

Kucharczuk Magda, Juraszek Karolina, Krajewski Stanislaw, Surman Wika Marta, Tkaczyński Karol. The assessment of the patients disability degree using the EDSS scale in various forms of multiple sclerosis. Journal of Education, Health and Sport. 2018;8(3):278-292. eISSN 2391-8306. DOI <http://dx.doi.org/10.5281/zenodo.1194654>  
<http://ojs.ukw.edu.pl/index.php/johs/article/view/5354>

The journal has had 7 points in Ministry of Science and Higher Education parametric evaluation. Part b item 1223 (26/01/2017).  
1223 Journal of Education, Health and Sport eissn 2391-8306 7

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The authors declare that there is no conflict of interests regarding the publication of this paper.

Received: 05.02.2018. Revised: 10.02.2018. Accepted: 09.03.2018.

## The assessment of the patients disability degree using the EDSS scale in various forms of multiple sclerosis

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### Abstract

**Purpose.** The aim of the study is to assess the patients disability degree using the Extended Scale of Disability in various forms of multiple sclerosis.

**Material and Methods.** The study was conducted on a group of 40 people suffering from multiple sclerosis, diagnosed and treated in the Neurology Clinic of the 10th Military Clinical Hospital in Bydgoszcz. In order to assess the patients disability degree, the Extended Disability

Management Scale was used. The other information needed for statistical analysis was obtained from the clinical observation chart established for each patient.

**Results.** The disability degree of patients with multiple sclerosis is determined by many variables. The Expanded Disability Rating Scale is a good tool to assess the degree of disability of patients with multiple sclerosis.

**Conclusion.** 1. In the group of people with relapsing remitting MS, the average value of the degree of disability in the Expanded Disability Scale was the smallest. 2. The childbirth during the course of multiple sclerosis causes exacerbation of clinical symptoms immediately after the childbirth. 3. Optic neuritis as the initial symptom of multiple sclerosis predisposes to a milder course of the disease. 4. Symptoms of the first relapse of multiple sclerosis that support faster progression of disability are: lower limb paresis, sphincter dysfunction and balance disorders. 5. Multifocal symptomatology of the first relapse of multiple sclerosis speaks for faster progression of disability in relation to patients with the first relapse characterized only by one symptom.

**Key words:** Multiple Sclerosis, EDSS Scale

## **Introduction**

Multiple sclerosis (sclerosis multiplex, MS) is an acquired, inflammatory-degenerative demyelinating disease with an immunological basis. It leads to the destruction of the myelin sheath, damaging the axons, degeneration and death of oligodendrocytes and the formation of astroglial scars. The effect of these changes is multifocal damage to the central nervous system (CNS), which results in diverse neurological symptoms and multiphase course. MS is a chronic disease, with periods of relapsing and remission [1]. The first description of morphological changes in the CNS was published in 1835 by a French professor of pathological anatomy Jean Cruveilier. However, the first, who combined the image of pathological changes with neurological symptoms, and thus presented MS as a separate disease entity, is considered to be a French neurologist Jaen Martin Charcot. In 1868 he presented a detailed clinical description of a patient with MS, and in the following years he described dozens of similar cases. He named the new disease - sclerose en plaques. To date, the three main symptoms of this disease, namely dysarthria, nystagmus and intention tremor, are known as the Charcot triad [2]. MS is a disease that occurs mainly among Caucasian people. In Europe, the incidence of MS ranges from 30 to 150 cases per 100,000 residents. In Poland, according to the Polish Society for Multiple

Sclerosis, the number of patients is around 45,000 [3]. This disease can occur at any age but the highest number of cases is between the age of 20 and 40 years. Women suffer from MS twice as often as men. The average survival time of the patient from the moment of diagnosis is 35-40 years [4].

MS in each patient is different, both in terms of the frequency of relapses, severity of symptoms and the progression of disability. It is not possible to predict when and to what extent the course of the disease will worsen over the next few years.

We distinguish four clinical forms of MS:

1. The most common is Relapsing Remitting Multiple Sclerosis (RRMS). It occurs in approximately 55-59% of patients, and in 80% of cases it starts MS. The characteristic feature of RRMS is the occurrence of the relapse and remission periods. We define the relapse as the occurrence of new neurological symptoms or exacerbation of old ones, lasting longer than 24 hours. After the relapse period, the neurological symptoms recede partly or completely.
2. Secondary Progressive Multiple Sclerosis (SPMS) results in systematic deterioration of the patient's health due to incomplete remission of the symptoms of relapses. The form of SPMS affects about 27-31% of the entire population of patients [5].
3. A further variant of the course of MS is the Primary Progressive Multiple Sclerosis (PPMS). It occurs in approximately 15-20% of patients. Most people who develop MS are relatively late in PPMS. In its course, a steady progress of neurological symptoms is observed, mainly related to pyramidal paralysis of the lower limbs and sphincter function disorders.
4. Benign Multiple Sclerosis (BNMS) occurs the least often, only in about 1-5% of patients. They are relatively efficient people who after 15 years of the disease were diagnosed with the most moderate degree of disability (EDSS <3.0) [6,7,8].

Clinical symptoms occurring in the course of MS are varied. The most frequent and most typical ones include pyramidal limb paresis, sensory disturbances, vision and sphincter control disorders (Table 1).

Tab. 1. Symptoms occurring in the course of MS [9]

Symptom	Occurrence frequency (%)	
	Ever	At the beginning of the disease
Pyramid paresis	90	25
Sensory disturbances	85	35
Coordination disorders	70	15
Sphincter control disorders	65	1
Visual acuity disorders	60	15
Dizziness	60	25
Nystagmus	50	5
Muscle spasms	50	1
Fatigue syndrome	50	2
Double vision	30	8
Dysarthria	25	1
Dysphagia	10	0

## Material and methods

The study was carried out on a group of 40 people suffering from MS, diagnosed and treated in the Neurology Clinic of the 10th Military Clinical Hospital in Bydgoszcz. In order to assess the degree of disability of MS patients, the Expanded Disability Status Scale (EDSS) was used (Table 2) [10]. It is the most frequently used tool to assess the functional and clinical status of patients with MS [11, 12]. The scale range includes 10 points describing the patient's efficiency from 0 - without disability, up to 10 - patient's death due to MS. Points from 0 to 5.5 mean that the patient can walk alone. The limitation of the walking distance starts at 4 points, where it is 500m. In subsequent points of the EDSS scale, the reduction in walking distance is 4.5pkt - 300m, 5.0pkt - 200m, 5.5pkt - 100m respectively. The score from 6 to 6.5 points indicates that the patient needs one or two-sided assistance while walking. The necessity to move using a wheelchair is confirmed by 7 points on the EDSS scale. Patients who receive 8.5 points spend most of the day in bed, and stay in bed, depending on other people for 9.0 points[13]. The EDSS scale includes 8 functional subscales describing the efficiency of individual systems: vision, brainstem, pyramidal system, cerebellum, sensory system, sphincter function, higher cerebral functions [12].

Tab. 2. Extended scale of EDSS

Points	Symptoms	Functional Scale
0.0	Normal neurological exam	all grade 0 in all Functional System (FS) scores
1.0	No disability	minimal signs in one FS* (i.e., grade 1)
1.5	No disability	minimal signs in more than one FS* (more than 1 FS grade 1)
2.0	Minimal disability	Minimal disability in one FS (one FS grade 2, others 0 or 1)
2.5	Minimal disability	Minimal disability in two FS (two FS grade 2, others 0 or 1)
3.0	Able to walk without limited	Moderate disability in one FS (one FS grade 3, others 0 or 1) or mild disability in three or four FS (three or four FS grade 2, others 0 or 1) though fully ambulatory
3.5	Able to walk without limited	Fully ambulatory but with moderate disability in one FS (one grade 3) and one or two FS grade 2; or two FS grade 3 (others 0 or 1) or five grade 2 (others 0 or 1)
4.0	Able to walk without aid or rest some 500 meters	Fully ambulatory without aid, self-sufficient, up and about some 12 hours a day despite relatively severe disability consisting of one FS grade 4 (others 0 or 1), or combination of lesser grades exceeding limits of previous steps
4.5	Able to walk without aid or rest some 300 meters	Fully ambulatory without aid, up and about much of the day, able to work a full day, may otherwise have some limitation of full activity or require minimal assistance; characterized by relatively severe disability usually consisting of one FS grade 4 (others or 1) or combinations of lesser grades exceeding limits of previous steps
5.0	Ambulatory without aid or rest for about 200 meters; disability severe enough to impair full daily activities (e.g., to work a full day without special provisions)	Usual FS equivalents are one grade 5 alone, others 0 or 1; or combinations of lesser grades usually exceeding specifications for step 4.0
5.5	Ambulatory without aid for about 100 meters; disability severe enough to preclude full daily activities	Usual FS equivalents are one grade 5 alone, others 0 or 1; or combination of lesser grades usually exceeding those for step 4.0
6.0	Intermittent or unilateral constant assistance (cane, crutch, brace) required to walk about 100 meters with or without resting	Usual FS equivalents are combinations with more than two FS grade 3+
6.5	Constant bilateral assistance (canes, crutches, braces) required to walk about 20 meters without resting	Usual FS equivalents are combinations with more than two FS grade 3+

<b>7.0</b>	Unable to walk beyond approximately 5 meters even with aid, essentially restricted to wheelchair; wheels self in standard wheelchair and transfers alone; up and about in wheelchair some 12 hours a day	usual FS equivalents are combinations with more than one FS grade 4+; very rarely pyramidal grade 5 alone
<b>7.5</b>	Unable to take more than a few steps; restricted to wheelchair; may need aid in transfer; wheels self but cannot carry on in standard wheelchair a full day; May require motorized wheelchair	usual FS equivalents are combinations with more than one FS grade 4+
<b>8.0</b>	Essentially restricted to bed or chair or perambulated in wheelchair, but may be out of bed itself much of the day	retains many self-care functions; generally has effective use of arms; usual FS equivalents are combinations, generally grade 4+ in several systems
<b>8.5</b>	Essentially restricted to bed much of day	has some effective use of arm(s); retains some self-care functions; usual FS equivalents are combinations, generally 4+ in several systems
<b>9.0</b>	Helpless bed patient	can communicate and eat; usual FS equivalents are combinations, mostly grade 4+
<b>9.5</b>	Totally helpless bed patient	unable to communicate effectively or eat/swallow; usual FS equivalents are combinations, almost all grade 4+
<b>10.0</b>	Death due to MS	

The other information that was needed for statistical analysis was obtained from the clinical observation chart established for each patient. (Fig.1).

Fig.1. Clinical observation card.

**Clinical observation card.**

Surname..... Medical history number.....

Birth date.....

Name..... Age..... Height..... Weight..... Sex M  F

**The form of multiple sclerosis:**

1. RRMS       2. SPMS       3. PPMS       4. BNMS

Age at the time of getting sick				
Number of childbirths	not at all			
	during the course of MS			
Exacerbation of postpartum symptoms				
MS in the family	Parents			
	Siblings			
Symptoms of the first wave	Sensory disturbances			
	Pyramid paresis	Upper limbs	Lower limbs	
		R	L	R
	Retrobulbar optic neuritis			
	Balance disorders			
Sphincter dysfunction				
Multifocal symptomatology of the first relapse				
The number of relapses during the first two years of the disease				
The period of time from the first symptoms of establishing the diagnosis				
Remission period between the first two relapses				
Retreat of neurological deficits after the first relapse	complete			
	substantial			
	minor			
	it didn't happen			
Current symptoms	Sensory disturbances			
	Pyramid paresis	Upper limbs	Lower limbs	
		R	L	R
	Retrobulbar optic neuritis			
	Balance disorders			
Sphincter dysfunction				
Current EDSS level				

**Results**

Among the examined 40 people there were 33 women (82%) and 7 men (12%). The largest number of people (47.5%) suffered from the form of RRMS. The smallest group was people diagnosed with PPMS, which constituted 20% of all patients. Patients with SPMS constituted 32.5% of the study population (Figure 2).

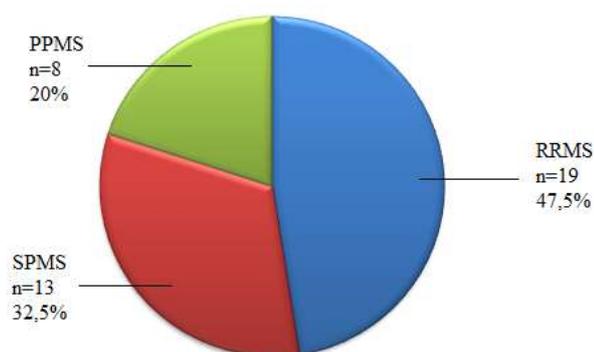


Fig. 2. Quantitative and percentage distribution of subjects in clinical groups

The degree of disability in the study group ranged from 1 to 8 points in the EDSS scale, average 3.875 points. The lowest average number of points in the EDSS scale was found among patients with RRMS where it was  $2.92 \pm 1.158$  points. However, the highest average disability rate ( $5.15 \pm 1.625$  points) was found in the group of patients with SPMS. Differences in the mean disability severity in the studied groups were statistically significant ( $p = <0.001$ ). The average level of disability in individual MS forms is shown in Table 3.

Tab. 3. The average value of the degree of disability in individual forms of MS

The form of MS	N	Average EDSS	Standard deviation	F	p
RRMS	19	2,92	1,158	11,218	<0,001
PPMS	8	4,06	1,086		
SPMS	13	5,15	1,625		
The total	40	3,87	1,624		

p- level of statistical significance

F- value of the analysis of variance

Out of 33 examined women, 13 gave birth during the course of MS. Figure 3 shows the effect of childbirth during MS on exacerbating symptoms in women. The severity of symptoms after childbirth occurred in 8 women (62% of the population who gave a birth). 5 women (38% of the population who gave a birth) did not complain about exacerbation of symptoms resulting from the birth of a child.

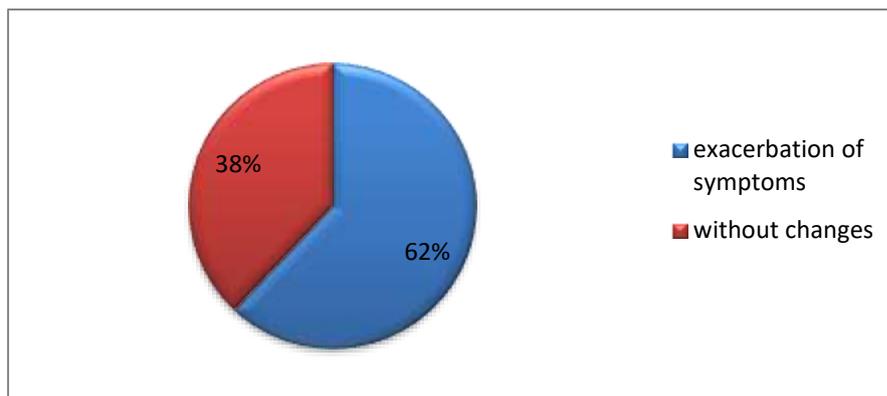


Fig. 3. Influence of childbirth during MS on exacerbation of symptoms in women

In the examined group of women the impact of labour, during the course of MS on the degree of disability, was assessed. The average EDSS level of disability in the group of women giving birth during the duration of MS was  $4.5 \pm 1.323$  points. However, in the remaining group of women, the average disability rate in the EDSS scale was at the level of  $3.5 \pm 1,522$  points. The difference in the average level of disability between these groups of women is statistically significant ( $p = 0.05$ ). The mean value of the degree of disability in the group of women who gave birth and those who didn't give birth during MS is presented in Table 4.

Tab. 4. The average value of the degree of disability in the group of women giving birth and women who didn't give a birth during the course of MS

Childbirth during MS	N	Average EDSS	Standard deviation	t	p
no	20	3,5	1,522	-1,938	0,05
yes	13	4,5	1,323		

p - level of statistical significance

t - the value of the test statistic

In the group of patients in whom the first symptom of MS was the paresis of the lower limb, the average disability rate was found in the EDSS scale at  $4.67 \pm 1.382$  points. In the remaining group of people, the average disability rate is  $3 \pm 1,434$  points. The difference in the average value of the degree of disability between a group of people who had a limb paralysis at the time of first relapse and the remaining group of patients was statistically significant ( $p = 0.001$ ). The mean value of the degree of disability in a group of people with or without paresis of the lower limb during the first relapse MS is shown in Table 5.

Tab. 5. The average value of the degree of disability in a group of people with or without paresis of the lower limb during the first relapse MS

Paresis of the lower limb	N	Average EDSS	Standard deviation	t	p
no	19	3	1,434	-3,743	0,001
yes	21	4,67	1,382		

In the group of 11 people in which optic neuritis (ON - Optic Neuritis) was the first relapse symptom of MS, the average disability rate was  $3 \pm 1.304$  points. In the remaining group of 29 people, the average disability rate was  $4.21 \pm 1.628$  points. The difference in the average disability severity in the EDSS scale between the group of people who had ON during the first relapse MS and the rest of the studied population was statistically significant ( $p = 0.034$ ). The mean value of the degree of disability in the group of people with and without ON as the first symptom of MS is presented in Table 6.

Tab. 6. The average value of the degree of disability in the group of people with and without previous ON as the first symptom of MS

Suffered ON	N	Average EDSS	Standard deviation	t	p
no	29	4,21	1,628	-2,199	0,034
yes	11	3	1,304		

In the studied group, the effect of balance disorders as being the first relapse symptom of MS on the degree of disability was assessed. The average EDSS severity level in the group of people who experienced balance disorders during the first MS relapse was  $4.64 \pm 1.352$  points. However, in the remaining group of people, the average disability rate in the EDSS scale was at the level of  $3.03 \pm 1.495$  points. The difference in the mean value of the degree of disability between the group of people who experienced imbalance during the first MS relapse and the rest of the studied population was statistically significant ( $p = 0.001$ ). The mean value of the degree of disability in a group of people with or without an imbalance during the first MS relapse is presented in Table 6.

Tab. 6. The average value of the degree of disability in a group of people with or without an imbalance in the first MS relapse

Balance disorders	N	Average EDSS	Standard deviation	t	p
no	19	3,03	1,495	-3,591	0,001
yes	21	4,64	1,352		

The next analyzed issue concerned the assessment of the impact of sphincter dysfunctions during the first MS relapse on the progression of disability. The efficiency of the sphincter has been preserved in as many as 36 people whose average disability rate was  $3.71 \pm 1.485$  points. Sphincter dysfunction occurred only in 4 subjects, in whom the average level of disability was at the level of  $5.37 \pm 2.287$  points. The difference in the average level of disability between the group of people who developed sphincter dysfunction during the first MS relapse and the rest of the studied population was statistically significant ( $p = 0.05$ ). The average value of the degree of disability depending on the occurrence of sphincter dysfunction as the first symptom of MS is presented in Table 7.

Tab. 7. The average value of the degree of disability depending on the occurrence of sphincter dysfunction as the first symptom of MS

Spincter dysfunction	N	Average EDSS	Standard deviation	t	p
no	36	3,71	1,485	-2,023	0,05
yes	4	5,37	2,287		

The difference in the average level of disability between the group of people with the first relapse was multi-symptom and the subjects with only one symptom of the first crop were statistically significant ( $p = 0.005$ ). The average level of disability in these groups was  $4.48 \pm 1.488$  and  $3.06 \pm 1.467$  points, respectively. This indicates that the occurrence of more than one symptom during the first relapse causes a faster progression of the patient's disability. The mean value of the degree of disability depending on the multifocal symptomatology of the first MS relapse is presented in Table 8.

Tab. 8. The average value of the degree of disability depending on the multifocal symptomatology of the first MS relapse

Multifocal symptomatology of the first MS relapse	N	Average EDSS	Standard deviation	t	p
no	17	3,06	1,467	-3	0,005
yes	23	4,48	1,488		

## Discussion

The main goal of the study was to assess the degree of disability of patients in various forms of MS using the EDSS scale. The study was also supposed to show what influence on the degree of disability of the patient brings with its factors such as: the form of the disease, its course, or the first symptoms. In the own study, the mean value of the disability rate in patients with specific forms of MS was determined. In people with the form of RRMS, the average EDSS level of disability was the lowest and amounted to  $2.92 \pm 1.158$  points, while in the group of patients with SPMS and PPMS the mean disability was higher and amounted to  $5.15 \pm 1.625$  points and  $4.06, \text{ respectively. } \pm 1,086$ . In the published studies, H. Tremeltt et al. And A. Degenhardt et al., it was found that the primary progressive course of MS is associated with a faster progression of disability than the course with relapses [14,15]. These results do not fully comply with our own research, in which the highest degree of disability was found in the group of patients with SPMS. The data obtained may result from the duration of the disease, which in the case of patients with diagnosed SPMS was the longest and amounted to 11.85 years. In Mirowska's publication - Guzel et al., it was also found that disability increases faster in patients with PPMS [13].

The literature data show that women who gave birth to a child during MS experience a sudden deterioration in the first three months after labour, whereas after this period the level of disability was comparable to women who didn't give birth [16,17,18,19]. In the studied population, exacerbation of symptoms after childbirth occurred in 62% of women giving birth during the course of the disease, which is consistent with data from the literature. The average EDSS level of disability in women giving birth during the duration of MS was  $4.5 \pm 1.323$  points, while in the remaining group of women the average disability rate was  $3.5 \pm 1.522$  points. In this respect, the results of our own study are in contradiction with the data from the literature.

Similarly to the work of other authors [5, 14, 16, 20, 21, 22], in our studies, the beneficial effect of the presence of ON during the first MS relapse on reducing the progression

of disability was found. In the group of 11 people in whom ON was the first relapse symptom of MS, the average disability rate was  $3 \pm 1.304$  points. In the remaining group of 29 people, the average disability rate was  $4.21 \pm 1.628$  points. This means that the average level of disability was by 1.21 points lower in those with ON as the initial symptom of MS.

In our own research, the mean value of motor disability was determined in the group of people who had more than one symptom in the first relapse compared to those who had only one symptom at the first. The average level of disability in these groups was  $4.48 \pm 1.488$  and  $3.06 \pm 1.467$  points, respectively. The study shows that the mean EDSS disability rate in patients with multifocal symptomatology first relapse was 1.42 points higher than in patients with the first relapse symptom showing only one symptom. This is consistent with the publications by Bartosik-Psujek et al. And Bonka et al., according to which the occurrence of more than one symptom at the first relapse causes a faster progression of the disease [5,16].

## **Conclusions**

1. In the group of people with RRMS, the average disability level in the EDSS scale was the lowest and amounted to 2.92 points, while in the group of patients diagnosed with SPMS, the average disability degree was 5.15 points.
2. Childbirth during MS causes exacerbation of clinical symptoms immediately after labour and increases the degree of disability by 1 point in the EDSS scale in relation to women who didn't give a birth.
3. ON, as the initial symptom of MS, predisposes to a milder course of the disease.
4. Symptoms of the first MS relapse that support a faster progression of disability are: lower limbs paresis, sphincter dysfunctions and balance disorders.
5. Multifocal symptomatology of the first MS relapse speaks for faster progression of disability in relation to patients with the first relapse characterized only by one symptom.

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