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Effect of Health Promotion Program on Therapeutic Regimen Compliance for Patients with Multiple Sclerosis

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Abstract
Background: Multiple sclerosis (MS) is a common neurological disease that can have devastating effects on patients' physical and mental well-being. Complying with therapy regimen is a beneficial step in improving a person's behavior while on modified life style, take medication, or follow a diet. **The aim of the study**: Evaluate the effect of health promotion program on therapeutic regimen compliance for patients with multiple Sclerosis. **Design**: A pre/posttest quasi experimental design was carried out. **Setting:** This study was conducted in neurology out patients' clinic at zagazig university hospital. **Sample:** A purposive sample of 60 adult patients with multiple sclerosis. **Tools:** Four tools used in the study**:** patient assessment questionnaire, self-care Practice checklist, compliance assessment scale, and factors affecting patients' compliance based on health belief model (HBM). **Results:** The study found that the age's mean and standard deviation among the studied patient was 42.03±11.23. Approximately 73.3% of them were female. About 85%, and 88.3% respectively of studied patients had satisfactory level of knowledge regarding MS, and their lifestyle habit post program. While 91.7% of them had adequate level of practice, and patients' compliance improved to 78.3% post program. Furthermore a positive correlation with a statistically significant between the overall knowledge score, total practice score, total lifestyle habits, and total health beliefs. **Conclusion**: It can be concluded that health promotion program for adult patients with multiple sclerosis improved patients' knowledge, which can reflect an improvement in their self-care practice and therapeutic regimen compliance, in addition to raising all constructs of the Health Belief Model. **Recommendations**: Incorporate the health belief model into the design of health focused interventions by enabling participants to take an active role in self-care practice.

Keywords: Compliance, Health Promotion program & Multiple Sclerosis

Introduction
Multiple sclerosis (MS) is an autoimmune disease that affects the central nervous system (CNS) and is signified by axonal transaction and inflammatory demyelination, which are pathological markers of permanent brain damage **(Ginley, et al., 2021)**

The exact etiology of MS is undetermined, but nutritional, infectious, environmental, and genetic variables have been implicated in the MS development. There are numerous symptoms that might be indicative of this disease, such as exhaustion, blurred vision, weakened muscles, problems with the bladder and excretion, sexual dysfunction, imbalance issues, cognitive decline, and emotional/mental abnormalities. (**Rooddehghan, et al., 2023**).

Multiple sclerosis is classified into fifth categories, each of which describes a unique pattern of the disease's progression, the patient's prognosis, the frequency of attacks, and the patient's state in between them. These five classifications include progressive relapsing, relapsing-remitting, main progressive, secondary progressive, and benign. (**Shabany, et al., 2021**).

Multiple sclerosis is typically treated with disease-modifying drugs (DMDs) that target specific immune cell types (such as lymphocytes) and/or immunological signaling proteins. DMDs regulate inflammation but not neurodegenerative processes. Because there is no recognized treatment for MS, patients continue to suffer from symptoms and disability. Other symptom treatment, function restoration, and quality of life enhancement strategies include physical activity, particularly exercise training. (**Motl, et al., 2020)**

According World Health Organization "WHO" Compliance defined as the degree to which an individual's conduct when taking medication, adhering to a diet, and/or lifestyle modification is in line with established guidelines from a healthcare professional. (**Alhazzani, et al., 2019)**. Adherence to therapy is crucial for MS patients undergoing disease-modifying therapies ("DMTs") to achieve favorable results, including delaying the disease's progression and preventing or minimizing symptoms and relapses **(Burkhard, et al., 2021).**

Health promotion programs provide activities and events that are well planned, organized, and

structured throughout time with the goal of assisting individuals in making educated health decisions and preventing new health cases or incidents. Programs for health promotion play a vital role in promoting understanding of discrimination and equality, as well as taking action to improve everyone quality of life. **(Fertman& Grim, 2022).**

In the 1950s, **Godfrey Hochbaum, Irwin Rosenstock, and Rosenstock and Kirsch**t developed the health belief model. Cues to action, the perceived advantages and disadvantages of preventive behavior, the severity and vulnerability of disease, and self-efficacy in implementing preventive behavior into practice are some of the constructs included in the model. **(Dehbalaei, et al., 2022).**

In individuals who have chronic illnesses, health-promoting behaviors (HPBs) have been identified to be an important strategy for preserving and enhancing independence, well-being, and quality of life. (**Feng, et al., 2020**). However, in MS patients, chronic illnesses are associated with a reduction in HPBs. HPBs, a type of function and planning provided to promote health, increase productivity, prevent disease, and avoid bad effects, allow patients to manage and regulate their health.**(Dehghani**, **2023)**

Nurses may perform an integral part in the recovery of patients with physical and mental problems. They can assist patients in improving their daily activities while also addressing social, psychological, and economic concerns. A nurse could help the patient and family make the correct decisions about how to manage their problems. (**Razazian, et al., 2020)**

Significance of the study

As stated by **WHO (2020),** 2.8 million persons globally are predicted to have MS (35.9 per 100,000 population). Additionally, recent studies in the Middle East show prevalence rates ranging from 55 to 85/100,000 patients. According to the **MS International Federation (2022),** around 59,671 people in Egypt live with MS. This translates to one in every 1,500 persons, and 9,244 new cases are diagnosed each year. MS patients face significant challenges since they are expected to actively participate in several preventive, treatment, and health maintenance behaviors. Additionally, nurses face challenges because health promotion initiatives require additional time and counseling abilities. Consequently, the current study will be carried out to evaluate the effect of health promotion program on therapeutic regimen compliance for patients with multiple sclerosis.

Aim of the study:

The study aimed to evaluate the effect of health promotion program on therapeutic regimen compliance for patients with multiple Sclerosis.

Objectives:

1. Assess the patient's level of knowledge, and practice regarding multiple sclerosis.
2. Assess patient's knowledge regarding lifestyle habits.
3. Assess the patients' compliance with therapeutic regimen.
4. Assess factors affecting therapeutic regimen compliance based on the use of Health Belief Model.
5. Design, implement, and evaluate the effect of health promotion program on therapeutic regimen compliance for patients with multiple sclerosis.

Research Hypothesis:

H1: Patients' knowledge, and practice score will be improved after health promotion program than before.

H2: Patients' knowledge regarding life style habit will improve after health promotion program than before**.**

H3: Patients' level of compliance with therapeutic regimen will improve after health promotion program than before.

H4: Health belief model factor on patient perception will raise after health promotion program than before.

Subjects and Methods

Research design: A quasi experimental design (pretest-posttest) was used to conduct this study. Studies of this type on interventions test causal hypotheses. Programs and policies are viewed as "interventions" in experimental and quasi-experimental designs, where a treatment comprising program/policy components is evaluated for its efficacy in accomplishing the goals. **(White & Sabarwal, 2014).**

Study setting:

The study was carried out in Neurology Outpatient clinic at Zagazig University, Sharqia Governate Hospitals, which is located on the second floor. The neurology clinics have five rooms for patient examinations, an electroencephalogram room, a nerve conduction room, two lecture rooms, and a waiting space for patients**.**

Subjects:

A purposive sample of 60 adult patients with multiple sclerosis must meet these criteria as follows: consent to participate in the study, age range of 20 to 60 years, have any type of multiple sclerosis**,** and able to communicate. Exclusion criteria include**:** Pregnant women, patients who become severely ill, Patients who had fracture, surgery or end stage of a chronic illness, as well as patients with major complications from multiple sclerosis**.**

The sample size was calculated by using a statistical computer program (Epi-Info software version 6.04) with a95% confidence level, and 80% power **(Ahmed et al., 2020)**. Use the single proportion equation (Epi info 6.04 statistics application) with finite population modification. The sample size can be calculated using the method n=N*X/(X+N-1), where X = Zα2 ¬*p*(1-p) / MOE2. There must be 60 patients in the sample.

Tools for data collection:

The researcher prepared four data collection tools:

Tool I: Patient Assessment Questionnaire: the researcher designed it after reviewing literature (**Hamdy et al., 2017**). To collect the necessary data which covered the following parts:

Part1: Patients' Personal Characteristics: concerned with assessment of personal characteristics of studied patients. It was included seven closed ended question covered the following items: age, sex, marital status, educational level, occupation, place of residence, and income.

Part 2: Patients' Medical History: It was included 11closed ended questions about: diagnostic test of MS, disease duration, types of MS, had an attack, Frequency of MS attack, first clinical manifestation, family history, degree of consanguinity, chronic disease and patient's commitment to the treatment.

Part 3: Patient Assessment Knowledge regarding multiple sclerosis: (**Pre/ Posttest**): it was developed by **Lewis et al., 2021, Hinkle & Cheever, 2020, DeLaune et al., 2019; Linton & Matteson, 2019, Timby& Simth, 2022)** and modified by researcher. It consisted of 26 MCQ, and Yes or No questions which classified under two sections:

First section: Patient's knowledge regarding anatomy and physiology of CNS. It consisted of four MCQ questions related to composition of CNS, composition of neuron, types of neuron and function of neuron.

Second section: Patient's knowledge of multiple sclerosis disease, which consisted of 22 Yes or No, and MCQ questions related to definition of MS, causes, risk factors, types, clinical manifestation, diagnosis, complications, and treatment.

Scoring system: Based on statistical analysis, and literature review **(Alhussin, et al., 2024).** Knowledge is considered satisfactory if the score is ≥ 60% of the maximum score and unsatisfactory if the score is < 60%.

Part 4: Assessment Knowledge about the patient's lifestyle habits**:** (**Pre, Post test)**, focused on evaluating the patient's behavior toward life style habits. It comprised of 22 MCQ, and the Yes or No questions covering the following items: Nutritional habit (7items), physical activity (5 items), smoking habit (4 items), and stress management (6 items).

Scoring system:

Each item was scored as follow: two score was assigned for complete correct answer, one score for incomplete correct answer, and zero for incorrect answer or don't know. The total score of each patient was calculated by adding the scoring items from the questionnaire tool. The sum of scores for each dimension, as well as the total score, was calculated by adding the scores given for its responses. The scores of total and all dimensions of lifestyle habits then transformed into score percent as the following: For patient with score < 60% indicated unsatisfactory level of lifestyle habit. While satisfactory lifestyle habits: for patient who had score ≥ 60%. **Note:** A number of the questions were answered in a negative manner, and scoring was done in reverse order.

Tool II: Patients' Self Care Practice Observational Checklist:(**Pre/ Posttest**): The researcher modified and adapted it from **potter, et al., (2021)** to assess patients' self-care practices toward most important skills covering 10 procedures before and after the program, including the following: management of fatigue(6 items), spasm(6items), heat intolerance(7 items), falling(6 items), balance(5items), memory deficit(6 items), Healthy food(8items), urinary incontinence (7 items), , constipation(6items), and sleep problems(7items)

Scoring System:

Each procedure is given a score-"zero" for not done, "one" for done incorrect, and two for done correct then each patient's points are totaled. Based on statistical analysis, a practice is considered inadequate for the general patient if its score is < 60%, while a practice is considered adequate if its score is ≥ 60%.

Tool III: Compliance assessment scale (**Pre, Post-test**): It was adapted from **Salaffi, et al, (2020)** It was used to evaluate how closely multiple sclerosis patients complied with their therapy regimen. It included 24 questions that addressed the following topics: compliance with diet regimen consisted of 7 questions, compliance with treatment regimen: it consisted of 9 questions, and compliance with lifestyle habits**:** it consisted of 8 questions.

Scoring system:

Every item in the patient's compliance with the therapy regimen was scored as follows: Never take a point 0, sometimes take point 1, and always take point 2. The total score of overall Patients' compliance were 40 grades and categorized as follows:- Good compliance ≥ 60%, and Low compliance< 60%. Classification of all compliance scores based on statistical analysis and literature review (**Mensah, et al., 2023**). **Note:** There were some questions with a negative format and reversed scoring codes.

Tool IV: **Questionnaire for Factors Affecting patients' Compliance(Pre/Post)**: Based on the health belief model the researcher designed it to assess factors affecting therapeutic regimen compliance for patients with multiple sclerosis by assessing patients' perception for susceptibility (6items), perceived benefits (6items), perceived barriers(12items), perceived severity (6 items), self- efficacy (7items), and cues to action(6 items).

Scoring system:

Each item of the health belief model constructs had score as: "one" for agree, and "zero "for disagree. The total score of all the health belief model constructs is classified as the following: Positive perception ≥ 60% and Negative perception < 60%. After converting these scores into a percent score, averages and standard deviations were calculated. Based on statistical analysis and a review of the literature, all factors affecting compliance are categorized according to their overall scores. **(Goda et al, 2017)**.**Note:** Some of the questions had a negative format and were scored in reverse.

Content Validity and Reliability:

It was ascertained by five experts in the fields of medical surgical nursing—two professors and three assistant professors—evaluated the tools based on their readability, applicability, comprehension, and simplicity of use. Their comments were taken into consideration and minor modifications were made before developing the final form tools' instruments' reliability. The purpose of the test was to determine whether patient knowledge regarding multiple sclerosis, checklist for patients' practice, and compliance assessment scale had internal consistency. The results showed that the reliability test for the factor affecting patients' compliance based on (HBM) was 0.87 and the agreement percentage was 97%.

Field work

Before starting to apply the study plan, the neurology outpatient clinics at Zagazig University Hospital were given official letters of approval. The researchers also informed the clinics about the time and date of data collection, as pre/post was completed by the researchers' availability two days a week in the morning in the study setting. For baseline information regarding patient conditions, the researchers collected the data before implementing the health promotion program. The research was conducted in four phases, which were preparatory, planning, implementation, and evaluation. These phases were conducted over an eight-month period, beginning in February 2023 and ending in September 2023.

The preparatory Phase:

The initial phase was dedicated to establishing the program and developing the study tools. Data analysis is being used to design a health promotion program. It was prepared by the researcher, written in plain Arabic, and added pictures to help patients understand the program which contained the appropriate knowledge related to anatomy and physiology of the central nervous system, definition of multiple sclerosis, causes, risk factors, clinical features, types, complications, lifestyle modification for the treatment of MS, practices which contained self care practice for fatigue, spasm, heat intolerance, falling, balance, memory deficit, healthy food, urinary incontinence, constipation, and sleep problem , compliance related to diet, treatment and lifestyle habits, and health promotion. Throughout this phase, the researcher conducted interviews with each patient upon admission to gather baseline data on demographics, health history, and knowledge assessment using the tool I. As a pre-test for the program, each patient was asked to complete an assessment questionnaire prepared in simple Arabic. The tool takes approximately 15-20 minutes to complete. The identified needs of patients were based on the responds submitted by each patient in the previous tool. The phone numbers of the patients was obtained initially when corresponding with them to ascertain the additional appointments necessary to complete the data collection.

The planning phase:

The researcher developed the program for patients with MS and session content based on the patient's condition and the study objectives, taking into account the relevant literature about health promotion for patients with MS and the results of the data analysis of the assessment phase. The program's aim and objectives were established based on the needs, requirements, and problems that were identified. An illustrated, colorful booklet was handed out to each patient under study, acting as a guide for all relevant program information. The booklet composed of three chapters: The first chapter provided patients with information about the anatomy and physiology of the central nervous system as well as the definition of MS, its causes, risk factors, clinical features, types, and complications, as well as lifestyle modifications that could be used to treat MS. The purpose of the second chapter was to provide patients with self-care instructions for relieving fatigue, spasm, heat intolerance, how to avoid falling, how to deal with constipation, memory deficit, and sleep problems. The third chapter focused on helping patients adhere to their treatment plans, which included diet, exercise, and lifestyle modifications. It also included information about factors that could impact compliance based on the Health Belief Model (HBM), including patients' perceptions of their susceptibility, benefits, barriers, perceived severity, and cues to act.

The implementation phase:

The researchers designed a booklet to complement a health promotion program that included all knowledge and skills related to multiple sclerosis; each patient received a detailed presentation of the booklet's contents through the use of presentation and posters. The program was implemented through patient sessions that were performed in research settings. Small groups, each consisting of 4 to 5 patients, were formed. Eight continuous sessions comprising both theoretical and practical components represented the program's content. Each session lasts for 20 to 30 minutes. During the initial orientation session, the purpose and contents of the program were explained including its general objectives, methods of teaching, learner activities, and evaluation methods. The program's theoretical, and practical part was covered in eight sessions: **First session**: included an introduction about anatomy, physiology of the central nervous system, and information about definition of MS, causes, risk factors, clinical features, types, and complications. **Second session**: focus on lifestyle modification for the treatment of multiple sclerosis. **Third session:** included factors affecting therapeutic regimen compliance based on the health belief model and HBM components (perceived susceptibility, severity, barriers, benefits, cues to action and action related to MS disease. **Forth session**: demonstrated the administering of self-care practice and identify general measures before practicing exercise. **Fifth, sixth, seventh, eighth session:** demonstrated and explained the rationale for each item in the procedure to avoid complication to the patients. To identify self-reflection, evaluate with re-demonstration and post-test. The researchers reviewed the goals of the previous session and provided feedback at the start of each one. They also answered any questions from the patients at the conclusion of each session.

Evaluation phase:

Evaluation phase was conducted immediately after the health promotion program had been implemented, using the same pretest tools to assess its efficacy.

Pilot study

A pilot study was done on 10% of the total study subjects (6 patients) to assess the clarity and applicability of the tools as well as estimate the time needed to complete each form. The necessary modifications were made based on the pilot study's result. Pilot subjects were later excluded from the main study sample.

Administrative design and Ethical consideration

The Ethics Committee of the Faculty of Nursing approved the study on January 1, 2023, under approval ID 0149. The Dean of the Faculty of Nursing issued an official letter to the Head of the Neurology Outpatient Clinic, directing the collecting of the relevant data. After being fully informed about the purpose and objectives of the study, consenting participants provided their informed consent. There was an assurance of confidentiality and anonymity. Patients are free to decline participation in the study at any time or to withdraw from it entirely.

Statistical analysis

All of the data were coded once it was collected. The statistical presentation and analysis of the current study were performed using the linear correlation coefficient to find correlation between two quantitative variables in one group and the mean, standard deviation, and chi-square test to compare groups in qualitative data (IBM SPSS Statistics for Windows, Version 20.0). Armonk, NY-based IBM Corp.

Results

Table (1): Frequency and percentage distribution of the studied patients according to their personal characteristics data (n=60)

Personal characteristics	N	%
Age		
20-35	17	28.3
35- <45	16	26.7
45- <55	16	26.7
55 or 60	11	18.3
Mean±SD	42.03±11.23	
Sex		
Male	16	26.7
Female	44	73.3
Marital status		
Single	9	15.0
Married	40	66.7
Widow	5	8.3
Divorced	6	10.0
Level of education		
Illiterate	9	15.0
write&read	2	3.3
Primary	9	15.0
Secondary	27	45.0
high education	13	21.7
Occupation		
Employed	21	35.0
unemployed, house wife	39	65.0
Residence		
Rural	37	61.7
Urban	23	38.3
Income		
Enough	17	28.3
Not enough	43	71.7

Table (2): Frequency and percentage of medical history of the studied patients with MS (n=60)

Medical History of Multiple Sclerosis Patients	N	%
Diagnostic test of MS		
MRI	35	58.3
spinal fluid	19	31.7
Excited voltage test	6	10.0
Duration of MS		
less than 5years	39	65.0
From 5-10 years	12	20.0
More than 10 years	9	15.0
Types of MS		
isolated clinical syndrome	1	1.7
relapsing multiple sclerosis	36	60.0
primary progressive multiple sclerosis	11	18.3
secondary progressive multiple sclerosis	10	16.7
no type identify	2	3.3
Had an attack		
Yes	45	75.0
No	15	25.0
Frequency of attack		
Less than 5 times	40	66.7
From 5 to 10 times	13	21.7
More than 10 times	7	11.7
Clinical manifestation		
Sensory manifestation	3	5.0
Optic neuritis	11	18.3
Motor weakness	30	50.0
Ataxia	7	11.7
Cognitive decline	5	8.3
Oculomotor affection	4	6.7

Medical History of Multiple Sclerosis Patients	N	%
Family History of MS		
Yes	4	6.7
No	56	93.3
Degree of consanguinity		
first degree	4	6.7
History of other chronic disease		
Yes	13	21.7
No	47	78.3
Ifyes what disease		
No disease	47	78.3
Heart disease	4	6.7
Hypertension	3	5.0
Hepatitis	2	3.3
Diabetes mellitus	4	6.7
Commitment to the treatment		
Committed to the treatment	3	5.0
Not committed	42	70.0
Some what committed	15	25.0

Table (3): Frequency and percentage distribution of patients' knowledge regarding MS Pre and post program (n=60)

Knowledge	Pre				Post				Chi-square	
	Satisfactory		Unsatisfactory		Satisfactory		Unsatisfactory			
	N	%	N	%	N	%	N	%	X^2	P-value
Anatomy & physiology of CNS	16	26.7	44	73.3	50	83.3	10	16.7	38.923	<0.001*
Knowledge regarding MS	13	21.7	47	78.3	53	88.3	7	11.7	53.872	<0.001*
Total knowledge	14	23.3	46	76.7	51	85.0	9	15.0	45.952	<0.001*

X2 Chi-square test *P ≤ 0.05 (significant)*

Table (4): Frequency and percentage distribution of patients' knowledge regarding lifestyle habits pre and post program (n=60)

Life style items	Pre				Post				Chi-square	
	Satisfactory		Unsatisfactory		Satisfactory		Unsatisfactory			
	N	%	N	%	N	%	N	%	X^2	P-value
Nutrition habits	21	35.0	39	65.0	54	90.0	6	10.0	38.720	<0.001*
Physical activity	23	38.3	37	61.7	50	83.3	10	16.7	25.497	<0.001*
Smoking	17	28.3	43	71.7	51	85.0	9	15.0	39.231	<0.001*
Stress management	19	31.7	41	68.3	53	88.3	7	11.7	40.139	<0.001*
Total lifestyle habits	20	33.3	40	66.7	53	88.3	7	11.7	38.088	<0.001*

X2 Chi-square test *P ≤ 0.05 (significant)*

Table (5): Frequency and percentage distribution of patients' practices regarding MS Pre and post program (n=60)

Practice	Pre				Post				Chi-square	
	Adequate		Inadequate		Adequate		Inadequate			
	N	%	N	%	N	%	N	%	X^2	P-value
Fatigue	6	10.0	54	90.0	54	90.0	6	10.0	76.800	<0.001*
Spasm	2	3.3	58	96.7	52	86.7	8	13.3	84.175	<0.001*
Heat intolerance	4	6.7	56	93.3	57	95.0	3	5.0	93.659	<0.001*
Falling	5	8.3	55	91.7	54	90.0	6	10.0	80.056	<0.001*
Balance	9	15.0	51	85.0	53	88.3	7	11.7	64.605	<0.001*
Memory deficit	3	5.0	57	95.0	56	93.3	4	6.7	93.659	<0.001*
Healthy food	7	11.7	53	88.3	56	93.3	4	6.7	80.234	<0.001*
Constipation	3	5.0	57	95.0	53	88.3	7	11.7	83.705	<0.001*
Sleep problem	6	10.0	54	90.0	54	90.0	6	10.0	76.800	<0.001*
Total practice	4	6.7	56	93.3	55	91.7	5	8.3	86.724	<0.001*

X2 Chi-square test *P ≤ 0.05 (significant)*

Table (6): Frequency and percentage distribution of patients' compliance with therapeutic regimen pre and post program (n=60)

Compliance	Pre				Post				Chi-square	
	Good		Low		Good		Low			
	N	%	N	%	N	%	N	%	X^2	P-value
Diet regimen	20	33.3	40	66.7	44	73.3	16	26.7	19.286	<0.001*
Treatment regimen	19	31.7	41	68.3	49	81.7	11	18.3	30.543	<0.001*
Life style compliance	16	26.7	44	73.3	48	80.0	12	20.0	34.286	<0.001*
Total Compliance	18	30.0	42	70.0	47	78.3	13	21.7	28.229	<0.001*

X2 Chi-square test *P ≤ 0.05 (significant)*

Table (7): Frequency and percentage distribution of perceived factors affecting patients' compliance with therapeutic regimen based on health belief model pre and post Program (n=60)

Health belief model(HBM) items	Pre				Post				Chi-square	
	Positive		Negative		Positive		Negative			
	N	%	N	%	N	%	N	%	X^2	P-value
Perceived severity	7	11.7	53	88.3	49	81.7	11	18.3	59.063	<0.001*
Perceived susceptibility	4	6.7	56	93.3	52	86.7	8	13.3	77.143	<0.001*
Perceived benefit	5	8.3	55	91.7	56	93.3	4	6.7	86.724	<0.001*
Perceived barriers	6	10.0	54	90.0	54	90.0	6	10.0	76.800	<0.001*
Self-efficacy	9	15.0	51	85.0	52	86.7	8	13.3	61.650	<0.001*
Cues to action	5	8.3	55	91.7	51	85.0	9	15.0	70.848	<0.001*
Total HBM scores	6	10.0	54	90.0	53	88.3	7	11.7	73.654	<0.001*

X2 Chi-square test *P ≤ 0.05 (significant)*

Table (8): Relation between Satisfactory patients' knowledge, adequate practice and their personal characteristics pre and post program (n=60)

	Satisfactory knowledge								Adequate practice							
	Pre				Post				Pre				Post			
	N	%	X^2	P-value	N	%	X^2	P-value	N	%	X^2	P-value	N	%	X^2	P-value
Level of education																
Illiterate	0	0.0			6	66.7			0	0.0			7	77.8		
Write & read	0	0.0			1	50.0			0	0.0			1	50.0		
Primary	1	11.1	20.503	<0.001*	6	66.7	10.182	0.037*	0	0.0	15.495	0.004*	7	77.8	12.727	0.013*
Secondary	4	14.8			25	92.6			0	0.0			27	100.0		
high education	9	69.2			13	100.0			4	30.8			13	100.0		
Residence																
Rural	5	13.5	5.203	0.023*	29	78.4	3.319	0.068	1	2.7	2.437	0.118	33	89.2	0.776	0.379
Urban	9	39.1			22	95.7			3	13.0			22	95.7		
Income																
Enough	8	47.1	7.464	0.006*	13	76.5	1.354	0.245	2	11.8	0.991	0.320	15	88.2	0.366	0.545
Not enough	6	14.0			38	88.4			2	4.7			40	93.0		

X2 Chi-square test *P ≤ 0.05 (significant)*

Table (9): Correlation Coefficient between total knowledge, life style habits, practices, and health belief model of studied patients pre and post Program (n=60)

	Total compliance score		Total Life style habitats score		Total knowledge score		Total practice score	
	R	P-value	R	P-value	R	P-value	R	P-value
Pre								
Total Life style habitats score	0.047	0.723						
Total knowledge score	0.384	<0.001*	0.372	<0.001*				
Total practice score	0.198	0.035*	0.425	<0.001*	0.356	<0.001*		
Total health belief score	0.43	<0.001*	0.169	0.015*	0.240	0.064	0.323	<0.001*
Post								
Total Life style habitats score	0.284	<0.001*						
Total knowledge score	0.129	0.201	0.375	0.002*				
Total practice score	0.298	<0.001*	0.395	<0.001*	0.23	0.004*		
Total health belief score	0.234	0.003*	0.401	<0.001*	0.219	0.028*	0.337	<0.001*

r= correlation coefficient test. *p= p-value* ***highly significant at p ‹ 0 01*

Table (1): Demonstrates that the age's mean and standard deviation among the studied patient was 42.03±11.23. Approximately three-quarters (73.3%) of them were female, with male patients accounting for 26.7% of the sample. In terms of marital status, approximately 66.7% of the studied patients were

married, with 45% having secondary education, 35% employed, and 65% unemployed or housewives. In regards to their residence, 61.7% of the assessed patients live in rural areas, while 71.7% claimed that their income was not enough.

Table (2): Reports the diagnosis of multiple sclerosis (MS) among the studied patients was predominantly done through MRI 58.3%. Regarding the duration of MS 65.0% of them had the disease for less than 5 years. A significant 75.0% of the studied patients had an MS attack; clinical manifestations include motor weakness (50.0%) as the most common type of presenting manifestation of relapsing multiple sclerosis (60.0%). Only 6.7% of the individuals in the study had a positive family history of multiple sclerosis. In addition, 21.7% had chronic diseases such as heart disease, and diabetes mellitus represented 6.7%. Regarding commitment to treatment, it varies, with 70.0% of patients not committed, 25.0% somewhat committed, and only 5.0% fully committed.

Table (3): Presents that in the pre program phase, 76.7% of the studied patients had unsatisfactory level of knowledge regarding MS, while 85.0% of them had satisfactory level of knowledge at the post program phase. Finally, there were highly statistically significant differences between knowledge pre and post program phases, with P value <0.001.

Table (4): Reveals overall, total lifestyle habits showed 33.3% satisfactory and 66.7% unsatisfactory pre-program. Post-program, satisfactory habits rose to 88.3%, and unsatisfactory habits fell to 11.7% . a statistically significant difference following the health promotion program, as indicated by a p-value of <0.001.

Table (5): Demonstrates that a very low percentage of adequate level of patients' practice regarding MS in the preprogram phase in relation to spasm, memory deficit, constipation, heat intolerance, and fatigue observed in 3.3%, 5.0%, 6.7%, and 10% respectively, as well as adequate practices improved to 91.7%, with a p-value of <0.001, indicating highly significant overall improvement in practices following the program.

Table (6): Shows that there are statistical significant difference as regard patients' compliance with therapeutic regimen pre and post program with p-value of <0.001

Table (7): Clarifies that 90% of patients had negative perceived factors affecting their compliance based on the Health Belief Model pre program, while post program, 88.3% of patients had positive perceived factors affecting their compliance based on the Health Belief Model with p-value of <0.001, indicating a significant overall improvement in patient perceptions for all HBM post program.

Table (8): Describes that only among their education level pre and post program there was a statistically significant relation between satisfactory patients' knowledge and their personal characteristics with P value <0.001, and 0.037 respectively. Similar pattern was seen for adequate patient's practice where the improvement is also statistically significant. The level of education consistently showed significant differences pre and post program with P value 0.004*, and 0.013* respectively.

Table (9): Illustrates that Total knowledge score demonstrates a significant positive correlation with total lifestyle habits score ($r = 0.375$, $p = 0.002$), total practice score ($r = 0.395$, $p < 0.001$), and total health belief score ($r = 0.401$, $p < 0.001$) through post program. As well as total practice score correlates positively with total lifestyle habits score ($r = 0.298$, $p < 0.001$) and total health belief score ($r = 0.337$, $p < 0.001$) post program. Also total health belief score shows positive correlations with total lifestyle habits score ($r = 0.234$, $p = 0.003$) and total practice score ($r = 0.219$, $p = 0.028$).

Discussion

Multiple sclerosis patients can benefit from health promotion that promotes physical, emotional, and social well-being. The success of a health promotion initiative is significantly influenced by the proper application of theories and models relevant to the discipline. Among these, the health belief model plays a crucial role in enhancing the perceived susceptibility of multiple sclerosis patients, as well as disease severity while considering the perceived advantages, barriers, and cues for taking action. (**Momenabadi, et al., 2020**).

According to the results of the present study, the mean age of the studied patients was 42.03±11.23, with over two-thirds were married and unemployed, three-quarters were female and low-income, and nearly half having only a secondary education. This may be related to the immune system may be activated by sex steroid hormones during puberty. Furthermore, the increasing prevelance of multiple sclerosis in females indicates that hormonal variation render women more vulnerable to environmental risk factors.

These results align with **Braley et al. (2020),** who concluded that the patients mean age of was 51.2. Similarly, **Abdallah et al. (2022)** found that the percentage of unemployed among the patients was more than two thirds. **Buja et al. (2021)** also discovered that the majority of the patients under study were married. Similarly, **Ozer and Altun (2021)** reported that almost three-quarters of the studied patients were female. Meanwhile, this conclusion contradicts **Farran et al. (2020),** who

maintained that the majority of the studied patients attained university education.

Relating disease duration, more than two thirds of studied patients had MS for less than five years. **Shawli et al. (2019)** supported this finding, reporting that the disease lasted approximately five years on average. Also, the current study discovered that around two-thirds of the patients studied had relapsing remitting multiple sclerosis. This finding is consistent with **Visser et al (2021),** who indicated that the majority of the patients assessed had the relapsing remitting multiple sclerosis phenotype.

In terms of clinical manifestations in the present study, motor weakness was the most commonly reported presenting symptom, about half, less than fifth optic neuritis, and less than tenth ataxia. This might be explained by the fact that, in contrast to motor weakness, individuals may not seek medical attention for moderate symptoms such ataxia, modest cognitive impairment, or oculomotor affection. This is consistent with **Hussein et al. (2019),** who found that motor was the most common clinical manifestation, followed by sensory and visual.

According the current study, the majority of studied patients had a positive family history of MS. This could be related to the conditions of marriage, as marriage between close relatives is associated with an increased chance of developing hereditary illnesses such as multiple sclerosis. This finding was consistent with **Yamout et al. (2020)**, who discovered that nearly a quarter of the patients studied had a positive family history of MS.

The present study's findings stated that the majority of studied patients experienced significant improvement and satisfaction in all aspects of their lifestyle habits, including nutritional habits, physical activity, smoking, and stress management. This may pertain to the distribution of educational booklets and verbal instructions, combined with the curiosity exhibited by the subjects under study. **Elkhalii-Wilhem et al. (2022)** reported similar group results, demonstrating that, after implementing specific exercise and dietary adjustments into their daily lives, multiple sclerosis patients have a high prevalence of dietary habits, physical activity, and stress management habits.

In light of the study's findings, there was a statistically significant improvement in patients' level of knowledge regarding multiple sclerosis following the implementation of a health promotion program. This could be associated with a lifestyle modification session that improved the studied patient's knowledge scores. This finding is consistent with **Claflin et al. (2022),** who found that after the intervention, MS knowledge significantly increased.

The results of this study demonstrated that, as compared to before the program, the total score of adequate patients' practice level showed a highly statistically significant improvement. It is possible that the patient requires sufficient training in self-care practices to improve his or her ability to manage disease-related issues. **Hassan et al. (2024)** found a significant increase in self-care scores between the pre/post and follow-up time points, which is consistent with this result.

Regarding compliance with therapeutic regime, the results of this study demonstrated that the patients under study were good compliance toward diet regimen and treatment regimen as well as lifestyle compliance with highly statistically significant after health promotion program. These findings indicate that providing more specific information on multiple sclerosis was associated with better treatment compliance and MS symptom control. The current results are in line with those of **AbdElgayed et al. (2022),** who found that patients' compliance with the treatment regimen increased overall throughout the post-intervention phases compared to the pre-intervention phases, with a highly statistically significant.

Concerning factors affecting patients' compliance based on the Health Belief Model, which is frequently used to research health behavior, has four main components that are thought to influence patients' compliance: perceived severity, perceived benefits, perceived barriers, and perceived susceptibility. The model states that the degree to which a person believes they are susceptible to a disease, the severity of the disease, the benefits of adopting the necessary behavior, and the barriers that stand in their way all have an impact on their health behavior toward a disease or treatment. The expanded version of the model includes variables such as self-efficacy and action cues. **Salazar, et al., (2015) .** Regarding the HBM model constructs, the current study's result was estimated: the majority of them had positive perceptions of perceived severity, susceptibility, benefits, barriers, self-efficacy, and cues to action. Additionally, there were statistical differences for each construct**.** This finding is consistent with **Habibi et al. (2021),** who demonstrated in their study that when knowledge, perceived benefits and cues of action in practices increase and perceived barriers decrease, patients perform better self-care.

The present study result pointed out, a statistically significant relationship between satisfied patients' knowledge and practice, and personal characteristics only among their education level pre and post program. This may be connected to a lack of education, which makes it more difficult to comprehend how learning occurs. Similarly, **Daniali et al. (2017)** found a statistically significant

relationship between a high educational level and patients' knowledge. Furthermore, the current study indicated positive correlation with a statistically significant between lifestyle habits, total practice, and total knowledge. This finding is agree with **Salime et al (2022),** who observed a statistically significant with strong correlation between total score knowledge and total score practice.

Regarding the correlation between patients' practice, compliance, and HBM, the present study demonstrated a statistically significant positive correlation between patients' practice, compliance, and HBM post program phase. This may be the case due to the fact that the majority of MS patients already know what behaviors—like losing weight, giving up smoking or participating in physical activity-are appropriate. However, knowledge is not enough to encourage patients to adopt these behaviors; rather, patients must have confidence in their own abilities. This result is on the same line as **Bakhshi et al. (2023),** who observed a positive and significant effect on medication adherence and patient perception (perceived sensitivity, severity, benefits, and barriers). Additionally, the quality of their care could be improved.

While the total knowledge score does not connect positively with the total compliance score post-program. This may be supported by the fact that knowledge alone was insufficient to produce compliance and lifestyle change, because a positive attitude and appropriate behavior are just as important for achieving the goal as knowledge. This outcome opposes the conclusion of **Erfan et al. (2022)** that, following three months of program implementation, The overall knowledge score and adherence to the treatment plan have a highly, statistically significant correlation.

Conclusion

Based on the current study's results, it can be concluded that a health promotion program for adult patients with multiple sclerosis improved patients' knowledge, which can reflect an improvement in their self care practice and therapeutic regimen compliance, in addition to raising all constructs of the Health Belief Model. There was a positive correlation with a statistically significant between the overall knowledge score, total practice score, total lifestyle habits, and total health beliefs.

Recommendations

- Improve patient awareness of multiple sclerosis risk factors in order to encourage and empower them to live a healthy lifestyle and decrease complications of disease. This can be achieved by using the mass media and health education programs to explain the causes of diseases and the advantages of maintaining a healthy lifestyle.
- Incorporate the health belief model into the design of health focused interventions by enabling participants to take an active role in self care practice.
- Conduct further research to assess the effectiveness of the HBM over an extended follow-up period following the intervention.

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