Journal of Population Therapeutics & Clinical Pharmacology

RESEARCH ARTICLE
DOI: 10.47750/jptcp.2023.30.13.003

Assess the knowledge and attitude towards multiple sclerosis (MS) and its effects on pregnancy among women with Multiple sclerosis in Saudi Arabia

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Submitted: 17 March 2023; Accepted: 15 April 2023; Published: 13 May 2023

ABSTRACT

Multiple sclerosis (MS) is a CNS autoimmune disorder that mainly affects young and childbearing age females. Pregnancy in patients with MS has protective effects on the patient, particularly in the 3rd trimester period, and no adverse effects on the fetus. Being aware of the consequences of MS and pregnancy can substantially reduce the stress and anxiety among MS pregnant woman. This study aims to measure the knowledge among MS females about MS and its effects on pregnancy in Saudi Arabia.

Methods: A validated questionnaire's link was distributed among a convenient sample of females with definitive diagnosis of multiple sclerosis (MS) from different regions of Saudi Arabia. Local patients were found in MS clinics in National Guard Health Affair.

Results: The mean age of the women in the sample was 33.78 + 8.16. More than three quarters (83.6%) of the sample had their ages ranged between 20 to 40 years old. About 60% of the sample were married and 58.2 % had children. About one quarter 26.4% of the sample had the disease for 11 and more years. More than have (58.2%) of the women in the sample completed either their bachelor or postgraduate education. More than two thirds (70.3%) were not working. More than half (57.1) of the women in the sample were from the Eastern Region. About two thirds (67%) of the sample had good knowledge score regarding MS. In addition, there was a statistically significant negative relationship between age and total knowledge score (p= 0.036).

Conclusion: Most of our participants were educated and at the age of 40 and below with a good knowledge about multiple sclerosis and its effects on pregnancy and childbirth which contributes to a better perception of conception and acceptance of their disease.

Keywords: *Multiple sclerosis, Pregnancy*

J Popul Ther Clin Pharmacol Vol 30(13):e18–e27; 13 May 2023.

INTRODUCTION

Multiple Sclerosis (MS) is a chronic autoimmune neurodegenerative disease of the central nervous system (CNS) and it is characterized by the presence of multiple relapses followed in time by a remission state of the disease activity.(1,2) An increase in the prevalence of MS has been described in the recent decade being three times more common in females than males with a typical presentation at the third decade of life.(3,4) As the incidence of MS is 150-folds higher with an affected monozygotic twin and 15-fold higher in first-degree relatives, this makes genetic predisposition a main cause of MS. Other causes of MS include vitamin D deficiency, climate change and most recently focused on Epstein-barr virus. (1,3,4,5,6) These result in degeneration, demyelination, and progressive axonal loss.(1) As a consequence, symptoms such as vision impairment, imbalance, fatigue, cognitive dysfunction, numbness, bladder dysfunction, pain, weakness, and mood changes will develop.(7,8) The current medicines and stem cells therapy are only capable of fighting off the symptoms of the disease, but not the disease itself. (9) over time, the accumulation of neurologic deficits will lead to life-long disabilities impacting the quality of life, fertility, and pregnancy. (3,7,8)

Multiple Sclerosis is the most common inflammatory demyelinating disease, and it has a global prevalence of 33 per 100,000 individuals. (1,10,11) The prevalence of Multiple Sclerosis increases after adolescence, and it peaks between the age of 25 and 35 years old.(12) Also, the prevalence of MS in Saudi Arabia was reported to be 40.40 per 100,000 individuals in the total population. It was reported that it was specifically higher among females, young and educated individuals. (13,14,15,16)

The knowledge of MS effects in pregnancy and fetus survival was thought to be negative in the twenties. For that, pregnancy was continuously falsely discouraged in females with MS. However, recent literature negates these findings as pregnancy in patients with MS has protective effects on the patient and no adverse effects on the fetus, particularly in the 3rd trimester period. On the virtue of that, it is curial to increase the knowledge of MS effects towards pregnant women to reduce the stress encountered during making the decision of conception, yet local literature lacks reports of the actual magnitude of MS knowledge in pregnant women and its effects. However, nationally, a study was done in 2018 to asses pregnant womens' knowledge towards MS which showed a moderate to low knowledge rate about MS effects.(4) The aim of this study is to measure the knowledge amoung females about MS and its effects on pregnancy in Saudi Arabia.

METHODS

Study Design and area and settings

This cross-sectional study was conducted among females diagnosed with MS in Saudi Arabia in which data was collected in one point of time. Given the large population in Saudi Arabia and the diversity of cultural backgrounds, Arabic translation was done first for our population. two bilingual translators whose native language was Arabic translated the English version and pilot-testing of the Arabic version was done. Participants were allocated into 5 main regions (central region, eastern region, northern region, southern region, and western region) for a better representation of the population. This diversity was aiming to study the different educational backgrounds and their impact on their perceptions. The participants were approached by self-administrated hard copy and an online survey, which was distributed through multiple social media platforms. Approval of the Institutional Review Board (IRB) from King Abdullah International Medical Research Center (KAIMRC) IRB# NRC22R/276/06.

Identification of study participants

Female patients diagnosed with MS in Saudi Arabia were the target population of this study. An estimated population size of 13,552,000 females are in Saudi Arabia. With 95% confidence level and 5% margin of error, the recommended sample size was 385 which was calculated using roasoft.com. A non-probability convenient sampling technique was used and 91 responses were collected. The inclusion criteria

applied were: female, MS diagnosis, ages from 18 to 50 years old.

Data collection process

After receiving the approval from the institutional review board in King Abdullah International Medical Research Center (KAIMRC), data was collected by the co-authors using two main approaches: a self-administered and an online questionnaire. The survey was adopted from a published study after obtaining the corresponding author consent.(4) Data was collected by the co-investigators in the waiting area at the neurology clinic in KAMC after gaining patients' consent. Patients selection was based on the inclusion criteria for this study. Online questionnaires were distributed among females in different regions in Saudi Arabia through different platforms in social media such as twitter, WhatsApp, and telegram. The questionnaire is subdivided into three sections. The first section was focused on the demographics of the study participants which included participants' age, marital status, number of children, and year of diagnosis, number of affected family members, occupation, education, and region. The second section was to assess the knowledge rate of women about general information regarding MS which it included 6 questions. Answer in this section were recorded as either true, false, or I don't know. The Last section was focused on assessing women's knowledge rate about the association of MS with pregnancy and delivery which included 11 questions. Answers in this section were also recorded as either true, false, or I don't know. Questionnaire filling time was estimated to be between 2-4 minutes. The answers these questions were encoded in the following manner: 2 if the answer was "correct", 1 if the answer was "I do not know", and 0 if the answer was "wrong". A total score was computed for the sum of all the items. If the calculated score was less than 50% of the total score, this was considered as poor knowledge. If the score is 50 to 75% of the total score, it was considered as fair knowledge. If the score is above 75% of the total score, it was considered as good knowledge. The independent variables that were collected from the questionnaire included the participants' age, marital status, number of children, and year of diagnosis, number of affected family members, occupation, education, and region. While the dependent variables were about females' knowledge about the general information regarding MS, and the knowledge rate of pregnant women about the relation between MS, pregnancy and childbirth.

Data analysis

The collected data of this study was entered in an excel sheet and analyzed by Statistical Package for the Social Sciences (SPSS) version 24, statistical analysis software. The demographics of the patients were analyzed using descriptive statistics. The categorical data were presented as percentages and frequencies. The categorical data included the education, marital status, age group, the questions about women's Knowledge Rate on General Information on Multiple Sclerosis, and the questions about women's Knowledge Rate on the Relationship between Multiple Sclerosis, Pregnancy and Childbirth. Nominal and ordinal variables were presented in form of numbers and percentages. Interval and ratio variables were presented in the form of means and standard deviations. Person r was used to test the correlation between bivariate with interval and ratio variables. A p-value <0.05 of all tests was considered to be statistically significant. Anonymity and confidentiality were maintained throughout this research. Patients' names and medical record numbers were not used, and data were kept confidential at all times and accessed only by the designated investigators.

RESULTS

The aim of the current study was to assess the knowledge of women with multiple sclerosis (MS) about its effects on pregnancy. A cross-sectional design was conducted by using an online survey which was distributed among a convenient sample of females with multiple sclerosis in different regions in Saudi Arabia.

The mean age of the women in the sample was 33.78 + 8.16. More than three quarters (83.6%)

of the sample had their ages ranged between 20 to 40 years old, while only 16.5% were more than 40 years old. About 60% of the sample were married and 58.2 % had children. The average duration of having MS was 7,65 + 5.88 years. About one quarter 26.4% of the sample had the disease for 11 and more years. More than have (58.2%) of the women in the sample completed either their bachelor or postgraduate education. More than two thirds (70.3%) were not working. More than half (57.1) of the women in the sample were from the Eastern Region (Table 1)

The majority of the women in the sample reported the correct answer for, Multiple sclerosis is an infectious disease and MS patient can get married in the future (91.2 and 96.7% respectively). High percentage of the women in the sample also reported the correct answer for the statement that women have high prevalence of multiple sclerosis compared to men, there is no specific treatment for multiple sclerosis, and women with multiple sclerosis can get pregnant (82.4%, 80.2% and 89% respectively (Table 2)

TABLE 1: Socio-Demographic Data of the Sample N = 91

Variable	Number	Percent
Age 30 or less 31-40 41- 50 51 - 60	35 41 13 2	38.5 45.1 14.3 2.2
Mean SD	33.78 8.16	
Marital Status Married Single Divorced Widow	54 28 8 1	59.3 30.8 8.8 1.1
Number of Children No children One child Two children Three children Four children More than 4 children	38 11 16 9 9 8	41.8 12.1 17.6 9.9 9.9 8.8
Duration of the disease 1-5 years 6-10 years 11-15 years More than 15 years	40 27 15 9	44.0 29.7 16.5 9.9
Mean Sd	7.64 5.88	
Education High School Diploma Bachelor Postgraduate	25 13 47 6	27.5 14.3 51.6 6.6
Occupation Working Not working	27 64	29.7 70.3
Region Central Eastern Northern Southern Western	24 52 2 6 7	26.4 57.1 2.2 6.6 7.7

TABLE 2: Assessment of Knowledge of Pregnant Women with Multiple Sclerosis About their disease N = 91

Items	Wrong answer		I do not Know		Correct Answer	
	Number	Percent	Number	Percent	Number	Percent
High prevalence of multiple sclerosis among women compared to men	2	2.2	14	15.4	75	82.4
Multiple sclerosis higher in cold people	30	33.0	32	35.2	29	31.9
Multiple sclerosis is an infectious disease.	4	4.4	4	4.4	83	91.2
There is no specific treatment for multiple sclerosis	15	16.5	3	3.3	73	80.2
Multiple sclerosis is a controllable disease	13	14.3	10	11.0	68	74.7
Multiple sclerosis does not deal with complete disability in patients	33	36.3	17	18.7	41	45.1
Ms patient can get married in the future.	0	0	3	3.3	88	96.7
The disease in women is more pronounced during menopause	15	16.5	63	69.2	13	14.3
Women with multiple sclerosis can get pregnant	1	1.1	9	9.9	81	89
Multiple sclerosis has no effect on pregnancy.	8	8.8	21	23.1	62	68.1
Multiple sclerosis adjusts during the third trimester of pregnancy	5	5.5	46	50.5	40	44.0
Drugs used in MS patients cause miscarriage in pregnant women	24	26.4		50.5	21	23.1
Drugs used in multiple sclerosis have an impact on the condition of the fetus	14	15.4	33	36.6	44	48.4
The best way to give birth was through vaginal delivery	14	15.4	62	68.1	15	16.5
Anesthesia during childbirth is not prohibited in women with multiple sclerosis	7	7.7	49	53.8	35	38.5
The rate of complications in newborns is no different from normal individuals	5	5.5	46	50.5	40	44
A woman with multiple sclerosis can maintain pregnancy	0	0	23	25.3	68	74.7

More than one third (36.3%) of the women in the sample (believe that it is incorrect that multiple sclerosis patients do not deal with complete disability) incorrectly answered the statement of multiple sclerosis does not deal with complete disability in patients. Also 33% incorrectly answered the statement of multiple sclerosis prevalence is higher in cold people. About two thirds (67%) of the sample had good knowledge score regarding MS. Thirty-point eight percent (30.8%) of the sample had a fair knowledge about MS while only 2.2% had poor knowledge (Figure 1).

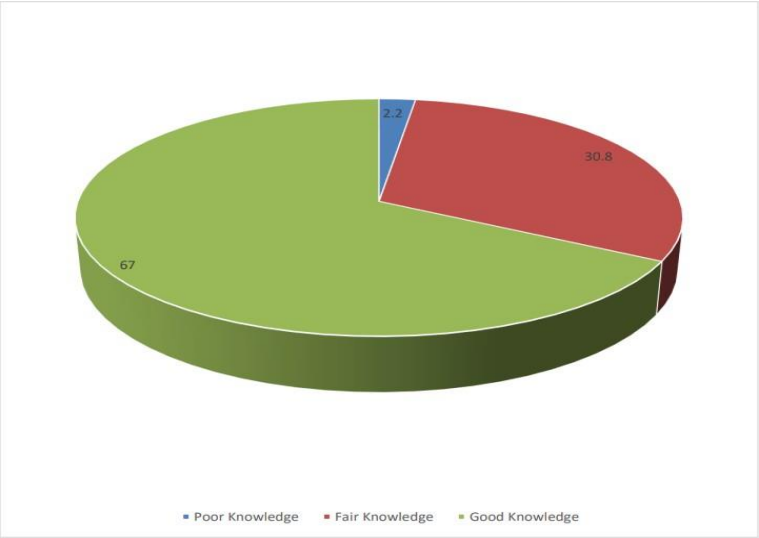

FIGURE 1: Total Knowledge Score of the women in the Sample N = 91

There was a statistically significant negative relationship between age and total knowledge score (p= 0.036). this showed that the knowledge score increased when the age the women in the sample decreases . However, there were no statistical relationship between duration of disease and number of children and total knowledge score (p = 0.154 and p = 0.056 respectively) (Table 3)

TABLE 3: Relationship between Age and Duration of the disease and Total Knowledge Score of the Sample N = 91

Variables	Total Knowledge Score	
	r	P
Age	-0.220*	0.036
Duration of Disease	0.151	0.154
Number of children	-.201	.056

There were no statistical significant differences of the mean total knowledge score and the categories of marital status, education, occupation, and region (p = 0.136, p = 0.649, p = 0.498, and p = 0.873 respectively) (Table 4)

TABLE 4: Comparison between the Mean Total Knowledge Score and Marital Status, Education, Occupation and region

Variables		Total Knowledge Score				
		Sum of Squares	df	Mean Square	F	P
Marital Status	Between Groups	1.979	2	0.990	2.037	0.136
	Within Groups	42.746	89	0.486		
Education	Between Groups	0.897	2	0.449	0.434	0.649
	Within Groups	90.861	89	1.033		
Occupation	Between Groups	0.298	2	0.149	0.702	0.498
	Within Groups	18.691	89	0.212		
Region	Between Groups	0.345	2	0.173	.137	0.873
	Within Groups	111.325	89	1.265		

DISCUSSION

Assessment of Knowledge of Pregnant Women with Multiple Sclerosis About their disease

This study was set out with the aim of assessing women diagnosed with MS about their knowledge of the disease effects on pregnancy and childbirth. upon reviewing the knowledge of pregnant women in this study, the majority of the participants believe that the prevalence of MS is higher in females compared to males. However, Abbasi et al results showed that more than half of the participants believed that this is a wrong statement.(4) In fact, evidence have reported gender differences in the disease prevalence with that being 3:1 female ratio.(16) MS is a known autoimmune disease with unidentified etiology.(1) However, the pathogenesis of MS is closely related to genetic predisposition and environmental causes.(18) An example of which is EBV which has gained much of the researchers focus as being a causative agent for MS, yet this has been found to have an epidemiological link rather than a pathophysiological association reflecting that this disease is non-infectious in nature.(19) In Abbasi et al paper, the majority were well informed about the disease as being noncontagious which also supports Abdulaban et al findings.(4,20) Surprisingly, most of the respondents in this study believe that MS is an infectious disease. An encouraging finding is that the majority of our respondents believed that future marriage and pregnancy for MS patients is possible. The immunomodulation of the maternal immune system during pregnancy has been known of its protective effect on the fetus. This is partially attributed to estrogen and progesterone effects on the maternal immune system. Due to that, improvements in the patients' disease state in a number of autoimmune diseases not only MS but also psoriasis and rheumatoid arthritis has been explained in the literature.(21) These were further explained to be most pronounced during the third trimester because of the peak of estrogen and progesterone levels during this period.(3,21) In this study, the knowledge of the participants is not strongly consistent with those explained in the literature as 68% believe that MS has no effect on pregnancy and half of the participants are not aware of the protective effect of pregnancy on MS patients particularly during the third trimester. Regarding the knowledge about maintaining pregnancy in woman with MS, Albrecht et al study revealed that only few of the participants answered correctly which corresponds with that out of 146 patients, only 7 answered with true.(22) Encouragingly, in our research the majority answered with true which corresponds with that out of 91 participants, 40 chose true as an answer. This could be attributed to the fact that the majority of our participants are young (i.e. less than 40 years old) and are educated. Unexpectedly, the majority of pur participants have no children despite having the knowledge of MS and its effects on maintaining pregnancy and childbirth. Although the knowledge about MS in general in our participants was good, certain questions included in the survey about pregnancy and MS were unknown by most of the participants. For example, half of our participants were not aware about the fact that MS medications used during pregnancy does not cause abortion as an adverse effect. In addition, whether vaginal delivery is better for MS patients or not is as well unknown to our participants as seen as well in Abbasi et al study which showed almost 80% in 150 participants did not answer correctly.(4)

Relationship between Age and Duration of the disease and Total Knowledge Score

Our research showed a significant negative correlation between age and the total knowledge score in which the younger the age, the more increase in knowledge is seen. In the contrary, Abulaban et al paper revealed no statistically significant difference between MS knowledge and age.(19) Our study revealed that there is no association between patient' knowledge and length of illness which is consistent with the evidence found in the literature.(23) The majority of our participants have a good knowledge about MS and its effects on pregnancy and childbirth. These results indicate a satisfactory amount of knowledge about our participants' knowledge about their illness which may contribute to a better prognosis and acceptance of their disease.

Comparison between the Mean Total Knowledge Score and Marital Status, Education, Occupation, and region

Patient knowledge about their condition is crucial and can lead to a massive improvement or deterioration of their condition. However, the level of knowledge patients has about their condition varies due to multiple factors such as age or literacy. In the case of multiple sclerosis, previous studies showed an association between patients' knowledge and level of education, patients' gender and level of knowledge, or patients' experience and their depth of knowledge. (20,22) In Saudi Arabia, a study was done in 2019 on Multiple Sclerosis patients found that female patients tend to have a higher level of knowledge about the disease compared to male patients. In addition, patients in Saudi Arabia had more understanding of the disease pathophysiology compared to options of treatments or the types of the disease.(20)

Summarized in table 7 are the results of comparing the level of knowledge in female patients compared to their material status, education, occupation, and region. These results indicate no significant difference between any of the tested variables. This outcome in addition to the outcome on figure 1 reflect a good level of knowledge about MS among most MS female patients. Similar findings were established in previous studies in Saudi Arabia which showed a relatively higher level of knowledge about the disease in female patients compared to male patients.(20) However, it is important to point that insignificant differences between the level of knowledge in all variables may not be consistent with the results of previous studies done worldwide. As mentioned above, multiple studies showed a significant difference associated with patients' experience or education and level of knowledge about MS.(3,23) This opposition between our results and the results of the previous studies could be due to multiple factors: material status independency to pregnancy experience, Saudi healthcare system effective effort to increase level of knowledge in all MS patients despite their backgrounds, or low sample size.

CONCLUSION

In conclusion, most of our participants were educated and at the age of 40 and below with a good knowledge about multiple sclerosis and its effects on pregnancy and childbirth which contributes to a better perception of conception and acceptance of their disease. This research also showed a significant negative correlation between age and total knowledge score. One of the limitations of this study is the number of participants as it is less than the required sample size. Another limitation is that the sampling technique being convenient. We recommend that more research should be conducted in a larger sample size and in wider range. Educational campaigns to increase the awareness about MS directed to the whole community and MS patients in particular is a recommendation to have a better understanding of the disease. .

CONFLICT OF INTEREST

The authors have no conflict of interest to declare.

Ethical approval

Approval of the Institutional Review Board (IRB) from King Abdullah International Medical Research Center (KAIMRC) IRB# NRC22R/276/06

Authors contributions

AA-conceived and designed the study, organized and analysis data.

AA, RA, NN, NA and HA collected and wrote initial and final draft of article.

AAlH, AALQ, FA, MA, YA , HA and OA, collected, analyzed and interpreted data.

MA, YA and HA provided logistic support.

All authors have critically reviewed and approved the final draft and are responsible for the content and similarity index of the manuscript.

ACKNOWLEDGMENT

The authors of this study acknowledge. (جمعية أرفى للتصلب العصبي المتعدد) Afra Organization for Multiple sclerosis for their contribution in this research by distributing this research questionnaire to the desired population.

REFERENCES

1. Robbins S, Aster J, Perkins J, Abbas A, Kumar V. Robbins basic pathology. Philadelphia: Elsevier; 2018.
2. Labuz-Roszak, B.; Kubicka-B ˛aczyk, K.; Pierzchała, K.; Horyniecki, M.; Machowska-Majchrzak, A.; Augusty´nska-Mutryn, D.; Kosałka, K.; Michalski, K.; Pyszak, D.; Wach, J. Jako´s´c ˙zycia chorych na stwardnienie rozsiane–zwi ˛azek z cechami klinicznymi choroby, zespołem zm˛eczenia i objawami depresyjnymi. Psychiatr. Pol. 2013, 47, 433–442.
3. Lamaita, R., Melo, C., Laranjeira, C., Barquero, P., Gomes, J., & Silva-Filho, A. (2021). Multiple Sclerosis in Pregnancy and its Role in Female Fertility: A Systematic Review. JBRA assisted reproduction, 25(3), 493–499. https://doi.org/10.5935/1518-0557.20210022
4. Abbasi V, Tabrizian S, Atalu A, Aslanian R, Zakeri A. Knowledge of pregnant women towards multiple sclerosis. Int J Community Med Public Health. 2018 Dec;5(12):5025.
5. Zhang Y, Zhang J, Liu H, He F, Chen A, Yang H, et al. Meta-analysis of FOXP3 gene rs3761548 and rs2232365 polymorphism and multiple sclerosis susceptibility. Medicine. 2019;98(38):e17224.
6. Sadovnick D. The place of environmental factors in multiple sclerosis: Genes, environment and the interactions thereof in the etiology of multiple sclerosis. Revue neurologique. 2019.
7. Wallin MT, et al. Global, regional, and national burden of multiple sclerosis 1990–2016: a systematic analysis for the global burden of disease study 2016. Lancet Neurol. 2019;18:269–85.
8. Mulitple Sclerosis International Federation. What is MS? Available at: https://www.msif.org/about-ms/what-is-ms/. Accessed: 20 June 2019.
9. Alanazi A, Alassiri M, Jawdat D, Almalik Y. Mesenchymal stem cell therapy: A review of clinical trials for multiple sclerosis. Regen Ther. 2022
10. Browne P, Chandraratna D, Angood C, Tremlett H, Baker C, Taylor BV, Thompson AJ. Atlas of multiple sclerosis 2013: a growing global problem with widespread inequity. Neurology. 2014;83(11):1022–4.
11. Karikari TK, Charway-Felli A, Höglund K, Blennow K, Zetterberg H. Commentary: global, regional, and national burden of neurological disorders during 1990–2015: a systematic analysis for the global burden of disease study 2015. Front Neurol. 2018;9:201.
12. Ascherio A, Munger KL. Epidemiology of multiple sclerosis: from risk factors to prevention—an update. Semin Neurol. 2016;36(02):103–14 Thieme Medical Publishers.
13. AlJumah M, Bunyan R, Al Otaibi H, Al Towaijri G, Karim A, Al Malik Y et al. Rising prevalence of multiple sclerosis in Saudi Arabia, a descriptive study. BMC Neurology. 2020;20(1).
14. Alshanqiti M, Alotaibi F, Alahmed J, Alrehaili M, Alalwi S, Mansuri D. PREVALENCE OF MULTIPLE SCLEROSIS IN SAUDI ARABIA. International Journal of Advanced Research. 2016;4(12):1581-1600.
15. Nazish S, Shahid R, Zafar A, Alshamrani F, Sulaiman A, Alabdali M et al. Clinical Presentations and Phenotypic Spectrum of Multiple Sclerosis at a University Hospital in Saudi Arabia. Journal of Clinical Neurology. 2018;14(3):359.
16. Al-Abdullah M, Siddiqui A. Demographic and disease characteristics of multiple sclerosis in the Southwest Region of Saudi Arabia. Neurosciences. 2018;23(4):320-325.
17. Coyle PK. What Can We Learn from Sex Differences in MS?. Journal of Personalized Medicine. 2021 Oct 7;11(10):1006.
18. Ghasemi N, Razavi S, Nikzad E. Multiple sclerosis: pathogenesis, symptoms, diagnoses and cell-based therapy. Cell Journal (Yakhteh). 2017 Apr;19(1):1.
19. Lanz TV, Brewer RC, Ho PP, Moon JS, Jude KM, Fernandez D, Fernandes RA, Gomez AM, Nadj GS, Bartley CM, Schubert RD. Clonally expanded B cells in multiple sclerosis bind EBV EBNA1 and GlialCAM. Nature. 2022 Mar;603(7900):321-7.
20. Abulaban, A., Altowairqi, A., Altowairqi, H., Almutairi, A., Altalhi, S., Alotaibi, F., & Alabbadi, I. (2019). Multiple Sclerosis Patients Knowledge in Saudi Arabia. Neurosciences (Riyadh, Saudi Arabia), 24(4), 327–330. https://doi.org/10.17712/nsj.2019.4.20190031
21. Voskuhl R, Momtazee C. Pregnancy: effect on multiple sclerosis, treatment considerations, and breastfeeding. Neurotherapeutics. 2017 Oct;14(4):974-84.

22. Albrecht, P., Fischer, D. & Moser, A. (2010). Multiple sclerosis and pregnancy: what does the patient think? a questionnaire study. BMC Res Notes, 3(91). https://doi.org/10.1186/1756-0500-3-91
23. Heesen C, Kasper J, Segal J, Kopke S, Muhlhauser I. Decisional role preferences, risk knowledge and information interests in patients with multiple sclerosis. Mult Scler. 2004;10:643–650. [PubMed] [Google Scholar]