# Disability Status and Quality of Life in Iraqi Patients with Multiple Sclerosis; an Observational Study

**Fatima Moufeed Hassan*, Mohammed Mahmood Mohammed*, Gheyath Abd Ali Shallal Al-Gawwam****

**** Department of Clinical Pharmacy, College of Pharmacy, Mustansiriyah University, Baghdad, Iraq.***

***** Department Medical, College of medicine, University of Baghdad, Baghdad, Iraq.***

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Corresponding Author email:
fatimamoufeed96@uomustansiriyah.edu.iq
Orcid: https://orcid.org/0009-0005-4090-1318

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**Abstract:**

**Background:** Multiple sclerosis is a chronic inflammatory demyelinating disease of the central nervous system and a major non-traumatic disabling in young adults. Disability adversely affects quality of life, daily activities, and psychological abilities, reducing independence. Therefore, evaluating disability and quality of life is essential to understand the disease burden.

**Aim:** To evaluate the level of disability and its association with health-related quality of life, and to identify sociodemographic and clinical factors associated with both outcomes in Iraqi patients with multiple sclerosis.

**Methods:** A cross-sectional study was conducted at the Multiple Sclerosis consultation clinic, Baghdad Medical City. A total of 150 patients with multiple sclerosis were enrolled. Health-related quality of life was assessed using the multiple sclerosis quality of life-29 questionnaire, and disability was evaluated using the Expanded Disability Status Scale (EDSS).

**Results:** Relapsing-remitting multiple sclerosis was observed in 86%. The median Expanded Disability Status Scale (EDSS) among multiple sclerosis patients was 4.5 indicating a moderate level of neurological disability. EDSS showed significant negative correlations with the physical health composite ($r = -0.705$, $P < 0.001$) and the mental health composite ($r = -0.481$, $P < 0.001$) each combining multiple domains of the MSQoL-29.

**Conclusion:** Higher neurological disability is associated with lower quality of life in patients, and the impact is more pronounced on the physical side than the mental. This finding indicates that physical disability alone may not fully capture the overall impact of the disease.

**Key words:** Multiple sclerosis, Disability, Expanded Disability Status Scale (EDSS), Multiple Sclerosis Quality of Life-29 (MSQoL-29)

**حالة الإعاقة وجودة الحياة لدى المرضى العراقيين المصابين بالتصلب المتعدد؛ دراسة رصدية**

**فاطمة مفيد حسن*، محمد محمود محمد*، غياث عبد علي شلال الكوام****

****فرع الصيدلة السريرية، كلية الصيدلة، الجامعة المستنصرية***

***** قسم الطب الباطني، كلية الطب، جامعة بغداد***

## الخلاصة

**الخلفية:** التصلب المتعدد مرض التهابي مزمن يصيب الجهاز العصبي المركزي ويؤدي إلى إزالة الميالين، أي تلف الغمد الدهني الذي يحيط بالألياف العصبية والمسؤول عن تسريع انتقال الإشارات العصبية، وهو أحد الأسباب الرئيسية للإعاقة غير الرضحية لدى الشباب. تؤثر الإعاقة سلبًا على جودة الحياة والأنشطة اليومية والقدرات النفسية، مما يقلل من الاستقلالية. لذلك، يُعد تقييم الإعاقة وجودة الحياة أمرًا ضروريًا لفهم عبء المرض..

**الهدف:** لتقييم مستوى الإعاقة وارتباطها بجودة الحياة المتعلقة بالصحة، ولتحديد العوامل الاجتماعية والديموغرافية والسريرية المرتبطة بكلا النتيجتين لدى المرضى العراقيين المصابين بالتصلب المتعدد.

**المنهجية:** أُجريت دراسة مقطعية في استشارية التصلب المتعدد التابعة لمستشفى بغداد التعليمي/ مدينة الطب في بغداد، العراق وشملت الدراسة 150 مريضًا بالتصلب المتعدد. تم تقييم جودة الحياة المرتبطة بالصحة باستخدام استبيان جودة الحياة لمرضى التصلب المتعدد وتم تقييم الاعاقة باستخدام مقياس حالة الإعاقة الموسع.

**النتائج:** لوحظ وجود التصلب المتعدد الانتكاسي الهدئي 86%. بلغ متوسط مقياس الإعاقة الموسع 4.5، أظهر مقياس حالة الإعاقة الموسع ارتباطات سلبية معنوية مع كل من مؤشر الصحة البدنيه**(r = - 0.705, P < 0.001)** ومؤشر الصحة النفسية **(r = -0.481, P < 0.001)**.

**الاستنتاج:** كلما زادت الإعاقة العصبية لدى مرضى التصلب المتعدد، انخفضت جودة حياتهم، ويكون التأثير أكثر وضوحًا على الجانب البدني منه على الجانب النفسي. وهذا يسلط الضوء على الحاجة إلى تقييم شامل للمريض، وليس مجرد تقييم يعتمد على الإعاقة الجسدية.


**الكلمات المفتاحيه:** التصلب المتعدد، الإعاقة، مقياس حالة الإعاقة الموسع (**EDSS**)، جودة الحياة لمرضى التصلب المتعدد-29 (**MSQoL-29**)

## Introduction

Multiple sclerosis (MS) is a prevalent neurological condition that is closely associated with immune-inflammatory disorders, while the name "multiple" primarily refers to the multi-focal zones of inflammation in addition to oligodendrocyte death [(1)]. Multiple sclerosis usually manifests between the ages of 20 and 40, and its prevalence has been rising globally. Currently, 2.9 million people have the disease [(2)].

Environmental and genetic factors influence the incidence of MS, with vitamin D deficiency and insufficient sun exposure consistently associated with heightened risk and disease progression, whereas supplementation may confer a protective effect [(3-5)]. In Iraq, relapsing-remitting multiple sclerosis (RRMS) was the predominant clinical variant, with visual symptoms occurring most frequently as initial manifestations. The prevalence of multiple sclerosis in Iraq was recently reported as 11.73 per 100,000, with a female-to-male ratio of 2.18:1 (16.2 per 100,000 for females and 7.3 per 100,000 for males).

In 2018, the incidence was 1.5 per 100,000 (6). These data highlight the growing burden of MS in the country and justify the need to assess disability and quality of life among Iraqi patients [(6)]. Moreover, over 80% of patients suffer from varying degrees of disability, mostly as a result of either slow progression without relapses or incomplete recovery following relapses, both of which have a significant impact on how well they perceive their physical and mental health [(7)] [(8)]. Thus, evaluating disability has become a crucial component of understanding disease burden in MS. Furthermore, disability with aggravated symptoms, extended disease duration, stress, anxiety, depression, and absence of social support substantially impair the quality of life (QoL) for individuals with MS [(9)].

In fact, it has been suggested that the psychological effect of MS may be more

significant than its physical effect [10]. Therefore, enhancements in the QoL for MS patients can only be achieved via the comprehension of beneficial behavioral, mental, and social variables. Consequently, examining the QoL in MS patients would assist health authorities and governments in devising and executing strategies to enhance this outcome for these individuals [11] Similarly, studies conducted in Germany and Poland have examined QoL in MS patients, identifying several influencing factors such as disability, depression, and disease characteristics. However, most of these studies examined all these factors together and did not focus directly on the relationship between the severity of disability and quality of life [40, 41].

In Iraq, previous studies have focused primarily on assessing QoL and psychological well-being in MS patients, and have shown a clear decline in these aspects. However, disability has not been adequately analyzed as a major factor influencing these results [29]. Therefore, there remains a clear lack of studies on this subject, especially in terms of direct assessment of the severity of disability using the EDSS scale, and its relationship to health-related quality of life using disease-specific tools such as MSQoL-29, particularly among Iraqi patients.

## Methods

Study design

This cross-sectional observational study was performed at Baghdad Medical City Hospital, under the supervision of a neurologist.

### Study population

Patients with MS, aged 18 years and older, diagnosed according to the McDonald criteria at least one year prior to enrollment [12, 13] , were recruited from Baghdad Medical City Hospital between October 2024 and April 2025.

### Inclusion and Exclusion Criteria

Patients aged 18 years or older with a confirmed diagnosis of MS based on the revised McDonald criteria for at least one year were eligible for inclusion. All participants were receiving disease-modifying therapies (DMTs) and were in a state of clinical remission at the time of enrollment. Additionally, participants were required to have the ability to understand and complete the study questionnaires. Conversely, exclusion criteria were patients with other autoimmune diseases, pregnant or lactation women and those with cognitive or speech impairment.

### Ethical Approval

The study protocol was reviewed and approved by the Scientific Committee on Ethics at the College of Pharmacy, Mustansiriyah University (approval no. 77 in Aug. 2024). Another ethical approval was achieved from the Ministry of Health to conduct this research at Baghdad Medical City (approval no. 34776 in Oct. 2024). All patients were fully informed about the purpose and procedures of the research, and written informed consent was obtained prior to participation.

### Data Collection

Demographic and clinical information was collected through semi-structured interviews. The socio-demographic characteristics included sex, age, marital status, BMI of the patient, co-existing diseases of patients, family history of disease, residency, educational level, economic state, drinking alcohol, and smoking, while the clinical data included type of MS, disease duration, number of relapses, years of treatment, the last relapse refers to how long it has been since the last acute attack of the disease before the assessment.

### Quality of Life Assessment

Quality of life was assessed using the validated Arabic version of the Multiple

Sclerosis Quality of Life-29 (MSQoL-29) questionnaire [14]. It is an improved and shorter version of the older, longer questionnaire known as the MSQoL-54[15]. This questionnaire consists of 29 items and provides two composite scores (Physical Health Composite (PHC) and Mental Health Composite (MHC)) [16], transformed onto a standardized 0–100 scale according to the manual, with higher scores indicating a better QoL [17].

**Disability Assessment**

Disability was assessed by a neurologist using the Expanded Disability Status Scale (EDSS), which is the most widely used tool and ranges from 0 (normal neurological examination) to 10 (MS-related death) [18] ; disability severity was categorized into three groups: mild (0–3.5), moderate (4–6.5), and severe (7–9.5) [19]. During routine follow-up visits, patients underwent clinical evaluations via direct patient interviews and neurological examinations, supervised by a neurologist.

**Statical analysis**

All statistical analyses were conducted utilizing IBM SPSS Statistics software, version 25. Normality was assessed using the Shapiro-Wilk test. Continuous variables were informed as median and range, while categorical variables were presented as number and percentage (n, %). Comparisons between groups were performed using the Mann–Whitney U test or the Kruskal–Walli's test, attended by Bonferroni post hoc adjustment. Categorical variables were inspected using the Chi-square test or Fisher's exact test, contingent upon distribution assumptions. The bivariate correlation between variables has been investigated consuming Spearman's rank correlation coefficient. A p-value less than 0.05 were considered statistically significant.

**Sample size justification**

Sample size estimation was performed using power analysis for correlation. For a two-tailed test at $\alpha = 0.05$, power $(1–\beta) = 0.80$ and a predictable correlation of $r = 0.30$ (moderate effect size according to Cohen [42, 43], the minimum essential sample was considered using the formula:

$$n = \left(\frac{Z_{1-\alpha/2} + Z_{1-\beta}}{0.5 \times \ln\left(\frac{1+r}{1-r}\right)}\right)^2 + 3$$

Where: $Z_{1-\alpha/2} = 1.96$ (for $\alpha = 0.05$, two-tailed); $Z_{1-\beta} = 0.84$ (for 80% power); and $r = 0.30$.

Replacing values produces a minimum sample size of $n \approx 85$ patients. To enhance the robustness of the findings, address potential missing data, and allow for subgroup analyses such as stratification based on EDSS scores or levels of psychiatric symptoms the sample size was increased to include 150 patients with MS.

## Results

A total of 150 patients with MS were enrolled in the study. Their mean age was $35.3 \pm 0.9$ years, ranging from 18 to 68 years, with 56 individuals (37.3%) classified as young adults aged 30–39. The cohort showed a slight female predominance, with 87 females (58%), resulting in a male-to-female ratio of 1:1.4 with RRMS 86% of patients. Memory problems were the most frequent complaint, affecting 95 individuals (63.3%), among patients reporting memory problems, 85.26% experienced them at a mild level. Gait disturbances were the second most common symptom, reported by 89 patients (59.3%). Fatigue was also frequently noted, affecting 66 patients (44%). A small subset of patients 6 individuals (4%), were not reported symptoms. Severity of the symptoms is also illustrated in Figure 1.

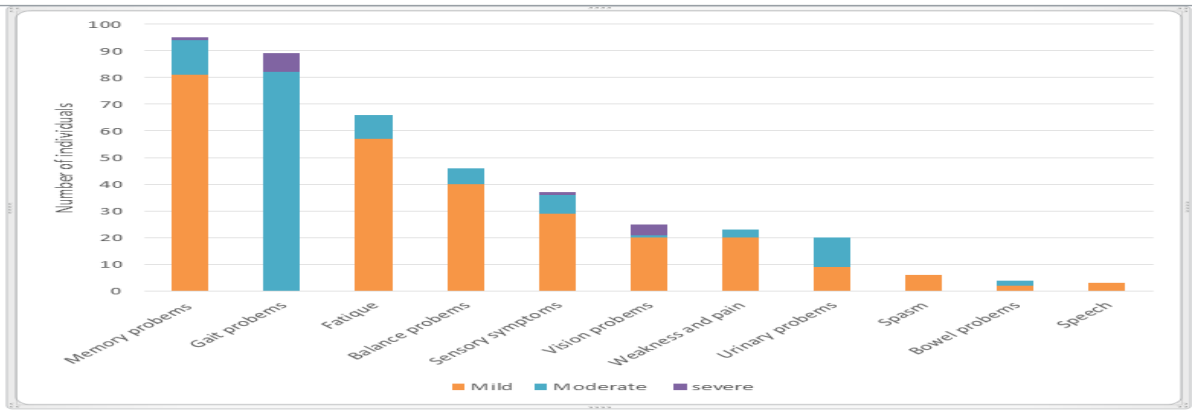


**Figure (1) Symptoms of MS Patients with Their Severity Grades. Orange bars represent mild symptoms, blue bars represent moderate symptoms, and dark blue bars represent severe symptoms.**

The median of EDSS score among all MS patients was 4.5, with scores ranging from 0 to 8. The majority of patients exhibited mild to moderate disability, and approximately 55.30% had moderate EDSS scores between 4 and 6.5. A small subset of 7 patients (4.7%) demonstrated severe disability with EDSS scores of 7 or higher, as shown in Table (1).

**Table (1) EDSS scores and categories for MS patients**

| ESDSS category | EDSS scores range | N (%) |
|---|---|---|
| Mild | 0-3.5 | 60 (40%) |
| Moderate | 4-6.5 | 83 (55.30%) |
| Severe | 7-9.5 | 7 (4.70%) |

Data expressed as N: number, %: percentage. Abbreviations: EDSS: Expanded disability status scale

Among patients' demographic and clinical characteristics, age ($p = 0.014$), MS subtype ($p < 0.001$), and disease modifying therapies (DMTs) ($p = 0.006$) showed significant associations with EDSS scores, as presented in Table (2). A trend towards higher EDSS scores with increasing age was observed, although this did not remain significant after post-hoc adjustment for multiple comparisons it revealed that middle-aged adults (40–50 years) and older (>50years) patients had higher median EDSS scores compared to younger patients (30-39) and (18-29) years.

With respect to treatment, adjusted post hoc testing identified natalizumab and rituximab as significantly associated with lower EDSS scores when compared to ocrelizumab (4.5 vs. 6). Interferons and teriflunomide were prescribed more frequently in the early stages of disease (mild to moderate EDSS) and were not used in cases of severe disability. Conversely, ocrelizumab was more commonly prescribed in moderate and severe EDSS categories ($p = 0.028$), Table (2). Regarding MS subtypes, both PPMS and SPMS were linked to significantly higher EDSS scores compared to RRMS (6 vs. 4.5). In terms of severity distribution, the proportion of patients with RRMS declined as EDSS severity increased. By contrast, primary progressive multiple sclerosis (PPMS) and secondary progressive multiple sclerosis (SPMS) representation rose in the severe EDSS group (28.6% and 14.3%, respectively), compared to moderate (15.7% and 4.8%) and mild (1.7% and 0%) EDSS categories ($p = 0.001$). More details in Table (2).

**Table (2) Association between EDSS Scores and Categories with socio-demographic Data and Disease Characteristics in MS Patients**

| Variable | EDSS Scores | P-value * | EDSS categories | | | | | | P- value ** |
|---|---|---|---|---|---|---|---|---|---|
| | | | Mild N=60 | | Moderate N=83 | | Severe N=7 | | |
| | Median (range) | | No | % | No | % | No | % | |
| Age | | | | | | | | | |
| 18-29 Years [a] | 3.3(0-7.5) | 0.014 | 24 | 40.00 % | 23 | 27.70 % | 1 | 14.30 % | 0.248 |
| 30-39 Years [b] | 4.5(0-8) | | 23 | 38.30 % | 31 | 37.30 % | 2 | 28.60 % | |
| 40-50 Years [c] | 6(0-8) | | 9 | 15.00 % | 21 | 25.30 % | 2 | 28.60 % | |
| >50 Years [d] | 6(0-7.5) [ab] | | 4 | 6.70 % | 8 | 9.60 % | 2 | 28.60 % | |
| Treatment | | | | | | | | | |
| Interferon beta-1a(Avonex) [a] | 4.5(2-6) | 0.006 | 1 | 1.70 % | 4 | 4.80 % | 0 | 0.00 % | 0.028 |
| Interferon beta-1a(Rebif) [b] | 5.3(0-6) | | 1 | 1.70 % | 3 | 3.60 % | 0 | 0.00 % | |
| Inter1beron beta-1b(Betaseron) [c] | 2(0-6) | | 14 | 23.30 % | 10 | 12.00 % | 0 | 0.00 % | |
| Teriflunomide (Aubagio)[d] | 2.3(0-6.5) | | 2 | 3.30 % | 2 | 2.40 % | 0 | 0.00 % | |
| Natalizumab (Tysabri) [e] | 4.5(0-8) | | 28 | 46.70 % | 40 | 48.20 % | 1 | 14.30 % | |
| Fingolimod (Gilenya)[f] | 5(0-7.5) | | 4 | 6.70 % | 5 | 6.00 % | 1 | 14.30 % | |
| Rituximab (Rituxan)[g] | 4.5(0-7.5) | | 10 | 16.70 % | 12 | 14.50 % | 2 | 28.60 % | |
| Ocrelizumab (Ocrevus)[h] | 6(6-8)[eg] | | 0 | 0.00 % | 7 | 8.40 % | 3 | 42.90 % | |
| Disease duration | | | | | | | | | |
| 1-5 Years | 4.5(0-7.5) | 0.086 | 27 | 45.00 % | 30 | 36.10 % | 2 | 28.60 % | 0.529 |
| >5 Years | 5.5(0-8) | | 33 | 55.00 % | 53 | 63.90 % | 5 | 71.40 % | |
| MS type | | | | | | | | | |
| RRMS[a] | 4.5(0-8) [bc] | <0.001 | 59 | 98.30 % | 66 | 79.50 % | 4 | 57.10 % | 0.001 |
| PPMS[b] | 6(2-7.5) | | 1 | 1.70 % | 13 | 15.70 % | 2 | 28.60 % | |
| SPMS[c] | 6(6-7.5) | | 0 | 0.00 % | 4 | 4.80 % | 1 | 14.30 % | |
| Last MS relapse in Years | | | | | | | | | |
| No relapse | 2(0-7.5) | 0.336 | 8 | 13.30 % | 6 | 7.20 % | 1 | 14.30 % | 0.586 |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 1-2 Years | 4.5(0-8) | | 17 | 28.30 % | 26 | 31.30 % | 3 | 42.90 % | |
| >2- <3 Years | 2.8(0-7) | | 17 | 28.30 % | 16 | 19.30 % | 1 | 14.30 % | |
| 3-5 Years | 5.5(0-8) | | 11 | 18.30 % | 19 | 22.90 % | 2 | 28.60 % | |
| >5 Years | 5.5(0-6.5) | | 7 | 11.70 % | 16 | 19.30 % | 0 | 0.00 % | |
| Duration of current MS treatment(years) | | | | | | | | | |
| <1 Year | 6(1-8) | 0.135 | 3 | 5.00 % | 11 | 13.30 % | 2 | 28.60 % | 0.387 |
| 1-<2 Years | 4.5(0-7) | | 13 | 21.70 % | 15 | 18.10 % | 1 | 14.30 % | |
| 2-5 Years | 4.5(0-7.5) | | 30 | 50.00 % | 34 | 41.00 % | 3 | 42.90 % | |
| >5 Years | 5.3(0-8) | | 14 | 23.30 % | 23 | 27.70 % | 1 | 14.30 % | |

*P - value by Mann Whitney test or Kruskal Wallis test as appropriate. ** P-Value by Chi Square test. Superscript letters represented Bonferroni post hoc test, red color ([c,g]) indicated significant difference after adjustment for multiple testing, black color ([a,b]) denoted not maintained significant after adjustment for multiple testing. P-value of ≤0.05 is considered significant difference, while >0.05 is considered not significant difference. Abbreviations: RRMS: relapsing-remitting multiple sclerosis; PPMS: primary progressive multiple sclerosis; SPMS: secondary progressive multiple sclerosis; K: thousands Iraqi dinar; M: million Iraqi dinar.

The numerical values of the QoLMS-29 subscales among the eleven domains assessed, MS patients reported lower scores in change in health, energy, and social function, with median values not exceeding 50%. In contrast, the highest scores were observed in sexual health and bodily pain, with median values of 100% and 76.9%, respectively. The median PHC among MS patients was 59.9%, with values ranging from 12.4% to 82.9%, as in Figure (2). The median MHC was 56.72%, with a range between 25.5% and 83.98%, as in Figure (3).

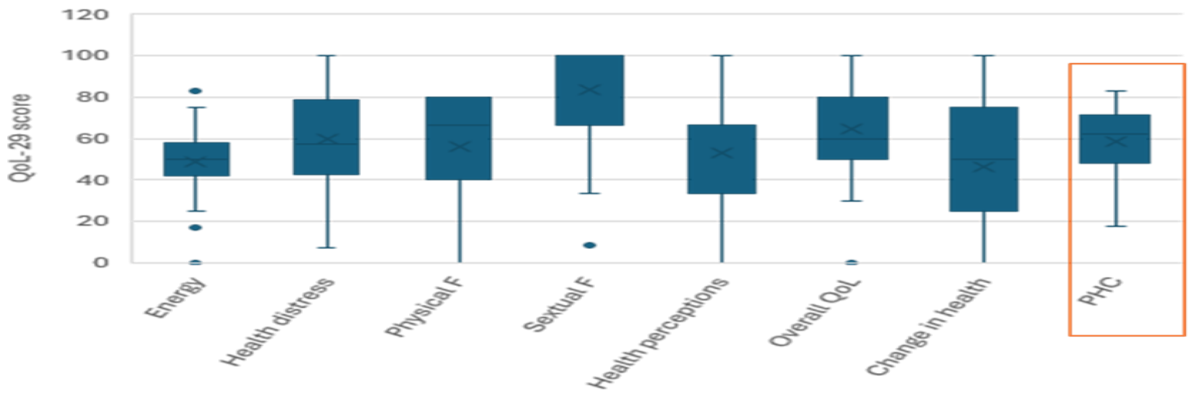


**Figure (2) Physical health scores (PHS) and associated subscale-level scores based on the 29-item Quality of Life (QoL) instrument**

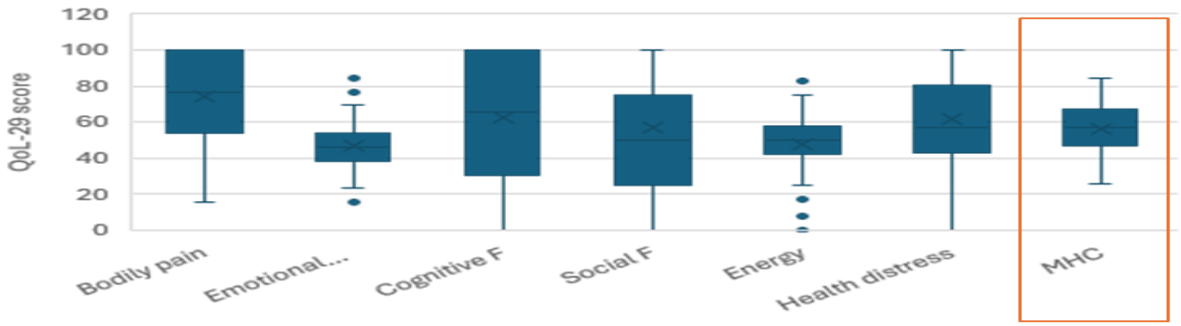


**Figure (3) mental health composite (MHC) and associated subscale -level scores based on the 29-item Quality of Life (QoL) instrument**

Several socio-demographic and disease-related factors associated with lower PHC included lower income (p = 0.002) and lower educational attainment (p = 0.012). Patients diagnosed with RRMS demonstrated higher median PHC (62.2) compared to those with PPMS, who had a median score of 41.5 (p = 0.002).

Concerning the type of treatment, the median PHC score was lower for ocrelizumab (30) than for those receiving interferon beta-1a (Avonex) (65.0) and natalizumab (60.2), with a statistically significant difference between treatment groups (p = 0.011).

Additionally, patients receiving treatment for more than two years had significantly higher median PHC (62.0) than those in their first year of treatment, whose median score was 41.05 (p = 0.023). Among all variables assessed, only age demonstrated a significant association with MHC (p = 0.012). Patients under 30 years of age had a higher median MHC of 63.8% compared to those aged 30–39 years (52.13%). As shown in Table (3).

**Table (3) Association of Physical Health Composite and Mental Health Composite Scores with Socio-demographic Data and Disease Characteristics in Multiple Sclerosis Patients**

| Variable | | PHC Median (range) | P value | MHC Median (range) | P value |
|---|---|---|---|---|---|
| Age | 18-29 Years | 62.7(22-82.9) | 0.095 | 63.82(38.05-79.64) | 0.012 |
| | 30-39 Years | 62.3(12.4-82.6) | | 52.13(25.5-83.98)[a] | |
| | 40-50 Years | 55.5(23.2-80.3) | | 54.49(35.62-73.14) | |
| | >50 Years | 48.15(17.7-74.9) | | 53.99(34.51-75.89) | |
| SEX | Female | 59.6(17.7-82.9) | 0.583 | 55.94(31.3-79.64) | 0.319 |
| | Male | 60(12.4-82.6) | | 57.23(25.5-83.98) | |
| BMI | Underweight | 58.8(22-74.5) | 0.063 | 57.23(41.21-69.64) | 0.322 |
| | Normal | 58(12.4-80.3) | | 56.73(25.5-83.98) | |
| | Overweight | 63.2(17.7-82.9) | | 56.81(34.51-76.75) | |
| | Obese class I | 62.6(23.2-80.5) | | 59.61(31.3-75.11) | |
| | Obese class II | 71.45(68-74.9) | | 60.71(45.52-75.89) | |
| | Obese class III | 27(23.6-48.4) | | 39.19(32.91-44.81) | |
| Marital status | Married | 62(17.7-82.9) | 0.209 | 52.54(31.3-83.98) | 0.187 |
| | Single | 58.7(12.4-77.6) | | 59.34(25.5-79.64) | |

| | | | | | |
|---|---|---|---|---|---|
| | Divorced | 55.3(29.7-74.9) | | 53.42(42.2-75.89) | |
| Economic state | <500K[a] | 52.75(22-75) | 0.002 | 52.98(30.64-79.64) | 0.147 |
| | 500K-1M[b] | 64.1(12.4-82.9)[a] | | 57.87(25.5-83.98) | |
| | >1M[c] | 59.2(48.5-74.5) | | 63.9(46.59-76.75) | |
| Educational level | Illiterate[a] | 48.4(30.4-66.3)[de] | 0.012 | 48.97(39.19-62.71) | 0.081 |
| | Primary school[b] | 56.9(23.6-77.3)[d] | | 54.33(32.91-79.64) | |
| | Secondary school[c] | 57.05(22-82.6)[d] | | 53.95(30.64-76.33) | |
| | Collage[d] | 64.5(17.7-82.9) | | 62.39(34.51-83.98) | |
| | Higher education[e] | 65(12.4-80.5) | | 52.41(25.5-69.64) | |
| Residency | Urban | 59.4(12.4-82.9) | 0.805 | 56.81(25.5-83.98) | 0.99 |
| | Rural | 62.7(23.2-78) | | 55.85(31.3-79.64) | |
| Family history | No | 59.7(12.4-82.9) | 0.754 | 56.72(25.5-83.98) | 0.751 |
| | Yes | 65.05(37.1-72) | | 59.17(35.62-73.74) | |
| Drinking | No | 59.9(12.4-82.9) | 0.84 | 56.72(25.5-79.64) | 0.655 |
| | Yes | 58.35(39.8-76.9) | | 63.51(43.04-83.98) | |
| Smoking | No | 59.9(12.4-82.9) | 0.91 | 56.19(25.5-79.64) | 0.494 |
| | Yes | 59.9(22-80.5) | | 59.32(30.64-83.98) | |
| Comorbidity | No | 59.9(12.4-82.9) | 0.987 | 56.72(25.5-83.98) | 0.93 |
| | Yes | 59.75(27-78) | | 56.77(37.94-79.64) | |
| Disease duration | 1-5 Years | 60.2(12.4-82.9) | 0.774 | 59.61(25.5-79.64) | 0.106 |
| | >5 Years | 59.6(17.7-82.6) | | 54.16(30.64-83.98) | |
| Type of MS | RRMS[a] | 62.2(17.7-82.9)[b] | 0.002 | 56.9(30.64-83.98) | 0.294 |
| | PPMS[b] | 41.5(12.4-80.3) | | 48.88(25.5-70.67) | |
| | SPMS[c] | 47.9(27-64.4) | | 60.74(40.11-67.17) | |
| Treatment | Interferon beta-1a(Avonex)[a] | 65(36.8-70.7) | 0.011 | 56.43(39.94-62.39) | 0.26 |
| | Interferon beta-1a(Rebif)[b] | 57.8(47.9-80.5) | | 62.51(40.11-67.17) | |
| | Interferon beta-1b(Betaseron)[c] | 64.5(43.1-78) | | 60.43(38.52-79.42) | |
| | Teriflunomide (Aubagio)[d] | 64.4(40.8-73.2) | | 59.98(42.26-62.71) | |
| | Natalizumab(Tysabri)[e] | 60.2(30.4-82.9) | | 56.9(31.3-83.98) | |
| | Fingolimod (Gilenya)[f] | 58.2(22-82.6) | | 50.92(41.21-70.13) | |
| | Rituximab(Rituxan)[g] | 58.8(17.7-73.9) | | 56.88(32.91-76.75) | |
| | Ocrelizumab(Ocrevus)[h] | 30(12.4-64.4)[ae] | | 45.86(25.5-70.67) | |
| | < 1 Year[a] | 41.05(22.3-73.5)[cd] | 0.023 | 45.61(30.64-76.33) | 0.246 |
| | 1-<2 Years[b] | 58.6(17.7-82.9) | | 57.04(34.51-79.64) | |

| | | | | | |
|---|---|---|---|---|---|
| Duration of current MS treatment | 2-5 Years[c] | 62(12.4-82.6) | | 55.24(25.5-79.11) | |
| | >5 Years[d] | 62.85(23.6-80.5) | | 59.33(32.91-83.98) | |
| Last MS relapse | No relapse | 64.4(12.4-74.9) | 0.177 | 61.68(25.5-76.33) | 0.068 |
| | 1-2 Years | 57.4(17.7-80.3) | | 57.4(31.3-79.64) | |
| | >2 -<3 Years | 64.25(22.3-77.3) | | 59.17(35.62-79.11) | |
| | 3-5 Years | 57.75(26.4-82.9) | | 51.38(30.64-75.55) | |
| | >5 Years | 62.6(23.6-82.6) | | 56.73(32.91-83.98) | |

P- value by Mann Whitney test or Kruskal Wallis test as appropriate. Superscript letters represented Bonferroni post hoc test, red color ([a,b,c ,d,e]) indicated significant difference after adjustment for multiple testing, black color ([d,e]) denoted not maintained significant after adjustment for multiple testing. p-value of ≤0.05 is considered significant difference, while >0.05 is considered not significant difference. Abbreviation: PHC: physical health composite, MHC mental health composite, MS: Multiple Sclerosis, RRMS: relapsing-remitting multiple sclerosis, PPMS: primary progressive multiple sclerosis, SPMS: secondary progressive multiple sclerosis, BMI: body mass index, K: thousands Iraqi dinar, M: million Iraqi dinar.

EDSS demonstrated a strong negative correlation with PHC (r = - 0.705, P < 0.001) and a moderate negative correlation with MHC (r = - 0.481, P < 0.001), as shown in Table (4)
, Figure (4) determine the correlation between EDSS and PHC.

**(Table 4) Correlation between QoL and EDSS**

| Variable | r-value | p-value |
|---|---|---|
| EDSS vs PHC | –0.705 | <0.001 |
| EDSS vs MHC | –0.481 | <0.001 |

Spearman linear correlation. p-value of ≤0.05 is considered significant difference Abbreviation: EDSS: Expanded disability status scale, PHC: Physical health composite, MHC: Mental health composite

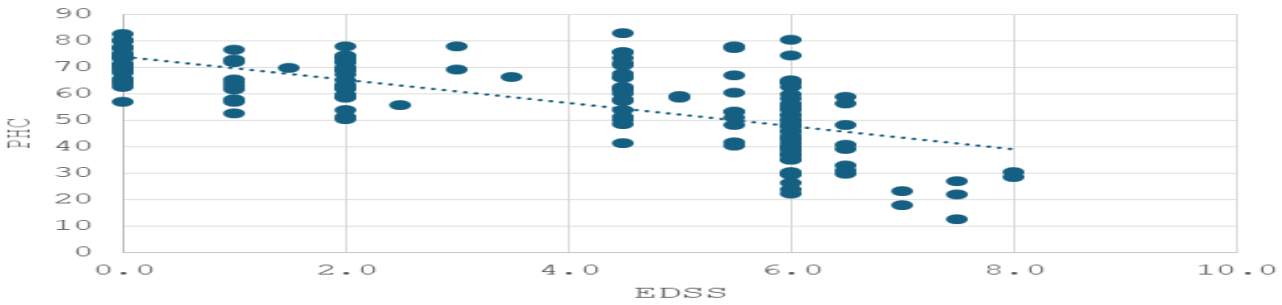


**Figure (4) The Correlation Between EDSS and PHC**

## Discussion

Given the multiplicity and overlap of clinical symptoms in multiple sclerosis, interpreting these findings requires a comprehensive understanding of the disease's complexity, particularly its impact on patients' functional abilities and daily lives. Moreover, the variability in symptom severity and presentation across patients necessitates careful interpretation of the results within the appropriate clinical context. This study observed a range of neurological and functional symptoms in MS patients, reflecting the complex and multidimensional nature of the disease. Interpreting these findings is crucial for a

better understanding of how MS affects patients' clinical status and daily lives.

The current study found that memory loss was the most common symptom among MS patients. This data is in line with previous research that showed cognitive impairment affects up to 65% of cases due to pathological changes in both lesioned and normal-appearing white matter, as well as affecting the gray matter and autoimmune changes that disrupt neural communication [20]. The second most frequent symptom was moderate ambulatory dysfunction. It is known to be a severe cause of disablement and progresses with prolonged disease [21], while fatigue was reported by 43% of patients in our study, which is comparable to findings by Vergani *et al.* (2025) [22]. A trend towards moderate levels of impairment was observed, consistent with previous studies, whereas Ponzio *et al.* (2024) demonstrated a more significant trend toward moderate to severe impairment [23].

Disability levels in the study population were associated with treatment selection, where patients with lower levels of impairment were more likely to receive DMTs such as interferons and teriflunomide. In contrast, individuals with more advanced disability associated to receive higher efficacy medications, particularly ocrelizumab, which seemed to be more prescribed in cases of severe disability compared with natalizumab and rituximab. Since ocrelizumab is approved for the treatment of adult patients with PPMS [24], this association reflects routine clinical practice, whereby treatment choice is largely guided by the baseline level of disability.

This research confirmed an association between the MS phenotype and the degree of disability. Progressive phenotypes were associated with higher disability levels, while RRMS was more frequently linked to lower EDSS scores, consistent with earlier findings. In agreement with these findings a recent retrospective cohort study (CLIMB database; n = 2,599) confirmed that progressive MS phenotypes are associated with higher EDSS scores, while RRMS is linked to lower disability levels [46]. Msheik et al. (2025) showed that progressive forms of multiple sclerosis, such as SPMS and PPMS, are characterized by continuous neurological deterioration with limited potential for recovery, leading to a gradual accumulation of disability compared to RRMS [44]. In line with this, Arteaga-Noriega et al. (2025) identified several factors associated with higher EDSS scores, particularly progressive disease subtype, longer disease duration, and greater neurological involvement, reinforcing the link between disease phenotype and disability severity [45]. Likewise, Dahlke et al. (2021), based on a large integrated dataset of clinical trials, demonstrated that progressive phenotypes and increasing age are key contributors to higher disability levels, whereas RRMS patients tend to present with lower EDSS scores, especially in the early stages of the disease [25].

This variability in the degree of impairment among different types of MS and treatment approaches reflects clinical practice and treatment selection according to the condition of the patient. The findings of this study are consistent with previous studies, which found that the prevalence of impairment steadily increased with increasing age. Comorbidities associated with aging, a prolonged duration of the illness, and decreased ability for neurological healing might be the cause of this tendency [26, 27].

In the current study, the PHC and MHC scores of MS patients fell within a moderate range, which is similar to findings reported by Alharbi *et al. (*2025) [28], while a study conducted on Iraqi patients showed similar results, with almost half of the MS patients suffering from a decline in QoL and a deterioration in their psychological state [29], on an individual domain scale, health change, energy, emotional well-being, and social functioning received the lowest

scores. These are markers of patient instability and a decline in engagement and motivation. Similar research have been observed in Iranian and regional research, where individuals with MS often exhibited diminished vitality, less emotional control, and decreased social involvement [11] [30].

Higher PHC demonstrated an association with higher economic status, consistent with previous studies showing that economic status affects physical outcomes in MS patients [31]. Furthermore, higher education levels trended with higher PHC scores, this finding may reflect better health awareness and disease understanding among more educated patients, which could contribute to improved coping and adaptation to the disease [32]. Regarding disease-related characteristics, the study indicated an association with higher PHC scores among patients with RRMS. In contrast, lower PHC scores were observed among patients treated with ocrelizumab, likely reflecting the nature of the disease in these patients, as this treatment is often used in more severe or progressive forms of multiple sclerosis, such as PPMS and SPMS, where physical function is primarily affected. Therefore, the decrease in PHC is unlikely to be a direct result of the medication itself. However, prior studies have yielded inadequate results concerning the correlation between DMTs and QoL, indicating that this relationship is more likely influenced by disease severity and treatment choice rather than a direct treatment effect [33, 34].

In patients treated for less than one year, there was a lower PHC score when compared to those who received treatment for over two years, as found in a study showing an increase in QoL over time [35]. The current study demonstrated that advancing age in MS patients was associated with a decline in MHC scores. Moreover, previous research has shown that the effect of age on mental health is not constant and may vary across different populations and disease contexts [36].

Finally, the findings indicated that increasing neurological disability was correlated with a strong, significant negative correlated in PHC, while its association with MHC was moderate and negatively significant. A study by Majerníková *et al.* (2024) reported that declines in physical HrQoL were more strongly and directly affected by increasing severity of physical disability [37]. Other studies suggest that depression and coping strategies influence psychological factors more than the extent of disability [8, 38]. This inconsistency may be explained by the fact that disability studies are objective investigations into the neurological status of the patient, whereas QoL is subjective and depends on the patient's personal perception and psychosocial view of their life [39].

This study has several limitations. First, its cross-sectional design limits the ability to establish a cause-and-effect relationship, allowing only the observation of associations. Second, only patients in remission were included to ensure more stable measurements of disability and QoL. However, this may introduce selection bias, as patients experiencing relapses were not included. These patients may have higher levels of disability and poorer QoL, which could slightly influence the overall findings. Third, the study was conducted at a single center, which may limit the generalizability of the findings to all multiple sclerosis patients in Iraq.

## Conclusion

The findings of this study identify neurological impairment as a major determinant of the impact of MS on the QoL in patients. Increasing levels of impairment were associated with a more pronounced decline in PHC, whereas the effect on MHC was less marked. This finding suggests that mental health outcomes in MS are shaped by broader psychological and social factors, rather than being solely driven by physical disability.

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