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Research Article

Predictors of Patient Activation among Individuals with Multiple Sclerosis: Evidence from a Cross-Sectional Study

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Abstract

Background: Multiple sclerosis (MS) is a chronic neurological disease that requires long-term self-management and active patient engagement. Patient activation reflects an individual's knowledge, confidence, and skills to manage their health, yet evidence in MS populations, particularly in low- and middle-income countries, remains limited**.** ***Objective***: To determine the level of patient activation in people with MS and investigate its connection with demographic and clinical characteristics**.** ***Methods***: This is a cross-sectional study carried out on 100 individuals diagnosed with MS and admitted to a specialized MS center of Baghdad Teaching Hospital. The Patient Activation Measure (PAM-13) was used to measure patient activation. The demographic and clinical factors were represented by age, gender, educational attainment, marital status, residential status, and level of disability assessed by the Expanded Disability Status Scale (EDSS). ***Results***: The average age of the participants was 33.98±10.4 years, with an average PAM-13 score of 77.18±3.83. The majority (98%) of the participants fell to the highest level of activation (level 4). Patient activation did not have any significant association with demographic or clinical variables. ***Conclusions***: Patients with MS were highly patient activated, which means that they were very active in the self-management of the disease.

Keywords: Cross-sectional study; Multiple sclerosis; Patient activation; PAM-13; Self-management.

مؤشرات تنشيط المرضى بين الأفراد المصابين بالتصلب المتعدد: أدلة من دراسة مقطعية

الخلاصة
الخلفية: التصلب المتعدد هو مرض عصبي مزمن يتطلب إدارة ذاتية طويلة الأمد ومشاركة نشطة من المرضى. يعكس تنشيط المرضى معرفة الفرد وثقته ومهاراته لإدارة صحته، ومع ذلك لا تزال الأدلة في مجموعات مرضى التصلب المتعدد، خاصة في البلدان ذات الدخل المنخفض والمتوسط، محدودة. **الهدف**: تحديد مستوى تنشيط المرضى لدى الأشخاص المصابين بالتصلب المتعدد والتحقيق في علاقته بالخصائص الديموغرافية والسريرية. **الطرائق**: هذه دراسة مقطعية أجريت على 100 شخص تم تشخيصهم بالتصلب المتعدد وتم إدخالهم إلى مركز متخصص للتصلب المتعدد في مستشفى بغداد التعليمي. تم استخدام مقياس تنشيط المريض (PAM-13) لقياس تنشيط المرضى. تم تمثيل العوامل الديموغرافية والسريرية بالعمر، والجنس، والتحصيل التعليمي، والحالة الاجتماعية، والحالة السكنية، ومستوى الإعاقة الذي تم تقييمه بواسطة مقياس حالة الإعاقة الموسع (EDSS). **النتائج**: كان متوسط عمر المشاركين 33.98 سنة، مع متوسط درجة PAM-13 بلغ 77.18. سقط غالبية المشاركين (98٪) إلى أعلى مستوى من التنشيط (المستوى 4). لم يكن لتنشيط المرضى أي ارتباط ذي دلالة إحصائية بالمتغيرات الديموغرافية أو السريرية. **الاستنتاجات**: كان مرضى التصلب المتعدد نشطين بشكل كبير على المرضى، مما يعني أنهم كانوا نشطين جدا في إدارة المرض بأنفسهم.

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INTRODUCTION

Multiple sclerosis (MS) is a chronic, immune-mediated neurodegenerative disease of the central nervous system and is emerging as a worldwide public health issue. The global burden of MS has been increasing, with significant physical, psychological, and socioeconomic impacts on individuals and health systems [1,2]. MS has heterogeneous clinical manifestations—including motor impairment, sensory dysfunction, fatigue, visual disturbance, balance issues, cognitive impairment, depression, and anxiety—all of which can severely affect patients' quality of life and daily functioning [3–5]. As the disease progresses, self-management becomes central to optimizing health outcomes. "Self-management" refers to the daily activities individuals carry out to manage chronic conditions such as taking medication, monitoring symptoms, and adjusting lifestyle behaviors [6]. Patient activation is a related but distinct concept: it reflects an individual's knowledge, skills, and confidence in managing their own health and care [7]. Where self-management describes specific behaviors, patient activation describes the psychological readiness that drives them. The Patient Activation Measure (PAM) is a

validated tool for assessing this readiness [7]. We chose the 13-item short form (PAM-13) for its brevity, strong psychometric properties, and widespread use across chronic disease populations — features that make cross-study comparison more meaningful. Higher activation has consistently been associated with better self-management, improved clinical outcomes, greater treatment adherence, and lower healthcare use in diseases such as diabetes, heart failure, and asthma [8–10], and similar patterns have been reported in neurological populations [11]. Although the PAM tool is widely used, its application in neurological diseases is scarce, and most validation studies have been done in heterogeneous neurological groups instead of cohorts of the disease [12]. Patients with MS often have unpredictable disease activity, progressive impairment, exhaustion, and cognitive impairment, and this can be unique to different patients with other neurological diseases in their capacity to self-manage themselves [13–15]. Therefore, the generalization of the results on a larger neurological sample might not be as appropriate as the experience and needs of MS patients. Thus, there is a significant gap in the research on patient activation among MS patients, especially in low and middle-income nations like Iraq, which may have limited healthcare resources and formal self-management assistance. To fill this gap, the current study will be used to evaluate the level of patient activation in Iraqi patients with MS based on the use of the PAM-13 instrument. The paper also investigates the relationship between patient activation and disease severity and demographic variables such as age, educational level, marital status, place of residence, and gender.

METHODS

Study design, settings, and participants' recruitment

The research was carried out at the largest MS center in Iraq, housed at Baghdad Teaching Hospital. The study period was from September 2025 to January 2026. Two board-certified neurologists recruited a total of 100 MS patients. The patients were diagnosed with MS based on the McDonald criteria (2017 revision). A consecutive sample of patients was invited to participate while attending the outpatient clinic, and a trained researcher informed each patient about the study and invited them to participate.

Inclusion criteria

Participants aged 18 years or above and able to communicate verbally. The minimum age of 18 was set because the clinical course, disease trajectory, and self-management responsibilities of MS differ considerably between pediatric and adult patients, which can significantly impact the study's outcomes and the applicability of the findings to adult populations. Participants also had to show no evidence of cognitive impairment on the Six-Item Cognitive Impairment Test (6CIT) and be willing to participate.

Exclusion criteria

Patients with cognitive impairment (screened by the Six-Item Cognitive Impairment Test (6CIT)), severe communication difficulties, or patients who declined to participate in the study.

Sample size and sampling method

We used convenience sampling to recruit 100 patients from the neurology outpatient clinic. We acknowledge this approach may lead to selection bias, as the sample was drawn from a single, specialist clinic; the results may not be applicable to patients treated in primary care or those who do not attend a clinic. The sample size was determined using G*Power (version 3.1.9.7) for bivariate correlation between PAM scores and major independent variables, such as age, sex, and disease severity.

Data collection tools

Patient Activation Measure (PAM-13) is a 13-item scale with validation to determine the level of patient activation. This tool, which was created by Insignia Health, is a set of Likert-scale questions, providing a continuous score, usually ranging between 0 and 100, and corresponding to either of four levels of incremental activation, 1) disengaged and overwhelmed, 2) become aware but continue to struggle. 3) take action, and 4) and maintain behaviors and push further. The tool was applied in a venerable Arabic version, as it should. Additionally, the Demographic Questionnaire was used identify the other variables such as age, gender, marital status, education level, residency, and disease stage according to the Expanded Disability Status Scale [17], which classified a patient with MS into stages.

Validation of the Arabic version of PAM-13

We conducted a pilot study to validate Arabic PAM [18]. The English version was translated into Arabic by two independent bilingual translators and then harmonized. Five clinical pharmacists from the Clinical Pharmacy Department at Baghdad University, College of Pharmacy, and two neurologists from Baghdad Teaching Hospital reviewed the instrument for its face validity; this resulted in some minor changes in wording. The preliminary version was then checked for reliability and stability. We asked 25 MS patients to complete the questionnaire. We recognize this is a small sample and that the instrument should be considered preliminarily validated. We did not formally cross-culturally adapt the questionnaire according to international guidelines (e.g., ISPOR), which should be addressed in future studies. The

internal consistency of the tool was acceptable to good (Cronbach's alpha= 0.834), and test-retest reliability over two weeks demonstrated good stability (r= 0.880, $p< 0.001$). These findings give preliminary evidence for the instrument's reliability in this population.

Data collection procedure

Recruitment took place during clinic visits. We administered the PAM-13 and a questionnaire of demographic information through a face-to-face interview after obtaining informed verbal consent. A neurologist confirmed the neurological stage. We invited all eligible patients to avoid selection bias. Where needed, the investigator provided instructions in the participant's preferred language to aid understanding and assured participants that there were no correct or incorrect answers and responses would be kept confidential. We acknowledge that interview bias may have been present with a single interviewer, despite efforts to standardize the process.

Ethical considerations

The research was conducted in accordance with the Declaration of Helsinki and was approved by the scientific and ethical committee of the College of Pharmacy, University of Baghdad (approval number RECAUBCP610202506R). Each participant gave verbal consent to the study before participating, following a comprehensive elucidation of the study's objectives and assuring the participant of the confidentiality of the acquired data, which will remain anonymous and utilized solely for the present research. No incentive was offered to any participant.

Statistical analysis

The IBM Statistical Package of the Social Sciences (SPSS) software of version 26 was performed to analyze the data. The descriptive statistics were done to present the clinical and demographic variables of the participants. Means and standard deviations were used to describe the continuous variables (age and PAM-13 scores), whereas frequency and percentages were used to describe the categorical variables (educational level, residency, marital status, gender, disease stage, and PAM-13 levels). Inferential statistics were applied in order to test the relationship between the scores of the Patient Activation Measure (PAM-13) and the different demographic and clinical variables. An independent samples t-test and a one-way ANOVA were compared to compare binary and multi-categorical mean PAM-13 scores, respectively. Post hoc comparisons that followed ANOVA were done by using the Tukey HSD test. Associations between continuous and ordinal scores, including age, disease level, PAM-13 scores, and PAM-13 levels, were determined using Pearson or Spearman coefficients of correlations, respectively. PAM-13 scores were analyzed using multiple linear regression to determine the predictors of the scores. The analysis was done using a Fisher exact test to verify the relationship between such categorical variables as gender, education levels, marital status, and PAM-13 levels. Lastly, the Classification and Regression Tree (CRT) analysis was also done to identify complex relationships between the predictors and the levels of PAM-13. There was no missing dataset. A p-value of less than 0.05 was found statistically.

RESULTS

This study involved 100 MS patients. The average age was 33.98 ± 10.4, which was between 18 and 60 years. The average score of PAM-13 was 77.18 ± 3.83, and the range of scores was between 64.3 and 85.7. Gender distribution was female predominant (66%), and the males made up a third part of the participants (33%). The majority of the respondents were married people (63%), and the other 36% were unmarried people. Moreover, most of the respondents were Baghdadi (66%), as compared to other provinces (34%). In this population, education levels were mixed: 18% had primary education, 30% had secondary education, and 52% of them had college degrees (Table 1). The average Expanded Disability Status Scale (EDSS) was 1.66 ± 2.85 (range: 0-8). Cognitive status measured by means of the 6-item Cognitive Impairment Test (6CIT) had a mean of 0.81 ± 1.56 (range: 0-6).

Table 1: Demographic and clinical characteristics of study participants (n=100)

Characteristic	Value
Age (year)	33.98±10.40 [18–60]
Gender	
Male	33(33)
Female	66(66)
Marital status	
Married	63(63)
Unmarried*	36(36)
Residency	
Baghdad	66(66)
Other provinces	34(34)
Education level	
Primary	18(18)
Secondary	30(30)
College degree or higher	52(52)
EDSS score	1.66±0.85 [0–8]
Cognitive status (6CIT)	0.81±1.56 [0–6]
PAM-13 score	77.18±3.83 [64.3–85.7]
PAM-13 activation levels	
Level 1	0(0.0)
Level 2	0(0.0)
Level 3	2(2.0)
Level 4 (highest)	98(98)

Values are presented as frequency (%), and mean±SD. *Unmarried includes single, divorced, and widowed participants.

In terms of the levels of activation, there were no Level 1 and Level 2 participants, and 2 (2%) participants were level 3, and the majority are level 4 (highest level of activation) (98%). The age and gender of the study

participants are presented in Table 1. The Pearson correlation analysis indicated that age and PAM-13 score did not have a significant relationship (r= 0.048, *p*= 0.635). The correlation by Spearman was not significant between patient activation level and EDSS (r= 0.106, *p*= 0.294), as well as between EDSS and age (r= 0.421, *p*< 0.001). Figures 1 and 2 depict the correlations between the PAM-13 scores and EDSS and the age.

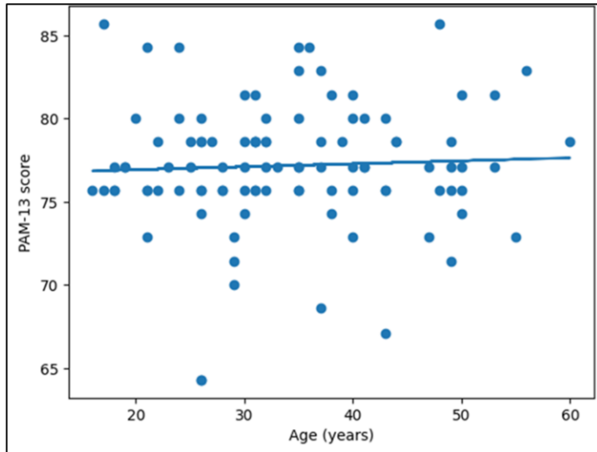

Figure 1: Relationship between age and the PAM-13 score in multiple sclerosis (MS) patients. There was no statistically significant linear correlation (*p*= 0.635, $R^2 \approx$ 0.002), which shows that age did not correlate with the level of patient activation in this group of patients.

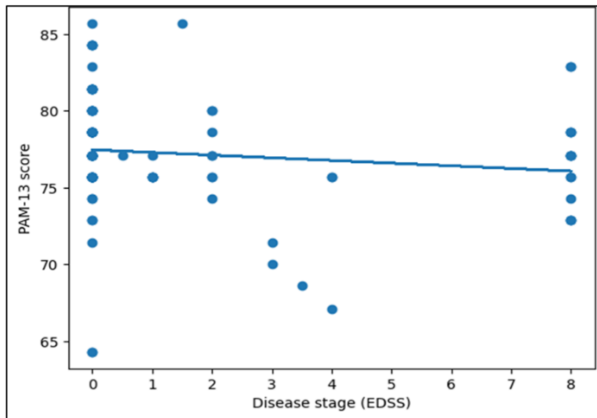

Figure 2: Relationship between the disability level, represented by the Expanded Disability Status Scale (EDSS) and the PAM-13 score among patients with multiple sclerosis (MS). The linear relationship was not statistically significant (*p*= 0.199, $R^2 \approx$ 0.017), which shows that the level of disability did not positively correlate significantly with patient activation among this group of patients.

The difference between independent samples was undertaken to compare PAM-13 between males and females with MS. Males exhibited a slightly higher score with PAM-13 than females (male: M= 78.27 ± 3.87, n= 33; female: M=76.66 ± 3.76, n= 66); the difference was not significant (*p*= 0.050). The test of equality of variances performed by Levene was not significant (*p*= 0.491), and it means that the assumption of homogeneity of variance is fulfilled. We used a one-way ANOVA to determine whether PAM-13 scores differed by level of education. The results demonstrated a trend in the expected direction, but this was not statistically significant (*p*= 0.068). While the mean PAM-13 score of patients with primary education was lower than that of patients with secondary education (Δ mean= -2.64), this difference was not significant after adjusting for multiple testing (*p*= 0.054; primary: 75.37, and secondary: M= 78.01). Equally, there were no significant differences between secondary and college or higher education groups (*p*= 0.643; secondary: M= 78.01, college or higher: M= 77.25) or between the primary and college or higher education ones (*p*= 0.183; primary: M= 75.37, college or higher= 77.25). In Table 2, the Fisher-Freeman-Halton exact test was used to assess the correlation between the educational level of the patients and the level of the PAM-13 activation (level 3 *vs*. level 4). The comparison showed that educational level and the level of activation did not have a statistically significant correlation with each other (*p*= 0.419). Descriptively, most of the patients of all levels of education were high activation (level 4), as it represented 98% of the total sample. High activation was found to be 16.3% in patients who were mainly educated in primary education, 33.7% among patients who had secondary education, and 50% among patients who had college education or higher. The strength of association, which was measured by Cramer's V, was insignificant and not significant (V= 0.141, *p*= 0.371), meaning that there is a weak correlation between the level of education and patient activation. The findings are indicative that educational attainment was not a decider on the involvement and empowerment of patients as assessed by PAM-13. Moreover, the level of patient activation was not statistically significantly related to the marital status (married vs. unmarried) (*p*= 0.153).

Table 2: Association between demographic variables and PAM-13 activation level among MS patients (n=100)

Variable	Categories	PAM-13 level	*p*-value†	Cramer's V
Education level	Primary *vs*. Secondary/College	Low *vs*. High	0.419	0.141
Gender	Male *vs*. Female	Low *vs*. High	0.560	0.103
Marital status	Married *vs*. Unmarried	Low *vs*. High	0.153	0.199

† Fisher–Freeman–Halton exact test was used due to small, expected cell counts. PAM-13 activation was dichotomized into low (Level 3) and high (Level 4).

The strength of the association was low and insignificant as shown by Cramer's V (V= 0.199, *p*= 0.266). The statistical significance could be partly explained by the fact that not all marital status categories were distributed equally and had small sample sizes and therefore reduced the power to establish a meaningful association, especially with divorced and widowed participants. According to the analysis, there was no statistically significant gender and PAM-13 activation level (*p*= 0.560). Descriptively, all patients who received low

activation (level 3) were female; most of the patients in both gender groups were referred to as having high activation (level 4). Nevertheless, this difference was not statistically significant. Cramer's V (V= 0.103, p= 0.591) was small and not significant, which gives us the strength of association. We conducted a multiple linear regression to determine the predictors of PAM-13 scores (age, gender, EDSS, and education). The model as a whole was not significant (p= 0.083) and explained only 8.2% of the variance in PAM-13 scores (R^2= 0.082; adjusted R^2= 0.044). Gender was the only significant individual predictor (B= −1.69, p= 0.038), but the significance of this result should be viewed with caution due to the omnibus test not reaching significance. This finding may be due to a Type I error or skewing due to the gender imbalance of our sample (66% female). Age (B= 0.04, p= 0.334), education (B= 0.44, p= 0.399), and EDSS (B= −0.23, p= 0.117) were not significant predictors. A Classification and Regression Tree (CART) model was conducted in order to predict the level of PAM-13 activation in individuals with Multiple Sclerosis (MS). The model had six independent variables: age, education level, gender, marital status, residency, and EDSS score. The age was found to be the most important and only significant predictor and the cut-off at 26.5 years. In younger patients (≤ 26.5 years), level 4 was the dominant group (93.1%), and level 3 was the minority (6.9%). Conversely, all the patients who were over 26.5 years (>26.5 years) were considered level 4 (100%). The general accuracy of the model was 98%. The clinical value of this CART model is limited. The very low improvement index (0.002) and the heavily skewed distribution of activation levels (98% level 4) mean the model has minimal ability to discriminate beyond predicting the dominant class. These findings should therefore be treated as exploratory. The cross-validation risk estimate was 0.020 ± 0.014, which is low but largely a function of the level 4 majority (Figure 3).

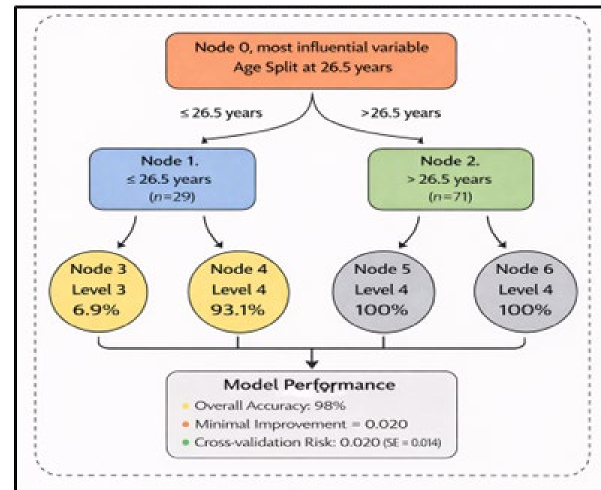

Figure 3: CART model predicting PAM-13 activation levels in multiple sclerosis. A Classification and Regression Tree (CART) model was used to predict patient activation levels in individuals with MS. Age (split at 26.5 years) emerged as the primary significant predictor. Patients aged ≤ 26.5 years 93.1% are classified as level 4.0, and 6.9 as level 3. Patients aged> 26.5 years are classified as level 4 (100%). The model demonstrated an overall classification accuracy of 98% with minimal improvement (0.002), and a cross-validation estimate of 0.020±0.014.

DISCUSSION

The study assessed the experience of patient activation and its relation to patient demographic and clinical factors in MS patients in Iraq by using PAM-13 Tool. The results found that there was a very high degree of patient activation in the cohort. The average PAM-13 score was 77.18 ± 3.83, with the vast majority of the participants (98%) being in level 4, the highest level of activation, with only 2% in level 3 and 0% in levels 1 and 2. These results indicate that the majority of patients in this cohort have a good degree of knowledge, confidence, and skills necessary to manage their health and healthcare. The almost-universal level of activation (level 4) in our sample needs to be viewed with caution. There are a couple of possible reasons. First, we recruited from a specialized MS center, where patients are likely to be more motivated to seek treatment than in a community or general neurology clinic.

Our sample also had low average disability (EDSS= 1.66 ± 2.85) scores, so most participants were likely in early stages of the disease without the physical or cognitive symptoms that limit self-management ability. On the other hand, face-to-face data collection may have led to a social desirability bias, and we know that PAM-13 has a ceiling effect in very healthy samples. The lack of level 1 and 2 patients in our sample is in contrast to what has been reported in other chronic disease samples [8,10] and suggests caution should be exercised when applying our results to other MS patients who are more severely disabled or not receiving specialty care. It has been demonstrated in previous studies that patients and other interested parties who are more patient-activated are more likely to live with effective self-management practices, better treatment adherence, and better health outcomes in chronic illnesses [8]. The high level of activation found in this study could be partly clinically justified by the nature of the study population. The average disability score was 1.66 ± 2.85 using the EDSS, with most of the patients having a mild disability. The earlier stages of the disease can enable patients to be physically and cognitively oriented so that they can actively engage in the disease management processes. Multiple sclerosis is a disease that typically occurs in young and middle-aged adults and can require adherence to treatment throughout their entire life, symptom monitoring, and lifestyle adjustments [1]. In the long run, MS patients could develop coping strategies and self-management techniques, which will increase patient activation. Age did not find any significant relationship with scores of PAM-13 (r= 0.048, p= 0.635) or with the level of activation (r= 0.124, p= 0.220). These results indicate that the age factor in this cohort might not highly contribute to patient activation in MS. Other recent

research [12] carried out on MS has shown similar results, stating that patient activation in MS patients did not correlate with age, and again, disease management and healthcare interaction may be more important determinants of disease management than age. The CART model indicated that age was the most important variable in the correlation analysis, although it was not statistically significant, and the split point was at 26.5 years. Patients aged 26.5 years and older had 93.1 and 6.9 percent level 4 and level 3, respectively, and 100 percent level 4 among patients aged above 26.5 years. Nevertheless, the CART model was not improving significantly (index = 0.002), although the accuracy of classification was high (98%). This slight increase may be explained by the fact that the level of activations is distributed extremely unequally in the dataset, with nearly all the participants already belonging to the highest level of activation. These unbalanced distributions may diminish the predictive ability of classification models and are therefore to be taken with care. The CART model found age ≤26.5 years predicted lower levels of activation; 6.9% of younger patients were predicted to be Level 3. But the model provides little new information. Given 98% of cases are classified into Level 4, a model predicting the most frequent class would be almost as good—a common issue when dealing with imbalanced outcomes. The improvement index (0.002) shows that the tree does not improve prediction. We report these results for completeness and as a foundation for future research but not as an indication of a predictive model with value. The correlation between the level of disability and patient activation was also examined. Results of the analysis indicated that there was no significant correlation between the EDSS scores and PAM-13 scores (p= 0.199) or the EDSS and the level of activation (r= 0.106, p= 0.294). These results show that physical disability is not always likely to decrease the self-management behaviors of a patient. The same event has been reported in MS research, where self-management capacity was found to be more psychological resilience, knowledge of the disease, and access to healthcare support than physical disability itself [19]. However, there was a moderate, positive correlation between age and EDSS (r= 0.421, p< 0.001) that showed that the disability is more likely to increase due to the increase in age. This is in line with the earlier evidence that neurological impairment is accumulative with advancements in MS [20]. The gender disparities in patient activation were examined. Even though male patients showed somewhat more significant PAM-13 scores (78.27 ± 3.87) than female patients (76.66 ± 3.76), it was not statistically significant (p= 0.050). Besides, there was no substantial association between gender and level of activation (p= 0.560). These results show that the patients in this cohort (both male and female) revealed equal participation in disease management. Prior studies investigating the activation of patients in the context of chronic conditions have indicated the same inconsistent or low gender disparity [8]. In our analysis, we have what seems to be a contradiction: the gender difference was borderline significant in a t-test (p= 0.050), but gender was significant in the regression model (p= 0.038), which did not reach significance (p= 0.083). There are a number of ways this could occur. The t-test's borderline significance could indicate a trend that would be significant in a larger sample. Entering multiple predictors into the regression may reduce variance and make the effects of individual predictors appear larger than they are. Given the non-significant omnibus test, it is also possible that the gender result is a type I error, especially given the imbalance in our sample (66% female). We do not believe we should overemphasize this finding, and we would recommend replicating our findings in a larger, more representative sample before making inferences about gender differences in patient activation. Interestingly, though, the regression analysis of this study showed that the gender was a statistically significant predictor of the PAM-13 scores (B= -1.69, p= 0.038), but the overall explanatory power of the regression model was also rather low (R^2= 0.082). This implies that patient activation in relation to other psychosocial or behavioral variables could also be another variable that could be influencing the patient activation in the current study. The level of education was also considered as a possible determinant of patient activation. Even though the PAM-13 scores of those with primary education were slightly lower than those with secondary education or college education; the differences were not statistically significant (p= 0.068). Moreover, there was no considerable correlation between education degree and the type of activation (p= 0.419). These results indicate that formal education might not have a significant impact on patient activation among patients with MS. Disease-specific education provided by medical professionals could be of greater significance to the knowledge and involvement of patients in managing this disease. Past research has expressed that structured self-management education interventions have the potential of greatly enhancing the ability to cope and quality of life in an individual with MS [6]. In the same way, the patient activation was not significantly correlated with the marital status (p= 0.153). Although family members' social support could play a role in coping with chronic illness, the results indicate that marital status alone may not be a determinant of the degree of patient involvement in managing the disease. This absence of association is possibly partly due to unequal distribution of the participants to the marital categories and poor statistical strength to detect small differences. These findings have implications for clinical practice and healthcare systems. The extremely high patient activation rates found in the research indicate that a large number of MS patients visiting specialized neurology centers in Iraq might already have good self-management skills. Therefore, medical practitioners are advised to emphasize these behavioral patterns and

cement them using patient education programs, ongoing counseling, and multidisciplinary care plans and strategies. It has been shown that the strategies of patient empowerment can greatly positively affect the disease outcomes and quality of life of patients with MS [15]. As a healthcare concept, a greater focus on patient activation can be especially helpful in low- and middle-income environments, where access to healthcare can be low. With the provision of patient empowerment by giving them knowledge and self-management capabilities, it will improve adherence to treatment, better monitoring of symptoms, and the use of unneeded healthcare resources. To provide education, control the level of treatment adherence, and help patients to cope with the long-term difficulties associated with MS, healthcare providers may have a vital role: neurologists, nurses, and clinical pharmacists. This research paper is useful to the sparse range of literature researching the topic of patient activation among people with multiple sclerosis, especially in Middle Eastern populations. Knowing the factors linked to patient activation should assist healthcare professionals in designing specific interventions to enhance the participation of patients and the management of the diseases in MS, such as tailored educational programs and support groups that address the unique challenges faced by individuals with MS.

Study Limitations

There are several weaknesses that must be considered when explaining the findings of this research. First, the study was an investigation carried out in one specialized MS center at Baghdad Teaching Hospital. Though the sample size was representative of people in various provinces, it may not be a complete indication of the rest of the population living with multiple sclerosis in Iraq. The ability to conduct future research in various locations and centers would contribute to the provision of a more thorough picture. Second, convenience sampling was used, which may have introduced selection bias by over-representing motivated patients who actively seek specialized care. Third, the face-to-face interview format may have encouraged socially desirable responses, introducing potential interviewer bias. Fourth, the CART analysis has low discriminative power (98% level 4). The model has therefore limited clinical utility and should be considered a preliminary exploratory finding. Fifth, the Arabic PAM-13 was validated on a small pilot sample (n= 25) and without formal cross-cultural adaptation, which limits confidence in its psychometric properties. Sixth, the concentration of activation at Level 4 raises questions about both generalizability and the validity of the PAM-13 in this setting. Future studies would benefit from probability-based sampling, multi-site recruitment, and the inclusion of behavioral measures alongside self-report to better capture the full spectrum of patient activation in Iraqi MS patients**.**

Conclusion

The results indicate the fact that the majority of patients in this cohort are highly confident with adequate knowledge and skills needed to actively engage in the management of their illness. Patient activation was not strongly related to demographic factors or severity of disability, which implies that the activity of disease self-management can be similar in the various groups of patients. This indicates how disease awareness, clinical follow-up, and patient education may play a role in the self-management behaviors of patients with MS. Clinically, maintaining high levels of patient activation is crucial in MS care. Enhancing techniques of patient education, multidisciplinary work, and patient-centered care can contribute to maintaining patient engagement and optimizing long-term health outcomes. It is suggested that further research using bigger and more diverse populations would help to further comprehend the patient activation determinants and help to create specific self-management interventions that may be applied to individuals living with multiple sclerosis.

Conflict of interest

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Data sharing statement

Supplementary data can be shared with the corresponding author based on a reasonable request.

REFERENCES

1. Compston A, Coles A. Multiple sclerosis. *Lancet*. 2008;372(9648):1502-1517. doi: 10.1016/S0140-6736(08)61620-7.
2. Walton C, King R, Rechtman L, Kaye W, Leray E, Marrie RA, et al. Rising prevalence of multiple sclerosis worldwide: Insights from the Atlas of MS, third edition. *Mult Scler*. 2020;26(14):1816. doi: 10.1177/1352458520970841.
3. Filippi M, Bar-Or A, Piehl F, Preziosa P, Solari A, Vukusic S, et al. Multiple sclerosis. *Nat Rev Dis Primers*. 2018;4(1). doi: 10.1038/S41572-018-0041-4.
4. Amato MP, Zipoli V, Portaccio E. Cognitive changes in multiple sclerosis. *Expert Rev Neurother*. 2008;8(10):1585-1596. doi: 10.1586/14737175.8.10.1585.
5. Boeije HR, Duijnstee MSH, Grypdonck MHF, Pool A. Encountering the downward phase: Biographical work in people with multiple sclerosis living at home. *Soc Sci Med*. 2002;55(6):881-893. doi: 10.1016/S0277-9536(01)00238-6.
6. Lorig KR, Holman HR. Self-management education: history, definition, outcomes, and mechanisms. *Ann Behav Med*. 2003;26(1):1-7. doi: 10.1207/S15324796ABM2601_01.
7. Hibbard JH, Stockard J, Mahoney ER, Tusler M. Development of the patient activation measure (PAM): conceptualizing and measuring activation in patients and consumers. *Health Serv Res*.

8. 2004;39(4 Pt 1):1005-1026. doi: 10.1111/J.1475-6773.2004.00269.X.
9. Hibbard JH, Greene J. What the evidence shows about patient activation: better health outcomes and care experiences; fewer data on costs. *Health Aff (Millwood)*. 2013;32(2):207-214. doi: 10.1377/HLTHAFF.2012.1061.
10. Begum N, Donald M, Ozolins IZ, Dower J. Hospital admissions, emergency department utilisation and patient activation for self-management among people with diabetes. *Diabetes Res Clin Pract*. 2011;93(2):260-267. doi: 10.1016/J.DIABRES.2011.05.031.
11. Greene J, Hibbard JH. Why does patient activation matter? An examination of the relationships between patient activation and health-related outcomes. *J Gen Intern Med*. 2012;27(5):520-526. doi: 10.1007/S11606-011-1931-2.
12. Skolasky RL, Green AF, Scharfstein D, Boult C, Reider L, Wegener ST. Psychometric properties of the patient activation measure among multimorbid older adults. *Health Serv Res*. 2011;46(2):457-478. doi: 10.1111/J.1475-6773.2010.01210.X.
13. Stepleman L, Rutter MC, Hibbard J, Johns L, Wright D, Hughes M. Validation of the patient activation measure in a multiple sclerosis clinic sample and implications for care. *Disabil Rehabil*. 2010;32(19):1558-1567. doi: 10.3109/09638280903567885.
14. Marrie RA, Horwitz R, Cutter G, Tyry T, Campagnolo D, Vollmer T. High frequency of adverse health behaviors in multiple sclerosis. *Mult Scler*. 2009;15(1):105-113. doi: 10.1177/1352458508096680.
15. Benedict RHB, Zivadinov R. Risk factors for and management of cognitive dysfunction in multiple sclerosis. *Nat Rev Neurol*. 2011;7(6):332-342. doi: 10.1038/NRNEUROL.2011.61.
16. Kalb R, Beier M, Benedict RHB, Charvet L, Costello K, Feinstein A, et al. Recommendations for cognitive screening and management in multiple sclerosis care. *Mult Scler*. 2018;24(13):1665-1680. doi: 10.1177/1352458518803785.
17. Erdfelder E, Faul F, Buchner A, Lang AG. Statistical power analyses using G*Power 3.1: Tests for correlation and regression analyses. *Behav Res Methods*. 2009;41(4):1149-1160. doi: 10.3758/BRM.41.4.1149.
18. Expanded Disability Status Scale (EDSS) | MS Trust [Internet]. [cited 2026 Feb 3]. Available from: https://mstrust.org.uk/a-z/expanded-disability-status-scale-edss
19. Roesel I, Froehlich D, Joos S, Valentini J, Mauch H, Martus P. The patient activation measure-13 (PAM-13) in an oncology patient population: psychometric properties and dimensionality evaluation. *Health Qual Life Outcomes*. 2024;22(1). doi: 10.1186/s12955-024-02255-w.
20. Benedict RHB, Amato MP, DeLuca J, Geurts JJG. Cognitive impairment in multiple sclerosis: clinical management, MRI, and therapeutic avenues. *Lancet Neurol*. 2020;19(10):860. doi: 10.1016/S1474-4422(20)30277-5.
21. Filippi M, Brück W, Chard D, Fazekas F, Geurts JJG, Enzinger C, et al. Association between pathological and MRI findings in multiple sclerosis. *Lancet Neurol*. 2019;18(2):198-210. doi: 10.1016/S1474-4422(18)30451-4.