


# The Role of Stress Perception and Coping with Stress and the Quality of Life Among Multiple Sclerosis Patients

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**Purpose:** Multiple sclerosis (MS) is one of the most common neurological disorders and a cause of disability in young adults. Adequate stress management in MS patients may merit the benefits of both physical and psychological well-being. This study aimed to evaluate the quality of life in MS patients and its correlation with stress levels and coping strategies.

**Methods:** This descriptive and correlational study was conducted among 109 patients diagnosed with relapsing-remitting MS (RRMS). The study was based on a questionnaire designed by the authors and the following standardized questionnaires: the Perceived Stress Scale (PSS-10), the Inventory for Measuring Coping with Stress (Mini-COPE), and the Multiple Sclerosis International Quality of Life Questionnaire (MusiQoL).

**Results:** Data analysis showed that 47.71% of the patients experienced a high level of stress, and the most often used strategies under challenging situations included seeking emotional support (2.11) and active coping (1.96). Also, it showed that when the level of stress is higher, the QOL in all domains is lower. Coping strategies such as sense of humor, turning to religion, self-distraction, denial, venting, substance use, behavioral disengagement, and self-blame are negatively correlated with the quality of life of MS.

**Conclusion:** Quality of life in MS patients is negatively affected by a higher level of perceived stress. The use of coping strategies such as active coping, positive reframing, acceptance, and seeking emotional and instrumental support is positively correlated with the quality of life of MS patients.

**Keywords:** multiple sclerosis, stress perception, coping with stress, quality of life

## Introduction

Multiple sclerosis (MS) is one of the most common neurological disorders and a cause of disability for young adults. It is a chronic, progressive, inflammatory, and demyelinating disease of the central nervous system that increases incidence and prevalence globally.<sup>1,2</sup> Based on the third edition of Atlas Reports is estimated that in the world live over 2.8 million patients with MS (35.9 per 100,000 population). Most people with MS are diagnosed between the age of 20 and 40.<sup>3</sup> Pediatric MS is rare and makes up approximately 2–10% of total patients with MS.<sup>4</sup> The disease affects women two to three times more than men.<sup>5,6</sup>

The etiology of MS is still unknown.<sup>7</sup> A genetic predisposition with specific HLA-DRB1\*15 region and many factors are involved in the pathogenesis of the disease.<sup>6,8–10</sup> The pathology of MS is characterized by two main processes inflammation and neurodegeneration.<sup>11</sup> The symptoms of the disease are varied and

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depend on which areas of the brain or spinal cord are affected.<sup>12,13</sup> Typical signs of MS include loss of motor and sensory function, the problem with bowel or bladder control, sexual dysfunction, fatigue, blindness due to optic neuritis, diplopia, imbalance, cognitive impairment, and emotional changes. The most common subtype of MS is a relapsing-remitting form (RRMS), which accounts for approximately 80% of all MS cases. The RRMS is characterized by relapse (acute neurological symptoms) and periods of relative clinical stability (remissions).<sup>14,15</sup>

The patients with MS have a lower quality of life (QOL) comparing to a healthy population.<sup>16,17</sup> The low QOL depends on multiple factors, especially chronic disease, fatigue, pain, and cognitive impairments. One of the factors that play a primary role in the quality of life is stress.<sup>18</sup> Based on the probably first definition proposed by Hans Selye, stress is a non-specific response of the body to any demand.<sup>19,20</sup> Cohen et al<sup>21</sup> defined stress as a process in which environmental factors strain an organism's adaptive capacity resulting in both psychological demands and biological changes. Stressors factors can be different, including an event in the environment or psychological consequences. Stress is every fact of life or disease that we must all deal with. According to the DSM-IV definition, acute stress occurs after months of exposure to a traumatic event and has a significant impact on the person.<sup>22</sup>

The stress is chronic when the exposure to stressor factors continues above 48 hours. Responses to stress are ultimately based on the predispositions of the individual organism. The connection between stress and MS is well known and complex.<sup>23–26</sup> Many studies suggest that stress is more common in patients with MS than in the general population.<sup>27</sup> Firstly, newly diagnosed MS patients commonly experience increased levels of psychological distress. During the disease, patients are exposed to many stressors, such as the unpredictability of disease, symptoms, the risk of relapse, the side effects of treatment, changes in interpersonal relationships, daily activities, and employment.<sup>28</sup> Some studies demonstrated that patients with MS with higher levels of disability had higher stress intensity.<sup>29,30</sup> Some symptoms (like pain, fatigue) are not visible to other people and can cause people with MS to feel misunderstood by others. These problems in daily life can lead to anxiety and depression symptoms and affect the quality of life.<sup>17,31,32</sup> Many patients with MS feel a connection between stress life and the course of the disease.

Most patients believe that stress can cause exacerbations.<sup>33</sup> Some studies showed the association between stress and worsening disease.<sup>34,35</sup> The association between stress and the exacerbation of neurological symptoms is well documented. Golan et al<sup>36</sup> demonstrated that war stress was associated with increased risk for MS exacerbations. Also, Mohr et al<sup>33</sup> suggest that is an association between MS exacerbation and stressful life events. Some studies report exacerbations after several weeks after the onset of stress.<sup>24,37,38</sup> Stressful events or perceived stress may be linked to the development of new Gd+ MR lesions.<sup>39</sup> In the study of Burns et al<sup>40</sup> showed that major negative, stressful events were associated with increased risk for subsequent Gd+ and new or enlarging T<sub>2</sub> lesions, while positive stressful events were associated with decreased.

This relationship is followed by stress-induced inflammatory factors (eg, TNF $\alpha$ , IFN $\gamma$ ), which influence the nerve conductance of demyelinated axons.<sup>35,41</sup> The influence of stress on the disease course could be explained by alterations in the stress-response systems of the hypothalamic-pituitary-adrenal axis and autonomic nervous system.<sup>42,43</sup> In MS, the hypothalamic-pituitary-adrenal axis hyperactivity is observed, reducing the sensitivity of lymphocytes on glucocorticoid.<sup>44</sup> The research suggests that psychological and neural stress impact neurodegeneration and may lead to atrophy of grey matter in MS patients. In the study Meyer-Arnst<sup>45</sup> based on results of functional MRI, the stress was negatively related to brain atrophy. Some studies have shown that disease-related chronic stressors do not increase the possibility of attacks in MS patients than acute stressors, creating more pressure and having a more significant impact.<sup>46</sup> Also, in contrast to other publication Nisipeanu et al<sup>47</sup> found that stress was connected with decreased risk of exacerbation.

Patients with MS have developed a lot of techniques and strategies for taming stress. Adequate stress management in MS patients may merit benefits of both physical and psychological well-being. The ability of a patient to control the stress by leading a healthy life and avoiding stressful situations, and modify their behavior and reaction to stressors is crucial.<sup>48</sup> Much sleep, physical activity (like yoga, tai chi), thinking patterns, relaxation, deep breathing are the stress reducers.<sup>49</sup> The ability to relax during exposition on stress factors is connected with higher QOL and lower level of anxiety and depression in patients with MS.<sup>50,51</sup> Some studies showed evidence of these strategies having a positive impact on the physical and mental health of patients with

MS.<sup>52–55</sup> Progressive muscle relaxation (PMR) and autogenic training, reflexology has a good influence on the health-related quality of life and well-being in MS.<sup>56–58</sup> Also, a variety of psychological interventions ranging from mindfulness-based and cognitive-behavioral approaches can improve the quality of life and mental health of patients with MS.<sup>59</sup> Patients who use less emotional coping strategies assess their HRQoL highly.<sup>60</sup>

The factors that contribute to HRQoL in MS are both disease-related and person-specific. High levels of perceived stress and use some coping strategies are the factors that are negatively affecting QoL in MS.<sup>61</sup> Their identification is essential; therefore, the aim of the study was the assessment of the quality of life in patients with MS by different independent variables (sex, age, place of residence, marital status, education, the time since the diagnosis) and its association with the level of stress and its management techniques.

## Methods

### Study Participants

A cross-sectional descriptive design with a questionnaire survey was used. The study included 109 patients with a relapsing-remitting form of MS (RRMS), with a mean age of 37.45 years, treated at a neurological health center in Wrocław, Poland. Data were collected between December 2019 and March 2020. The study follows the Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) recommendations for observational studies reporting.

The inclusion criteria were as follows: (1) a confirmed diagnosis of MS based on McDonald Criteria 2010 or 2017 (depending on the time of diagnosis), (2) a stable MS disease without any episodes of relapse within 30 days before the study, (3) being over 18 years old, (4) being treated with a disease-modifying therapy (DMT) (5) written informed consent to participate in the study. The exclusion criteria were as follows: (1) participants without a confirmed diagnosis of MS, (2) participants with a confirmed diagnosis of RRMS but without treatment with first-line DMT, (3) patients unable to follow the test instructions, (4) psychiatric comorbidities, and (5) lack of written consent to participate in the study.

### Ethical Considerations

The research project was approved by the Bioethics Committee of Wrocław Medical University, Poland

(permission no. KB–10/2020). Participation in the study was anonymous and voluntary. All patients were informed about the study, and their written consent to participate in the study was required. The study was carried out following the Declaration of Helsinki and Good Clinical Practice guidelines.

### Data Collection

The respondents were qualified to participate in this study based on the inclusion and exclusion criteria during each check-up visit to the neurological center, where they received their DMTs for the next month. Afterward, they received traditional self-administered pencil-and-paper questionnaires, designed to be completed in approximately 20 minutes. Researchers also gained access to the complete medical records of the patients. A total of 125 surveys were returned, but only 109 were completed correctly.

### Research Tools

In the study, the diagnostic survey method was used, along with the authors' questionnaire (AQ), as well as the following standardized questionnaires: the 10-item Perceived Stress Scale (PSS-10),<sup>62</sup> the Inventory for Measuring Coping with Stress (Mini-COPE),<sup>63</sup> and the Multiple Sclerosis International Quality of Life Questionnaire (MusiQoL).<sup>64</sup>

#### Authors' Questionnaire (AQ)

The questionnaire included a survey designed by the authors, which comprised questions concerning socio-demographic data (ie, sex, age, place of residence, marital status, education) and clinical data (ie, time from the diagnosis and duration of DMT).

#### 10-Item Perceived Stress Scale (PSS-10)

In the Polish adaptation,<sup>62</sup> it is a research tool that employs self-report to measure the degree to which situations in one's life are considered stressful. The scale consists of 10 questions describing subjective feelings related to personal problems, emotional states, current levels of experienced stress, and possibilities of controlling one's own life. Individual scores on the PSS range from 0 to 40, with higher scores indicating greater perceived stress. After transformation into standardized sten scores, results from 1 to 4 sten scores are considered low perceived stress, from 7 to 10 as high, and 5 and 6 as average perceived stress. Cronbach's alpha for the Polish version is 0.86, and for the original PSS-10, 0.84.

## Inventory for Measuring Coping with Stress (Mini-COPE)

In order to determine stress-coping strategies, the Polish version of the MiniCOPE was applied.<sup>63</sup> The Mini-COPE consists of 28 statements, which are divided into 14 categories of coping with stress: active coping, planning, positive reframing, acceptance, sense of humor, turning to religion, seeking emotional support, seeking instrumental support, self-distraction, denial, venting, substance use, behavioral disengagement, and self-blame.

## Multiple Sclerosis International Quality of Life Questionnaire (MusiQoL)

The MusiQoL is a research tool aimed at assessing the quality of life of MS patients. It contains 31 questions concerning the patient's life during the last four weeks, with the following verbal answers: never, rarely, sometimes, often, always, not applicable. The MusiQoL questionnaire makes it possible to assess the quality of life of MS patients in 10 domains: ADL – activities of daily living, PWB – psychological well-being, RFr – relationships with friends, SPT – symptoms, RFa – family relationships, RHCS – satisfaction with the healthcare system, SSL – sentimental and sexual life, COP – coping, REJ – rejection, and Total – overall quality of life.

The quality of life in each domain is expressed by a number, ranging from 0 to 100—the higher the number, the better the quality of life. No norms exist in the case of MusiQoL, and as such, it is impossible to say whether the respondents' results indicate high or low quality of life; one can only compare the individual domains with each other to identify the areas of the high and low quality of life. The dimensions of the scale exhibited high internal consistency (Cronbach's alpha between 0.67 and 0.90 for the Polish version).<sup>64</sup>

## Data Analysis

The analysis of quantitative variables (ie, expressed numerically) was conducted by calculating the mean, standard deviation, median, quartiles, minimum, and maximum. The analysis of qualitative variables (ie, not expressed numerically) was performed by calculating the number and percentage of occurrences of each value. The comparison of the values of quantitative variables in the two groups was performed using the Mann–Whitney test. The comparison of the values of quantitative variables in three and more groups was performed using the Kruskal–Wallis test. A post-hoc Dunn's test was performed to

identify statistically significantly different groups when statistically significant differences were detected. Correlations between quantitative variables were analyzed using Spearman correlation coefficient. A significance level of 0.05 was assumed in the analysis. Thus, all *p* values below 0.05 were interpreted as indicating significant correlations.

## Results

### Participants' Characteristics

A total of 109 participants with RRMS took part in the study to evaluate the relationship between stress intensity and coping methods and the quality of life. The most numerous group was composed of females, namely 64.22%, persons aged 31–40 (35.78%), with secondary education (44.04%). The average time from MS diagnosis was 9.63 years, while the drug program participation was 4.71 years. As many as 68.81% of patients declared that they know support groups, while 27.52% regularly use this form of assistance. Detailed characteristics of the study group are presented in Table 1.

### Stress Level

Analysis of the obtained data showed that 47.71% of the patients experienced high-stress levels, 34.86% had low-stress levels, and 17.43% experienced moderate stress. We also found that stress level was significantly higher among divorced and widowed individuals (24.77) than singles (18.38) or married persons (17.03) (*p*=0.001). Non-working individuals experienced more severe stress (22.21) than working ones (18.27); however, the difference was on the borderline of significance (*p*=0.05). There were no statistically significant differences in the level of stress intensity due to other socio-demographic characteristics.

### Stress-Coping Strategies

Analysis of the obtained data showed that under challenging conditions, MS patients most often used the strategies of seeking emotional support (2.11) and active coping (1.96). On the other hand, the least frequently used coping mechanisms included turning to religion (0.48) and substance use (0.6). We also found that: (1) with age, the strategies of positive reframing, sense of humor, turning to religion, seeking instrumental support, denial, venting, substance use, and behavioral disengagement are used more frequently; (2) with more time following the diagnosis, patients are less likely to use the planning strategy;

**Table 1** Characteristics of the Study Group

| Variable                                | Value                   |
|---|-------------------------|
| Age [years], mean $\pm$ SD              | 37.45 $\pm$ 9.66        |
| Sex, n (%)                              |                         |
| Female                                  | 70 (64.22)              |
| Male                                    | 39 (35.78)              |
| Education, n (%)                        |                         |
| Basic or vocational education           | 21 (19.27)              |
| Secondary education                     | 48 (44.04)              |
| Higher education                        | 38 (34.86)              |
| Place of residence, n (%)               |                         |
| Village                                 | 86 (79.81)              |
| City                                    | 22 (20.19)              |
| Marital status, n (%)                   |                         |
| Single                                  | 29 (26.61)              |
| Married                                 | 58 (53.21)              |
| Widowed                                 | 4 (3.67)                |
| Divorced                                | 18 (16.51)              |
| Professional activity, n (%)            |                         |
| Study                                   | 2 (1.83)                |
| Employed                                | 90 (82.57)              |
| Disability or retirement pension        | 1 (0.92)                |
| Unemployed                              | 16 (14.68)              |
| Clinical type of MS, n (%)              |                         |
| RRMS                                    | 109 (100)               |
| SPMS                                    | 0 (0)                   |
| PPMS                                    | 0 (0)                   |
| PRMS                                    | 0 (0)                   |
| Disease duration                        |                         |
| 0–5 years                               | 36 (33.03)              |
| 6–10 years                              | 26 (23.85)              |
| > 10 years                              | 47 (43.11)              |
| Using DMT                               |                         |
| Yes                                     | 109 (100)               |
| No                                      | 0 (0)                   |
| DMT duration                            |                         |
| 0–4 years                               | 59 (54.12)              |
| 5–8 years                               | 40 (36.69)              |
| 9–12 years                              | 10 (9.17)               |
| PSS-10, mean $\pm$ SD (min–max)         | 18.82 $\pm$ 7.46 (8–24) |
| Stress-coping strategies, mean $\pm$ SD |                         |
| Active coping                           | 1.96 $\pm$ 0.65         |
| Planning                                | 1.79 $\pm$ 0.71         |
| Positive reframing                      | 1.66 $\pm$ 0.83         |
| Acceptance                              | 1.91 $\pm$ 0.66         |
| Sense of humor                          | 0.65 $\pm$ 0.71         |
| Turning to religion                     | 0.48 $\pm$ 0.74         |

(Continued)

**Table 1** (Continued).

| Variable                     | Value           |
|------------------------------|-----------------|
| Seeking emotional support    | 2.11 $\pm$ 0.9  |
| Seeking instrumental support | 1.97 $\pm$ 0.9  |
| Self-distraction             | 1.72 $\pm$ 0.77 |
| Denial                       | 0.94 $\pm$ 0.96 |
| Venting                      | 1.86 $\pm$ 0.69 |
| Substance use                | 0.6 $\pm$ 0.79  |
| Behavioral disengagement     | 0.88 $\pm$ 0.72 |
| Self-blame                   | 1.36 $\pm$ 0.85 |

**Abbreviations:** MS, multiple sclerosis; n, number of participants; SD, standard deviation; PSS-10, 10-item Perceived Stress Scale; DMT, disease modifying therapy; RRMS, relapsing-remitting MS; SPMS, secondary progressive MS, PPMS, primary progressive MS, PRMS, progressive relapsing MS.

(3) with longer treatment time, patients are more likely to use positive reframing, sense of humor, and seeking instrumental support; (4) females use planning, positive reframing, turning to religion, seeking instrumental support, self-distraction, and venting significantly more often than males; (5) individuals with primary, lower secondary, and vocational education are considerably more likely than those with higher education to turn to substance use; (6) married individuals were significantly more likely to use positive reframing and seeking emotional support than individuals in other groups; (7) residents of rural areas were significantly more likely to turn to substance use than those living in large cities; and (8) professionally inactive individuals were significantly more likely to employ sense of humor, denial, venting, substance use, behavioral disengagement, and self-blame as stress coping strategies (Table 2 and [Supplementary Table 1](#)).

## Quality of Life

The overall quality of life index in the study group averaged 65.39 points out of 100 and ranged from 27.43 to 96.18 points (MusiQoL). The highest self-rated quality of life included RFa (81.37), RFr (69.83), and REJ (69.04) domains. The lowest quality of life was reported in COP (51.72) and PWB (55.67).

In psychological well-being (PWB) and coping (COP), males reported a higher quality of life than females (64.9 vs 50.45,  $p=0.001$ , and 62.18 vs 45.89,  $p<0.001$ ). Also, age correlates with quality of life scores - the older the patient the lower the quality of life in the MusiQoL total score ( $r=-0.338$ ,  $p<0.001$ ), with ADL ( $r=-0.3$ ,  $p=0.002$ ), PWB ( $r=-0.315$ ,  $p=0.001$ ), RFr  $r=-0.369$ ,  $p<0.001$ ), SPT ( $r=-0.403$ ,  $p<0.001$ ), RHCS  $r=-0.342$ ,  $p<0.001$ ), and SSL



**Table 2** Correlations Between Age, Disease Duration, DMT Duration and Coping Strategies in MS Patients

| Mini-COPE                    | Age                              | MS Duration              | DMT Duration            |
|------------------------------|----------------------------------|--------------------------|-------------------------|
|                              | Spearman Correlation Coefficient |                          |                         |
| Active coping                | $r=-0.022$ , $p=0.82$            | $r=-0.12$ , $p=0.222$    | $r=-0.144$ , $p=0.31$   |
| Planning                     | $r=-0.091$ , $p=0.347$           | $r=-0.197$ , $p=0.044$ * | $r=-0.133$ , $p=0.349$  |
| Positive reframing           | $r=0.313$ , $p=0.001$ *          | $r=0.206$ , $p=0.035$ *  | $r=0.275$ , $p=0.049$ * |
| Acceptance                   | $r=-0.158$ , $p=0.102$           | $r=-0.11$ , $p=0.265$    | $r=-0.066$ , $p=0.64$   |
| Sense of humor               | $r=0.426$ , $p<0.001$ *          | $r=0.328$ , $p=0.001$ *  | $r=0.373$ , $p=0.006$ * |
| Turning to religion          | $r=0.333$ , $p<0.001$ *          | $r=0.124$ , $p=0.209$    | $r=0.06$ , $p=0.671$    |
| Seeking emotional support    | $r=0.154$ , $p=0.112$            | $r=0.126$ , $p=0.199$    | $r=0.161$ , $p=0.255$   |
| Seeking instrumental support | $r=0.266$ , $p=0.005$ *          | $r=0.291$ , $p=0.003$ *  | $r=0.3$ , $p=0.031$ *   |
| Self-distraction             | $r=0.056$ , $p=0.562$            | $r=-0.089$ , $p=0.368$   | $r=-0.085$ , $p=0.55$   |
| Denial                       | $r=0.462$ , $p<0.001$ *          | $r=0.283$ , $p=0.003$ *  | $r=0.159$ , $p=0.259$   |
| Venting                      | $r=0.251$ , $p=0.009$ *          | $r=0.198$ , $p=0.043$ *  | $r=-0.006$ , $p=0.966$  |
| Substance use                | $r=0.361$ , $p<0.001$ *          | $r=0.248$ , $p=0.011$ *  | $r=0.169$ , $p=0.232$   |
| Behavioral disengagement     | $r=0.224$ , $p=0.02$ *           | $r=0.037$ , $p=0.709$    | $r=-0.009$ , $p=0.95$   |
| Self-blame                   | $r=0.06$ , $p=0.535$             | $r=-0.056$ , $p=0.57$    | $r=-0.218$ , $p=0.12$   |

**Note:** \* Statistically significant correlation ( $p<0.05$ ).

**Abbreviations:** MS, multiple sclerosis, Mini-COPE, Inventory for Measuring Coping with Stress; DMT, disease modifying therapy.

$r=-0.268$ ,  $p=0.005$ ). The quality of life in the domain of sentimental and sexual life (SSL) is significantly higher in those with higher education compared to those with secondary education (72.04 vs 57.29,  $p=0.038$ ). In all domains except for rejection (REJ), it was significantly higher in unmarried and married individuals than in divorced and widowed persons. Subjects from large cities rated their quality of life in terms of relationships with friends (RFR) (88.1 vs 69.3,  $p=0.027$ ), family relationships (RFa) (77.68 vs 66.67,  $p=0.003$ ), satisfaction with the healthcare system (RHCS) (70.83 vs 62.5,  $p=0.028$ ), and sentimental and sexual life (SSL) (69.64 vs 42.5,  $p=0.021$ ) significantly higher than those living in rural areas. Quality of life in total MusiQoL (67.37 vs 55.23,  $p=0.005$ ), ADL (66.42 vs 53.78,  $p=0.034$ ), PWB (57.44 vs 47.37,  $p=0.029$ ), RFR (72.13 vs 58.33,  $p=0.023$ ), SPT (65.1 vs 55.9,  $p=0.038$ ), RFa (84.47 vs 66.2,  $p=0.008$ ), and SSL (66.99 vs 44.74,  $p=0.018$ ) was significantly higher in the professionally active group. We also found that the longer the time from MS diagnosis, the higher the quality of life in REJ ( $r=0.223$ ,  $p=0.022$ ) and lower in RFR ( $r=-0.27$ ,  $p=0.006$ ) and SPT ( $r=-0.32$ ,  $p=0.001$ ). Also, the longer the participation in a drug program, the higher the patients rated their quality of life in REJ ( $r=0.344$ ,  $p=0.012$ ).

## Variable Correlations

The correlations between the PSS 10 questionnaire results and all MusiQoL, Mini COPE questionnaire domains were shown in [Table 3](#). The patients, who more frequently

employed active coping, seeking emotional support, and seeking instrumental support, reported a higher quality of life (MusiQoL total). In contrast, patients, who were more likely to use coping strategies such as sense of humor, turning to religion, denial, venting, substance use, behavioral disengagement, and self-blame rated their quality of life lower (MusiQoL total). Detailed data are presented in [Supplementary Table 2](#).

## Discussion

We investigated whether perceived stress and emotion-related coping strategies may indicate a poor adjustment to MS.<sup>65</sup> Patients with MS appear unable to integrate peripheral stress signals into their perception of relaxation.<sup>66</sup> Blunted neural and psychological stress processing have a detrimental effect on the course of MS<sup>45</sup> and, consequently, can decrease quality of life.

In this study, the mean stress level was 18.88, consistent with the results reported by other authors.<sup>67–71</sup> Ifantopoulou<sup>72</sup> showed that elderly individuals more often than younger ones and MS patients with tertiary education more frequently than those with secondary education reported significantly higher stress levels. However, this was not confirmed in our study. Among the socio-demographic variables, only marital status and occupational status significantly differentiated the respondents regarding the level of perceived stress.

The data analysis showed that MS patients most often used the strategies of seeking emotional support (2.11) and

**Table 3** Correlations Between Stress Intensity Levels and Domains of Quality of Life and Coping Strategies in MS Patients

| Variable                     | PSS-10                           |
|------------------------------|----------------------------------|
|                              | Spearman Correlation Coefficient |
| <b>MusiQoL</b>               |                                  |
| MusiQoL Total                | $r=-0.74, p<0.001 *$             |
| ADL                          | $r=-0.553, p<0.001 *$            |
| PWB                          | $r=-0.647, p<0.001 *$            |
| RFr                          | $r=-0.515, p<0.001 *$            |
| SPT                          | $r=-0.207, p=0.032 *$            |
| RFa                          | $r=-0.471, p<0.001 *$            |
| RHCS                         | $r=-0.516, p<0.001 *$            |
| SSL                          | $r=-0.612, p<0.001 *$            |
| COP                          | $r=-0.567, p<0.001 *$            |
| REJ                          | $r=-0.432, p<0.001 *$            |
| <b>Mini-COPE</b>             |                                  |
| Active coping                | $r=-0.2, p=0.037 *$              |
| Planning                     | $r=-0.144, p=0.135$              |
| Positive reframing           | $r=-0.4, p<0.001 *$              |
| Acceptance                   | $r=-0.276, p=0.004 *$            |
| Sense of humor               | $r=0.136, p=0.157$               |
| Turning to religion          | $r=0.174, p=0.071$               |
| Seeking emotional support    | $r=-0.425, p<0.001 *$            |
| Seeking instrumental support | $r=-0.32, p=0.001 *$             |
| Self-distraction             | $r=0.195, p=0.042 *$             |
| Denial                       | $r=0.568, p<0.001 *$             |
| Venting                      | $r=0.396, p<0.001 *$             |
| Substance use                | $r=0.422, p<0.001 *$             |
| Behavioral disengagement     | $r=0.71, p<0.001 *$              |
| Self-blame                   | $r=0.751, p<0.001 *$             |

**Note:** \* Statistically significant correlation ( $p<0.05$ ).

**Abbreviations:** PSS-10, 10-item Perceived Stress Scale; MusiQoL; Multiple Sclerosis International Quality of Life Questionnaire; Mini-COPE, Inventory for Measuring Coping with Stress; ADL, activities of daily living, PWB, psychological well-being, RFr, relationships with friends, SPT, symptoms, RFa, family relationships, RHCS, satisfaction with the healthcare system, SSL, sentimental and sexual life, COP, coping, REJ, rejection.

active coping (1.96). The studies by Holland et al<sup>73</sup> and Cornero Contentti et al<sup>74</sup> show that the most commonly applied strategies included acceptance and active coping. On the other hand, the least frequently used mechanisms were turning to religion (0.48) and substance use (0.6), which was confirmed in studies by other authors.<sup>73,74</sup>

The overall quality of life index in the study group averaged 65.39 points out of 100 (MusiQoL) and is similar to the results obtained by Farran et al and Nickel et al.<sup>77</sup> In contrast, Beltrán et al<sup>78</sup> reported a significantly higher score (84.1), and this difference may be since the participants in the Colombia study were characterized by good functional status (low EDDS scores) and short disease duration (average 4.8 years). In our study, the highest self-rated quality of life concerned RFa (81.37), RFr (69.83),

and REJ (69.04) domains. In contrast, the lowest quality of life was reported regarding COP (51.72) and PWB (55.67), which is consistent with the results obtained by Koltuniuk et al<sup>79</sup> among female MS patients and Farran et al.<sup>76</sup> On the other hand, in the validation study of the Polish version of the MusiQoL questionnaire, MS patients scored significantly lower on average – 42.5 points, and they rated their quality of life highest in terms of SPT and lowest in RFa. This difference is likely because all patients included in our study suffered from RRMS and were participating in a drug program that translates into better functional ability and the capacity to participate in family and work-life more actively. Previous studies have also shown a link between socio-demographic variables and specific domains of quality of life in MS patients.<sup>64,76,77</sup> For instance, age is negatively correlated with the MusiQoL total score,<sup>76</sup> which was also confirmed in our study. Jamroz-Wisniewska et al<sup>64</sup> and Nickel et al<sup>77</sup> showed that males rated the quality of life in PWB higher than females, which was also confirmed by our study. Our subjects from large cities rated their quality of life in terms of RFr, RFa, RHC, and SSL significantly higher than those living in rural areas. In the study by Jamroz-Wisniewska et al,<sup>64</sup> city-dwelling patients had higher scores than their counterparts who lived in rural areas in ADL, PWB, and SPT.

Our study also indicated that the level of perceived stress negatively correlates with the level of quality of life, which is consistent with the results of Senders et al,<sup>69</sup> Bishop et al,<sup>80</sup> Wollin et al,<sup>81</sup> and Strober et al.<sup>61</sup>

Previous studies have shown that in MS patients, emotion-oriented coping has a negative impact on the quality of life.<sup>60,82,83</sup> and was associated with more significant disability.<sup>73</sup> Strategies such as behavioral disengagement,<sup>61,84</sup> denial,<sup>84</sup> self-controlling,<sup>75</sup> escape avoidance,<sup>75</sup> distancing,<sup>75</sup> social withdrawal,<sup>85</sup> and wishful thinking<sup>85</sup> were also associated with a lower QoL. Our study showed that denial, venting, substance use, and behavioral disengagement strategies were also associated with a lower QoL in MS patients across domains. In contrast, the use of mechanisms based on acceptance and active engagement, such as active coping,<sup>61</sup> planning,<sup>61</sup> humor,<sup>61</sup> problem resolution,<sup>85</sup> emotional and instrumental social support,<sup>61</sup> and acceptance<sup>61,84</sup> were associated with a higher QoL in MS, which was also confirmed in our study.

Frequent use of denial-based coping predicted significantly higher stress severity,<sup>84</sup> consistent with our research and research by Somer et al,<sup>86</sup> who found that denial

coping was related to higher perceived stress and psychological distress. In contrast, higher mental disengagement predicted a higher frequency of stressful events. Also, venting-based coping was significantly correlated with stress severity,<sup>84</sup> which was reflected in our research.

## Study Limitations

The study group could be more extensive and randomly selected. The tools chosen involve self-assessment, which entails the risk of receiving biased data. This study did not have a control group. The approach of testing multiple associations with multiple bivariate correlation analyses is sensitive to the effects of third variable causation.

## Practical Implications

Because MS is a chronic disease that significantly affects both the patient's physical and psychological functioning, professional care should involve the performance of medical procedures and interventions related to the physical condition and assistance aimed at improving the patient's psychological well-being. It is not uncommon for patients to experience high-stress levels, which correlate with perceived life satisfaction. Healthcare providers, especially nursing staff, should support the patient in developing the ability to cope with stress because effective coping strategies in challenging situations, conditioned by the health status, positively impact the QOL of MS patients. It also appears that psychological support should concern the patient and include guidance to the medical staff who directly care for the MS patient and who can contribute through their actions to reduce the level of stress experienced by the patient.

## Conclusions

QOL in MS patients is negatively affected by a higher level of perceived stress. The use of coping strategies such as active coping, positive reframing, acceptance, and seeking emotional support is positively correlated with the quality of life of MS patients.

## Abbreviations

Mini-COPE, Inventory for Measuring Coping with Stress; MS, multiple sclerosis; MusiQoL, Multiple Sclerosis International Quality of Life Questionnaire; PSS-10, Perceived Stress Scale; RRMS, relapsing-remitting MS.

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## Disclosure

The authors have declared no conflicts of interest for this work.

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