Original Article

# Determinants of physical activity in women with multiple sclerosis based on theory of planned behavior

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## Abstract

**Background:** In recent decades, the scientific evidence has demonstrated that regular physical activity (PA) provides abundant physiological and psychological benefits in people with multiple sclerosis (MS). However, most persons with MS are physically inactive. This study examined determinants of PA based on the theory of planned behavior (TPB) among women with MS. **Method:** Participants (178)-completed measures included Godin Leisure-Time Exercise and TPB questionnaires. Descriptive statistics and hierarchical linear regression were analyzed using IBM SPSS. **Result:** Most participants were homemaker and the mean age was 34.2 years. The mean of PA was 11.6 ± 7.9 and only 10% of participants had sufficient amount of PA. The result of hierarchical linear regression indicated that attitude ($\beta$ = 0.27; $P$ < 0.05), subjective norm ($\beta$ = 0.18; $P$ < 0.05), and perceived behavioral control ($\beta$ = 0.44; $P$ < 0.05) explained 58% variance in exercise intention. Intention ($\beta$ = 0.20; $P$ < 0.05) and other variables explained 18% variance in PA. **Conclusion:** Our findings indicate that constructs of TPB could be used in behavioral interventions by health-care providers for increasing PA among women with MS.

**Keywords:** Multiple sclerosis, physical activity, theory of planned behavior

## Introduction

Multiple sclerosis (MS) is the most common neurological disorder in central nervous system (CNS).[1] The immune system attacks myelin of CNS and causes inflammation, demyelination, and lesions.[2,3] This chronic disease affects young adults and the prevalence ratio is 2 or 3 times more among women than men.[4]

This process results in a wide range of symptoms depended on areas of affected nerve fibers including blurred vision, double vision, balance disorder, spasticity, dysfunction of cognition, and mobility disability.[5,6] The patients with MS also suffer from pain, fatigue, depression, and muscle weakness.[7,8] Patients reduce their activities due to increase in these symptoms and subsequently decrease in their quality of life (HRQOL).[9,10] There is abundant evidence supporting physical activity (PA) has considerable benefits for improving fatigue, balance, coordination, and health-related quality of life.[11–13] Moreover, PA in people can prevent increased risk of comorbid illness such as cardiovascular diseases, obesity, type 2 diabetes, cancer, arthritis, osteoporosis, depression, and fatigue.[5,14,15] Researchers recommended that exercise behavior should be considered as the most effective nonpharmacological approach in MS patients.[16–18] Despite the benefits of PA, the existing evidence indicates the most of people with MS do not engage in sufficient amounts of PA.[19–21] This highlights the importance

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of identifying effective factors for changing behavior and increasing PA.[22] Theoretical frameworks can help to identify key factors that promote behaviors as well as can inform development of effective behavioral interventions.[23–25] The theory of planned behavior (TPB) as theoretical frameworks has been widely applied in many fields and in various populations.[26–28] TPB proposes that a person's intention to perform a behavior is the immediate determinant of that behavior. Intention is influenced by three main constructs involving attitude toward the behavior, subjective norms (SNs), and perceived behavioral control (PBC). Attitude reflects a person's positive or negative evaluation of performing a behavior. SN refers perception whether important others approve or disapprove of the behavior and whether important others perform the behavior. PBC reflects controllability of the behavior and ability to perform behavior.[26] Several studies were performed for examining associations between PA and construction of TPB in cancer survivors.[29–32] Ahmad *et al.*[33] examined predictors of exercise using TPB in sarcopenic elderly. Saber *et al.*[34] identified determinants of PA based on the TPB in the housewives. However, to our knowledge, there is no research that has been examined relationship between PA and variables based on TPB in people with MS. Therefore, it motivated us to conduct this study to investigate determinants of PA based on TPB in women with MS. Understanding variables from TPB that are associated with PA provides specific information for promoting PA among people with MS. This information could be targeted in behavioral interventions and clinical care by health-care providers such as health educators, physicians, and nurses.

# Methods

## Participants and procedures

This cross-sectional study was conducted between September 2018 and April 2019. Participants were recruited from MS clinics of two hospitals affiliated to the Tehran University of Medical Sciences (TUMS) in Tehran, Iran. The sample size was calculated based on 10 subjects for each observed variables.[35,36] In this study, there were 18 observed variables and finally the total sample size was considered 200 samples.

The first individual was screened based on inclusion criteria and then a member of the research team described the research and its procedures.

The inclusion criteria were (a) definite diagnosis of MS, (b) relapse-free in the past 30 days, (c) age of 18–65 years, (d) Expanded Disability Status Scale (EDSS) < 4, and (e) willingness to complete the questionnaire. EDSS was checked by neurologists in MS clinics.

Ultimately, 200 participants signed a written informed consent and then completed the questionnaires in MS clinics. After eliminating incomplete questionnaires, 178 samples were included.

### Measures

PA was measured using the Godin Leisure-Time Exercise Questionnaire (GLTEQ) which is a self-reported scale with two part.[37] We used only the first part in this study which includes three items which measure the frequency of strenuous, and moderate and mild exercise for more than 15 min during a typical week. The frequencies of strenuous, moderate, and mild activities are multiplied by 9, 5, and 3 metabolic equivalents, respectively, and summed into a total score. There is evidence for the validity this measure in persons with MS.[38]

### Theory of planned behavior

The TPB questionnaires were measured using standard items recommended by Ajzen[39] as well as previous studies.[32,35] The items focused on regular PA based on guideline in MS, 3 times per week for 20 min or more in each time.

Attitude was assessed using instrumental attitude and affective attitude. The main phrase was "For me, exercising regularly is …." Instrumental attitude was measured by three items that were rated on a 7-point bipolar adjective scale (unimportant/important, harmful/beneficial, useful/useless). Written descriptors were extremely (points 1 and 7), quite (points 2 and 6), and slightly (points 3 and 5). The affective attitude component was measured by two items. Each item was rated on a 7-point bipolar adjective scale (stressful/relaxing, unenjoyable (tiring)/enjoyable). Internal consistencies ($\alpha$) for the instrumental and affective attitude scales were 0.86 and 0.85, respectively.

SN was assessed by four items on a 7-point scale (1 = strongly disagree to 7 = strongly agree). The three items that measured injunctive norm were "Most people who are important to me would … exercise regularly" (approve–encourage–supportive). One item assessed descriptive norm "Most people who are important to me will be doing exercise program in the next month." Internal consistency ($\alpha$) for four items was 0.77.

PBC was measured by four items on 7-point scale (strongly disagree to strongly agree): (a) "I confident that I could exercise regularly," (b) "for me regular exercise would be easy," (c) "regular exercise completely up to me," and (d) "regular exercise is completely under my control." Cronbach's alpha coefficients were 0.915.

Intention was assessed using three items based on 7-point scale (strongly disagree to strongly agree): (a) "I intend to participate in regular PA," (b) "I plan to participate in regular PA," and (c) "I try to participate in regular PA." Cronbach's alpha coefficient for this scale was 0.9.

## Statistical analysis

The statistical analyses were conducted using IBM SPSS Statistics version 21. Differences in PA levels and TPB constructs based on demographic variables were examined using independent sample *T*-test. Bivariate correlations were performed using Pearson

correlation coefficients to determine associations between demographic, medical, TPB, and PA variables.

We conducted hierarchical linear regression analyses to examine key determinants of PA and intention. Only significant correlations were entered into the regression analysis. The first we performed hierarchical linear regression analysis; when PA was dependent variable, we entered intention, PBC in step 1, SN, attitude in step 2. For the second analysis, when intention was dependent variable, we entered PBC, SN, and attitude variables. The variance inflation factor was used to test for multi-collinearity.

## Ethical consideration

This project was approved by the ethics committee of TUMS (IR.TUMS.REC.1395.2280).

# Results

Most participants were married (60.1%), and 61.8% of women were homemaker. Most sample had university degree (68.5%) and 98% had relapsing remitting MS (RRMS). The mean age was 34.2 years (SD = 8.4) and the mean duration of disease was 7.6 years (SD = 5.1). The mean BMI was 23.49 (SD = 4.37), and 33.7% of women had BMI ≥ 25. The median EDSS was 2.

The descriptive statistics for PA and the TPB variables as well as differences are reported in Table 1. The bivariate correlations among continues variables are presented in Table 2. The TPB constructs were significantly correlated with each other and with PA ($P < 0.001$). The correlations between PA with components of TPB were moderate in magnitude. PA had the strongest significant correlations with intention and attitude ($r = 0.36$). Exercise intention had the strongest significant correlations with PBC ($r = 0.71$). Results of the first hierarchical linear regression analysis are reported in Table 3. Based on this analysis, the final model included exercise intention as significant predictor of GLTEQ scores. These variables explained 18% variance in PA. Results of the second multiple linear regression analysis are presented in Table 4. In this regression analysis, the key determinants of exercise intention were PBC, attitude, and SN. These variables explained 58% variance in exercise intention. The values for variance inflation factor did not indicate the presence of multicollinearity.

# Discussion

The purpose of this cross-sectional study was to examine determinants of PA based on TPB in women with MS.

The preliminary results of our study indicated that only 10% women with MS were physically active. This result is consistent with a recent study that reported the majority of persons with MS are not meeting PA guidelines while there is remarkable evidence about the benefit of PA.[19] Our findings demonstrated which only intention was key determinant of PA. According with the tenets of TPB, intention is one of the main determinants of behavior.[26,39] In addition, we observed the statistically significant association between attitude with PA intention. In current study, attitude toward exercise reflected both instrumental attitude and affective attitude. Instrumental attitude is defined by people's beliefs about positive or negative outcomes of performing the behavior and affective attitude consists of emotional response toward a behavior. This result is in line, in part, with previous research by Kasser *et al.*[40] which reported perceived benefits of exercise as key predictor of PA in people with MS. Similar with our findings, other studies founded instrumental attitude and affective attitude are important predictors of exercise intention.[30,31] Therefore, this finding suggests that attitude toward exercise is an important factor for increasing PA in individuals with MS and should be considered in behavioral interventions by health-care providers.

The other results demonstrated that PBC had the strongest effect on exercise intention. This finding in line with other research reported PBC is the main determinant of intention.[31,32]

We expected that PBC would have both direct and indirect relationships with physical activity but PBC had only the indirect effect with PA through intention. This result has been

**Table 1: Descriptive statistics for the theory of planned behavior in women (*n*=178)**

| Variables (*n*) | Mean (SD) | | | | |
|---|---|---|---|---|---|
| | Attitude | SN | PBC | Intention | PA |
| Married (107) | 28.5 (5.6) | 23.2 (4.6) | 21.3 (6.2) | 17.3 (3.8) | 11.1 (7.1) |
| Single (71) | 29.0 (5.4) | 23.2 (3.8) | 22.3 (6.1) | 17.5 (4) | 12.4 (9.) |
| *P* | 0.51 | 0.99 | 0.28 | 0.73 | 0.28 |
| Homemaker (110) | 28.2 (5.7) | 22.8 (4.6) | 21.6 (6.4) | 17.3 (4.0) | 10.9 (7.4) |
| Employed (68) | 29.5 (5.0) | 23.8 (3.8) | 22.0 (5.9) | 17.5 (3.5) | 12.8 (8.6) |
| *P* | 0.11 | 0.16 | 0.67 | 0.72 | 0.10 |
| University (122) | 29 (5.4) | 23.6 (3.9) | 21.8 (6.2) | 17.6 (3.6) | 11.9 (8.5) |
| Diploma and lower (56) | 28 (5.7) | 22.2 (5.0) | 21.5 (6.1) | 17.0 (4.3) | 10.9 (8.5) |
| *P* | 0.30 | 0.07 | 0.74 | 0.38 | 0.4 |
| Total mean | 28.7 (5.5) | 23.2 (4.3) | 21.7 (6.2) | 17.4 (3.8) | 11.6 (7.9) |
| Range | 5-35 | 4-28 | 4-28 | 3-21 | 0-119 |

PBC: Perceived behavior control, PA: physical activity, SN: subjective norm

**Table 2: Correlations for the theory of planned behavior and demographic variables**

| Variables | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
|---|---|---|---|---|---|---|---|---|
| Physical activity | | | | | | | | |
| Attitude | 0.36* | | | | | | | |
| Subjective norm | 0.27* | 0.45* | | | | | | |
| Perceived behavioral control | 0.31* | 0.67* | 0.46* | | | | | |
| Intention | 0.36* | 0.65* | 0.51* | 0.71* | | | | |
| Age | −0.10 | 0.03 | 0.02 | −0.14 | −0.07 | | | |
| Diseases duration | −0.08 | −0.06 | 0.04 | −0.09 | −0.04 | 0.47* | | |
| BMI | 0.02 | 0.06 | 0.05 | 0.05 | 0.03 | 0.31* | −0.05 | - |

*$P$<0.001. BMI: Body mass index

**Table 3: Hierarchical linear regression model**

| Physical activity | *B* | SE *B* | *β* | $R^2$ |
|---|---|---|---|---|
| Step 1 | | | | |
| Intention | 0.58 | 0.20 | 0.28* | 14% |
| Perceived behavioral control | 0.13 | 0.13 | 0.10 | |
| Step 2 | | | | |
| Intention | 0.29 | 0.14 | 0.20* | |
| Perceived behavioral control | 0.02 | 0.13 | 0.01 | 18% |
| Attitude | 0.35 | 0.21 | 0.17 | |
| Subjective norm | 0.23 | 0.19 | 0.08 | |

*β*=Standardized coefficient of regression; *B*=unstandardized coefficient of regression; SE *B*=unstandardized standard error. *$P$<0.001

**Table 4: Multiple linear regression**

| Exercise intention | *B* | SE *B* | *β* | $R^2$ |
|---|---|---|---|---|
| Perceived behavioral control | 0.28 | 0.04 | 0.44* | 0.58 |
| Subjective norm | 0.21 | 0.06 | 0.18* | |
| Attitude | 0.19 | 0.05 | 0.27* | |

*β*=Standardized coefficient of regression; *B*=unstandardized coefficient of regression; SE *B*=unstandardized standard error. *$P$<0.001

supported with the findings of Gholamnia in women which indicated PBC did not have direct effect on PA.[35] Some studies in cancer population are consistent with our data[30,31] and some are inconsistent.[29,32]

To promote PBC, exercise barriers and their solutions should be identified. People are motivated to do physical activity when they feel that the behavior is under their control. In current research, SN had a statistically significant relationship with intention. One previous study founded SN as an important factor,[35] but some researcher reported SN as a weak predictor.[29–31] This result suggests that enlisting important others to support and encouragement to participate in exercise behavior could play important role for increasing PA in individual with MS. For example, physicians could encourage and prescribe appropriate exercise in these persons and follow-up such as medicine. Overall, regression analysis indicated that the TPB constructs explained 58% and 18% of the variance in intention and PA, respectively. This finding is in line with previous studies in inactive people with MS that explained 10–17% variance in PA.[7,41] Also, these results are consistent with other research based on TPB in bladder cancer survivors which reported 21% variance in PA behavior[29] and inconsistent in kidney cancer survivors which founded 42% variance in PA.[32]

The results of this study suggest that the persons with MS engage in PA when they ensure PA has positive outcomes, the most important people approve it, and PA is under their control. In current research, there were several limitations. The participants were women and majority of the sample had RRMS and mild disability. Therefore, our results could not be generalized among men and in other types of MS as well as those who have more disability. The other limitation is that the data were collected using self-reported measures and participants may underestimate or overestimate their beliefs and behavior in self-reported questionnaires.

## Conclusion

Our results demonstrated that majority of women with MS had insufficient amount of PA. Moreover, exercise intention was strongly associated with PBC, attitude, and SN. Our finding indicated only intention was associated with PA. These data provided the new information that constructs of TPB could be used in behavioral interventions by health-care providers for increasing PA among women with MS.


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## Conflicts of interest

There are no conflicts of interest.


## References


1. Streber R, Peters S, Pfeifer K. Systematic review of correlates and determinants of physical activity in persons with multiple sclerosis. Arch Phys Med Rehabil 2016;97:633-45.
2. Criste G, Trapp B, Dutta R. Axonal loss in multiple sclerosis. Causes and mechanisms. In: Handbook of Clinical Neurology. Elsevier B.V.; 2014. p. 101-13.
3. Sá MJ. Exercise therapy and multiple sclerosis: A systematic review. J Neurol 2014;261:1651-61.
4. Asano M, Duquette P, Andersen R, Lapierre Y, Mayo NE. Exercise barriers and preferences among women and men with multiple sclerosis. Disabil Rehabil 2013;35:353-61.
5. Halabchi F, Alizadeh Z, Sahraian MA, Abolhasani M. Exercise prescription for patients with multiple sclerosis; potential benefits and practical recommendations. BMC Neurol 2017;17:1-11.
6. Frohman TC, Castro W, Courtney A, Ortstadt J, Davis SL, Logan D, *et al.* Symptomatic therapy in multiple sclerosis.

Ther Adv Neurol Disord 2011;4:83–98.

7. Dlugonski D, Wójcicki TR, McAuley E, Motl RW. Social cognitive correlates of physical activity in inactive adults with multiple sclerosis. Int J Rehabil Res 2011;34:115–20.
8. Latimer-Cheung AE, Martin Ginis KA, Hicks AL, Motl RW, Pilutti LA, Duggan M, *et al.* Development of evidence-informed physical activity guidelines for adults with multiple sclerosis. Arch Phys Med Rehabil 2013;94:1829-36.
9. Motl RW, Arnett PA, Smith MM, Barwick FH, Ahlstrom B, Stover EJ. Worsening of symptoms is associated with lower physical activity levels in individuals with multiple sclerosis. Mult Scler 2008;14:140–2.
10. Klaren RE, Sasaki JE, McAuley E, Motl RW. Patterns and predictors of change in moderate-to-vigorous physical activity over time in multiple sclerosis. J Phys Act Heal 2017;14:183–8.
11. Latimer-Cheung AE, Pilutti LA, Hicks AL, Martin Ginis KA, Fenuta AM, MacKibbon KA, *et al.* Effects of exercise training on fitness, mobility, fatigue, and health-related quality of life among adults with multiple sclerosis: A systematic review to inform guideline development. Arch Phys Med Rehabil 2013;94:1800-28.
12. Motl RW, Sandroff BM. Benefits of exercise training in multiple sclerosis. Curr Neurol Neurosci Rep 2015;15:1–9.
13. Motl RW, Sandroff BM, Kwakkel G, Dalgas U, Feinstein A, Heesen C, *et al.* Exercise in patients with multiple sclerosis. Lancet Neurol 2017;16:848–56.
14. Newland PK, Lunsford V, Flach A. The interaction of fatigue, physical activity, and health-related quality of life in adults with multiple sclerosis (MS) and cardiovascular disease (CVD). Appl Nurs Res 2017;33:49–53.
15. Raj J, Norris J, Ploriya S. Prevalence of low physical activity, its predictors and knowledge regarding being overweight/obesity: A community-based study from urban South India. J Fam Med Prim Care 2020;9:82-6.
16. Pilutti LA, Platta ME, Motl RW, Latimer-Cheung AE. The safety of exercise training in multiple sclerosis: A systematic review. J Neurol Sci 2014;343:3–7.
17. Dalgas U, Langeskov-Christensen M, Stenager E, Riemenschneider M, Hvid LG. Exercise as medicine in multiple sclerosis—Time for a paradigm shift: Preventive, symptomatic, and disease-modifying aspects and perspectives. Curr Neurol Neurosci Rep 2019;19:1–12.
18. Benito-León J. Physical activity in multiple sclerosis: The missing prescription. Neuroepidemiology 2011;36:192–3.
19. Motl RW, Mcauley E, Sandroff BM, Hubbard EA. Descriptive epidemiology of physical activity rates in multiple sclerosis. Acta Neurol Scand 2015;131:422–5.
20. Learmonth YC, Adamson BC, Kinnett-Hopkins D, Bohri M, Motl RW. Results of a feasibility randomised controlled study of the guidelines for exercise in multiple sclerosis project. Contemp Clin Trials 2017;54:84–97.
21. Baird JF, Silveira SL, Motl RW. Social cognitive theory and physical activity in older adults with multiple sclerosis. Int J MS Care 2021;23:21–5.
22. Casey B, Coote S, Shirazipour C, Hannigan A, Motl R, Martin Ginis K, *et al.* Modifiable psychosocial constructs associated with physical activity participation in people with multiple sclerosis: A systematic review and meta-analysis. Arch Phys Med Rehabil 2017;98:1453–75.
23. Motl RW, Pekmezi D, Wingo BC. Promotion of physical activity and exercise in multiple sclerosis: Importance of behavioral science and theory. Mult Scler J Exp Transl Clin 2018;4:1-8.
24. Vafa F, Mazloomy Mahmoodabad S, Vaezi A, Karimi H, Fallahzadeh H. A survey on the enablers and nurturers of physical activity in women with prediabetes. J Fam Med Prim Care 2020;9:2940-4.
25. Dashti S, Dabaghi P, Tofangchiha S. The effectiveness of training program based on protective motivation theory on improving nutritional behaviors and physical activity in military patients with type 2 diabetes mellitus. J Fam Med Prim Care 2020;9:3328-32.
26. Ajzen I. The theory of planned behavior. OBHDP 1991;50:179–211.
27. Eng JJ, Martin Ginis KA. Using the theory of planned behavior to predict leisure time physical activity among people with chronic kidney disease. Rehabil Psychol 2007;52:435–42.
28. Bao Y, Chen S, Jiang R, Li Y, Chen L, Li F, *et al.* The physical activity of colorectal cancer survivors during chemotherapy: Based on the theory of planned behavior. Support Care Cancer 2020;28:819-26.
29. Karvinen KH, Courneya KS, Plotnikoff RC, Spence JC, Venner PM, North S. A prospective study of the determinants of exercise in bladder cancer survivors using the Theory of Planned Behavior. Support Care Cancer 2009;17:171–9.
30. Stevinson C, Tonkin K, Capstick V, Schepansky A, Ladha AB, Vallance JK, *et al.* A population-based study of the determinants of physical activity in ovarian cancer survivors. J Phys Act Heal 2009;6:339–46.
31. Speed-Andrews AE, Rhodes RE, Blanchard CM, Culos-Reed SN, Friedenreich CM, Belanger LJ, *et al.* Medical, demographic and social cognitive correlates of physical activity in a population-based sample of colorectal cancer survivors. Eur J Cancer Care (Engl) 2012;21:187–96.
32. Trinh L, Plotnikoff RC, Rhodes RE, North S, Courneya KS. Correlates of physical activity in a population-based sample of kidney cancer survivors: An application of the theory of planned behavior. Int J Behav Nutr Phys Act 2012;9:96.
33. Ahmad MH, Shahar S, Mohd Fahmi Teng NI, Abdul Manaf Z, Mohd Sakian NI, Omar B. Applying theory of planned behavior to predict exercise maintenance in sarcopenic elderly. Clin Interv Aging 2014;9:1551–61.
34. Saber F, Shanazi H, Sharifirad G, Hasanzadeh A. Checking the determinants of physical activity based on the theory of planned behavior in the housewives. J Educ Health Promot 2014;3:94.
35. Gholamnia Shirvani Z, Ghofranipour F, Gharakhanlou R, Kazemnejad A. Predictors of women's exercise behavior based on developed theory of planned behavior with action and coping planning. Heal Educ Heal Promot 2013;1:3–17.
36. Green S B. How many subjects does it take to do a regression analysis. Multivariate Behav Res 1991;26:499–510.
37. Godin G. The Godin-Shephard Leisure-Time physical activity Questioinnaire (GLTEQ). Health Fitness J Can 2011;4:18–22.
38. Sikes EM, Richardson EV, Cederberg KJ, Sasaki JE, Sandroff BM, Motl RW. Use of the Godin leisure-time exercise questionnaire in multiple sclerosis research: A comprehensive narrative review. Disabil Rehabil 2019;41:1243–67.
39. Ajzen I. Perceived behavioral control, self-efficacy, locus of control, and the theory of planned behavior. J Appl Sport Psychol 2002;32:1-20.
40. Kasser SL, Kosma M. Health beliefs and physical activity

behavior in adults with multiple sclerosis. Disabil Health J 2012;5:261–8.
41. Uszynski MK, Casey B, Hayes S, Gallagher S, Purtill H, Motl RW, *et al.* Social cognitive theory correlates of physical activity in inactive adults with multiple sclerosis. Int J MS Care 2018;20:129–35.