Social Cognitive Theory and Physical Activity in Older Adults with Multiple Sclerosis

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Background: The expanding population of older adults with multiple sclerosis (MS) likely experiences many of the same benefits of physical activity (PA) as younger and middle-aged adults with MS. However, participation in PA is exceedingly low in this segment of the MS population. This study examined variables from social cognitive theory (SCT) as correlates of PA in older adults with MS to inform the subsequent development of behavioral interventions.

Methods: Older adults with MS (≥60 years of age, N = 180) completed an online survey including demographic and clinical characteristics, SCT variables (exercise self-efficacy, exercise goal setting, social support, and outcome expectations), and PA (total PA [TPA] and moderate-to-vigorous PA [MVPA]).

Results: Bivariate correlation analyses indicated that all SCT variables were significantly associated with TPA and MVPA (all $P \leq .001$). Hierarchical linear regression analyses indicated that disability status was a significant correlate of TPA ($\beta = –0.48$, $R^2 = 0.23$) and MVPA ($\beta = –0.44$, $R^2 = 0.19$) in step 1; disability and self-efficacy were significant correlates of TPA (disability $\beta = –0.20$, self-efficacy $\beta = 0.59$, $R^2 = 0.50$) and MVPA (disability $\beta = –0.16$, self-efficacy $\beta = 0.60$, $R^2 = 0.47$) in step 2; and disability, self-efficacy, and exercise goal setting were significant correlates of TPA (disability $\beta = –0.21$, self-efficacy $\beta = 0.50$, exercise goal setting $\beta = 0.14$, $R^2 = 0.55$) and MVPA (disability $\beta = –0.17$, self-efficacy $\beta = 0.51$, exercise goal setting $\beta = 0.15$, $R^2 = 0.51$) in step 3.

Conclusions: These results suggest that behavioral interventions focusing on self-efficacy and exercise goal setting as targets from SCT may be appropriate for increasing PA in older adults with MS.

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Social cognitive theory (SCT)\(^{12}\) represents a common approach for identifying modifiable variables as correlates of PA in those with MS.\(^{13}\) It posits self-efficacy as a proximal determinant of health behaviors and further posits a causal structure among self-efficacy, outcome expectations, perceived impediments/facilitators, and goal setting with health behaviors.\(^{14}\) Furthermore, SCT recognizes key sources or factors for targeting self-efficacy, including mastery experiences and vicarious experiences, that may translate into health behavior change. There is a wealth of cross-sectional and longitudinal data indicating that SCT variables correlate with PA in young and middle-aged adults with MS.\(^{15-20}\) Importantly, SCT has further informed the design and delivery of behavioral interventions that have increased PA participation in young and middle-aged adults with MS.\(^{21,22}\) This suggests that adopting SCT for examining correlates of PA represents an important first step in the subsequent design and delivery of behavioral interventions for older adults with MS.

The present study examined variables from SCT as correlates of PA in older adults with MS. We first examined SCT variables as correlates of total PA (TPA) and MVPA in the sample of older adults. We then examined the hierarchical associations among SCT variables and TPA and MVPA. We expected bivariate associations among SCT variables and PA outcomes and further expected that self-efficacy would be the primary correlate of PA, followed by other SCT variables, even after controlling for disability status as a confounder.

**Methods**

**Participants**

This cross-sectional study recruited participants from across the United States via an e-mail distribution from the National Multiple Sclerosis Society. Participants were invited to complete an online survey that focused on correlates of PA behavior. To be included, participants self-reported a diagnosis of MS and age of 60 years or older.

**Measures**

**Demographic and Clinical Characteristics**

Participants self-reported sex, age, race (selected from a predetermined list), type of MS, and disease duration (years). Disability status was measured using the Patient-Determined Disease Steps (PDDS) scale.\(^{23}\)

**Physical Activity**

Participants completed the Godin Leisure-Time Exercise Questionnaire (GLTEQ) as a validated self-measure of PA for persons with MS.\(^{24-27}\) Participants recorded the number of bouts (≥15 minutes) of mild (eg, easy walking, yoga), moderate (eg, fast walking, easy bicycling or swimming), and strenuous (eg, jogging, running, vigorous swimming or bicycling) activity completed during a typical week. The number of bouts was multiplied by weights of 3, 5, and 9 for mild, moderate, and strenuous activity, respectively, and then summed into a total leisure-time PA score (GLTEQ-total); higher scores reflect more TPA. The GLTEQ was further scored by summing the weighted values for moderate and strenuous activity only, which provided a health contribution score (GLTEQ-HCS) that corresponded with health-promoting PA (ie, MVPA); higher scores reflect more MVPA.

**Self-efficacy**

Self-efficacy was measured by the Exercise Self-Efficacy Scale (EXSE). The EXSE contains six items regarding one’s confidence for accumulating 30 minutes or more of MVPA on most days of the week in 1-month increments across the next 6 months.\(^{20,28}\) The items were rated on a scale ranging from 0 (not confident at all) to 100 (highly confident) and were averaged into a total exercise self-efficacy score, with higher scores reflecting greater self-efficacy.

**Outcome Expectations**

The Multidimensional Outcome Expectations for Exercise Scale (MOEES) assessed beliefs about the benefits of regular participation in exercise and PA.\(^{29}\) The MOEES contains 19 items across three subdomains of physical, social, and self-evaluative outcome expectations. The items were rated on a 5-point scale ranging from 1 (strongly disagree) to 5 (strongly agree), and item scores were summed, yielding a total score reflecting perceptions of benefits of regular exercise and PA.

**Social Support**

The abbreviated Social Provisions Scale (SPS) measured social support for PA.\(^{30,31}\) This version of the SPS contains six-items that measure current relationships/support for PA behaviors, and the items were rated on a 4-point scale ranging from 1 (strongly disagree) to 4 (strongly agree). The item scores were summed into a total score, with higher scores reflecting greater perceived support for PA.

**Goal Setting**

Goal setting for PA was measured using the ten-item Exercise Goal-Setting Scale (EGS).\(^{32}\) The items reflect goal-setting behaviors for PA and include statements such as “I often set exercise goals,” “I usually set dates for achieving my exercise goals,” and “I usually achieve the exercise goals I set for myself.” Items were rated on a 5-point scale ranging from 1 (does not describe) to 5 (completely describes), and the scores for each item were summed into a total score reflecting goal setting for exercise and PA engagement.

**Procedures**

All study procedures were approved by the University of Alabama at Birmingham institutional review board. After receiving the initial e-mail invitation that provided a brief overview of the survey, interested participants were prompted to access the questionnaire online. Participants provided informed consent and confirmed both age and MS diagnosis before accessing the survey. Participants then completed the questionnaires online using survey software (Qualtrics, Provo, UT) within 1 week of starting the research process. The use of internet-based self-report measures increases the accessibility of the survey and, therefore, the generalizability of the data. In addition, all measures included in the survey were validated for use in persons with MS. Participants who were interested in receiving compensation provided an address for receipt of remuneration ($10 USD).

**Data Analysis**

Data were analyzed using IBM SPSS Statistics for Windows, Version 25.0 (IBM Corp, Armonk, NY), and descriptive statistics are presented as mean ± SD unless otherwise
Results

Participant Characteristics

The demographic and clinical characteristics of the 180 participants are presented in Table 1. The mean ± SD age of the sample was 65.2 ± 4.7 years, and the participants were mostly female and White. The sample had a mean ± SD disease duration of 20.8 ± 9.9 years and presented with a relapsing-remitting course of MS with moderate disability (median PDDS scale score = 4.0). This sample is generally consistent with the demographic characteristics of older adults with MS who are primarily female and White race. Descriptive statistics for the measures of PA and SCT variables are presented in Table 2.

Associations Between PA and SCT Variables

Results from the Spearman rank-order correlation analyses are presented in Table 3. Disability status and all SCT variables were significantly associated with TPA (GLTEQ-total) and MVPA (GLTEQ-HCS) (all \( P \leq .001 \)). The associations between exercise self-efficacy (EXSE) and disability status with PA were large in magnitude, whereas all other associations were between small and moderate in magnitude.

Regressions by Outcome Measure

Total Physical Activity (GLTEQ-Total)

Results of the regression are presented in Table S1, which is published in the online version of this article at ijmsc.org. Disability status (PDDS scale) was included in step 1 of the hierarchical linear regression as a possible confounding variable and accounted for 23% of the variance in TPA (\( R^2 = 0.23, \beta = -0.48 \)). Exercise self-efficacy was included in step 2 and explained an additional 28% of the variance in TPA (\( R^2 = 0.50, \Delta R^2 = 0.28, \beta = 0.59 \)). The remaining SCT variables (EGS, SPS, and MOEES) were included in step 3. This model explained an additional 4% of the variance (\( R^2 = 0.55, \Delta R^2 = 0.04 \)), and disability status (\( \beta = -0.21 \)), exercise

Table 1. Correlates of Physical Activity in Older Adults

| Characteristic                  | Value          |
|---------------------------------|----------------|
| Age, y                          | 65.2 ± 4.7     |
| Sex                             |                |
| Female                          | 147 (81.7)     |
| Male                            | 33 (18.3)      |
| Racea                           |                |
| White/Caucasian                 | 174 (96.7)     |
| Black/African American          | 4 (2.2)        |
| Other                           | 2 (1.1)        |
| Type of MS                      |                |
| RRMS                            | 105 (58.3)     |
| SPMS                            | 55 (30.6)      |
| PPMS                            | 20 (11.1)      |
| Disease duration, y             | 20.8 ± 9.9     |
| PDDS scale score                | 4.0 [5.0]      |

Note: Values are given as mean ± SD, number (percentage), or median [interquartile range].

Abbreviations: PDDS, Patient-Determined Disease Steps; PPMS, primary progressive multiple sclerosis; RRMS, relapsing-remitting multiple sclerosis; SPMS, secondary progressive multiple sclerosis. *Choices were American Indian, Asian, Black or African American, Native Hawaiian or Other Pacific Islander, Caucasian, Latino/a, or other.

Table 2. Mean scores of PA and SCT variables

| Variable                        | Scale       | Scale range | Score, mean ± SD |
|---------------------------------|-------------|-------------|------------------|
| Total leisure-time PA           | GLTEQ-t     | 0-119       | 23.9 ± 23.1      |
| Moderate-to-vigorous PA         | GLTEQ-HCS   | 0-98        | 14.3 ± 19.5      |
| Exercise self-efficacy          | EXSE        | 0-100       | 39.8 ± 39.6      |
| Exercise goal setting           | EGS         | 10-50       | 22.2 ± 10.7      |
| Social support                  | SPS         | 6-24        | 17.4 ± 3.3       |
| Outcome expectations            | MOEES       | 19-95       | 60.0 ± 8.3       |

Abbreviations: EGS, Exercise Goal-Setting Scale; EXSE, Exercise Self-Efficacy Scale; GLTEQ-HCS, Godin Leisure-Time Exercise Questionnaire health contribution score; GLTEQ-t, Godin Leisure-Time Exercise Questionnaire total leisure-time activity score; MOEES, Multidimensional Outcomes Expectations for Exercise Scale; PA, physical activity; SCS, social cognitive theory; SPS, Social Provisions Scale.

Table 3. Correlations between PA and SCT variables

| SCT variable | GLTEQ-t | GLTEQ-HCS |
|--------------|---------|-----------|
| PDDS scale   | -0.54   | -0.51     |
| EXSE         | 0.69    | 0.70      |
| EGS          | 0.37    | 0.33      |
| SPS          | 0.27    | 0.23      |
| MOEES        | 0.39    | 0.35      |

Abbreviations: EGS, Exercise Goal-Setting Scale; EXSE, Exercise Self-Efficacy Scale; GLTEQ-HCS, Godin Leisure-Time Exercise Questionnaire health contribution score; GLTEQ-t, Godin Leisure-Time Exercise Questionnaire total leisure-time activity score; MOEES, Multidimensional Outcomes Expectations for Exercise Scale; PA, physical activity; PDDS, Patient-Determined Disease Steps; SCS, Social Cognitive Theory; SPS, Social Provisions Scale. *\( P \leq .001 \) for all.
self-efficacy ($\beta = 0.50$), and exercise goal setting ($\beta = 0.14$) were significant correlates of TPA scores.

**Moderate-to-Vigorous Physical Activity (GLTEQ-HCS)**

Results of the regression are presented in Table S2. Variables were entered into the regression in the same manner as GLTEQ-total. Disability status initially explained 19% of the variance in MVPA ($R^2 = 0.19, \beta = -0.44$). Exercise self-efficacy explained an additional 28% of the variance in MVPA ($R^2 = 0.47, \Delta R^2 = 0.28, \beta = 0.60$), and including all SCT variables explained a total of 51% of the variance in MVPA ($R^2 = 0.51, \Delta R^2 = 0.04$). The final model included disability status ($\beta = -0.17$), exercise self-efficacy ($\beta = 0.51$), and exercise goal setting ($\beta = 0.15$) as significant correlates of MVPA scores.

**Discussion**

Older adults with MS are an expanding segment of the MS population, and these individuals experience a fast rate of disability progression that manifests as problems with walking and reduced physical and cognitive function. There are few options available for managing the consequences of aging with MS. There is evidence of an association between PA and improved symptoms in this particular population, yet levels of PA are exceedingly low in older adults with MS. We conducted bivariate correlation and linear regression analyses based on SCT for examining modifiable correlates of PA in older adults with MS. The analyses indicated that self-efficacy was significantly and independently associated with PA and consistently explained the largest portion of variance in PA outcomes, even after accounting for disability status and other SCT variables. The only other SCT variable explaining variance in PA was goal setting. These results support continued research on self-efficacy, as well as goal setting, for informing behavioral interventions that target PA and its secondary benefits in older adults with MS.

The results of the present study align with previous research on associations between self-efficacy and PA participation in comparatively younger adults with MS. Importantly, self-efficacy is a modifiable construct, and SCT identifies specific sources or influences of self-efficacy that can be targeted with behavioral interventions. The most effective source of self-efficacy is mastery experiences. By experiencing success, an individual’s confidence in their ability to make a change and adopt the new health behavior is increased. Vicarious experiences, or seeing someone similar to you succeed, is another strategy for increasing self-efficacy via social support. Another major source of self-efficacy is social persuasion and verbal encouragement, which suggests that developing interventions that provide strong social support are a powerful precursor and driver of behavior change. Last, a person’s emotional state or affective experiences can influence self-efficacy. To positively affect self-efficacy, it is important to reduce stress and minimize negative emotional responses. Specific behavior change techniques that target these sources of self-efficacy include action planning that involves explicit instructions of how to achieve goals, providing positive feedback, and focusing on small successes. Future research should consider focusing on the sources of self-efficacy using theory-based approaches to inform the design of behavioral interventions for increasing PA in older adults with MS.

According to the causal model proposed in SCT, self-efficacy may be associated with PA through goal setting; however, goal setting itself influences health behavior independent of self-efficacy. This is supported by the present results that demonstrated a relationship between goal setting and PA (TPA and MVPA) independent of disability status, self-efficacy, and other SCT variables. Together with previous research in MS that has demonstrated an independent association between goal setting and PA, this finding suggests that goal setting may be another target of behavioral interventions aimed at increasing PA in older adults with MS. Goals set the course for behavior change and provide incentives and motivation. Important characteristics of successful goal-setting behavior include setting goals that are clearly defined, attainable, measurable, and time limited. Behavioral interventions that incorporate goal-setting practices may have a positive effect on PA behavior in older adults with MS.

The present study is not without important limitations. The cross-sectional research design precludes any inferences of causality. Another limitation is the homogeneity of the primarily female and White sample; this may limit the generalizability of the results to males and other races with MS. Future research may benefit from including a more diverse sample. Also note that all data were based on self-report measures and, therefore, are inherently associated with certain limitations compared with objective measures. In addition, the present study considered only variables from SCT as possible correlates of PA. Future studies may consider examining determinants of PA proposed by alternative behavior change models (eg, the transtheoretical model or the health action process approach).

Overall, the primary result of this cross-sectional study indicated that self-efficacy was significantly and independently associated with both total leisure-time PA and health-promoting PA (ie, MVPA) in older adults with MS. Exercise goal setting was further identified as an independent correlate of PA. These SCT variables
are modifiable through focal intervention and may represent targets of behavioral change for increasing PA in older adults with MS. Future research may design and test behavioral interventions based on SCT for increasing PA in the expanding segment of older adults living with MS.

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Practice Points

- The expanding population of older adults with MS likely experiences many of the same benefits of physical activity (PA) as younger and middle-aged adults with MS. However, participation in PA is exceedingly low in this particular segment of the MS population.
- The present results suggest that behavioral interventions focusing on self-efficacy and exercise goal setting as targets from social cognitive theory may be appropriate for increasing PA in older adults with MS.