation related to decreased motility associated with PD. 		
	Orthostatic hypotension	<ul style="list-style-type: none"> • Reduce/discontinue antihypertensive medications. • Reduce/discontinue other medications that can cause hypotension. • Advise patients to change positions (sitting from sleeping position or standing from sitting position or after a meal) very slowly. • Advise patients to avoid large meals, alcohol, excessively warm areas. • Increase fluids, increase salt intake. • Elevate head on multiple pillows or elevate head of bed. • Initiate fludrocortisone or midodrine. 		

DA, dopamine agonist; COMT, catechol-o-methyltransferase; MAO B, monoamine oxidase B; PD, Parkinson's disease.

Monotherapy with a single agent may produce excellent results for the first few years of treatment; however, the majority of patients will eventually require polytherapy. Frequent monitoring of effectiveness and safety is necessary in order to determine the most optimal doses, optimal times of administration and appropriate adjunctive treatment as PD progresses. Pharmacists may encounter patients with PD or their caregivers with greater regularity than do other health professionals, given the fixed dispensing intervals for medications. This presents pharmacists with an opportunity to use their knowledge of pharmacotherapy, as well as long-standing relationships and comprehensive appreciation of their patients' drug therapy, to work collaboratively with patients and other health care providers. In this manner, pharmacists can collaboratively help determine the appropriate drug treatment as well as monitor and adjust pharmacotherapy to improve safety, effectiveness, adherence and attainment of patient-specific goals of therapy (Box 1). Pharmacists are also well placed to provide ongoing educational sessions with the patients.

Review of community pharmacy care in patients with PD

Two clinical trials have investigated the impact of community pharmacist involvement in the treatment of patients with PD.¹¹⁻¹³ Mynors et al.¹¹ designed a prospective pilot study in order to determine the feasibility of a community pharmacist intervention with patients with PD in the United Kingdom. Participants were asked to complete validated questionnaires evaluating their satisfaction and adherence upon entry into the study and after 6 months. Community pharmacists were recruited and trained to consult with patients with PD in order to elicit and address medication-related problems as appropriate. The majority of consultations among the 230 participants were carried out in the community pharmacy, while 40% were conducted in the patients' homes. Patient satisfaction with information on medicines improved significantly, as did patient mobility. Furthermore, 61% of the participants reported an improvement in their knowledge of PD, 63% reported an improvement in knowledge of their medicines and 70% claimed greater benefit from their drugs after participation in the trial. Mean adherence scores did not change significantly from baseline, although patients demonstrated high levels of compliance at both baseline and end of study.

BOX 1 Pharmacists' contribution to Parkinson disease (PD) detection and management

- Observe or examine patients who present with or complain of parkinsonian symptoms (tremor, rigidity, bradykinesia, postural hypotension).
- Review medications to determine possibility of drug-induced PD.
- Refer patients who present with PD symptoms to their family physician for an accurate diagnosis and further referral to neurologist.
- Provide written and verbal education to both patients and caregivers on the advantages and disadvantages of various anti-parkinsonian medications.
- Develop therapeutic goals with patients with PD, caregivers and other members of the patient's health care team.
- Actively assess anti-parkinsonian medications for appropriateness, effectiveness, tolerability, safety and affordability based on clinical and lifestyle characteristics of the patient.
- Assess patient's adherence to anti-parkinsonian medications.
- Assist patients, caregivers and other members of the health care team with adjusting doses of anti-parkinsonian medications.
- Assist patients with appropriate dosing, administration and timing of anti-parkinsonian medications.
- Recognize real and potential drug-related problems related to anti-parkinsonian medications and use full scope of practice available in your jurisdiction to facilitate resolution of drug-related problems in collaboration with patients, caregivers and other members of the health care team.
- Use the PD guidelines (available at www.parkinsonclinicalguidelines.ca/home), the PD guidelines for pharmacists⁶ and patient tools available through Parkinson Society Canada (available at www.parkinson.ca) to provide evidence-based information to patients, caregivers and other members of the health care team to ensure a consistent message.

The second study investigating the impact of community pharmacist involvement in the management of PD was conducted in 32 German pharmacies.^{12,13} This study was designed as an open-label, multi-centre, longitudinal, parallel-group study in which patients were recruited into the pharmacy intervention or comparison arms. Patients recruited into the pharmacy arm received standardized pharmaceutical care, while patients in the comparison or nonpharmacy arm did not. Measures of outcomes included 2 disease-specific questionnaires and 1 quality-of-life questionnaire. Patients were observed over a period of 8 months. Pharmacists established a therapeutic patient-pharmacist relationship, assessed drug-related problems, developed pharmaceutical care plans and evaluated patients' health and drug regimens. Results from this study indicate that scores in both

the disease-specific and quality-of-life outcome measures improved significantly in the pharmacy arm compared with the nonpharmacy arm. Additionally, use of inappropriate drugs improved significantly in the pharmacy arm compared with the nonpharmacy arm.¹² A total of 331 drug-related problems were identified, and pharmacists recommended 474 interventions for the 113 patients recruited to the pharmacy arm. The most frequently identified drug-related problem was untreated indication (26.3%), followed by symptoms of an adverse drug reaction (12.4%), unsuitable time of intake (10%), underdosage (9.7%) and drug interactions (9.4%). Forty-eight percent (48%) of the drug-related problems were associated with anti-parkinsonian medication, most frequently levodopa and dopamine agonists. An evaluation of the clinical significance of drug-related problems indicated that 4.5% were extremely important, 27.2% were of major importance, 29% were of moderate importance and 39.3% were of minor importance. The interventions most frequently performed by pharmacists were providing patients with special treatment advice (19.6%), addressing concerns with compliance (15.6%) and addressing adverse drug

reactions (11.6%).¹³ Other interventions included addressing drug interactions, inappropriate dosages, inappropriate drug choice, referrals to physicians and specialist clinical centres, contacting the physician and interviewing patients and caregivers.¹³

Summary

The practice of community pharmacy is evolving from one of distribution of prescribed products to one of patient-centred care through the provision of pharmaceutical care and focus on improvement of health outcomes. Pharmacists are well placed and well trained to assess and manage medical conditions such as PD through collaboration with patients and other health care professionals. The present article, in conjunction with the Canadian guidelines on PD¹ and the PD guidelines for pharmacists,⁶ will enable pharmacists to collaborate with health care professionals and patient advocacy organizations such as Parkinson Society Canada to facilitate changes in drug therapy, monitor for outcomes and empower their patients to improve their knowledge, therapeutic outcomes and quality of life. ■

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References

1. Grimes D, Gordon J, Snelgrove B, et al. Canadian guidelines on Parkinson's disease. *Can J Neurol Sci* 2012;39(Suppl 4):S1-S30. Available: www.parkinsonclinicalguidelines.ca/sites/default/files/PD_Guidelines_2012.pdf (accessed Feb. 6, 2014).
2. Lang AE, Lozano AM. Parkinson's disease: first of two parts. *N Engl J Med* 1998;339:1044-53.
3. Guttman M, Kish SJ, Furukawa Y. Current concepts in the diagnosis and management of Parkinson's disease. *CMAJ* 2003;168:293-301.
4. Parkinson's Disease CNI (Aug. 18, 2013). Parkinson's disease motor symptoms. Available: www.youtube.com/watch?v=3wg9ExKwZy4 (accessed Sept. 23, 2014).
5. Connolly BS, Lang AE. Pharmacological treatment of Parkinson disease: a review. *JAMA* 2014;311:1670-83.
6. Patel T, Chang F. Parkinson's disease guidelines for pharmacists. *Can Pharm J (Ott)* 2014;147:161-70.
7. Van Gerpen JA. Drug-induced parkinsonism. *Neurologist* 2002;8:363-70.
8. Shin HW, Chung SJ. Drug-induced parkinsonism. *J Clin Neurol* 2012;8:15-21.

9. López-Sendón J, Mena MA, de Yébenes JG. Drug-induced parkinsonism. *Expert Opin Drug Saf* 2013;4:487-96.
10. Olanow CW, Stern MB, Sethi K. The scientific and clinical basis for the treatment of Parkinson disease. *Neurology* 2009;72(Suppl 4):S1-S136.
11. Mynors GM, Jenkinson C, MacNeill V, et al. A pilot evaluation of specialist community pharmacy services for patients with Parkinson's disease. *Pharm J* 2007;278:709-12.
12. Schroder S, Martus P, Odin P, et al. Impact of community pharmaceutical care on patient health and quality of drug treatment in Parkinson's disease. *Int J Clin Pharm* 2012;34:746-56.
13. Schroder S, Martus P, Odin P, et al. Drug-related problems in Parkinson's disease: the role of community pharmacists in primary care. *Int J Clin Pharm* 2011;33: 674-82.