Journal of Research in Clinical Medicine

J Res Clin Med, 2024, 12: 13
doi: 10.34172/jrcm.34536
https://jrcm.tbzmed.ac.ir

TUOMS PRESS

Original Article

Evaluation of the COVID-19-induced anxiety role in the self-management of multiple sclerosis (MS) patients

Seyyedeh Tahereh Zolfaghari[1], Seyyed Sina Hejazian[2,3*], Mohammad Hossein Harirchian[4*]

[1]Department of Psychology, Shahrood Azad University, Shahrood, Iran
[2]Neurosciences Research Center (NSRC), Tabriz University of Medical Sciences, Tabriz, Iran
[3]Immunology Research Center, Faculty of medicine, Tabriz University of Medical Sciences, Tabriz, Iran
[4]Iranian Center of Neurological Research, Neuroscience Institute, Imam Khomeini Hospital Complex, Tehran University of Medical Sciences, Tehran, Iran

Article info

Article History:
Received: July 28, 2023
Accepted: November 27, 2023
ePublished: June 15, 2024

Keywords:
Anxiety, COVID19, Multiple sclerosis (MS), Self-management

Abstract

Introduction: Patients' engagement with their own therapeutic process has been reported to be correlated with improved clinical outcomes. A better comprehension of the relationship between self-management in patients with multiple sclerosis (MS) and adjustable psychological features may help clinicians with better solutions for MS patients. We evaluated the role of COVID-19-related anxiety in the self-management of MS patients.

Methods: A total number of 153 patients with MS were included in the study. All patients were assessed using three distinct questionnaires including MS Self-Management Scale-Revised (MSSM-R), Corona Disease Anxiety Scale (CDAS), and Beck Anxiety Inventory (BAI). The resulting scores were used to evaluate the study goals.

Results: MS patients didn't have a high level of COVID-19-related anxiety. General anxiety among the patients was higher than the COVID19-related anxiety. No statistically significant correlation was seen between CDAS and MSSM-R scores ($P=0.377$). The hierarchical multiple regression showed that the BAI score (b=-0.418, $P<0.001$) together with the gender as the control variable (b=0.227, $P=0.0.002$) explained about 24% of the variance in the MSSM-R as the dependent variable. The self-management skills among female married MS patients with a job were drastically higher than in single male patients without a job. Patients with relapsing–remitting multiple sclerosis (RRMS) and lower disability severity had better self-management ($P<0.001$).

Conclusion: Overall, our findings favor that anxiety has a vital role in the self-management skills of patients with MS which can lead to the altered state of an individual's perceived health condition.

Introduction

Multiple sclerosis (MS) is known as a disabling chronic neurological disorder involving the central nervous system. Current therapeutic strategies rely on symptom alleviation and mitigating pathology progression. However, the efficacy of these therapies varies based on the patient's own adherence to the prescribed therapies. Furthermore, various therapeutic adverse effects, absence of satisfactory improvement, symptom exacerbation, or paradoxically, prolonged relapse-free period of disease lead to treatment rejection, absence of follow-up/up visits, therapy noncompliance, nonadherence to the prescribed drugs, and repeated changes of clinician and therapy.[1] This significantly impedes the evaluation of the therapeutic efficacy and usually results in a greater relapse period, critical long-term complications, and enhanced costs of therapy.[2] This is why the low compliance of MS patients to therapy is listed among the priorities of research in this field. Patient self-management is one of the principal concepts in these studies.[3]

Self-management can be described as a person's capability of managing the symptoms, therapies, physical and psychosocial outcomes, and living habits alterations following a chronic disease, active searching for knowledge about their condition and the latest therapeutic choices available, preserving their social relations, and obtaining the appropriate emotional stability.[4] High self-management skills have been shown to be correlated with symptom attenuation in patients with MS. Self-management interventions (SMI) are relatively novel

***Corresponding Authors:** Seyyed Sina Hejazian, Emails: sina.hej95@gmail.com, sina.hej@yahoo.com and Mohammad Hossein Harirchian, Emails: harirchn@hotmail.com, harirchm@tums.ac.ir

© 2024 The Author(s). This is an open access article distributed under the terms of the Creative Commons Attribution License (http:// creativecommons.org/licenses/by/4.0/), which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly cited.

therapeutic strategies in patients with MS, and, they have proven efficacy in the management of long-lasting diseases.[5] Although surveys on self-management of MS is still an evolving topic, there is considerable evidence that shows self-management has a positive role in the clinical consequences of MS. It has been also established that better self-management in patients with MS is accompanied by improved outcomes, the ability of patients in handling fatigue and medication adherence.[6,7]

SMIs are also capable of promoting the psychological well-being of the patients.[5] Surprisingly, few surveys have been conducted on self-management-modifying factors in MS patients, especially ones that can be modified like psychosocial determinants such as anxiety. Therefore, the exact effect of anxiety on patients with MS is not clearly known. Moreover, the higher incidence of anxiety among patients with MS (37% during the lifetime) compared to the general population makes it more important to study the effect of anxiety on these patients.[8] COVID-19 was declared as a global pandemic in late 2020 by the WHO[9] and rapidly spread all over the globe. The worry of contracting the infection besides the unknown nature of this condition and its potential lethality even in healthy populations, alongside the strict health policies during the pandemic such as quarantine or lockdowns which caused social distancing, led to dramatic and considerable side-effect on mental health.

It has been previously reported that the prolonged isolation and the uncertain feeling regarding the pandemic are capable of worsening psychological distress.[10] Multiple surveys have revealed that COVID-19 infection has drastic psychosocial consequences such as increased anxiety in people with chronic conditions.[11,12] However, the exact psychological consequences of the COVID-19 infection on MS are still controversial. While some studies have shown elevated psychological distress during the pandemic in these patients,[11,12] others have not.[13,14] Therefore, the goal of this study was to study if potentially modifiable cognitive perceptions like COVID-19-related anxiety an associated with self-management in MS.

Materials and Methods

Participants and procedures

This was a cross-sectional quasi-experimental study and its protocol was reviewed and approved by the Tehran University of Medical Sciences. Verbal informed consent was obtained from participants prior to the study. The study population consisted of 153 patients with MS who were enrolled in cooperation with the Imam Khomeini Hospital, in Tehran, Iran. The data was collected during a three-month period from January 2022 to April 2022. Only patients with all of the following inclusion criteria were enrolled in the study: (1) positive for MS disease confirmed by a neurologist; (2) negative regarding past-30-day relapse to the enrollment; (3) absence of any other underlying disorder; and (4) lack of neurologist-confirmed cognitive disorders. For this purpose, an online questionnaire was uploaded to the online group of patients with MS, and patients were requested to reply to the questions completely. The uploaded questionnaire consisted of four separate parts including the Multiple Sclerosis Self-Management Scale-Revised (MSSM-R), Corona Disease Anxiety Scale (CDAS), Beck Anxiety Inventory (BAI), and general information about the patient which comprised of age, sex, marital status, education, employment, disease duration, type of MS and disease severity. Among the received answers, only patients with all of the inclusion criteria were included in the study (a total of 361 patients participated in the survey, among which 176 were excluded due to lack of inclusion criteria and 28 were excluded due to incomplete data). Verbal briefing and explanation of the survey were delivered to all patients before questionnaire uploading. They were told that their information would stay private and that they would only be asked to respond to the questions with informed permission. Furthermore, all patients were interviewed on the telephone by a research team member in conjunction with a neurologist to evaluate the disease severity and determine their disability subgroup based on the EDSS criteria. As reported by Papuć and Stelmasiak,[15] the study patients were categorized into three subclasses according to their score on the EDSS scale: mild (scores 1.0–3.5), moderate (scores 4.0–6.5) and high physical impairment (scores 7.0–9.5). We exploited the Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) checklist for cross-sectional studies to report the findings of our study.

Measures

In this study, we used the patient's replies to the MSSM-R questionnaire to assess the patient's level of self-management as the dependent variable. Bishop and Frain developed and validated the MSSM-R scale.[4] It comprises 24 items that are scored on a 5-point Likert scale from 1 (totally disagree) to 5 (absolutely agree), making it a viable instrument for assessing self-management. The 21st, 23th and 24th questions of this scale have reverse scoring. The total score varies from 24 to 120 and higher results reflect better self-management skills. Some earlier investigations have supported the revised scale's reliability and validity.[4,16] This self-report instrument has five subscales including healthcare provider relationship and communication (6 items: 9, 12, 14, 16, 18 and 20), treatment adherence/barriers (7 items: 11, 15, 17, 21, 22, 23 and 24), social/family support (3 items: 6, 10 and 13), MS knowledge and information (4 items: 1, 2, 3 and 4) and health maintenance behavior (4 items: 5, 7, 8 and 19). The Persian version of this scale was created and evaluated by Saadat et al,[17] which showed satisfactory face and content validity as well as confirmatory factor analysis. The Cronbach's α coefficient for the overall MSSM-R score

and its subscales varied from 0.70 to 0.89 which indicated an acceptable internal consistency.[17]

CDAS has been developed and validated by Alipour and colleagues to gauge the levels of COVID-19-driven anxiety.[18] This instrument has eighteen items and two subsections (items 1 to 9 represent a mental aspect of anxiety and items 10 to 18 represent a physical aspect of anxiety). CDAS has a 4-point Likert scale from zero (*never*) to three (*always*) and its overall score is rated up to 54. The Cronbach's α coefficient for the mental, physical, and overall questionnaire is 0.879, 0.860, and 0.919, respectively, which shows satisfactory reliability.[18]

BAI measures anxiety and includes 21 statements which are rated based on a 4-point Likert scale. The range of the overall score is 0 to 63. Scores between 0 to 7 indicate a lack of anxiety, scores between 8 to 15 show mild anxiety, scores from 16 to 25 are in favor of moderate anxiety, and scores above 25 demonstrate severe anxiety.[19] BAI was previously translated into Persian by Kaviani et al.[19] They showed high internal consistency, very good validity ($r = 0.83$, $P = 0.001$), and acceptable reliability ($r = 0.72$, $P = 0.001$) (Cronbach' $\alpha = 0.92$).

Data analysis

The IBM Statistical Package for Social Sciences software (IBM SPSS Statistics 21; IBM Corp., Armonk, NY, USA) was used to analyze the data. Qualitative data are demonstrated as frequency (%), quantitative data with normal distribution are shown as mean ± standard deviation (SD), and quantitative data without normal distribution are written in median (interquartile range, IQR). The comparison of variables among patients is done using Mann-Whitney or the Kruskal–Wallis tests. The results of correlation analysis are shown with Spearman's correlation coefficient (rs). Two distinct hierarchical multiple regression analyses were performed, each of which included two distinct models. The first model included control demographic factors or illness characteristics related to the MSSM-R score, and the second model was developed according to both of the aforementioned factors and the anxiety-related scores. *P* value < 0.05 was regarded as statistically significant.

Results

Demographic findings and illness characteristics

The study consisted of 101 female and 52 male patients, with a mean age of 32.7 ± 7.53 years old (Table 1). While most participants were married (55.6%) and employed (45.85), 37 patients were single and 41 patients were unemployed. Only 18 patients (11.8%) received disability pension. 109 patients (71.2%) had a university degree, 35 (22.9%) had a bachelor's degree, and 9 (5.9%) had a history of elementary education. The median (IQR) of disease duration among patients was 8 (5-12). While the most frequent course of MS was relapsing-remitting multiple sclerosis (RRMS, 66 cases), the progressive-relapsing multiple sclerosis (PRMS, 15 cases) type was the least frequent. Most patients suffered from a moderate degree of disability based on EDSS score (3.5 < EDSS ≤ 6.5).

Table 1. Demographic findings of the patients

Socio-demographic and illness characteristic	Patient (N = 153)
Age at the time of study (years ± SD; IQR)	32.71 ± 7.53; 27-38
Gender, n (%)	
Female	101 (66%)
Male	52 (34%)
Marital status, n (%)	
Single	37 (24.2%)
Married	85 (55.6%)
Separated/divorced/widowed	31 (20.3%)
Education, n (%)	
Elementary	9 (5.9%)
Bachelor's degree	35 (22.9%)
University degree	109 (71.2%)
Employment, n (%)	
Employed	70 (45.8%)
Unemployed	41 (26.8%)
Disability pension	18 (11.8%)
Retired	24 (15.7%)
Time since MS diagnosis (median, IQR)	8 (5-12)
Diagnosed course of MS, n (%)	
RRMS	66 (43.1%)
PPMS	39 (25.5%)
SPMS	27 (17.6%)
PRMS)	15 (9.8%)
Unknown	6 (3.9%)
Disability subgroups 'EDSS', n (%)	
Mild (EDSS ≤ 3.5)	45 (29.4%)
Moderate (3.5 < EDSS ≤ 6.5)	57 (37.3%)
High (EDSS < 6.5)	51 (33.3%)

IQR: interquartile range; SD: standard deviation; EDSS: expanded disability status scale; MS: multiple sclerosis; PPMS: primary progressive multiple sclerosis; PRMS: progressive–relapsing multiple sclerosis; RRMS: relapsing–remitting multiple sclerosis; SPMS: secondary progressive multiple sclerosis.

MSSM-R, CDAS, and BAI score of patients

MSSM-R, CDAS, and BAI scores of patients are shown in Table 2. The median (IQR) of the overall MSSM-R score among all patients was 92 (83.5-102.5). while the majority of patients had a low physical anxiety regarding COVID-19 infection and the median (IQR) of CDAS physical score was 0 (0-2), the median score of COVID-19-induced mental anxiety was 5 (2-9). However, a BAI-based study of patients' anxiety demonstrated severe overall anxiety among the majority of the patients (31.4%). While 42 patients (27.5%) had a negative anxiety level, 33 (21.6%) had mild, and 30 (19.6%) had moderate anxiety.

Table 2. Questionnaire-based findings of the patients

Questionnaire-based findings	Patient (N = 153)
MSSM-R score (median, IQR)	
Social/family support	10 (9-12.5)
Health maintenance behavior	14 (12-17)
MS knowledge and information	17 (15-18)
Healthcare provider relationship	24 (22-28)
Treatment adherence/barriers	27 (24-30)
Total	92 (83.5-102.5)
COVID-19 anxiety score (median, IQR)	
Physical aspect	0 (0-2)
Mental aspect	5 (2-9)
Total	7 (2-11)
Beck anxiety score	16 (20)
Severity of anxiety based on Beck	
Negative	42 (27.5%)
Mild	33 (21.6%)
Moderate	30 (19.6%)
Severe	48 (31.4%)

IQR: interquartile range; MSSM-R: multiple sclerosis self-management scale–revised.

Relationships between different variables and self-management

Relationships between demographic and disease-related variables, and overall MSSM-R score are shown in Tables 3 and 4. The overall MSSM-R score of female patients was significantly higher compared to males ($P = 0.009$). The median of the overall MSSM-R score among the single patients (86) was significantly lower than in married (96, $P < 0.001$) and separated/divorced/widowed (93, $P = 0.015$) cases. Furthermore, employed patients had a drastically greater overall MSSM-R score in comparison with the unemployed ones ($P < 0.001$), retired ($P = 0.012$), and patients receiving disability pension ($P < 0.001$). Moreover, the self-management skills among patients with RRMS were considerably higher than in patients with PPMS ($P < 0.001$), Secondary progressive multiple sclerosis (SPMS) ($P = 0.001$), and PRMS ($P < 0.001$). Besides, disability severity among patients was another determinant of MSSM-R score, in a way that patients with lower disability scores had higher MSSM-R scores and vice versa ($P < 0.001$). No significant difference regarding the overall MSSM-R score was seen among patients with different educational levels ($P = 0.577$). The only quantitative variable with a statistically significant correlation with the MSSM-R score was the BAI score ($r_s = -0.421$, $P < 0.001$).

Hierarchical multiple regressions

A hierarchical multiple regression analysis was conducted with the MSSM-R score as the dependent variable (Table 5). The control variables included two demographic factors, age, and gender, among which only gender

Table 3. Relationships between demographic and illness factors, and self-management in multiple sclerosis

Characteristic	Self-management in MS	
	Median (IQR)	*P* value
Demographic factors		
Gender		0.009[a]
Female	94 (86.5-103)	
Male	88.5 (81-95.5)	
Marital status		0.002[a]
Single	86 (79.5-94.5)	
Married	96 (87-104)	
Separated/Divorced/Widowed	93 (87-101)	
Education		0.577
Elementary	93 (89-99.5)	
Bachelor's degree	91 (78-103)	
University degree	92 (85.5-103)	
Employment		< 0.001[a]
Employed	102 (94-104)	
Unemployed	85 (71.5-91.5)	
Disability pension	84 (80-87)	
Retired	92 (86-25-97)	
Illness factors		
Diagnosed type of MS		< 0.001[a]
RRMS	101 (90.75-105)	
PPMS	86 (77-93)	
SPMS	91 (85-94)	
PRMS	89 (71-91)	
Unknown	88.5 (81.75-95.25)	
Disability subgroups 'EDSS'		< 0.001[a]
Mild (EDSS ≤ 3.5)	103 (99-107.5)	
Moderate (3.5 < EDSS ≤ 6.5)	93 (89-102.5)	
High (EDSS < 6.5)	81 (72-87)	

IQR: interquartile range; EDSS: expanded disability status scale; MS: multiple sclerosis; PPMS: primary progressive multiple sclerosis; PRMS: progressive–relapsing multiple sclerosis; RRMS: relapsing–remitting multiple sclerosis; SPMS: secondary progressive multiple sclerosis.
P values are calculated using Kruskal–Wallis test.
[a] *P* values < 0.05 are considered significant.

(β = 0.213, $P = 0.008$) was recognized as the significant correlates of MSSM-R among MS patients in the first model. Despite the model reaching statistical significance, it only explained a tiny portion of the variation in the self-management of MS patients (R2 = 0.061; F (2,150) = 4.84; $P = 0.009$). The demographic variables (age, gender) and BAI score were both included in the second regression model. The gender (b = 0.227, $P = 0.002$) and BAI score (b = -0.418, $P < 0.001$) were shown to be the two variables that significantly correlated with the MSSM-R score. In addition to the statistical significance of this model, it explained 23.4% of the variation in self-management of MS patients (ΔR2 = 0.173; F (1,149) = 33.69; $P < 0.01$; total R2 = 0.234; adjusted R2 = 0.219).

Table 4. Correlation between different variables and self-management in multiple sclerosis

Characteristic	Self-management in MS	
	r_s	*P* value
Age at the time study	0.152	0.060
Disease duration	0.116	0.152
COVID-19 anxiety score (median, IQR)		
Physical aspect	-0.070	0.393
Mental aspect	-0.082	0.316
Total	-0.078	0.337
Beck anxiety score	-0.421	<0.001[a]

[a] *P* values<0.05 are considered significant.
r_s: Spearman's correlation coefficient.

Table 5. Regression analysis predicting self-management in multiple sclerosis (first model)

Characteristic	Self-management in MS	
	B	*P* value
Model 1 (control variables)		
Age at the study	0.138	0.840
Gender	0.213	0.008[a]
$R^2=0.061$; F (2,150)=4.84; $P=0.009$		
Model 2 (control and personal variables)		
Age at the study	0.99	0.171
Gender	0.227	0.002[a]
Beck anxiety score	-0.418	<0.001[a]

$\Delta R^2=0.173$; F (1,149)=33.69; $P<0.01$; total $R^2=0.234$; adjusted $R^2=0.219$.
[a] *P* values<0.05 are considered significant.

Discussion

Our study showed that while MS patients do not suffer from a high level of COVID-19-related anxiety which may be due to the adaptations to the pandemic,[20] the level of general anxiety among these patients is higher than COVID19-related anxiety. During interviews, many patients indicated the positive effect of vaccination against the COVID-19 virus on their anxiety and fear of this infection. Furthermore, we demonstrated that COVID19-related anxiety is not considerably correlated with self-management in patients with MS. However, the predication model established based on a hierarchical multiple regression disclosed a marked role of general anxiety on self-management of patients with MS. Self-management in MS patients is reportedly impacted by unique psychosocial elements that interact intricately with one another.[21] Depression and anxiety are significant risk factors for decreased self-management in MS patients, according to a survey by Rahimian et al. [22] According to Lester et al[23], the self-management capacity of MS patients is hampered by higher levels of depression and anxiety. Besides, Jellinger[24] proposed that depression and anxiety have an essential role in decreasing the energy level of the brain and causing fatigue, the two factors that are associated with reduced self-management in MS patients. Also, Rae-Grant et al. demonstrated that higher education, marriage, and lower psychosocial conflicts are accompanied by better self-management in patients with MS.[6] As shown previously, SMIs that aim depression and anxiety lead to better health conditions in MS patients.[5] Therefore, targeting anxiety, as a probable determinant of self-management among patients with MS is a potential therapeutic strategy that may improve these patients' outcome. Other studies indicate that among the factors related to the low level of self-management in MS patients are reduced perceived control,[25] self/illness/treatment-appraisals by the patients, [16] family/social support, socioeconomic resources, and income.[26]

Besides, we showed that the self-management skills among female married MS patients with a job are significantly higher than in male patients. Similar to our study, one survey reported that female gender and high socioeconomic status are positively associated with increased self-management in MS patients. On the other hand, the same research showed a direct relation between level of education and self-management skills which is in contrast to our findings.[22] It has been suggested that the better management of disease and higher adherence to therapeutic diets in women with MS is due to the higher concern about their health status.[27] Similarly, another study by Rae-Grant et al demonstrated that gender and socioeconomic background are determinants of self-management skills in patients with MS.[6] Simmons et al suggested that patients with higher socioeconomic status are more capable of affording the treatment cost of their disease which rationalizes the higher self-management in these patients.[28]

Other principal determinants of self-management among our patients were type of MS and disability degree; so that patients with RRMS type of MS and lower disability severity had better self-management. This is consistent with previous findings from several studies.[6,29] Furthermore, our study demonstrated no significant correlation between education, MS duration, age, and self-management which is similar to the findings of Rahimian et al.[22] In contrast, Ploughman et al discovered an inverse correlation between age and self-management skills in MS patients.[30]

Conclusion

Although further prospective efforts are unquestionably required to elucidate how anxiety contributes to the development of self-management in MS patients, our findings suggest a vital role of anxiety in the self-management of patients with MS. Thus, anxiety may affect how people perceive their physical and mental health, which in turn affects the intensity of their symptoms and their general quality of life. These findings offer fresh perspectives on psychological interventions targeted at enhancing MS patients' self-management

Study Highlights

What is current knowledge?

- The efficacy of anti-MS therapies varies based on the patient's compliance. Patient self-management is an essential factor in determining the compliance capacity of these patients. Accordingly, high self-management skills have been shown to be associated with symptom attenuation and better outcomes. However, few investigations have been conducted on self-management-modifying factors among MS patients, especially modifiable factors such as anxiety. The COVID-19 pandemic had a drastic adverse effect on the mental health status of the general population and exposed them to anxiety. However, the exact effect of COVID-19-induced anxiety on MS patients is still controversial.

What is new here?

- We showed that while MS patients do not suffer from high levels of COVID-19-related anxiety, general anxiety levels among these patients are higher than COVID-19-related anxiety. Besides, we demonstrated that COVID-19-related anxiety is not considerably correlated with self-management in patients with MS. On the other hand, regression analysis favoured a marked role of general anxiety in the self-management of patients with MS.

abilities. However, we couldn't find a meaningful correlation between COVID-19-induced anxiety and self-management among patients with MS.

Acknowledgments

The research team is deeply grateful to all of the patients with MS who collaborated with us and completed the corresponding questionnaires.

Authors' Contribution

Conceptualization: Seyyedeh Tahereh Zolfaghari, Mohammad Hossein Harirchian.
Data curation: Seyyed Sina Hejazian.
Formal Analysis: Seyyed Sina Hejazian.
Investigation: Seyyedeh Tahereh Zolfaghari.
Methodology: Seyyedeh Tahereh Zolfaghari, Mohammad Hossein Harirchian, Seyyed Sina Hejazian.
Project administration: Mohammad Hossein Harirchian.
Supervision: Seyyedeh Tahereh Zolfaghari, Mohammad Hossein Harirchian.
Validation: Seyyedeh Tahereh Zolfaghari, Seyyed Sina Hejazian.
Writing–original draft: Seyyedeh Tahereh Zolfaghari, Seyyed Sina Hejazian.
Writing–review & editing: Mohammad Hossein Harirchian.

Competing Interests

The authors declare that there are no conflicts of interest.

Data Availability Statement

All data generated or analyzed during this study are included in this article. Further inquiries can be directed to the corresponding author.

Ethical Approval

This study protocol was reviewed and approved by Tehran University of Medical Sciences, approval number IR.TUMS.NI.REC.1400.058. Verbal informed consent was obtained from participants prior to the study. This consent procedure was reviewed and approved by Tehran University of Medical Sciences, approval number IR.TUMS.NI.REC.1400.058, date of decision: March 5, 2022. A verbal briefing and a description of the study were provided to all patients before the questionnaire uploading. All patients were requested to answer the questions only in case of informed consent and were assured that their data would remain confidential.

Funding

This research received no specific grant from any funding agency in the public, commercial, or not-for-profit sectors.

References

1. Saunders C, Caon C, Smrtka J, Shoemaker J. Factors that influence adherence and strategies to maintain adherence to injected therapies for patients with multiple sclerosis. J Neurosci Nurs. 2010;42(5 Suppl):S10-8. doi: 10.1097/jnn.0b013e3181ee122b.
2. Higuera L, Carlin CS, Anderson S. Adherence to disease-modifying therapies for multiple sclerosis. J Manag Care Spec Pharm. 2016;22(12):1394-401. doi: 10.18553/jmcp.2016.22.12.1394.
3. Wilski M, Tasiemski T. Meaning of self in multiple sclerosis: implications for treatment and rehabilitation. Adv Exp Med Biol. 2017;958:43-55. doi: 10.1007/978-3-319-47861-6_4.
4. Bishop M, Frain MP. The multiple sclerosis self-management scale: revision and psychometric analysis. Rehabil Psychol. 2011;56(2):150-9. doi: 10.1037/a0023679.
5. Kidd T, Carey N, Mold F, Westwood S, Miklaucich M, Konstantara E, et al. A systematic review of the effectiveness of self-management interventions in people with multiple sclerosis at improving depression, anxiety and quality of life. PLoS One. 2017;12(10):e0185931. doi: 10.1371/journal.pone.0185931.
6. Rae-Grant AD, Turner AP, Sloan A, Miller D, Hunziker J, Haselkorn JK. Self-management in neurological disorders: systematic review of the literature and potential interventions in multiple sclerosis care. J Rehabil Res Dev. 2011;48(9):1087-100. doi: 10.1682/jrrd.2010.08.0159.
7. Plow MA, Finlayson M, Rezac M. A scoping review of self-management interventions for adults with multiple sclerosis. PM R. 2011;3(3):251-62. doi: 10.1016/j.pmrj.2010.11.011.
8. Korostil M, Feinstein A. Anxiety disorders and their clinical correlates in multiple sclerosis patients. Mult Scler. 2007;13(1):67-72. doi: 10.1177/1352458506071161.
9. Cucinotta D, Vanelli M. WHO declares COVID-19 a pandemic. Acta Biomed. 2020;91(1):157-60. doi: 10.23750/abm.v91i1.9397.
10. Pietrabissa G, Simpson SG. Psychological consequences of social isolation during COVID-19 outbreak. Front Psychol. 2020;11:2201. doi: 10.3389/fpsyg.2020.02201.
11. Wang Y, Duan Z, Ma Z, Mao Y, Li X, Wilson A, et al. Epidemiology of mental health problems among patients with cancer during COVID-19 pandemic. Transl Psychiatry. 2020;10(1):263. doi: 10.1038/s41398-020-00950-y.
12. Stojanov A, Malobabic M, Milosevic V, Stojanov J, Vojinovic S, Stanojevic G, et al. Psychological status of

patients with relapsing-remitting multiple sclerosis during coronavirus disease-2019 outbreak. Mult Scler Relat Disord. 2020;45:102407. doi: 10.1016/j.msard.2020.102407.
13. Capuano R, Altieri M, Bisecco A, d'Ambrosio A, Docimo R, Buonanno D, et al. Psychological consequences of COVID-19 pandemic in Italian MS patients: signs of resilience? J Neurol. 2021;268(3):743-50. doi: 10.1007/s00415-020-10099-9.
14. Chiaravalloti ND, Amato MP, Brichetto G, Chataway J, Dalgas U, DeLuca J, et al. The emotional impact of the COVID-19 pandemic on individuals with progressive multiple sclerosis. J Neurol. 2021;268(5):1598-607. doi: 10.1007/s00415-020-10160-7.
15. Papuć E, Stelmasiak Z. Factors predicting quality of life in a group of Polish subjects with multiple sclerosis: accounting for functional state, socio-demographic and clinical factors. Clin Neurol Neurosurg. 2012;114(4):341-6. doi: 10.1016/j.clineuro.2011.11.012.
16. Wilski M, Tasiemski T. Illness perception, treatment beliefs, self-esteem, and self-efficacy as correlates of self-management in multiple sclerosis. Acta Neurol Scand. 2016;133(5):338-45. doi: 10.1111/ane.12465.
17. Saadat S, Kajbaf MB, Kalantari M, Hosseininezhad M. The multiple sclerosis self-management scale-revised (MSSM-R): Persian version and psychometric analysis. Int J MS Care. 2020;22(1):37-42. doi: 10.7224/1537-2073.2018-090.
18. Alipour A, Ghadami A, Alipour Z, Abdollahzadeh H. Preliminary validation of the corona disease anxiety scale (CDAS) in the Iranian sample. Health Psychol. 2020;8(32):163-75. doi: 10.30473/hpj.2020.52023.4756. [Persian].
19. Hossein Kaviani H, Mousavi A S. Psychometric properties of the Persian version of Beck Anxiety Inventory (BAI). Tehran Univ Med J. 2008;66(2):136-40. [Persian].
20. Ling S, Moss B, Wang Z, Sullivan AB. Exploring the impact of the COVID-19 pandemic on social isolation and mental health in people with MS. Mult Scler Relat Disord. 2022;68:104186. doi: 10.1016/j.msard.2022.104186.
21. Artemiadis AK, Vervainioti AA, Alexopoulos EC, Rombos A, Anagnostouli MC, Darviri C. Stress management and multiple sclerosis: a randomized controlled trial. Arch Clin Neuropsychol. 2012;27(4):406-16. doi: 10.1093/arclin/acs039.
22. Rahimian I, Tabatabaee SM, Taghvaei-Nia A, Jabari M. The relationship of psychological factors, demographic features and disease characteristics with self-management of multiple sclerosis patients. Hormozgan Med J. 2016;19(6):413-20. [Persian].
23. Lester K, Stepleman L, Hughes M. The association of illness severity, self-reported cognitive impairment, and perceived illness management with depression and anxiety in a multiple sclerosis clinic population. J Behav Med. 2007;30(2):177-86. doi: 10.1007/s10865-007-9095-6.
24. Jellinger KA. Depression and anxiety in multiple sclerosis. Review of a fatal combination. J Neural Transm (Vienna). Published online June 13, 2024. doi:10.1007/s00702-024-02792-0.
25. Bishop M, Frain MP, Tschopp MK. Self-management, perceived control, and subjective quality of life in multiple sclerosis: an exploratory study. Rehabil Couns Bull. 2008;52(1):45-56. doi: 10.1177/0034355208320000.
26. Wilski M, Tasiemski T, Kocur P. Demographic, socioeconomic and clinical correlates of self-management in multiple sclerosis. Disabil Rehabil. 2015;37(21):1970-5. doi: 10.3109/09638288.2014.993435.
27. Vlahiotis A, Sedjo R, Cox ER, Burroughs TE, Rauchway A, Lich R. Gender differences in self-reported symptom awareness and perceived ability to manage therapy with disease-modifying medication among commercially insured multiple sclerosis patients. J Manag Care Pharm. 2010;16(3):206-16. doi: 10.18553/jmcp.2010.16.3.206.
28. Simmons RD, Tribe KL, McDonald EA. Living with multiple sclerosis: longitudinal changes in employment and the importance of symptom management. J Neurol. 2010;257(6):926-36. doi: 10.1007/s00415-009-5441-7.
29. Eccles FJ, Simpson J. A review of the demographic, clinical and psychosocial correlates of perceived control in three chronic motor illnesses. Disabil Rehabil. 2011;33(13-14):1065-88. doi: 10.3109/09638288.2010.525287.
30. Ploughman M, Austin MW, Murdoch M, Kearney A, Godwin M, Stefanelli M. The path to self-management: a qualitative study involving older people with multiple sclerosis. Physiother Can. 2012;64(1):6-17. doi: 10.3138/ptc.2010-42.