

ECONOMIC BURDEN OF MULTIPLE SCLEROSIS IN SLOVAKIA

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ABSTRACT

The disabling nature and lifelong impact of multiple sclerosis (MS) imposes considerable socioeconomic burden despite its relative low prevalence compared to other chronic diseases. This is the first study of MS in the Slovak Republic that provides information about healthcare and social expenditures including costs of productivity loss caused by reduced work capacity of patients with MS.

Retrospectively direct and indirect costs of MS were investigated by prevalence based "bottom-up" approach. The societal and health insurance perspective was used to perform the overall economic burden caused by MS in Slovakia. The human capital method was used for the calculation of indirect costs, as this is the most common method applied in published studies. As not all detailed data on expenditures were available, the missing data were collected in the retrospective patient research.

Total annual costs in 2010 for 6.100 dispensed patients with MS in Slovakia were €54.723.592. Indirect costs (€31.728.757) prevailed over direct costs (€22.994.834). The highest part of both costs were €25.207.512 and €12.641.052 for loss productivity due to patients sickness and invalidity pensions and disease-modifying drugs respectively. The average cost per patient independently of disease severity was €8.971.

MS causes a high economic burden, with a strong predominance of indirect costs. Documenting and quantifying this burden among patients with MS in different disease stages through cost-of-illness study can lead to better disease management and it can provide valuable information for future cost analysis and for decision-making process.

UDC CODE & KEYWORDS

■ JEL: I19 ■ Multiple sclerosis ■ Costs ■ Slovakia ■

INTRODUCTION

Multiple sclerosis (MS) is a chronic and highly disabling condition that represents a significant burden both financially and personally [1]. It is characterized by an unpredictable course and it mostly occurs in females, between 20 and 40 years of age. Patients experience deterioration in functional status and a reduction of their work capacity, productivity and quality of life [2].

Majority of patients initially have a form of MS described as "relapsing-remitting", which manifests as a series of exacerbations followed by periods of partial or complete remission, and 30-50% of those will have progressive symptoms within the first ten years [3]. Total estimated number of people diagnosed with MS is 1.315.579 of whom approximately 630.000 are in Europe and 520.000 in the Americas. The European countries reporting the highest estimated prevalence of MS include Hungary (176 per 100 000), Slovenia (150) and Germany (149). The total number of patients with MS in Slovakia in 2008 was 8.400, with prevalence of 17.5 per 100.000 of population and incidence of 3 cases per 100.000 of population [4]. According to the number of dispensed patients in the state General insurance company and to the percentage of insured patients converted to all Slovakia, there are approximately 6.100 dispensed patients.

Standard principles of MS treatment concern 2 types of therapy. Short-term therapy with corticosteroids leads to reduce severity and duration of relapses and the long-term therapy with immunomodulants targets to prevent relapses and progression and to slow down relapses. The first line treatment of MS includes interferons types β -1a and 1-b and glatirameracetate, called as disease-modifying drugs (DMDs). Their efficacy was demonstrated in large number of clinical studies. The second line treatment is represented by biologic agent natalizumab and first oral DMD fingolimod registered recently in EU. [5-10]. However, benefits of DMDs have still not been confirmed for the long term. Discussion about their efficacy and beneficial effects with potential cost-saving aspects still arises among healthcare payers as well as health policy makers with a scope to highlight and to assess all related costs inside and outside healthcare procedures [11-12].

While traditional epidemiological data provide frequency figures on disease incidence and prevalence, cost-of-illness (COI) studies complement these data with socio-economic information with the aim to assess the economic burden of health problems on the overall population. COI studies identify measure and evaluate economic resources consumed by a specific illness. These resources include drugs, diagnostic and therapeutic costs, costs for prevention, rehabilitation, medical devices and long term care, all called direct costs. Indirect costs concern production losses including lost income due to unpaid sick leave ("absenteeism"), treatment related time off work, temporary unemployment, reduced on the job productivity ("presenteeism"), premature retirement trough morbidity or early mortality, as well as loss of unpaid production while ill and production losses of caregivers (indirect costs). [2, 13]

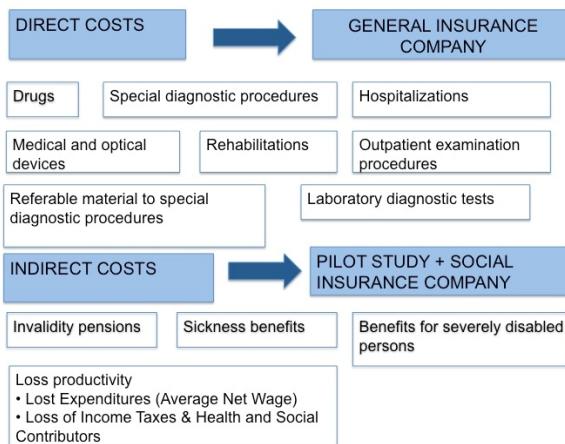
As for Slovak data about cost of MS, we found only one study published in 2005 that estimated the total cost of the disease in Slovakia by extrapolation method [14].

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The lack of recent data about economic burden of MS in Slovakia, led us to perform this type of study with the aim to estimate and calculate the direct and indirect costs of MS in 2010 using the data from various available national sources. Our prevalence-based approach could be extended to assess costs nationwide and presented results could be useful for future decision-making in healthcare.

Methods

Figure 1: Methodology of the study



Source: Authors

In order to investigate an economic burden of MS in Slovakia, we used a prevalence-based approach from both societal and healthcare payer views. (Figure 1) We analyzed disease-attributable cost to cases that occurs concurrently with prevalent cases over selected time period (2010). For cost quantification we used a "bottom-up" approach that assigns resource use and productivity loss of individuals with MS, either from data from real cases in specific timeframe of the study. We calculated mean per-person costs and we extrapolated them to the whole population [14, 15].

Direct medical costs were calculated based on data provided by General insurance company. Drugs estimated in our study included Avonex®, Rebif®, Betaferon®, Copaxone®, Extavia®, Tysabri® and Refador®. All drugs obtained by General insurance company by central purchasing. Their market price represents real costs of health insurance concerning also any pharmaceutical companies discounts. Drugs for managing symptoms and for treatment of relapses were not included in our study because the General insurance company didn't provide them to us on time.

To estimate the cost of outpatient examination procedures, referable material to special diagnostic procedures and laboratory diagnostic tests we used the official tariffs published by Ministry of Health [16].

Indirect costs, including social expenditure associated with invalidity pensions and sickness benefits were calculated from statistical data about invalidity provided by the Slovak Social Insurance Funds and from statistical data about productivity loss. We also use economic development indicators available from Slovak Statistical Institute [17-19].

Data about state benefit amount for severely disabled persons were not available in official institutes, therefore, we estimated them trough pilot investigation conducted by written questionnaire that also helped us to estimate an economic burden among patients with different severity of disease due to missing data about patients EDSS from General insurance company.

The human capital approach was used for estimation of indirect costs. We measured loss of productivity through the loss of net salary, contributions to health and social insurance companies and income tax associated with short-term or long-term sickness and early retirement due to disease of MS. Economic productivity loss due to absenteeism at work was measured by multiplying the national average salary with number of lost days among temporary sick and disabled persons. The burden of temporary sickness (TS) was expressed by amount of sickness benefit (without employer's income compensation) by average salary and average duration of TS caused by MS diagnosis. Costs calculation of TS is based on the 100% probability of employment before a reduced work capacity event. Expenditure on invalidity pensions (IP) was calculated as a proportion of number of recipients IP awarded on the base of MS to total number of IP recipients and multiplied by total expenditure of IP during the year 2010.

All estimated costs were expressed in euro and no discounting of costs was applied.

In our study was not tested any hypothesis and the results were processed by conventional methods and descriptive statistics outputs that include percentage, average, median and standard deviation measurement.

Results

Direct costs

Overall direct costs of MS in 2010 was €22.994.834 for patients from all insurance companies, corresponding to a total expenditure of €3.770 per patient. Direct costs of MS from General insurance company resulted as €15.406.539. 82% of

total expenses were counted by DMDs, other healthcare resources counted for less than 10% of total cost, with approximately 7% of joint diagnostic and therapeutic items from that magnetic resonance imaging (MRI) was the most costly and most commonly procedure (of €685.445 for 2.812 MRI exams) and 6% of costs counted by hospitalization. As for drugs cost, the total number of administered doses was 205.761 with 14.433 original drug packs. The overall cost of consumed drugs was €12.641.052, with an average cost per patient €8.712. All medical services provided during diagnostic procedures, treatments or patients control cost €1.277.620. The highest part of this amount absorbed joint examining and therapeutic items in number of 144.801 during the whole year with a total cost of €1.151.207. This sum included deductible items, films, contrast substances and others. As for hospitalization, in 2010 were recovered 1.022 patients with 1.451 hospitalizations and duration of 9.287 days. Average number of hospitalization per patient was 1.4. Total costs for overall hospitalization was €902.076. Average costs per patient, per hospitalization and per day of hospitalization were €883, €622 and €97 respectively. 86% of patients were recovered in Department of neurology.

The total number of specialist medical services was 32.044 which represented a cost of €135.666.

General insurance company reimbursed 47.444 medical devices including optical ones for an amount of €239.933 considering that average cost per reimbursed medical device was €5. Patients supplements accounted for €6.093.

All costs items are included in the Table 1.

Because not all patients with MS are treated, the average costs per patient managed intensively because of disease are higher than total average costs. In the case that a patient uses all types of healthcare services, the average cost for this patient represents an amount of approximately €11.200 (Table 2).

Table 1. Distribution of direct and indirect costs by items in patients with MS in Slovakia (year of costing, 2010)

Cost items	Total costs in €
Drugs	12.641.052
Special diagnostic procedures (Magnetic resonance imaging)	1.151.207 (685.445)
Hospitalizations	902.076
Medical and optical devices	239.933
Rehabilitations	223.757
Outpatient examination procedures	135.666
Referable material to special diagnostic procedures	99.011
Laboratory diagnostic tests	13.836
Total General Health Insurance	15.406.539
Total Slovakia	22.994.834
Average cost/patient (calculation for 6.100 patients)	3.770

Source: Authors

Table 2. Distribution of average direct costs per treated patient and per patient extrapolated from the total number of patients with MS in Slovakia (year of costing, 2010)

Cost items	Cost/treated patient in €	Cost/patient in €*
Drugs	8.712	3.093
Special diagnostic procedures (Magnetic resonance imaging - MRI)	882	221
Hospitalizations	793	282
Medical and optical devices	452	55
Rehabilitations	165	59
Outpatient examination procedures	93	33
Referable material to special diagnostic procedures	10	3
Laboratory diagnostic tests	68	24
Average cost/patient (calculation for 6.100 patients)	11.175	3.770

Source: Authors

Indirect costs

Loss of productivity accounted for 79% of total indirect costs (Table 3). Based on average gross salary estimated for 2010 as €769 and a number of missed working days (365 days for invalidity pensioners and in average 91 days for temporary sick leave), annual loss on GDP represented €25.21 millions with an average loss on GDP €4.132 per patient.

The social costs were calculated on the base of 1.887 recipients of invalidity pension, 535 recipients of sickness benefit and 1.813 recipients of benefit for severely disabled persons. Total social costs were estimated at €6.5 millions, that represented per patient with MS €1.069.

Costs of benefit for severely disabled persons was estimated at €126.882 and it was calculated from the average cost of €70 per patient based on the results from our pilot study.

Overall economic burden of MS in Slovakia was quantified as €54.7 million with average costs per patient of €8.971. Indirect costs outweighed direct ones, they accounted for 58% of total costs.



Table 3. Distribution of indirect costs by items calculated by human capital approach based on loss of GDP in General health insurance patients (year of costing, 2010)

Cost items	Total costs in €	Average cost/General health insurance patient	Average cost/patient
Invalidity pension (IP)	5.791.793	3.070	949
Sickness benefit (91 days)	602.571	1.126	99
Benefits for severely disabled persons	126.882	70	21
Loss productivity	25.207.512	11.857	4.132
Lost expenditures (average net wage)	14.449.459	6.796	2.369
Loss of income taxes and health and social contributions	10.758.053	5.060	1.764
Total social costs	6.521.246	4.266	1.069
Total indirect costs	31.728.757	16.123	5.201

Source: Authors (calculation based on 6.100 patients)

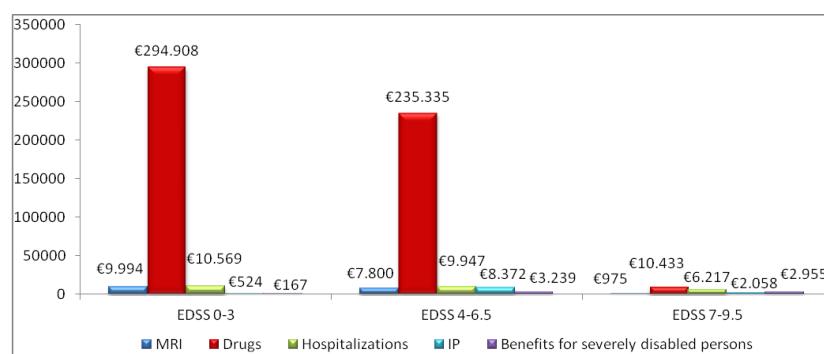
Pilot study

Our pilot study was carried out during May and June 2011. We processed baseline characteristics, healthcare resources and state benefits of 88 patients. All involved patients gave informed consent for their participation. We focused especially to the calculation of the therapy most expensive items (MRI, drugs, hospitalizations, IP and benefits for severely disabled persons) according to patients EDSS score. We simply summarized the percentage of consumed resources to refer at least a small picture of consumed resources dependently on the disease. resulted that 31.8% of patients got benefits for severely disabled persons and the proportion of patients getting this benefit increased with the EDSS score. Mostly, patients used benefit for personal assistance, transport, hygiene and car maintenance. Patients use the highest average part of benefits for clustering medical device, car and house adaptation.

We can conclude that with worsening of disease, the proportion of indirect costs considerably increases, from €691 to €11.611 and €5.013 respectively. (Figure 2).

Patients with EDSS ≥4 are hospitalized more often, they need higher financial support from state, especially in terms of invalidity and benefits for severely disabled persons. The group of patients with EDSS ≥7 was very small in our sample (7 against 41 with EDSS 0-3 and 29 with EDSS 4-6.5), so we can note that results obtained in pilot study suggest partially a real distribution of cost in different stage of the disease.

Figure 2. Cost distribution of selected items in percentage among patients from pilot study according to their EDSS score



Source: Authors

Discussion

We performed this study retrospectively using both healthcare payer and societal views.

We chose a prevalence approach based on an epidemiological method. For quantifying resources costs we used a "bottom-up" approach, since the purpose of our study was to include all relevant costs inside and outside the healthcare. Another method that quantifies healthcare resources is a "top-down" (population-based) approach that assigns resources aggregates to specific disease. Direct costs were calculated according to set tariffs from General insurance company database, where each medical service has a specific code with associated number of points. We estimated an overall cost of medical services at €15.406.539. In this amount, drugs were the most expensive item (€12.641.052), following by special diagnostic procedures (€1.151.207) with a magnetic resonance imaging (€685.445) and hospitalizations (€902.086). See Table 1.

Indirect costs were expressed through human capital approach that measures loss productivity by loss of gross salary associated with short-term or long-term sickness and with premature invalidity pensions caused by MS. Another competing method to calculate indirect costs is a friction method and it only values the estimated actual production lost during the time that takes to replace the ill worker. It assumes that organizations can minimize production losses by using internal capacity and, therefore, includes only a fraction of total income losses. Due to absence of any representative numbers of marginal employer costs, it wasn't possible to use this approach for our study [14]. Social costs represented 21% of total indirect costs accounting for 58% of total costs.



With our results we founded parallel link to some earlier published studies where indirect costs were higher than direct costs. In these following three studies, the total cost of MS was estimated before the introduction of DMDs into the therapy. [15, 21-22]. Authors highlighted considerable impact of DMDs on future costs with potential saving aspects on overall costs.

After the introduction of DMDs into the therapy, in 2006 was published a study where overall consumption and quality of life among patients with MS were assessed in 9 European countries in various groups of patients according to their EDSS. All type of costs tended to be higher with worsening disease. Direct costs were almost in all countries higher than indirect costs, except the Netherlands and the UK, where indirect costs exceeded the direct costs. Prescription of DMDs was concentrated in patients in early diseases and it varied among the countries, between 21% in the UK and 52% in Spain. According to authors, reducing relapse rate and slowing disease progression with DMDs treatment would bring changes in costs [23].

Another studies estimated a cost of relapse and they directly verified healthcare consumption increases with disease severity. For patients with EDSS<5, an average cost per relapse was calculated as \$1.561 in USA, £1.164 in the UK, €3.500 in France, €2.955 in Germany, €4.000 in Italy and in Spain €2.758. Relapses also caused increasing social costs and loss productivity, similarly confirmed in another study that determined a direct cost of MS relapses management in the USA and very closely relation between relapse severity and increasing healthcare costs. [3, 20, 24-25].

The high burden of MS was demonstrated also in Poland. The mean total cost per patient was estimated at 10.955 PLN, 15.603 PLN and 18.464 PLN for stage I, II and III respectively and regardless of EDSS stage, indirect costs with main costly item of productivity loss, exceeded direct costs. [26]

The large study by Sobocki et al. published in 2007 estimated the total annual cost of MS in 28 European countries with 380.000 individuals affected by MS at €12.5 billion. Direct costs represented 56% of total costs, indirect and informal care cost 22% each. The largest component of costs was found outside the formal care sector due to indirect costs with a majority part attributable to production loss due to early retirement and informal care costs provided by non-paid caregivers, generally by family members (€3.2 billion). Costs correlated with the disease severity. The total cost of MS in Slovakia was estimated at €71 million (adjusted for purchasing power). The biggest part of it was represented by healthcare services (€42 million), followed by informal care (€12 million) and indirect costs (€10 million). There were some limitations in this study. The prediction of cost in some countries were likely to be overestimated as well as underestimated, particularly due to used relative indexes for expenditure in different sectors across Europe. There was a high correlation between rich countries with high gross national income/capita and high levels of health care spending. A lower treatment intensity of disease could be a consequence of underestimation of indirect cost in the Central Europe [14].

There are some limitations in our study.

The first one is that we collected data only from one insurance company. Despite this, we can consider our results as a representative, because the General insurance company in 2010 covered 67% of all Slovak patients with MS.

Second, nonetheless we used a "bottom-up" approach, we didn't estimate in detail all non-medical costs, such as cost of transportation and cost of informal care. Due to high number of disabled patients with MS, often for long periods, some of that costs are substantial. We neither include intangible costs (costs due to pain, anxiety, social handicap) because of the their lack in the questionnaire. We need to complement our study with those costs to create a true picture of all costs and to see differences between whole economic burden according to the disease severity. We neither include intangible costs (costs due to pain, anxiety, social handicap) because of the their lack in the questionnaire.

Third, for the whole burden of MS we didn't capture all casually related costs associated to MS as a complex disease. We are aware that missing data about attributable co-morbidities can lead to serious bias. As for drug consumption, we processed information about consumed DMDs drugs without including drugs for managing symptoms and relapses. We focused only to that group of drugs due to their high costs and the fact that also in another before listed published studies resulted as the highest contributors to direct costs especially in the category of consumed drugs for MS.

Four, we have to highlight that for the calculation of indirect costs by human capital approach, we didn't include state levies for maternity, neither costs associated with reduced productivity at work that occurs often among patients with MS. The value of output imputed for housekeeping and other non-market activities is not included in measures of GNP [13]. These facts may underestimate indirect costs.

Conclusion

This is the first study that estimates costs of MS in Slovakia. Results show that calculated indirect costs (€31.728.757) are higher than direct costs (€22.994.834) hence we can conclude that MS represents a high economic burden to both payer and society sectors.

The extension of our study with patients clinical data about relapse rate and frequency of relapses may provide more information about used healthcare resources among patients and on the same time it may bring relevant information for future decision-making processes. Data in available literature show that therapy of MS with disease-modifying drugs can lead to reduction of disease economic burden through lower frequency and severity of relapses.

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