# ECONOMIC BURDEN OF MULTIPLE SCLEROSIS IN GEORGIA

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Multiple sclerosis (MS) is one of the most common chronic debilitating neurological diseases. That affects 2.8 million people worldwide [1]. It had an estimated prevalence of 9.72 people per 100,000 population in Georgia in 2010 [2]. The disease most often appears in early adulthood. Four main forms of MS were identified: relapsing remitting multiple sclerosis (RRMS - the most common), secondary progressive multiple sclerosis (SPMS), primary progressive multiple sclerosis (PPMS), progressive-relapsing (PR) MS. Patients with MS utilize healthcare services considerably more than those without MS. Patients with MS visit their neurologist more often than individuals without the disease and require of medical care increases with disease progression [3-7].

Multiple sclerosis is associated with a substantial economic burden resulting from direct medical costs associated with health and disability-related resource utilization and indirect costs relating to reduced productivity. Over half of total average costs were associated with direct medical costs [8]. Knowledge of the illness costs is essential to help health-care decision-makers to set up and prioritize health-care policies and interventions.

**Material and methods.** *Patients and data collection*

Hospital-based cohort study was conducting using data from neurology clinics of Tbilisi State University: P. Sarajishvili Institute of Neurology and Medical Center Pineo. All patients were assessed by neurologists experienced in MS using 2017 McDonald diagnostic criteria [9]. Patients were classified as RRMS, PRMS, SPMS and PPMS. All patients are seen at least four times per year. Disability was assessed using the expanded disability status scale (EDSS). Data were collected from medical records of patients managed in clinics for a period of 1 year from 2019 December to 2020 December. All direct medical costs were obtained from Institutional resources. In final analysis we included only expenses of following services: disease-modifying therapies (DMTs), main laboratory investigations (brain MRI with contrast, CBC, liver and renal function tests) and relapse treatment costs, which represent the main management plan for MS patients (Table 1).

All analyses were performed using STATA 7 (Stata Corporation, College Station, TX; USA).

Descriptive statistics were expressed as means (SD) for normally-distributed variables and percentages for categorical variables. For non-normally distributed variables (medical costs) means (SD) and confidence intervals (CIs) were reported. Between-group comparisons were conducted for demographic and clinical information: age, gender, disease duration and severity.

The t test for continuous (age) and the Chi-square test for categorical data were used. Cost comparisons were made between groups by means of the Wilcoxon rank sum test.

P-values <0.05 were considered statistically significant.

**Results and discussion.** A total of 274 patients (65.3% female, 34.7% male) with MS were included in the study. The mean duration of the disease was 18.2 (±10.3) years and mean age of MS onset was 29.9 (±9.1) years. The mean age of patients with mild and moderate disease severity (EDSS<6) was 46.6 (±11.3) years and with severe disease (EDSS>5.5) course 55.7 (±11.16) years. The difference was statistically significant (P<0.0001). Similarly longer mean duration of disease was observed for patients with severe disability than for patients with mild and moderate disability (25.3 years (±8.2) (95% CIs 22.5-28.1)versus 17.2 years (±10.1) (95%CIs 15.9-18.5); P<0.0001).

The proportion of patients with RR outnumbered all other types of MS (58.4% vs 30.7% for SP &5.8% for PP and PR accordingly). Detailed demographic and clinical characteristics are given in Table 2.

Seventy two (25.9%) patients in the studied cohort received DMTs. DMT was covered either by Municipality healthcare fund (in 52.1%) or by Institutional research programs resources (in 47.9%). The mean annual cost of DMTs was 21760.5 lari [6908 $] (CIs: 19691-23830), while cost of relapse therapy estimated as1495.4 lari [157.3$] (CIs:1398.1-1592.6). Mean DMTs expenses contribute as higher as 93.5% of mean total medical expenses in the group of patients on DMTs.

The mean annual number of relapses suffered per patient was 0.78 (CIs:0.68-0.88). In more than half of cohort patients relapses were presented(n=149; 54.4%). Most often one relapse per year per patient was documented (n=92, 61.7%), two and three relapses were less frequent (33.6% and 4.7% respectively).

*Table 1. Costs of direct medical expenses*

**MEDICAL TESTS**

| MRI BRAIN | 500 Lari |
|---|---|
| CBC | 15 lari |
| RFT | 23 lari |
| LFT | 35 lari |

**DMTs**

| FINGOLIMOD | 30.000 lari per year |
|---|---|
| GLATIRAMER ACETATE | 12.000 lari per year |
| INTERFERON BETA-1a, BETA-1b | 15.000 lari per year |
| OCRELIZUMAB | 30.000 lari per year |

**HOSPITALIZATION**

| METHYLPREDNISOLONE (5DAYS COURSE) | 500 lari |
|---|---|
| HOSPITALIZATION (DAILY) | 110 lari |

#-Gugutsidze D. and Gigineishvili D. are joined first authors.

*Table 2. Descriptive statistics, disease information*

| | All patients | Types of MS | | | | Disability level | | |
|---|---|---|---|---|---|---|---|---|
| | | RR | SP | PP | RP | EDSS: 0-3 | EDSS: 3.5-5.5 | EDSS: >5.5 |
| Number (%) | 274 | 160 (58.4) | 84 (30.7) | 14 (5.1) | 16 (5.8) | 105 (38.3%) | 121 (44.2%) | 48 (17.5%) |
| Age (years, SD) | 48.2 (11.8) | 43.8 (10.4) | 55.7 (9.8) | 58.6 (9.4) | 43.6 (10.7) | 42.5 (10.1) | 50.1 (11.1) | 55.7 (11.2) |
| MS duration (years, SD) | 18.2 (10.3) | 14.9 (9.6) | 23.9 (9.1) | 26.5 (5.3) | 13.4 (8.3) | 14.1 (9.8) | 19.4 (9.8) | 24.4 (8.5) |
| DMT use (n, %) | 72 (26.3%) | 49 (68.1%) | 17 (23.6%) | 1 (1.4%) | 5 (6.9%) | 31 (43.1) | 27 (37.5) | 14 (19.4) |
| EDSS (mean, SD) | 4.1 (1.7) | 3 (0.9) | 5.6 (1.4) | 6.6 (1.8) | 4.9 (0.7) | 2.5 (0.47) | 4.4 (0.77) | 6.9 (0.99) |
| Sex (f/m, %) | 65.3/34.7 | 68.1/31.9 | 64.3/35.7 | 42.9/57.1 | 62.5/37.5 | 68.6/31.4 | 65.3/ 34.7 | 58.3/41.7 |

Patients taking DMT had higher mean annual total direct costs compared with those not taking DMTs (23254.7Lari[7382.5$] (CIs:21133.7-25375.8) and 1429.1lari[453.7$] (CIs: 1309.5-1548.6) respectively; P<0.0001).

The mean total costs per patient per year increased with increasing of disability: 5966.4 lari (CIs 4383.7-7549.1) for patients with mild EDSS level (<3):7588.2 lari (CIs 5507.0-9669.5) with moderate EDSS (3.5-5.5) and 8715.8 lari (CIs: 4943.6-12487.9) for severe EDSS (>5.5). However the differences did not reach statistical significance.

Multiple Sclerosis is disease that has an early age of onset and may progress with disease exacerbations (relapses) interrupted by periods of stability. Health-related quality of life of individuals, their families, employers, health insurance and the entire healthcare system carry substantial clinical and economic burdens associated with the disease over of a period of many years. As patients with MS age and their disabilities progress, so do the costs of managing the disease [10].

To the best of our knowledge, the present study is the first cohort study investigating economic burden of patients with MS in Georgia. The study provides an insight into the distribution of direct medical costs and the resource utilization in Georgia. The mean total annual costs for MS patients were significantly lower in the Georgia than in the majority of European countries, but prices of DMTs were approximately the same [11]. Mean annual total direct medical costs per patient with MS on DMTs differ significantly from non-DMTs patients (7382.5 $ versus 453.7$), and once again proves that utilization of DMT was the main contributor for the direct medical cost.

Detailed analysis of the relapse rate in groups of patients taking DMT and not taking DMT did not reveal significant differences. Overall relapses were observed in 56.3% and 53.7% and one relapse per year was documented in 29.6% and 34.9%respectively. This is in contrast with resent publication where relapse rate is low in patients on DMT in compare with non-DMT patients [12]. However, one should take into account that more than two third of our patients are on a first year of treatment, while remaining patients on second year and therefore potential therapeutic benefit of DMTs might not be fully manifested.

DMT that modulate, modify, or suppress the immune system are the medication class used to treat people with MS. They reduce the frequency and severity of relapses and the development of new brain lesions and slow down the development of disability. With increasing age, people with MS are less likely to have clinical relapses or radiological disease activity. As a result younger patient with MS are more likely to derive the most evident benefit from using DMTs due to a higher likelihood of disease activity [13]. These agents come with higher prices and costs for drugs continue to grow. Unfortunately the number of patients on DMTs in Georgia is small (25.9% according to the present study). Georgia is considered a lower middle-income country by the World Bank [14] and assistance of patients with MS in covering of MS treatment is very important. Of note, that since 2019 in Georgia main costs of DMTs (Ocrelizumab, Fingolimod) partially is covered by the municipality funded program in two largest cities –Tbilisi and Batumi. At present there is uncertainty regarding how many patients will be treated with DMTs. We suggest that the potential candidates for DMTs will increase in Georgia (and associated charge and the costs of MS care) leading to an increasing need of healthcare resources. In this view introducing and availability of the assistance programs to help patients better afford and pay for their MS medications are important in the management of patient with MS. Considering country's limited resources, healthcare and benefit providers should developed improved action plans that balance appropriate access to optimal therapies with need to manage the high costs of DMTs and evolving treatments.

The study have limitations: we did not include in the direct costs all medical expenses (such cost units as CSF, spine MRI and other tests which were not performed regularly for all patients) focusing only on the costs of main components. However we believe that these relatively small expenses could not influence on the results, since DMTs are considered as primary cost driver which we included in the study. The relatively small sample size and the hospital-based study design could be additional limiting factors of this study. Further studies with higher power are needed to better understand the economic impact of MS on patient and society.

Whereas the main goal of treating patients with MS is to prevent disease progression and disability, healthcare and benefit providers are faced with an ever-tipping balance point between effectively managing the disease and maximizing the value of high-cost disease-modifying therapies in an already overburdened healthcare system. Our study provides new information on resource utilization and MS burden in Georgia, which must help national health policy makers to improve accessibility and quality of health care for patients with MS.

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## SUMMARY

### ECONOMIC BURDEN OF MULTIPLE SCLEROSIS IN GEORGIA

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The purpose of this study is to estimate economic burden of multiple sclerosis in Georgia and to compare costs of patients with different course of disease and disability level.

Hospital-based cohort study was conducted in the P.Sarajishvili Institute of Neurology and Medical Center Pineo to estimate direct medical costs in patients with MS treated between 2019-2020.

The mean annual direct medical cost for MS patient on disease-modifying therapies (DMTs) was statistically higher than for non-DMTs patient and estimated as 23254.7Lari[7382.5$] (SD 9026.3; CIs:21133.7-25375.8) versus 1429.1lari [453.6 $] (SD 861.7, CIs; 1309.5-1548.6) (P<0.0001).

MS places a huge economic burden on healthcare model and society in Georgia. DMTs are the main driver of cost.

**Keywords**: multiple sclerosis, burden of illness, EDSS, DMT, direct medical cost.

## РЕЗЮМЕ

### ЭКОНОМИЧЕСКОЕ БРЕМЯ РАССЕЯННОГО СКЛЕРОЗА В ГРУЗИИ

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Целью исследования явилась оценка экономического бремени рассеянного склероза в Грузии и сравнение финансовых затрат пациентов с различным течением заболевания и уровнем инвалидности.

Госпитальное когортное исследование проведено в Институте неврологии им. П. Сараджишвили и медицинском центре Пинео для оценки прямых медицинских затрат у пациентов с рассеянным склерозом, находившихся на лечении в 2019-2020 гг.

Среднегодовые прямые медицинские расходы для пациента с рассеянным склерозом, получающим болезнь-модифицирующую терапию (БМТ) были статистически выше, чем для пациента без БМТ и оценивались в 23254.7 лари [7382,5$] (SD 9026,3; CIs:21133.7-25375.8) в противовес 1429. 1лари [453,6$] (SD 861,7, CIs; 1309,5-1548,6) (P<0,0001).

Рассеянный склероз является огромным экономическим бременем для системы здравоохранения и общества в Грузии. Основная часть финансовых затрат приходится на болезнь-модифицирующую терапию.

რეზიუმე

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კვლევის მიზანს წარმოადგენდა გაფანტული
სკლეროზის ეკონომიური ტვირთის შეფასება საქარ-
თველოში და დანახარჯის შედარება პაციენტებში
დააავადების განსხვავებული მიმდინარეობითა და ინ-
ვალიდობის ხარისხით.

კ. სარაჯიშვილის სახ. ნევროლოგიის ინსტიტუტში
და სამედიცინო ცენტრში „პინეო" ჩატარდა პოსპიტა-
ლური კოჰორტული კვლევა, რომლის მიზანს წარ-
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შეფასება პაციენტებში გაფანტული სკლეროზით,
რომლებსაც უტარდებოდა მკურნალობა 2019-2020 წწ.

ყოველწლიური საშუალო პირდაპირი დანახარჯი
პაციენტისთვის გაფანტული სკლეროზით დააავადება-
მოდიფიცირებად მკურნალობაზე იყო სტატისტიკუ-
რად უფრო მეტი ვიდრე პაციენტისთვის გაფანტული
სკლეროზით დააავადება-მოდიფიცირებადი მკურნალო-
ბის გარეშე და შეადგინა 23254.7 ლარი [7382,5$] (SD
9026,3; CIs:21133.7-25375.8) საპირწონედ 1429.1 ლარისა
[453,6$] (SD 861,7, CIs; 1309,5-1548,6) (P<0,0001).

გაფანტული სკლეროზი მძიმე ეკონომიურ ტვირთად
აწევს საქართველოს საზოგადოებასა და ჯანდაცვის
სისტემას. დანახარჯის ძირითად ნაწილს წარმოად-
გენს დააავადება-მოდიფიცირებადი მკურნალობა.

# RESEARCH OF THE TEACHING EFFICIENCY THE SECTION "THERMAL TRAUMA" USING INTERACTIVE TECHNOLOGIES

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Despite the fact that the treatment of thermal trauma has a long history, they remain one of the current issue of modern medicine. These injuries are common injuries and make the lives of millions of people around the world worse. Every year about 6 million victims require medical assistance [1,5]. Burns, for example, are the cause of 180,000 deaths annually, most of them in the middle and low-income countries [1,6]. The average age of people with thermal injury is 24 years, and the average size of burn and frostbite wound is 19-22% of the total body surface area [6]. Near half of severe burn injuries are observed in children, among which 50-80% are children under the age of 5 years [2]. The heart of the problem lies in the fact that general practitioners provide first aid to patients with thermal trauma. So at this very stage the doctors make diagnostic and treatment-tactical errors. Relevant in this regard is the search for ways to optimize teaching students the issues of diagnosis, first aid, treatment of patients with thermal injury using interactive learning technologies [10,14]. The cooperative group method is one of the methods of interactive technologies, which is based on the cooperation of students in groups. It is based on interaction with each other, thereby involving all, without exception, students to interaction, discussion, verbalization of their thoughts, development creative thinking, respect for colleagues, alternative ideas and proposals [3,7,8,11,12,13].

Purpose of research - to form an educational community of students with certain skills which are to be ready to acquire new knowledge in the process of communicating with each other, joint cognitive activity through the usage of interactive technologies - method of cooperative groups.

**Material and methods.** The study involved 8 student groups of the third year of the Faculty of Medicine, Dneprovsk State Medical University. The total number of students is 79 students aged 20-21, of which 26 are men and 53 are women.

The technique methodology consisted of three stages.

1. Preparatory. At the preparatory stage, teacher explains to the students the essence: options for practical implementation of the method, the topic and goals of the practical lesson are highlighted. He helps to organize groups. Each group of students receives a package of teaching materials, consisting of an instructional card-task, recommended literature (printed and electronic sources as well), questions and clinical tasks of different levels of complexity, the unified card-answer.

2. Basic. It has been consisted of announcing final solution of each group and conducting discussion. When receiving an incorrect or incomplete final decision in one of the groups, students of other groups are motivated to defend their correct answer to the decision of the opponent group, which is credited to them at the next stage. The initial collective product of the main stage of the