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Analysis of the Relationship between Disease Duration, Comorbidities, and Emotional Disorders and the Level of Disability in Patients with Multiple Sclerosis

Analiza związku czasu trwania choroby, chorób współistniejących i zaburzeń emocjonalnych z poziomem niepełnosprawności u pacjentów ze stwardnieniem rozsianym

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Abstract

Introduction. Multiple sclerosis (MS) is a chronic disease of the central nervous system that leads to increasing disability and deterioration in patients' functioning.
Aim. To assess the relationship between disease duration, comorbidities, treatment modification, emotional disorders, and the level of disability in patients with MS.
Material and Methods. A retrospective analysis of medical records of 149 patients treated at the Neurology Outpatient Clinic of the Stanisław Staszic Specialist Hospital in Piła was conducted. The analysis included disease duration, disability level assessed using the Expanded Disability Status Scale (EDSS), treatment, comorbidities, and emotional disorders. Spearman's rank correlation and the Mann–Whitney U test were applied.
Results. A statistically significant, weak positive relationship was found between disease duration and disability level (r=0.185; p=0.024). Comorbidities were associated with a tendency toward higher EDSS scores, but the difference was not statistically significant (p=0.088). Treatment modifications, most commonly due to insufficient efficacy or adverse effects, were not significantly associated with disability level (p=0.101). Emotional disorders were present in 14.1% of patients, and their association with EDSS was not statistically significant (p=0.154).
Conclusions. Disease duration is significantly associated with the level of disability in patients with MS. Comprehensive and regular monitoring of patients' health status may support individualized care. **(JNNN 0000;0(0):0–0)**
Key Words: comorbidities, disability, disease duration, EDSS, emotional disorders, multiple sclerosis

Streszczenie

Wstęp. Stwardnienie rozsiane (SM) jest przewlekłą chorobą ośrodkowego układu nerwowego prowadzącą do narastania niepełnosprawności i pogorszenia funkcjonowania pacjentów.
Cel. Ocena zależności między czasem trwania choroby, chorobami współistniejącymi, modyfikacją leczenia, zaburzeniami emocjonalnymi a poziomem niepełnosprawności u pacjentów z SM.
Materiał i metody. Przeprowadzono retrospektywną analizę dokumentacji 149 pacjentów leczonych w poradni neurologicznej Szpitala Specjalistycznego im. Stanisława Staszica w Pile. Oceniano m.in. czas trwania choroby, poziom niepełnosprawności w skali EDSS, leczenie, choroby współistniejące i zaburzenia emocjonalne. Zastosowano korelację rang Spearmana oraz test U Manna–Whitneya.
Wyniki. Stwierdzono istotną, słabą dodatnią zależność między czasem trwania choroby a poziomem niepełnosprawności (r=0,185; p=0,024). Choroby współistniejące wiązały się z tendencją do wyższych wartości EDSS, jednak bez istotności

statystycznej (p=0,088). Modyfikacje leczenia, najczęściej z powodu niewystarczającej skuteczności lub działań niepożądanych, nie były istotnie związane z poziomem niepełnosprawności (p=0,101). Zaburzenia emocjonalne występowały u 14,1% pacjentów, a ich związek z EDSS nie był istotny statystycznie (p=0,154).
Wnioski. Czas trwania choroby jest istotnie związany z poziomem niepełnosprawności u pacjentów z SM. Kompleksowe i regularne monitorowanie stanu pacjenta może wspierać indywidualizację opieki. **(PNN 0000;0(0):0–0)**
Słowa kluczowe: choroby współistniejące, niepełnosprawność, czas trwania choroby, EDSS, zaburzenia emocjonalne, stwardnienie rozsiane

Introduction

Multiple sclerosis (MS) is a chronic inflammatory autoimmune disease of the central nervous system (CNS) that primarily affects young adults. Its course involves demyelination, neuronal damage, limited remyelination, oligodendrocyte death, and progressive neurodegeneration. The disease is characterized by multifocal and temporally disseminated CNS lesions involving both the white and gray matter of the brain, as well as the spinal cord. The clinical manifestations of MS are diverse, and the disease follows a chronic, progressive course that ultimately leads to significant motor disability [1,2].

The diagnosis of MS is based on clinical presentation and additional testing. It includes a detailed medical history and physical examination, as well as laboratory tests, neuroimaging — particularly Magnetic Resonance Imaging (MRI) — cerebrospinal fluid (CSF) analysis, and evoked potentials [3,4]. The EDSS scale is widely used to assess disability in patients with MS and serves as an important tool for monitoring disease progression and treatment effectiveness [4,5].

In the present study, the analysis of medical records of patients with MS enabled the assessment of relationships between disease duration, comorbidities, applied therapy, and the presence of emotional disorders, and the level of disability. The aim of the study was to identify clinical and demographic factors that may influence the course of the disease and the degree of disability, thereby contributing to a better understanding of the multidimensional nature of MS.

Material and Methods

Organization of Scientific Research

This study employed a retrospective design in which medical records of patients with MS treated at the neurology outpatient clinic of the Stanisław Staszic Specialist Hospital in Piła were analyzed. Medical documentation from 184 patients under the clinic's care was reviewed; however, due to incomplete information, a total of 149 patient records were included in the final analysis. The evaluated variables included sex, current age, disease duration, EDSS score, current medication, changes in pharmacotherapy and their reasons, as well as the presence of comorbidities and emotional disorders. The study was conducted between 24 June 2024 and 30 April 2025.

Research Procedures

In this study, the method of medical record analysis was applied. The study group consisted of adult patients (≥18 years of age) with a confirmed diagnosis of MS who were under continuous care at the neurology outpatient clinic.

Inclusion criteria: age≥8 years:
a. confirmed diagnosis of MS,
b. continuous care in a specialized neurology outpatient clinic.

Exclusion criteria:
a. absence of an MS diagnosis,
b. incomplete medical documentation.

Characteristics of the Study Population

The study based on medical record analysis included 149 patients with MS who were treated at the specialized neurology outpatient clinic for MS patients at the Stanisław Staszic Specialist Hospital in Piła. The study group consisted of 119 women (79.9%) and 30 men (20.1%), aged between 22 and over 60 years. The mean age of the sample was 46 years and 3 months. The mean age was 46.2 years (SD=11.404). The youngest participant was 22 years old, while the oldest was 68. The median age (48 years) indicates that half of the patients were younger than 48.

Table 1. Age of the participants

Age group	N	%
22–33 years	25	17
34–45 years	39	26
46–57 years	60	40
Over 57 years	25	17
Total	149	100

N — number of observations; % — percent

Statistical Analysis

Spearman's rank correlation coefficient (ρ) was used to assess the relationships between quantitative and ordinal variables, as it is robust to deviations from normal distribution. To compare the level of disability measured by EDSS between two independent groups of patients (e.g., with and without comorbidities, with and without treatment modification, with and without emotional disorders), the Mann–Whitney U test was applied, serving as a non-parametric alternative to the independent samples t-test. Results with $p<0.050$ were considered statistically significant. Values within $0.050<p<0.100$ were interpreted as approaching significance, while $p>0.100$ was regarded as not statistically significant (ns). The applied statistical methods were appropriately matched to the type of data and allowed for a reliable verification of the research hypotheses, as well as for the identification of significant factors influencing the level of disability in patients with MS.

Results

The distribution of patients (N=149) according to disease duration expressed in full years showed that the largest group consisted of patients with a disease duration of one year (16 individuals), while the smallest groups were those with a duration of 20, 22, 24, and 25 years (from 1 to 3 patients) — Figure 1. The highest concentration is observed within the range of 1–10 years, with the greatest proportion represented by patients with 8–10 years of disease duration. As the duration of the disease increases, a gradual decrease in the number of patients is observed (Figure 1). The mean disease duration was 9.2 years (SD=5.44), with values ranging from 1 to 25 years. The median of 9 years indicates that half of the patients had been living with MS for less than 9 years and half for longer. The 25th percentile was 5 years, and the 75th percentile was 12 years, indicating that most patients had a disease duration between 5 and 12 years. The density curve in the figure indicates an asymmetric distribution, meaning that individuals with a shorter disease duration constitute the majority. Only isolated cases appear above 20 years (Figure 1).

In the studied group, the highest number of patients (23 individuals) obtained an EDSS score of 1.5, indicating a predominance of mild disability levels. The next most frequent scores were 1.0 (20 patients) and 0.5 (19 patients). EDSS values above 5 were rare — each occurred in only 2–3 patients. An EDSS score of 7, indicating a substantial level of disability, was recorded in 2 patients (Figure 2).

Analysis of the Relationship between Disease Duration and EDSS Disability Level

In the studied group, the highest number of patients (23 individuals) obtained an EDSS score of 1.5, indicating a predominance of mild disability levels. The next most frequent scores were 1.0 (20 patients) and 0.5 (19 patients). EDSS values above 5 were rare — each occurred in only 2–3 patients. An EDSS score of 7, indicating a substantial level of disability, was recorded in 2 patients (Figure 2).

Regarding disability level measured with the EDSS scale, the mean score was 2.46 (SD=1.658). This suggests that patients most commonly experienced mobility limitations, although they were still able to walk

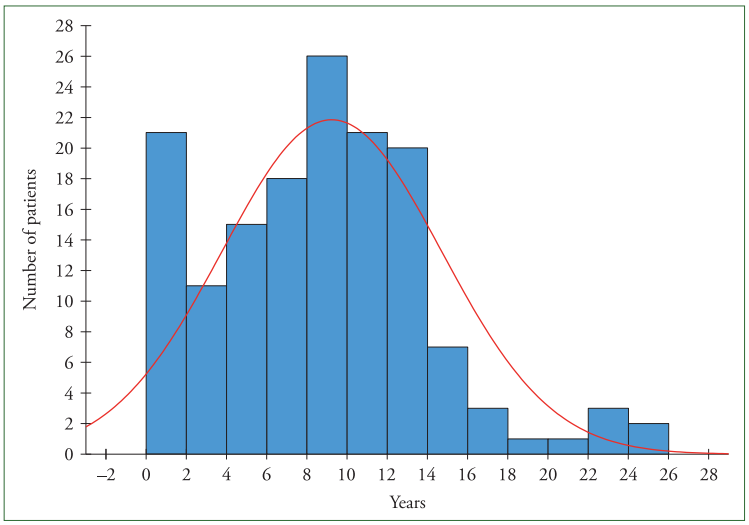


Figure 1. Disease duration in years

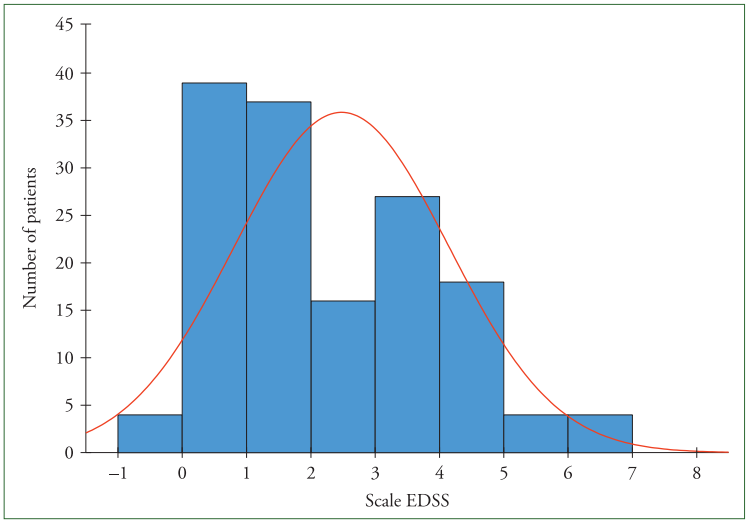


Figure 2. Distribution of disability level on the EDSS scale

independently. EDSS scores ranged from 0 to 7.0, with a median of 2. The interquartile range (1–3.5) indicates that most patients fell within the range of mild to moderate disability (Table 2). The results of the analysis showed that the longer a patient has been living with MS, the higher their level of disability according to the EDSS scale. A low, positive, and statistically significant correlation was found between disease duration and the degree of disability (r=0.185; p=0.024).

Table 2. Descriptive statistics for age, disease duration, and EDSS scores (N=149)

Variable	$\bar{x}$	SD	Me
Current age of patient	46.2	11.40	48.0
Disease duration (years)	9.2	5.44	9.0
EDSS score	2.46	1.66	2.0

$\bar{x}$ — mean; SD — standard deviation; Me — median

Analysis of the Impact of Comorbidities on EDSS Levels

Among the 149 analyzed patients, the distribution of individuals with and without comorbidities was nearly even. Comorbid conditions were present in 70 patients (47.0%), while 79 patients (53.0%) reported none. The most common comorbidities included arterial hypertension, diabetes, thyroid disorders, depressive and anxiety disorders, and other autoimmune diseases (e.g., psoriasis, Hashimoto's disease).

The analysis showed that the presence of comorbid conditions may be associated with increased disability levels among the patients. Patients without additional medical conditions had lower disability levels on the EDSS scale. The mean EDSS score in this group was 2.23, whereas among patients with comorbidities it was 2.71. This difference may suggest that the presence of additional conditions negatively affects patients' functioning and exacerbates their disability. In the group of patients with comorbidities, the median disability level was higher compared with those without comorbid conditions (2.50 vs. 1.50), indicating that half of the patients with comorbidities had an EDSS score equal to or greater than 2.5. Moreover, the quartile values also point to a tendency toward higher scores — 25% of patients with comorbidities had an EDSS of at least 1.0, and 25% reached a level of 4 or higher.

Although the maximum level of disability (EDSS =7.00) and the minimum value (0.00) occurred in both groups — indicating some degree of variability within each — the overall distribution clearly shows a greater severity of functional impairment among individuals with comorbid conditions, as illustrated in Figure 3.

In the Mann–Whitney U test, which compared EDSS disability levels depending on the presence of comorbidities, the result (U=2319.0; p=0.088) indicated no statistically significant difference between the analyzed groups but the result was close to significance.

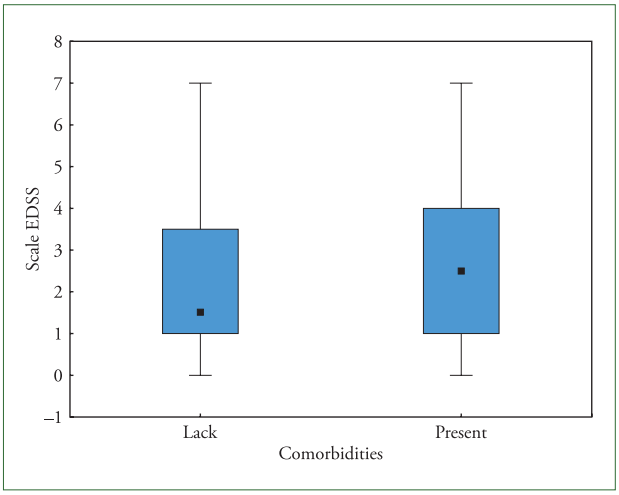


Figure 3. EDSS level in MS patients with or without comorbidities

Assessment of the Relationship between the Use of Different Therapies and the Need for Medication Changes and the Reasons for Such Changes

The analysis of the percentage of patients who required treatment modification indicates that medications such as Mavenclad, Tysabri, Gilenya, Ponvory, and Kesimpta were used almost exclusively after previous therapy (87–100%), meaning they were administered as second- or third-line treatments. In contrast, Betaferon and Avonex were mainly used as initial therapies, with treatment changes occurring in only 0% and 15.4% of cases, respectively. Medications such as Aubagio, Tecfidera, Mayzent, and Ocrevus occupied an intermediate position, being used both as first-line treatments and as part of therapy escalation.

In the case of switching to Aubagio, the most common reason for change was difficulties associated with previous injectable therapies, including fatigue related to frequent injections and skin reactions. This suggests that Aubagio was often introduced as an oral alternative for patients who did not tolerate injectable medications such as Avonex or Betaferon.

Kesimpta, on the other hand, was primarily initiated in response to poor tolerance of previous therapy or in situations involving disease exacerbation, such as relapses or progression of lesions on imaging. This distribution of reasons indicates that Kesimpta served as an escalation therapy, typically used in more aggressive forms of the disease.

Similarly, Tecfidera was frequently selected due to intolerance to earlier treatments, although some therapy changes were also motivated by disease progression. For medications such as Mavenclad and Ponvory, the dominant reasons for switching involved disease progression and insufficient efficacy of previous therapies, confirming their role as higher-efficacy options typically chosen in later lines of treatment.

The analysis of our patient cohort revealed a clear tendency to modify therapy in response both to clinical factors (such as relapses or MRI progression) and non-clinical factors (such as intolerance to the route of administration or adverse effects). These observations indicate that treatment modification decisions are influenced not only by disease activity but also by patient preferences and subjective experiences.

Table 3 presents the EDSS disability levels among patients with MS depending on whether treatment modification occurred. The mean EDSS score was higher in the group of patients who underwent treatment change (2.61) compared with those whose therapy remained unchanged (2.12). The median EDSS was also higher in the treatment-change group (2.25 vs. 1.50), suggesting more advanced disability in patients for whom therapy was modified. Quartile values and maximum scores further confirm greater variability and higher disability levels in the treatment-change group. This may suggest that decisions to modify therapy are more frequently made in patients with more advanced disease (Figure 4).

Table 3. Characteristics of disability level (EDSS) in MS patients depending on treatment modification

Treatment change	N	$\bar{x}$	SD	Me
No	45	2.12	1.56	1.50
Yes	104	2.61	1.68	2.25

N — number of observations; $\bar{x}$ — mean; SD — standard deviation; Me — median

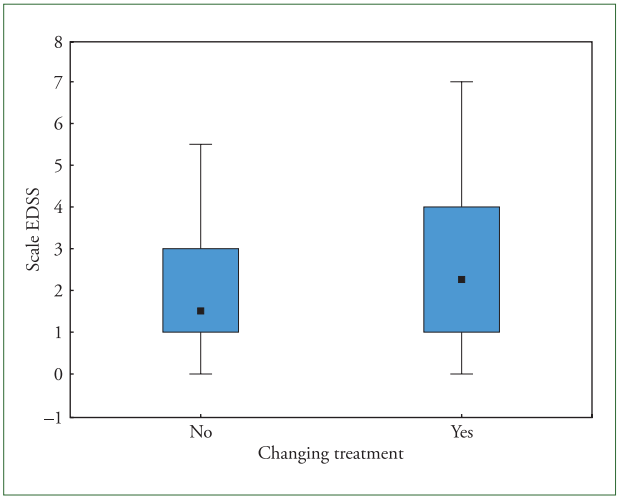


Figure 4. Distribution of disability level (EDSS) depending on treatment modification in patients with multiple sclerosis

The non-parametric Mann–Whitney U test showed no statistically significant difference between EDSS disability levels and treatment modification (U=1945.0; p=0.101). This indicates that treatment change was not significantly associated with a higher level of disability among patients.

Identification of the Prevalence of Emotional Disorders Among Patients with Multiple Sclerosis

The prevalence of emotional disorders among the 149 patients was as follows: the vast majority — 128 individuals (approximately 85.9%) reported no emotional disorders, whereas 21 patients (14.1%) were found to have such conditions. The most frequently emotional disorders included depressive disorders, adjustment disorders, and mixed conditions such as adjustment–depressive and neurotic–adjustment disorders occurring in the course of the disease.

Table 4 present the level of disability, measured using the EDSS scale, in patients with emotional disorders compared with those who did not report such difficulties. The mean EDSS score in the group with emotional disorders was 3.02, whereas in the group without emotional disorders it was 2.37, indicating that patients with emotional symptoms exhibited a higher average level of disability. The median EDSS was also higher in this group (2.5 vs. 2.0), further supporting this trend. Differences were also observed in the quartile values — the 75th percentile in the emotional-disorder group reached 4.5, compared with 3.5 in the group without such disorders. This may indicate greater disability severity among patients with emotional disturbances. The standard deviation was slightly higher in the emotional-disorder group (2.003 vs. 1.584), indicating greater variability in EDSS scores within this subgroup.

Table 4. Characteristics of disability level (EDSS) in MS patients depending on the presence of emotional disorders

Emotional disorders	N	$\bar{x}$ EDSS	SD	Me
No	128	2.37	1.58	2.0
Yes	21	3.02	2.0	2.5

N — number of observations; $\bar{x}$ — mean; SD — standard deviation; Me — median

To verify this observation statistically, the non-parametric Mann–Whitney U test was applied, as it is appropriate for comparing two independent groups without assuming a normal distribution. The obtained U statistic was 1084.0, with a corresponding p-value of

0.154. This indicates that differences in EDSS disability levels between patients with and without emotional disorders are not statistically significant; therefore, it cannot be conclusively stated that the presence of emotional disorders is associated with a higher level of disability.

Summary of Statistical Analysis Results

Spearman's rank correlation analysis revealed a significant positive relationship between disease duration and EDSS score (r=0.185; p=0.024). This indicates that longer disease duration was associated with a higher level of disability. This relationship is statistically significant (p=0.024).

The Mann–Whitney U test showed no statistically significant difference (U=2319.0; p=0.088) between the presence of comorbidities and EDSS disability level. However, this finding is near the threshold of significance, so the possibility of an association cannot be fully excluded. Likewise, the Mann–Whitney U test showed no statistically significant difference (U=1945.0; p=0.101) between treatment modification and EDSS scores, suggesting that treatment change was not associated with a higher level of disability.

In the case of emotional disorders, no statistically significant difference was found (U=1084.0; p=0.154) between the presence of emotional disturbances and disability level on the EDSS scale.

Discussion

The conducted study, based on the analysis of medical records of patients with multiple sclerosis, confirmed the multidimensional nature of the disease and the close interrelations between its clinical manifestations, comorbidities, disability, and quality of life [2]. The results not only corroborate previous observations but also highlight areas requiring broader clinical and systemic consideration.

In the analyzed sample, women constituted the clear majority (79.9%), which is consistent with epidemiological data showing a predominance of females in the MS population [6–8]. According to the Polish Ministry of Health, the prevalence of MS is more than twice as high in women as in men (21.5 vs. 9.4 per 10,000) [6]. Orton et al., in an analysis of birth cohorts spanning more than 50 years, demonstrated that the female-to-male ratio has systematically increased over time, reaching values exceeding 3.2:1 in the most recent cohorts [7]. Likewise, in a nationwide analysis conducted in Scotland (Kearns et al.), the average female-to-male ratio was 2.3:1, with notable regional variability — from 1.0:1 to 4.2:1 [8].

The age distribution showed that the dominant group consisted of middle-aged patients (46–57 years), reflecting the natural course of MS — typically beginning in early adulthood and leading to progressively increasing disability over time. In the present study, the highest concentration of cases was observed within the range of 1–10 years after diagnosis, which aligns with the observations of Koch-Henriksen and Sørensen [9], who reported that most patients experience the most intensive disease progression during the first 10–15 years following diagnosis. Similar findings were reported by Leray et al. [10] and Confavreux and Vukusic [11], who analyzed large French cohorts and confirmed that the first decade to decade and a half of disease duration is characterized by the highest frequency of relapses and accumulation of disability.

Furthermore, in a study conducted by Lefort et al. [12], the mean time to reach an EDSS score of 3.0 was approximately 10 years and 10 months over a 15-year follow-up period. This study [12], which focused on patients receiving early first-line treatment, provides valuable insight into long-term disability progression in individuals with multiple sclerosis.

In a study conducted in Poland by Kapica-Topczewska et al. [13], involving patients with MS receiving early first-line treatment, the results showed that the dominant group consisted of individuals with mild disability, with the largest subgroup scoring between 0.5 and 1.5 on the EDSS scale. Only a few patients demonstrated values above 5. These findings suggest that early treatment may contribute to maintaining a low level of disability among patients.

In the present analysis, a significant correlation between disease duration and higher EDSS values was confirmed (r=0.185, p=0.024), which is consistent with the observations of Stanikić et al. [14], who indicated that both age and disease duration are the main factors determining increasing disability. Similar results were found in multicenter studies [15]. Analysis of registry data from Sweden, Canada, and the United Kingdom showed a moderate correlation between disease duration and EDSS score (r=0.46, 95% CI: 0.45–0.47), as well as between patient age and EDSS score (r=0.44, 95% CI: 0.43–0.45) [15].

In the studied population, nearly half of the patients (47.0%) had at least one comorbidity, most commonly arterial hypertension, type 2 diabetes, thyroid disorders, and depressive or anxiety disorders. Although the statistical analysis did not demonstrate significant differences in EDSS levels between patients with and without comorbidities, it's worth noting that the median EDSS score was higher in the comorbidity group (2.5 vs. 1.5). These results may suggest that the presence of comorbidities constitutes an additional burden for patients, worsening their functional status and quality

of life. This phenomenon may have both clinical and social implications, highlighting the need for a comprehensive approach to the treatment and rehabilitation in this group of patients.

In a large study by Salter et al. [16], comorbidities were found to have a significant impact on disability progression in patients with MS. In this study, involving over 16,794 patients, the presence of ≥3 comorbidities increased the risk of disease progression and relapse occurrence [16]. Although the present findings indicate a similar trend.

Our findings showed that patients who underwent treatment modification (primarily due to lack of efficacy or adverse effects) had higher EDSS scores than those who remained on their initial therapy, although this difference was not statistically significant. Similar observations were reported by Brieva et al. [17], who noted that decisions to modify therapy are more frequently made in patients with a more advanced course of MS.

In our study, emotional disorders were identified in 14.1% of patients, and individuals with such disorders had slightly higher EDSS scores than those without emotional difficulties (3.02 vs. 2.37).

Based on the obtained results, it can be concluded that only disease duration had a statistically significant impact on disability in patients with MS. However, the potential influence of comorbidities and emotional disorders on disability should not be overlooked. The lack of statistical significance in the case of emotional disorders indicates the need for further research in this area, preferably on a larger cohort and with the use of additional diagnostic tools. Although the observed results did not reach statistical significance, they indicate a tendency for comorbidities and emotional disorders to influence disability in MS patients, which is consistent with existing literature [18–21]. In the study by Hanna and Strober [18], 24% of patients reported depressive symptoms and 22% reported anxiety symptoms, both of which strongly correlated with lower quality of life. Bejer and Ziemba [19] demonstrated that the presence of emotional disorders significantly reduces patients' subjective assessment of health and physical functioning. Berrigan et al. [20] found a high prevalence of hypertension, hyperlipidemia, and chronic pulmonary diseases among patients with MS. These findings emphasize the importance of monitoring and treating comorbidities to improve clinical outcomes in individuals with MS.

The conducted study confirms the need for a comprehensive and interdisciplinary approach to the care of patients with multiple sclerosis. Analyzing the interrelationships between disease duration, disability level, comorbidities, and emotional disorders enables better therapeutic planning and facilitates tailoring treatment to the individual needs of patients.

The obtained data may serve as a foundation for further research on the effectiveness of psychosocial support programs and may contribute to the development of systemic recommendations for the care of individuals with MS, taking into account both medical and psychosocial aspects.

Conclusions

1. The analysis demonstrated a significant relationship between disease duration and disability as measured by the EDSS scale. Longer disease duration is associated with a higher level of disability.
2. The presence of comorbidities showed a tendency to influence disability levels in patients with MS as measured by the EDSS scale, although the association did not reach statistical significance.
3. In the studied sample, treatment modification was most commonly related to insufficient efficacy of previous therapy or the occurrence of adverse effects, and it did not show a significant association with higher disability levels on the EDSS scale.
4. No statistically significant relationship was found between emotional disorders and the level of disability measured by the EDSS. However, patients with emotional disorders had higher mean EDSS scores than those without such disorders (3.02 vs. 2.37), although this difference did not reach statistical significance.

Implications for Nursing Practice

1. Although comorbidities did not show a statistically significant relationship with disability, the observed tendency suggests that nurses should conduct comprehensive health assessments, taking into account coexisting diseases. Effective nursing care should include monitoring chronic conditions, promoting adherence to treatment, and supporting patients in managing comorbidities to maintain overall health and quality of life.
2. As treatment modifications were most often related to insufficient therapeutic efficacy or adverse effects, nurses play an important role in monitoring treatment tolerance and effectiveness. Systematic observation of patient responses to therapy, early identification of side effects, and effective communication with the multidisciplinary team may contribute to more individualized and safer treatment strategies.
3. Even though no significant relationship was found between emotional disorders and disability level, their higher frequency among patients with poorer

motor functioning suggests the need for routine psychosocial assessment. Nurses should pay attention to early signs of emotional distress, provide psychological support, and, when necessary, refer patients for specialized mental health care.

4. The results highlight the importance of holistic, patient-centered nursing care in multiple sclerosis, integrating physical, psychological, and social aspects of health. Nursing interventions should also focus on patient education, self-management strategies, and support for maintaining independence and quality of life throughout the disease course.

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