

## Health Economics and Cost of Illness in Parkinson's Disease

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### Abstract

Parkinson's disease (PD) is the second most common neurodegenerative disorder worldwide. With a progressive course and no cure yet available, it is demanding for patients and their caregivers, but also for health and social support systems and ultimately for society as a whole. Everyday significant economic resources are spent due to PD, either directly on its treatment or in lost productivity. In this article, one tried to frame PD from an health economics' perspective and cost of illness studies conducted in 11 countries (Austria, Czech Republic, Finland, France, Germany, Italy, Portugal, Russia, Sweden, UK and US), published from 1998 to 2011, were reviewed. One main aspect subsists: costs associated with this disorder are high, disproportionately higher than its prevalence and PD poses a substantial economic burden on individuals and society.

### Keywords

Parkinson's disease, cost of illness, indirect costs burden of disease.

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Parkinson's disease (PD) is the second most common neurodegenerative disorder worldwide, the first being Alzheimer's disease. In industrialised countries, PD has an estimated overall prevalence of 0.3 % and an estimated 1 % prevalence in the population of individuals over 60 years of age. PD disease manifests itself through neuromotor symptoms such as tremor, bradykinesia, rigidity and postural instability, as well as cognitive and neuropsychiatric changes, with PD patients presenting an increased risk of developing dementia or depression, amongst other disturbances of the thought, mood, speech and behaviour.<sup>1</sup>

There are several pharmaceuticals available for the management of PD, but none that reaches the cure. With no cure yet possible, PD progresses chronically, affecting an increasing number of patients, imposing a heavy burden on these patients, their families, caregivers and on health and social support systems.<sup>2,3</sup>

### Economic Evaluation in Healthcare

One of the many areas in which economic evaluations are performed is in the field of health comprehending healthcare provision, products and systems. In economics, as a premise, resources are limited and the needs upon their use are potentially unlimited. Thus, economic evaluations attempt to combine those conflicting realities by proposing guidelines for allocation of existing resources in the most rational way in order to meet the greatest number of needs while maximising the health of the population.

Any contemporary healthcare system has to respond to the growing needs of the population covered, while having limited resources available to address those needs. To this problem adds the financial stress imposed by continuous healthcare innovation: with new drugs and new health technologies being created regularly, and increasingly faster. Therefore, it is of utmost importance and interest to payers of healthcare and to healthcare policy makers to have trustworthy information about

new healthcare products (either pharmaceuticals or new diagnostic or treatment techniques) enabling them to decide more rationally about whether or not to include those products in the services they provide to the users of the healthcare system.<sup>4,5</sup>

Economic evaluation is a technique by which one identifies, measures, values and compares different alternatives in terms of their costs and consequences.<sup>6</sup> Economic evaluation can be applied specifically to pharmaceuticals in a study area also known as pharmacoeconomics, as well as to other products and services in the healthcare sector, either meant to diagnose, treat or manage a medical condition.

Health economic evaluations aim to assess the economic advantage, i.e. as value for money, of a new drug or a new intervention by generating evidence showing that the health benefits are significant in relation to the benefits generated by the previously existing therapeutic alternatives and that implementing the new product would have costs that are bearable by the society when compared to the benefits arising from its use.<sup>6</sup> In the cases where, from the comparisons, the new technologies produce savings there are no doubts regarding the need for its adoption because resources are going to be freed for other uses in society.

### Economic Evaluation of Parkinson's Disease Treatments

To assess whether a given product provides economic advantage when compared to the existing alternatives, researchers conduct economic analysis. Thus the three main techniques used are cost-effectiveness analysis, cost-utility analysis and cost-benefit analysis. Other types of analysis can be performed in health economics, but these three techniques are the ones considered as complete, for they achieve the full purpose of an economic evaluation, which is to compare at least two alternatives both in terms of their costs and consequences.<sup>6</sup>

**Table 1: Cost of Illness Studies in Parkinson's Disease**

Study, Year of Publication	Country	Type of Study	Patients (n)	Direct Costs	Indirect Costs	Results
Chrischilles et al., 1998 <sup>9</sup>	US	Cost of illness; cross-sectional analysis	193 patients: 80 women (41.5 %); 113 men (58.5 %); mean age: 68.2 years	Healthcare services' use, use of community services, special equipment, modifications in home or car due to PD	Absenteeism, retirement or unemployment due to illness; impairment of daily activities	Productivity of subjects decreased with PD progression; most resources use increased (except for physician services); the burden of illness is higher with progression of disease
Dodel, Eggert et al., 1998 <sup>10</sup>	Germany	Cost of illness: cost of drug treatment; retrospective analysis	409 patients: 161 women (39.4 %); 248 men (60.6 %); mean age: 65.5 years	Drug treatment cost: Levodopa; dopamine agonists; MAO-B inhibitors; anticholinergics; amantadine; continuous infusion apomorphine (material included)	Not applicable	The mean cost of drug treatment was 10.7 DM per patient per day; assuming a prevalence of 183 per 100,000 (mean prevalence for both sexes), the authors estimated the costs with PD in Germany being 1.6 million DM per day
Dodel, Singer et al., 1998 <sup>11</sup>	Germany	Cost of illness; prospective study of a 3-month period	40 patients: 13 women (32.5 %); 27 men (67.5 %); mean age: 60.9 years	Drug costs; hospital care costs; diagnostic cost; medical and paramedical (therapists, caregiving, nursing) costs	Direct non-medical costs were not calculated due to the limited number of patients. Indirect costs were not computed but changes in socioeconomic status of patients attributable to PD were estimated	Assuming a prevalence of 183/100,000, the authors calculated that the direct medical costs of PD in Germany were 3 billion DM per year
LePen et al., 1999 <sup>12</sup>	France	Cost of illness: mainly direct medical costs; six-month observation period	294 patients: 132 (44.9 %) women; 162 (55.1 %) men; mean age: 68 years	Direct medical costs: healthcare use; drug therapy costs; laboratory tests; physiotherapy; diagnostic procedures;	Assessed as non-monetary social costs	Mean medical costs: €308 (followed by general practitioner); €2,580 (followed by neurologist)
Hagell et al., 2002 <sup>13</sup>	Sweden	Cost of illness: resource use	127 patients selected from 1996 medical records, of which 81 % (103) were alive at the time of postal survey. Mean age (survey respondents): 68 years	Inpatient and outpatient care; diagnostic tests; drug costs; transportation; non-neurological care: general practitioners, physio- and occupational therapists, nurses, dietitian; housing and home care	Productivity losses: receiving half- or full-time disablement pension due to PD; temporary leave due to PD	Mean total cost of PD per patient: 124,000 SEK (\$12,400; €13,800) per year. Direct medical costs: 29,000 SEK (\$2,900; €3,200); Non-medical direct costs: 43,000 SEK (\$4,300; €4,800); costs due to productivity losses: 52,000 SEK (\$5,200; €5,800) per patient per year (year 2000 costs and exchange rates)
Keränen et al. 2003 <sup>14</sup>	Finland	Cost of illness: direct costs; indirect costs; quality of life assessment	258 patients: 121 (46.9 %) women; 137 (53.1 %) men; mean age: 66.5 years	Inpatient care; outpatient care; formal home care; drug therapy costs and informal home care	Productivity losses: retirement due to PD (average salary loss)	Total annual costs of PD in Finland (10,000 PD patients) \$131 million (€118 million), including \$54.7 million (€49.2 million) in direct medical costs. Hospitalisations are the main cost driver in direct medical costs

**Table 1: Continued**

Huse et al., 2005 <sup>15</sup>	US	Cost of illness: direct medical costs, resource use; retrospective analysis; control group; studied for at least 365 days	20,016 patients: 10,251 (51.2 %) women; 9,765 (48.8 %) men; mean age 73.6 years. 20,016 controls	Direct healthcare costs: employer-sponsored health plans; government programmes (Medicaid)	Not applicable	Total annual direct medical costs per patient with PD: \$23,101 versus \$11,247 per individual in control group
Noyes et al., 2005 <sup>16</sup>	US	Cost of illness: healthcare use; burden of illness. Used 1992-2000 Medicare Current Beneficiary Survey	35,217 individuals, of which 717 PD patients: 52.34 % women; 47.66 % men; mean age: 78.29 years	Healthcare services use and level of medical expenditures: Medicare reimbursed total costs; Medicaid reimbursed costs; out-of-pocket costs	Not applicable	Annual healthcare expenses of patients with PD \$18,528 versus \$10,818 for individuals without PD (in 2002 USD; after adjustment for other factors)
McCrone et al., 2007 <sup>17</sup>	UK	Cost of illness: direct care costs; informal care costs	174 patients: 66 (37.9 %) women; 108 (62.1 %) men; mean age: 70.8 years	Healthcare services provided by health and social care agencies: hospital care; primary healthcare; social care; home adaptations; medication costs. Informal care, provided by family members or friends	Loss of employment was NOT included	Annual costs of PD per patient £13,804, with £11,088 accounted by informal care. Estimated annual cost of PD in the UK: £275 million, excluding informal care; £1.4 billion when including informal care
Winter et al., 2010 <sup>18</sup>	Germany	Cost of illness: direct and indirect costs, resource use	145 patients: 48 (33.1 %) women; 97 (66.9 %) men	Costs paid by health insurance and co-payments by patients: Inpatient care; outpatient care; ancillary services; special equipment; home care; drug costs	Productivity losses: premature retirement due to PD; temporary leave due to PD	In 2004 the total costs were calculated ranging from €18,660 to €31,660 per year, depending on clinical status of patients. Compared with 2000 costs, there was 25–31 % increase in total costs, most part due to the increase in the costs of drugs and inpatient care
von Campenhausen et al., 2011 <sup>3</sup>	Austria; Czech Republic; Germany; Italy; Portugal; Russia	Cost of illness: direct and indirect costs; six-month observation period	486 patients: 212 (43.6 %) women; 274 56.4 % men; mean age: 66 years	Inpatient care; outpatient care; special home equipment; drug treatment costs; patients' co-payments; informal care was calculated as a direct cost	Productivity losses: early retirement due to PD; temporary leave due to PD	Estimated total costs of PD from a societal perspective: Austria – €9,820 Czech Republic – €5,510 Germany – €8,610 Italy – €8,340 Portugal – €3,000 Russia – €2,620

DM = Deutsche mark; SEK = Swedish krona.

Several studies have been conducted that evaluate economic advantages of PD treatments. The most frequent economic evaluations of PD treatment are cost-effectiveness analysis where alternative therapeutic treatments are compared. With the advent of new forms of treatment for PD, such as surgical approaches as deep brain stimulation, for instance, new areas of study emerge to be addressed by economic evaluation studies.<sup>7</sup> Therefore, this is an area in which economic analysis are to flourish. However, the purpose of this article is to focus on the study of PD cost of illness.

**Cost of Illness**

In cost of illness studies, researchers identify and measure the total costs attributable to a specific disease. Information arising from these studies may be included a posteriori in economic evaluations that compare alternative interventions and is of great value while estimating the economic burden of the disease studied.<sup>5</sup>

**Direct Costs**

When assessing illness direct costs, two types should be included: direct medical costs and direct non-medical costs. Direct medical costs are the ones more easily identified, these being the costs of medical interventions (whether given at first treatment or in subsequent interventions) such as: medical appointments; hospitalisations; community care; follow-up consultations; diagnostic procedures; pharmaceuticals; medical equipment, etc. Costs generated by use of other therapeutic interventions, such as nursing, physio-, occupational – or speech-therapies are also considered as being direct medical costs. Direct non-medical costs are the ones that derive from other special interventions that are necessary due to the analysed illness and that are not provided by health specialists. Assessment of direct non-medical costs includes quantification of costs spent by patients or their caregivers with home or car improvements; special dietary needs; or time and/or money spent while travelling to the hospital, medical appointments, etc.<sup>6</sup>

It is of most relevance, especially when considering illnesses such as PD, that the time spent by informal caregivers providing care to patients is assessed, whether as working time lost or as leisure time lost.

### Indirect Costs

By indirect costs of an illness one considers the costs for lost productivity. Productivity losses can be due to illness-related morbidity: costs of early retirement due to illness, absenteeism or temporary work-leaves; and also to mortality from illness. Morbidity and mortality costs are conceptually different and should be presented separately. The economic burden of mortality due to an illness can be estimated in terms of the value of the life years lost attributable to the disease, for example.<sup>8</sup>

### Sources for Costs Assessment

In costs of illness studies, information about costs can be obtained either from pre-existing databases: government or insurance companies' data on healthcare use; national health inquiries; data on pharmaceutical prices, etc.; and/or they can be obtained through inquiries performed on patients, caregivers or health professionals.<sup>6</sup>

### Cost of Illness Studies of Parkinson's Disease

In *Table 1*, a synthesis of the results of 11 studies is presented. Those are cost of illness studies in PD for 11 countries (Austria; Czech Republic; Finland; France; Germany; Italy; Portugal; Russia; Sweden; UK and US) and were published between 1998 and 2011. Four studies account only or mainly for direct costs of PD; seven studies assess indirect costs as

well as direct costs of PD. Generically, the authors concluded that costs of PD increase with disease progression, more need for healthcare service or caregivers support, and greater impairment of PD patients to perform everyday activities or work. Costs estimated for PD vary from country to country and according to the methodology used, but overall the importance and magnitude of health and economic burdens of PD is clearly visible.

### Conclusions

Published studies presenting cost of illness information for PD, as expected, unveil many differences as to what methodological decisions and costs measurements are concerned. The difficulties in the assessment of indirect costs due to PD were evident, moreover in studies with higher number of subjects enrolled. Direct medical costs are more easily quantified and assessed and account for a substantial part of total costs, especially hospitalisations and pharmaceuticals. However, indirect costs of PD are also significant and its quantification is of great worth. PD prevalence, severity and course of progression pose a significant burden on those who suffer from it, patients and their caregivers, as well on health and social services and on society as a whole.

The costs associated with informal care represent a significant share of the total costs for society. It should be noted that those costs fall on elderly spouses or working-age children. The burden assumed by informal caregivers highlights the importance of using a societal perspective when estimating the economic burden of PD. ■

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