

## Assessment of mobility impairment in patients with multiple sclerosis

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### Abstract

Multiple sclerosis (Lat. sclerosis multiplex, SM) is a chronic inflammatory neurodegenerative disease that affects the central nervous system (CNS). Common symptoms of the SM include mobility impairment, sensory loss (paraesthesia), cerebellar dysfunctions (balance problems), visual disturbances, autonomic dysfunctions and pain syndromes as well as psychiatric disorders (cognitive and emotional disturbances).

Aim of work was to assess mobility impairment symptoms among patients with SM in relation to progression of the disease, length of time a patient suffered from it, and influence of the symptoms on functional capacity and self-care management.

The study was conducted on a group of 67 patients (74.6% women, 22-74 age range) of Neurology Ward of Medical Care Centre in Jarosław (south-eastern Poland) and its Neurology Clinic who were diagnosed with SM. The study was based on a self-constructed diagnostic questionnaire. The most prevalent (32; 47.8%) type of SM was progressive-relapsing.

Balance and coordination impairment (from 1 to 7, average 4.38) were indicated by 74.6% respondents. The incidence of spasticity and problems caused by it were indicated by 31.3%. Mobility dysfunctions were reported by respondents who had the disease longer in comparison to those who did not indicate such impairment (average 10.92 years vs 3.02;  $p < 0.001$ ). The amount of mobility issues, age of the respondents ( $r_s = 0.5821$ ,  $p < 0.001$ ) and the duration of the disease ( $r_s = 0.6208$ ,  $p < 0.001$ ) were found to be related. Substantial majority of respondents declared complete independence and self-sufficiency (46; 68.7%). Also amount of mobility impairment symptoms was related to patient's age, disease duration and its type.

**Keywords:** multiple sclerosis, mobility impairment, self-care

## **Introduction**

Multiple sclerosis (Latin: sclerosis multiplex, SM) is a chronic inflammatory neurodegenerative disease that affects the central nervous system (CNS) and causes multifocal demyelination which results in impaired impulse transmission along neural pathways in the brain and spinal cord [1, 2]. Multiple sclerosis is one of the most common causes of disability in young adults. Primarily prevalent among women aged between 20 and 40 [1].

Polish Multiple Sclerosis Association estimates that there are about 45 000 multiple sclerosis patients in Poland [3]. Common symptoms of the multifocal demyelination include mobility impairment, sensory loss (paresthesia), cerebellar dysfunctions (balance problems), visual disturbances, autonomic dysfunctions and pain syndromes as well as psychiatric disorders (cognitive and emotional disturbances) [2, 4]. At the onset, a patient frequently experiences upper- and lower-limb muscular fatigue. As the disease progresses, other manifestations include increased muscle tightness (spasticity) which significantly hinders a range of motions or results in complete disability [5, 6]. Autonomic nervous system dysfunctions are not infrequent (dysfunction of bladder and episodes of bowel incontinence and constipation) as well as incidence of swallowing disorder (dysphagia) [5, 6].

## **Objectives**

Purpose of work was to assess mobility impairment symptoms among patients with SM in relation to progression of the disease, length of time a patient suffered from it, and influence of the symptoms on functional capacity and self-care management.

## **Material and methods**

The study was conducted on a group of 67 patients of Neurology Ward of Medical Care Centre in Jarosław and its Neurology Clinic who were diagnosed with multiple sclerosis. Participation in the study was voluntary and anonymous. The study was based on a self-constructed diagnostic questionnaire. The respondents were interviewed by a neurologist. The questionnaire was designed to establish socio-medical data, i.e. sex, age, education, place of residence, marital status, stage of the disease and its effect on patient's functionality, incidence of mobility dysfunctions and patient's ability to maintain self-care. Results of the study were analysed using chi-square statistical test, Spearman's rank correlation, Kruskal-Wallis test and Mann-Whitney U test. The statistical significance was deemed sufficient at  $p < 0.05$ .

## **Results**

The analysis was conducted on questionnaires received from 67 patients including 50 women (74.6% of respondents) and 17 men (25.4%). The study population was in the age range of 22 to 74 years. Arithmetic mean age amounted to 42.88 years (standard deviation of 12.15), and median was calculated at 43 years of age. The average age of women (40.12 years of age) was lower than the average age of men (51.00 years of age); the difference was statistically significant ( $p < 0.01$ ).

The respondents constituted of 34 (50.7%) urban and 33 rural residents (49.3%). Majority of patients had secondary education (43.3%, including 3 participants who were studying). A higher degree education had 31.3% of respondents, 22.4% were vocational school graduates and 1.5% had completed elementary level of education. Diagram 1 illustrates the layout of education among the participants.

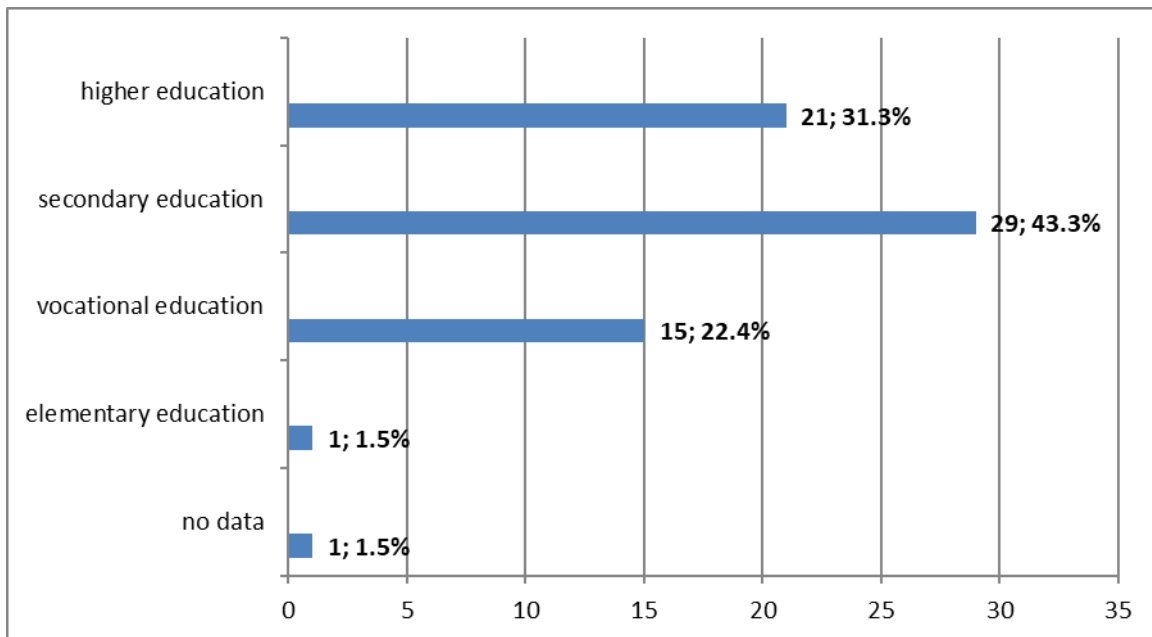


Diagram 1. Educational background of the respondents

According to numerous accounts provided by reference literature, the disease affects marital status and is oftentimes the reason of parting, especially when the patient develops mobility impairment and becomes dependent on others' assistance [1]. Most of the study population (71.6%) was married. Diagram 2 shows detailed data concerning the marital status of the respondents.

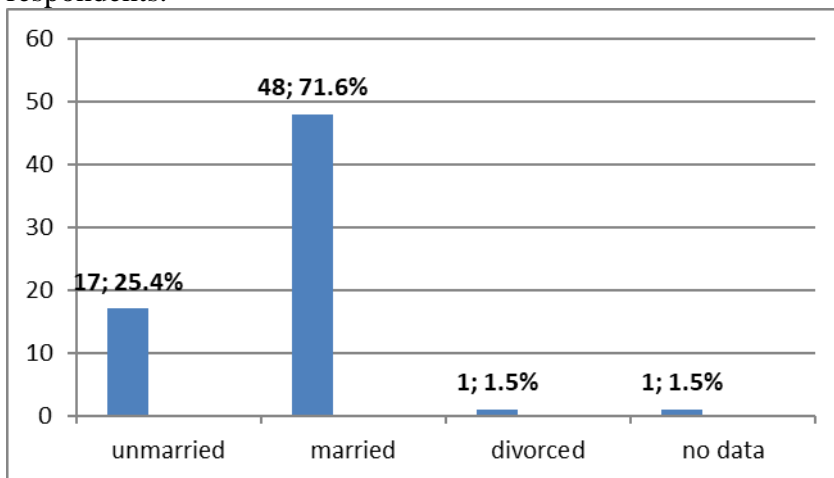


Diagram 2. Marital status of the respondents

The length of time the respondents had suffered from multiple sclerosis at the time of the study varied from 4 months to 32 years. Among 66 people who provided such data, the average disease duration amounted to 9.0 years (standard deviation of 8.35), with median of 5 years.

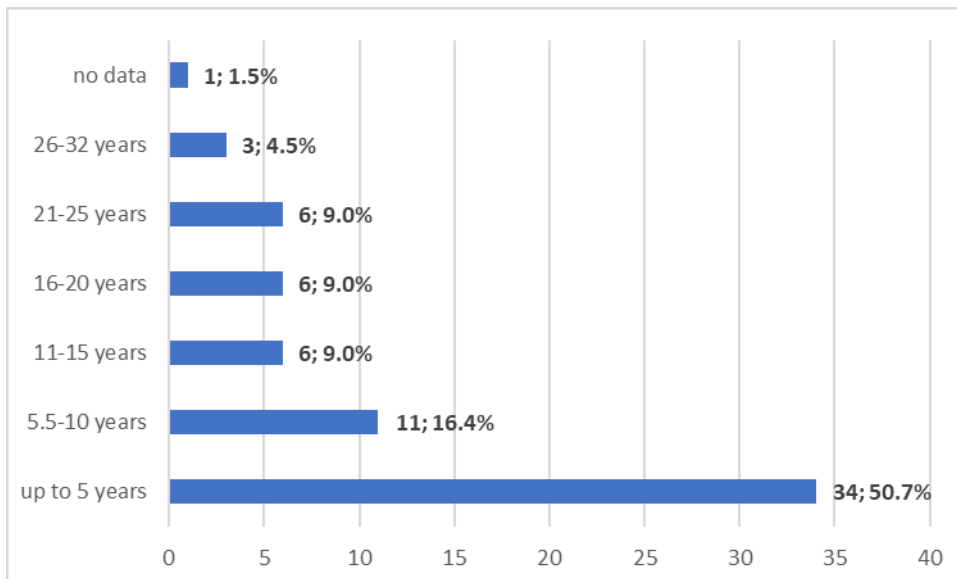


Diagram 3. Respondents' answers concerning the length of time since they had been diagnosed with multiple sclerosis

Each patient in the study population was asked about their result on the Kurtzke Expanded Disability Status Scale (EDSS) which serves as a tool to determine the level of mobility impairment in multiple sclerosis. It is a 20-step scale with grades every half a point (except for 0.5). The scale step of 0 is equal to no symptoms, whereas step 10 denotes death due to multiple sclerosis [7]. EDSS scale data was obtained from 51 respondents. The steps of the scale varied from 0 to 9; arithmetic average amounted to 3.20 (with standard deviation of 3.02), and median was established at 2.

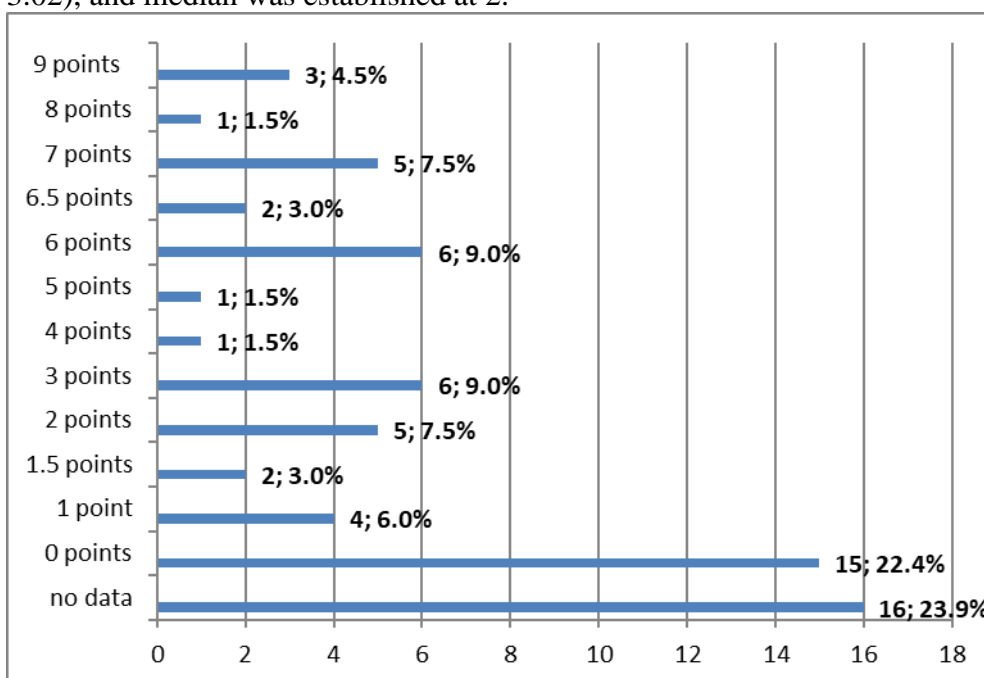


Diagram 4. Respondents results presented on EDSS scale

The course of the disease, severity of symptoms and quality of life of patients diagnosed with multiple sclerosis has significant influence on its type [8, 9]. Of all patients participating in the study, 61 provided information concerning the type of multiple sclerosis with which they were diagnosed. The most prevalent (n=32; 47.8%) type that was indicated by the respondents was progressive-relapsing. Less frequent type was that of secondary progressive (n=12; 17.9%) and relapsing-remitting multiple sclerosis (n=12; 17.9%), the least common was primary progressive (n=5; 7.5%).

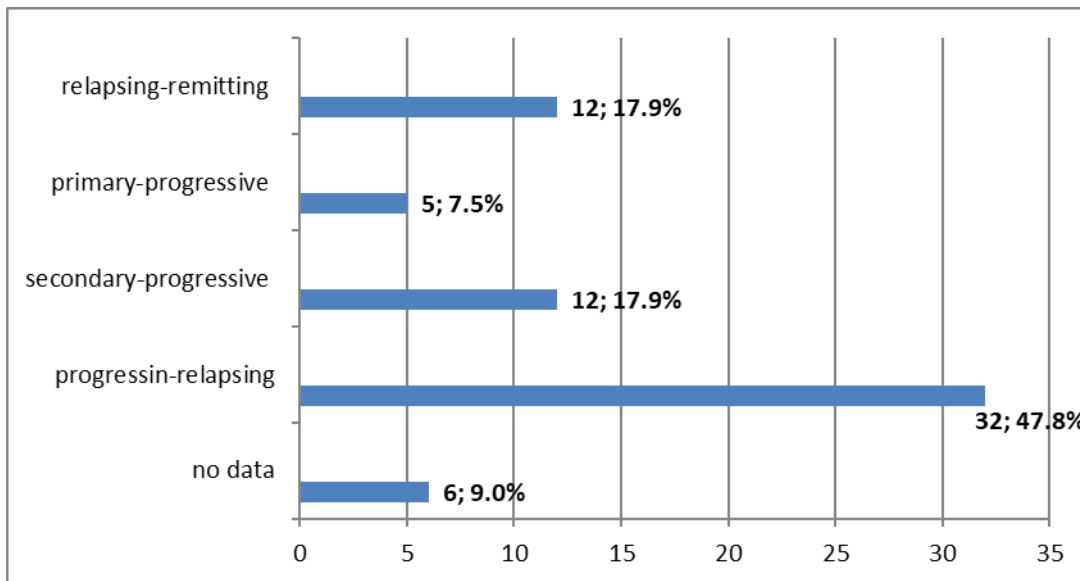


Diagram 5. Types of multiple sclerosis among the respondents

According to source literature, multiple sclerosis is a condition that is likely to be responsible for functional limitation. Substantial majority of respondents declared complete independence and self-sufficiency (n=46; 68.7%). Limited independence was indicated by 14 (20.9%) patients, and 7 (10.4%) stated they were dependent on others.

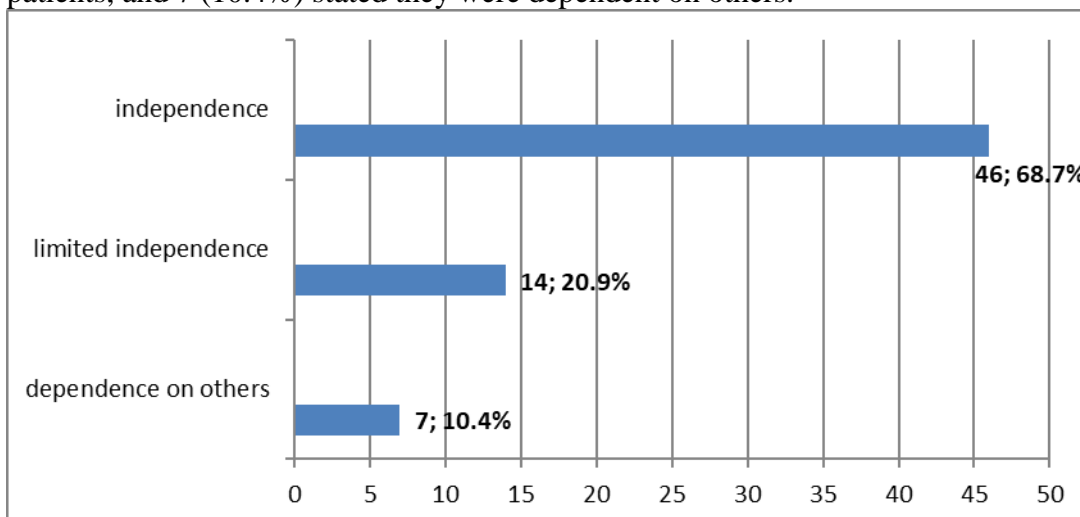


Diagram 6. Dependence in terms of functionality of respondents

Affirmative answer to question regarding the use of mobility aids like crotch, walker or wheelchair was provided by 14 patients (20.9%) which included all 7 who assessed their functional ability as very poor (i.e. dependent on others) and other 7 who indicated their independence as limited.

Further, the patients were asked if they experienced limitations in self-care due to increase in neurological symptoms. Respondents who provided affirmative response amounted to 44 (65.7%) and when asked for specifying, they indicated from 0 (no data) to 4 symptoms which altogether totalled at 91.

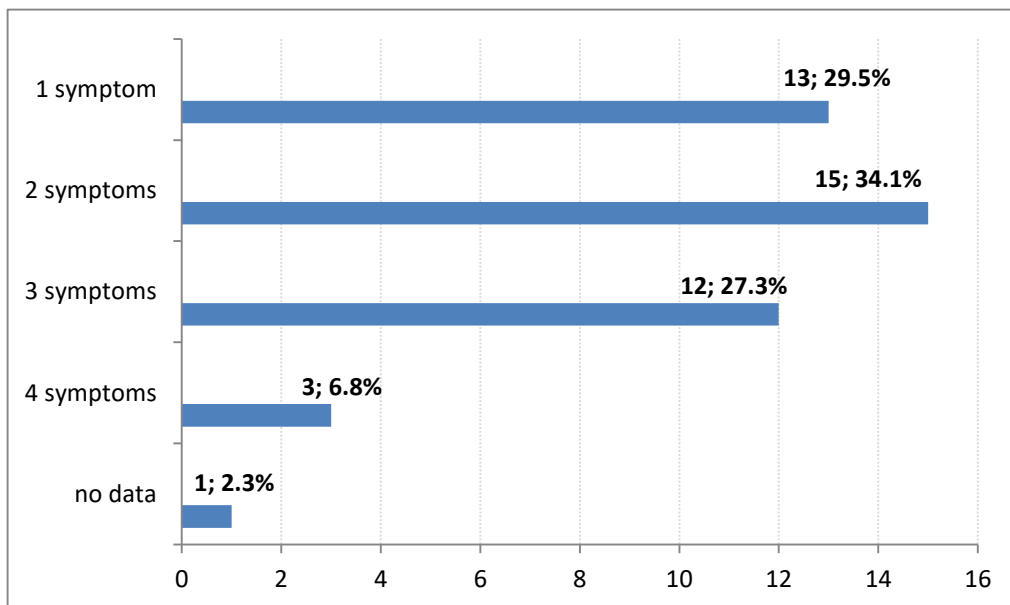


Diagram 7. Number of determined neurological symptoms responsible for limiting self-care among respondents (N=44)

Detailed analysis of neurological symptoms which limit the ability of managing self-care showed that respondents mainly indicated paresis and visual impairment. Table 1 presents detailed results in relation to a subgroup which experienced self-care limitations against the whole study population.

Table 1. Neurological symptoms resulting in self-care limitations (N=67)

No.	Symptom	n	% (for N=44)	% (for N=67)
1	Paresis	34	77.3	50.7
2	Cerebellar dysfunction symptoms	7	15.9	10.4
3	Proprioceptive sensation disorder	16	36.4	23.9
4	Vision disturbances	34	77.3	50.7
Total		91	–	–

Inability to maintain self-care may also result from the existence of other neurological signs in multiple sclerosis like balance and coordination impairment. These symptoms were indicated by 50 (74.6%) respondents. The number of symptoms indicated varied from 1 to 7 (average number amounted to 4.38, and median number of answers was 5) – a total of 219. The most common symptoms were “feeling of weakness”, unstable walk, balance loss, dizziness. Table 2 depicts a detailed list of obtained results.

Table 2. Identified balance and coordination impairment instances during the study

No.	Issue	n	% (for N=50)	% (for N=67)
1	Loss of balance	33	66.0	49.3
2	Tremor	24	48.0	35.8
3	Unstable walking	33	66.0	49.3
4	Dizziness	32	64.0	47.8
5	Partial loss of extremity control	28	56.0	41.8
6	Lack of coordination	23	46.0	34.3
7	Sensation of weakness	46	92.0	68.7
Total		219	–	–

The incidence of spasticity and problems caused by it have negative impact on patient’s mobility and limitations that result from it in terms of exercising self-care. There were 21

respondents who indicated it, with 16 pointed to one issue, and 5 to two issues which amounted to 26 issues in total. The most frequent answer provided was “a tendency of knee and ankle joint rotation”.

Table 3. Spasticity related problems indicated during the study

No.	Issue	n	% (for N=21)	% (for N=67)
1	Contractures	7	33.3	10.4
2	Tendency of knee and ankle joint rotation	19	90.5	28.4
Total		26	–	–

Mobility and coordination are not isolated as factors influencing the level of self-care but also activities such as self-feeding and avoiding the risk of choking during meals. During hospitalization, among 14 respondents, 13 determined only swallowing disorder and 1 also indicated biting and chewing issues.

Table 4. Issues related to food intake and risk of choking which appeared during hospitalization

No .	Issue	n	% (for N=14)	% (for N=67)
1	Swallowing disorder	14	100.0	20.9
2	Chewing disorder	1	7.1	1.5
3	Biting disorder	1	7.1	1.5
Total		16	–	–

Mobility dysfunctions were reported by respondents who had the disease longer (10.92 years) in comparison to those who did not indicate such impairment (3.02 years of disease duration, on average) – the difference was statistically significant ( $p < 0.001$ ).

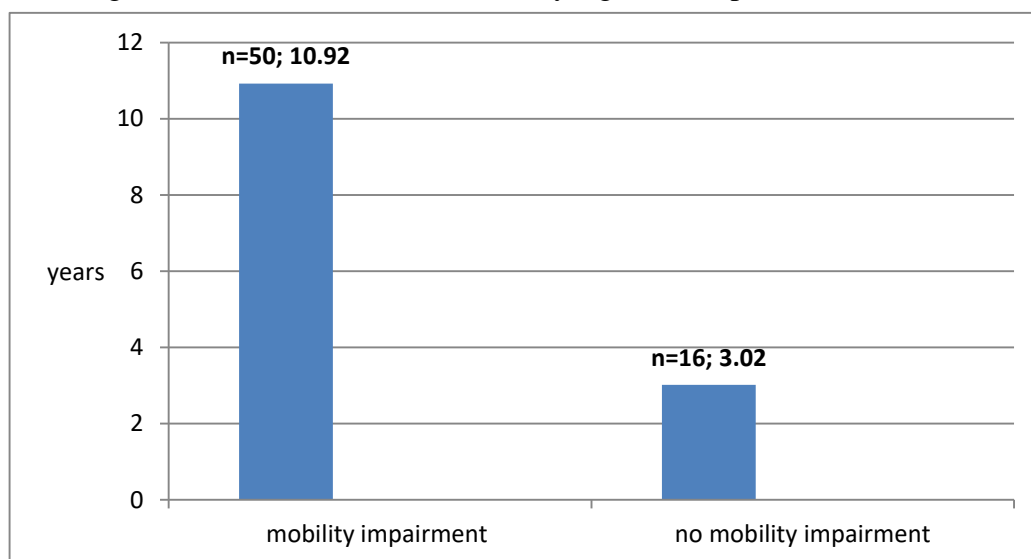


Diagram 9. Mobility impairment and the duration of the disease

The respondents who were diagnosed with primary-progressive, secondary-progressive and progressive-relapsing type of multiple sclerosis demonstrated a higher than 50.0% risk of developing mobility impairment.

Table 5. Type of multiple sclerosis and the incidence of mobility impairment

No.	Type	Mobility impairments		No mobility impairments	
		n	%	n	%
1	relapsing-remitting (n=12)	6	50.0	6	50.0
2	primary-progressive (n=5)	4	80.0	1	20.0
3	secondary-progressive (n=12)	12	100.0	0	0.0
4	progressive-relapsing (n=32)	24	75.0	8	25.0
Total		46	–	15	–

The Kruskal-Wallis test indicated differentiation in the amount of mobility impairments between respondents with different type of multiple sclerosis ( $p < 0.01$ ). *Post hoc* test demonstrated a significant difference between patients with secondary-progressive type (5.92 mobility issues, on average) and relapsing-remitting type (2.17) as well as progressive relapsing (3.26). Other distinctions were not statistically significant.

Table 6. Type of multiple sclerosis and amount of mobility issues

No.	Type	n	Min.	Max.	Average amount of mobility issues	Average duration of the disease
1	relapsing-remitting	12	0	6	2.17	7.36
2	primary-progressive	5	0	8	4.80	12.30
3	secondary-progressive	12	2	8	5.92	16.75
4	progressive-relapsing	32	0	8	3.26	6.92
Total		61	0	8	3.64	9.00

It has been found that the duration of the disease varied among respondents diagnosed with its different types. *Post hoc* test provided one statistically significant difference, namely between respondents who developed secondary-progressive type (average length of 16.75 years since diagnosis) and those with progressive-relapsing (6.92 years). Remaining differences were not statistically significant.

Additionally, the amount of mobility issues, age of the respondents ( $r_s = 0.5821$ ,  $p < 0.001$ ) and the duration of the disease ( $r_s = 0.6208$ ,  $p < 0.001$ ) were found to be related.

### Discussion

Multiple sclerosis is a chronic and progressive disease which results in disability. The first symptoms are often found to appear in working age and which intensify as the disease progresses. Symptoms may also depend on a type of the disease [1, 2, 6].

The study population consisted of 74.6% of women and 25.4% of men. The respondents fell into a range age of 22 to 74, however, the average age of women (40.12 years old) was lower than the average age of men (51.00 years old). The difference proved to be statistically significant ( $p < 0.01$ ). Snarska et al. have conducted a study among population comprising of 68% of women, but the average age was higher than that of male respondents [8]. In addition, Jamroz-Wisniewska et al. presented similar results as well as showed that incidence of multiple sclerosis is more prevalent in women than men [9]. The most respondents had received secondary education (43.3%), while slightly less had obtained higher (31.3%) and vocational education (22.4%). According to the source literature, the first symptoms may be noticed in young adults about the age of 20 which has a negative impact on continuing and obtaining education degree [1]. The population of our study was mainly married (71,6%).



The average duration of the disease since diagnosis amounted to 9 years, with minimum of 4 months and maximum of 32 years.

The average disability level on EDSS scale was 3.20 (+/- 3.02), with median of 2. The results obtained in this study do not show discrepancies towards the results of other scholars [8, 9]. For instance, analysis of multiple sclerosis patients in Swietokrzyskie Voivodeship conducted by Broła et al. in 2013 resulted in average EDSS level of 3.4 (+/-2.3) [10]. That study found the most prevalent type of multiple sclerosis was that of progressive-relapsing (47.8%) with less common secondary-progressive (17.9%) and relapsing-remitting (17.9%). However, RejSM-LEKARZ database suggests that the most common type is relapsing-remitting at 68.5%, secondary-progressive at 22.5%, primary-progressive at 6.4% and progressive relapsing at 2.9% of patients [10]. Yet, the database registers multiple sclerosis patients in all of the voivodeship regardless of health care form they use – stationary or open.

In our study, as the respondents assessed their self-sufficiency in basic functioning, majority declared full independence (68.7%), then limited self-sufficiency (20.9%), and a complete dependence on others (10.4%). Moreover, self-care limitations as a result of intensified neurological symptoms were indicated by significant number of patients (65.7%). The most common were: paresis and vision disturbances.

Balance and coordination impairment was confirmed by 74.6% of respondents. The impairment was experienced in the form of as weakening, unstable walking, loss of balance and dizziness. This study population rarely found limitations in self-care resulting from muscle spasticity or food intake issues. According to the study, mobility impairment intensifies as the disease progresses. By the same token, another factor is patient's age. Mobility impairment is additionally affected by the type of multiple sclerosis and is frequently indicated in primary-progressive, secondary-progressive and progressive-relapsing. The number of issues determined in respondents with secondary-progressive type amounted to 5.92, whereas relapsing-remitting to 2.17 and progressive-relapsing to 3.26.

Similar results were published by Snarska et al. who stated that disability of multiple sclerosis patients rises along with patient's age, duration of the disease and number of relapses [8].

### **Conclusions**

1. Intensification of neurological disorders, namely mobility impairment, swallowing disorders in the course of multiple sclerosis is related to patient's age, disease duration and its type.
2. Average result on the Kurtzke Expanded Disability Status Scale (EDSS) in the study population amounted to 3.20.
3. The prevalent type of multiple sclerosis in the study population was progressive-relapsing type.
4. The most common neurological issues which limited functionality of respondents were pareses, vision disturbances, balance and coordination impairment.

### **References**

- [1] Haselkorn JK, Balsdon Richer C, Fry Welch D, Herndon RM, Johnson B, Little JW et al. *Multiple Sclerosis Council for Clinical Practice Guidelines: Overview of spasticity management in multiple sclerosis. Evidence-based management strategies for spasticity treatment in multiple sclerosis.* J Spinal Cord Med. 2005; 28: 167-199.
- [2] Petajan JH, White AT. *Recommendations for physical activity in patients with multiple sclerosis.* Sports Med. 1999; 27: 179-191.
- [3] Polskie Towarzystwo Stewardnienia Rozsianego [Polish Society of Multiple Sclerosis]. *Czym jest SM? [What is SM?]* [www.ptsr.org.pl/stwardnienie\\_rozsiane,czym\\_jest\\_sm,102.asp](http://www.ptsr.org.pl/stwardnienie_rozsiane,czym_jest_sm,102.asp) (accessed: 12.10.2018).

- [4] Cella DF, Dineen K, Arnason B, Reder A, Webster KA, Karabatsos G et al.: *Validation of the functional assessment of multiple sclerosis quality of life instrument*. Neurology 1996; 47: 129-139.
- [5] Barnes MP, Kent RM, Semlyen JK, McMullen KM. *Spasticity in multiple sclerosis*. Neurorehabil. Neural Repair 2003; 17: 66-70.
- [6] Opara J. *Kompleksowa rehabilitacja chorych ze stwardnieniem rozszianym*. [Comprehensive rehabilitation of patients with multiple sclerosis] Neurol. Neurochir. Pol. 1998; 32: 623-632.
- [7] Opara J. *Klinimetria w stwardnieniu rozszianym*, [Clinimetry in multiple sclerosis]. Farmakologia w psychiatrii i neurologii. [Pharmacology in psychiatry and neurology] 2005, 3, 220-221. [http://old.ipin.edu.pl/fpn/archiwum/2005/3/t21z3\\_3.pdf](http://old.ipin.edu.pl/fpn/archiwum/2005/3/t21z3_3.pdf).
- [8] Snarska K, Karwowska M, Kapica-Topczewska K, Drozdowski W, Bachórzewska-Gajewska H. *Jakość życia pacjentów ze stwardnieniem rozszianym*. [Quality of life Patients with multiple sclerosis] Prob Piel. 2015, 23(3), 349-356.
- [9] Jamroz-Wisniewska A, Papuć E, Bartosik-Psujek H. *Analiza walidacyjna wybranych aspektów psychometrycznych polskiej wersji Skali Wpływu Stwardnienia Rozszianego na Jakość Życia Chorych (MSIS-29)*. [Validation analysis of selected psychometric aspects of the Polish version of the Impact of Multiple Sclerosis Scale on the Quality of Life of the Sick (MSIS-29)] Neurologia i Neurochirurgia Polska 2007. 41, 215-222.
- [10] Broła W, Fudala M, Flaga S, Ryglewicz D, Potemkowski A. *Polski rejestr chorych na stwardnienie rozsziane – stan obecny, perspektywy i problemy*. [Polish registry of patients with multiple sclerosis - current status, perspectives and problems] Aktualn Neurol. 2015, 15(2), 68-73.