Social Cognitive Correlates of Physical Activity: Findings From a Cross-Sectional Study of Adults With Relapsing-Remitting Multiple Sclerosis

Yoojin Suh, Madeline Weikert, Deirdre Dlugonski, Brian Sandroff, and Robert W. Motl

Background: Persons with multiple sclerosis (MS) are often physically inactive and sedentary. This observation has prompted the search for modifiable variables derived from established theories that act as correlates of physical activity. Such variables would presumably represent targets for interventions designed to promote change in physical activity behavior among persons with MS. The current study examined social cognitive variables as correlates of physical activity in persons with MS. Methods: Persons (N = 218) with relapsing-remitting MS completed a questionnaire battery that assessed physical activity behavior; self-efficacy for physical activity; physical, social, and self-evaluative outcome expectations for exercise, functional limitations as an impediment for physical activity, and exercise goal-setting. The battery was delivered and returned through the US postal service. Data were analyzed using covariance modeling in Mplus 3.0. Results: Self-efficacy had indirect effects on physical activity via impediments (path coefficient = .10, \( P < .005 \)), self-evaluative outcome expectations (path coefficient = .07, \( P < .025 \)), and goal-setting (path coefficient = .09, \( P < .01 \)). The model explained 40% of variance in self-reported physical activity. Conclusions: This cross-sectional study suggests that self-efficacy is indirectly associated with physical activity by way of goals, self-evaluative outcome expectations, and impediments in persons with relapsing-remitting MS.

Keywords: exercise psychology, health promotion, motivation

Multiple sclerosis (MS) is a chronic and disabling neurological disease that affects an estimated 400,000 adults in the United States.\(^1\) MS typically begins with intermittent bursts of focal inflammation in the central nervous system (CNS)\(^2\) and results in the demyelination and transection of axons in the brain, optic nerves, and spinal cord.\(^3\) The resulting axonal damage interferes with the conduction of electrical potentials along neuronal pathways in the CNS\(^4\) and is associated with the worsening of symptoms, neurological function, disability, and quality of life across time in people with MS.\(^5\)

Physical activity is a promising behavior strategy for managing many of the consequences associated with MS. The benefits have been summarized in general literature reviews,\(^6,7\) a systematic Cochrane review,\(^8\) and meta-analyses.\(^9,10\) One recent meta-analysis reported that exercise training was associated with a small, but clinically meaningful, improvement in walking mobility among individuals with MS.\(^9\) Another meta-analysis indicated that physical activity, in the form of exercise training, was associated with improved quality of life and fatigue in persons with MS.\(^10\) Other benefits of physical activity in persons with MS include improved muscle strength, body composition, and cardiorespiratory fitness as well as symptom management.\(^6-8\)

Nevertheless, there is considerable evidence that individuals with MS are relatively inactive and sedentary, particularly compared with the general population.\(^11\) This is supported by a meta-analysis indicating that individuals with MS were nearly 1 standard deviation less physically active than individuals without MS or any other disease condition.\(^12\) One study that was not included in the meta-analysis compared the leisure physical activity levels of those with MS against the general population and against groups of people who reported having either angina pectoris, asthma, or diabetes.\(^13\) Notably, the individuals with MS reported engaging in significantly fewer hours of strenuous and light physical activity per week than the other disease groups and the general population. Sixty-three percent of the individuals with MS reported engaging in no leisure physical activity, whereas roughly 27% of the general population reported no leisure time physical activity. Apart from missing the potential benefits of physical activity on symptoms, the prevalence of physical inactivity in persons with MS is alarming considering the likelihood of increased relative risks of preventable disease conditions (eg, obesity, cancer, diabetes, and cardiovascular diseases).

The study of variables that correlate with physical activity is critically important for identifying possible
targets of interventions for changing physical activity behavior among those with MS. To date, the categories and types of correlates have been thoroughly researched in the general population of adults, but much less research has been conducted on understanding correlates of physical activity among those with MS. Overall, literature reviews have suggested that elements of the physical and social environment, perceived barriers and self-efficacy, and disease status/disability are possible correlates of physical activity among those with MS.11,12,15

Ideally, an examination of correlates should be rooted in a well-developed theory that identifies correlates, strategies, and pathways of behavior change such as Bandura’s Social Cognitive Theory. One of the primary active agents for behavior change in Social Cognitive Theory is self-efficacy, defined as a situation specific belief in one’s ability to successfully undertake a course of action. Research has supported self-efficacy as a primary correlate of physical activity in the general population and persons with MS. The importance of self-efficacy operating as a correlate of physical activity is that there are sources of information that can be targeted for changing this variable and consequently behavior. Indeed, Social Cognitive Theory provides principles on how to change health behavior by targeting predictors (eg, sources of efficacy information), whereas many other models of health behaviors do not inform on the process of change, but rather simply the predictors of change. This supports the adoption of Social Cognitive Theory as a framework for examining correlates that can be targeted by an intervention for changing physical activity in those with MS.

Bandura has recently forwarded a model whereby self-efficacy has both direct and indirect pathways with health behaviors including physical activity (Figure 1).

The indirect pathway, in particular, includes physical, social, and self-evaluative outcome expectations; impediments and facilitators (ie, sociostructural factors); and goal setting as possible intermediate variables between self-efficacy and health behavior. As noted by Bandura, those with high self-efficacy expect more favorable physical, social, and self-evaluative outcomes, view impediments as more surmountable, and set higher goals for themselves. Bandura further notes that those with more favorable outcome expectations, fewer impediments, and higher goals engage in more positive health behaviors. Parts of this indirect pathway have been tested and supported for explaining the relationship between self-efficacy and physical activity behavior in the general population of healthy adults, but this pathway has yet to be tested among those with MS. Importantly, many other models of health behavior (eg, Health Belief Model, Theory of Planned Behavior, and Protection Motivation Theory) include predictors that are overlapping with Social Cognitive Theory, and, as previously noted, only consider predictors of health behaviors rather than both predictors and principles for targeting change.

We note that the nature of the relationship between self-efficacy and physical activity might be the same, or different, in those with MS compared with the general population. If the variables that predict physical activity are similar in individuals with MS, then researchers can develop and deliver standardized interventions based on Social Cognitive Theory for increasing physical activity. If the variables that predict physical activity are dissimilar, then researchers must develop and deliver interventions that are specifically tailored for those with MS and not simply adopt interventions that are effective in populations that do not have MS. This underscores the importance of the generalizability or specificity of

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Figure 1 — Model of the direct and indirect relationships between self-efficacy and physical activity based on Bandura.
designing interventions for increasing physical activity between populations, including those with MS.

To date, we are unaware of studies that have evaluated direct and indirect pathways between self-efficacy and physical activity in persons with relapsing-remitting MS; previous studies have focused on the association between self-efficacy and physical activity without including the roles of outcome expectations, impediments, and goal setting. Such an examination is important because practitioners and clinicians would seemingly be in a better position for developing targeted interventions for promoting physical activity in those with MS based on Social Cognitive Theory. We focused on relapsing-remitting MS (ie, disease course characterized by acute periods of new or worsening MS symptoms followed by partial or full remission) because it is the most common disease course (ie, 85% of MS cases) and represents the largest cohort of persons with MS for developing a behavioral intervention for promoting physical activity. Accordingly, the current study examined the relationship between self-efficacy and physical activity in persons with relapsing-remitting MS, and we expected that self-efficacy would have both direct and indirect relationships with physical activity, and the indirect relationship would operate through outcome expectations, impediments, and goals. This hypothesis is largely consistent with the model offered by Bandura and is illustrated in Figure 2; the inconsistency is that we did not include facilitators, but note that Bandura largely focuses on impediments in the presentation of Social Cognitive Theory.

### Methods

#### Participants

The sample was recruited through a research announcement on the main website of the NMSS. Individuals who were interested in participation initially contacted the research team through either e-mail or telephone. This contact was followed-up by a telephone call from a member of the research team who described the study and its procedures, answered all questions, and conducted a brief screening interview to assess participant eligibility. The screening criteria for inclusion involved (a) diagnosis of relapsing-remitting MS, (b) relapse-free in the last 30 days, and (c) ambulatory with minimal assistance (ie, walk independently or walk with a cane). There were 305 individuals who were contacted about participation in this study, and 300 of those individuals underwent screening. Of those who were screened, 53 individuals did not satisfy the inclusion criteria and 4 individuals declined participation. We sent study materials to the remaining 243 individuals who satisfied inclusion criteria and volunteered for participation over the telephone. Twenty-five individuals did not return the study materials and this yielded a final convenience sample of 218 individuals with relapsing-remitting MS.

#### Procedure

After initial telephone contact and screening, all participants were sent an informed consent document along with a battery of questionnaires through the United States.
postal service. We further provided prestamped and preaddressed envelopes for return postal service. The researchers called to make sure the participants received the documents, understood the directions, and signed the informed consent. The participants then completed the battery of questionnaires and returned the study materials through the United States postal service. We contacted participants by telephone and e-mail as a reminder to return the study materials up to 3 times. All participants received $10 upon returning the study materials.

Measures

Physical Activity. Physical activity was measured by the Godin Leisure-Time Exercise Questionnaire and the short-form of the International Physical Activity Questionnaire. The Godin Leisure-Time Exercise Questionnaire is a self-administered 2-part measure of usual physical activity; we only included the first part in this study consistent with previous research. The first part has 3 items that measure the frequency of strenuous (eg, jogging), moderate (eg, fast walking), and mild (eg, easy walking) exercise for periods of more than 15 minutes during one’s free time in a typical week. The weekly frequencies of strenuous, moderate, and mild activities are multiplied by 9, 5, and 3 metabolic equivalents, respectively, and summed to form a measure of total leisure activity. The short-form of the International Physical Activity Questionnaire was designed for population surveillance of physical activity among adults and contains 6 items that measure the frequency and duration of vigorous-intensity activities, moderate-intensity activities, and walking during a 7-day period. The respective frequency values for vigorous, moderate, and walking activities were multiplied by 8, 4, and 3.3 metabolic equivalents and then summed to form a continuous measure of physical activity. We did not include the duration component in the generation of an overall score based on previous research that identified problems with accurate recall of activity duration in persons with MS. The short-form of the International Physical Activity Questionnaire includes an additional question that measures time spent sitting as an indicator of sedentary activity and that is not included as part of the summary physical activity score. This study did not include the sitting item in the data analyses because we were not interested in sedentary behavior. Researchers have provided evidence for the validity of scores from both measures in persons with MS. Scores from the Godin Leisure-Time Exercise Questionnaire have correlated with steps counts from a pedometer (r = .51) and activity counts from an accelerometer (r = .51). Scores from the International Physical Activity Questionnaire have similarly correlated with steps counts from a pedometer (r = .46) and activity counts from an accelerometer (r = .53). The correlation between Godin Leisure-Time Exercise Questionnaire and International Physical Activity Questionnaire scores was .63 in the current study, and this is consistent with previous research (r = .59).

Self-Efficacy. Self-efficacy was assessed by the Exercise Self-Efficacy scale. This scale has 6 items that assess an individual’s beliefs in their ability to engage in 20+ minutes of moderate physical activity 3 times per week, in 1 month increments, across the next 6 months. The items were rated on a scale from 0 (Not at all confident) to 100 (Completely confident) and averaged into a composite that ranges between 0 and 100. Higher scores reflect greater confidence in one’s ability to regularly engage in exercise. This scale is internally consistent and has evidence of score validity. Coefficient alpha for the Exercise Self-Efficacy scale was .99 in the current study, and this is consistent with the estimate (α = .99) from previous research on persons with MS. The previous research further supported the validity of the Exercise Self-Efficacy scale in persons with MS based on correlations with measures of physical activity enjoyment (r = .46), social support (r = .30), and physical activity (r = .49).

Outcome Expectations. Outcome expectations for exercise were measured by the Multidimensional Outcome Expectations for Exercise Scale. This scale contains 15 items that reflect 3 subdomains of outcome expectations. Six items reflect physical outcome expectations (eg, “Exercise will increase my muscular strength,” “Exercise will improve my overall functioning”), 4 items assess social outcome expectations (“Exercise will improve my companionship,” “Exercise will increase my acceptability by others”), and 5 items measure self-evaluative outcome expectations (eg, “Exercise will give me a sense of accomplishment,” “Exercise will help me manage my stress”). The 15 items were rated on a 5-point scale from 1 (strongly disagree) to 5 (strongly agree) and summed to form the subscale measures of outcome expectations. Subscale scores range between 5 and 15 and higher scores reflect greater outcome expectations. This scale has good internal consistency and evidence of score validity in older adults and persons with MS. Coefficient alpha for the physical, social, and self-evaluated outcome expectation scales were .81, .81, and .87 in the current study, and this is consistent with previous estimates of .76, .77, and .83, respectively, in persons with MS. Regarding validity, scores from the physical, social, and self-evaluated outcome expectation scales were correlated with objectively measured physical activity (r = .22, r = .19, and r = .20, respectively), self-reported physical activity (r = .17, r = .20, and r = .19, respectively), and self-efficacy for exercise (r = .32, r = .18, and r = .33, respectively) in persons with MS.

Functional Limitations. Functional limitations represented impediments for physical activity and were measured using the Functional Limitations component of the abbreviated Late-Life Function and Disability.
The Functional Limitations component contains 15 items that correspond with advanced lower extremity function, basic lower extremity function, and upper extremity function. An example item for the advanced lower extremity function was “How much difficulty do you have with going up and down a flight of stairs outside, without using a handrail?” The 15-items were rated on a 5-point scale ranging from 1 (none) to 5 (cannot do) and were reverse-scored and then averaged to form composite measures of advanced lower extremity function, basic lower extremity function, and upper extremity function with higher scores representing better functioning; scores for each subscale range between 5 and 25. The subscale scores were summed into a composite measure of functional limitations that ranges between 15 and 75. Higher scores reflect fewer functional limitations. There is evidence for the factorial (strong fit of the measurement model for the 15-item scale) and construct (ie, discrimination between clinical MS course and level of mobility disability; correlations with neurological impairment \( r = –.71 \), symptoms of fatigue \( r = –.44 \) and depression \( r = –.42 \), and physical health status \( r = .74 \)) validity and responsiveness of the Functional Limitations component of the abbreviated Late-Life Function and Disability Instrument in persons with MS.\(^{34}\) The internal consistency reliability of the functional limitations component in the current study was .93.

**Goal-Setting.** Exercise goals were measured by the Exercise Goal-setting Scale\(^ {24}\) (EGS). This contains 10 items that reflect goal setting for exercise behavior and the items are rated on a 5-point scale ranging from 1 (does not describe) to 5 (describes completely). The item scores are summed into an overall score that ranges between 10 and 50. Higher scores reflect a stronger tendency for setting goals for exercise. There is evidence that supports the reliability \( (\alpha = .89) \) and validity of Exercise Goal-setting Scale scores in young healthy adults,\(^ {24}\) but not in persons with MS. For example, Exercise Goal-setting Scale scores have correlated with self-efficacy \( (r = .53) \), enjoyment \( (r = .42) \), social support \( (r = .34) \), and physical activity \( (r = .38) \) in young healthy adults.\(^ {24}\) Coefficient alpha for the EGS was .93 in the current study.

**Disability.** Disability was measured using the Patient Determined Disease Steps (PDDS) scale.\(^ {35}\) The PDDS is a self-report questionnaire that contains a single item for measuring disability using an ordinal scale from 0 (Normal) through 8 (Bedridden). This scale was developed as an inexpensive surrogate for the Expanded Disability Status Scale (EDSS) and scores from the PDDS are linearly and strongly related with physician-administered EDSS scores \( (r = .93) \).\(^ {35}\)

**Data Analysis**

We initially performed descriptive and bivariate correlation analyses in SPSS, version 17.0 for Windows. The data were then analyzed using covariance modeling and the maximum likelihood estimator as fit function in *Mplus* 3.0.\(^ {36}\) Covariance modeling is a family of techniques that allow for testing the fit of hypothetical models that describe explanatory relationships among manifest (ie, underlying construct that is represented by a single indicator or measure) and latent (ie, underlying construct that is represented by 2 or more indicators or measures) variables. Importantly, covariance modeling does not allow for inferences about causation based on covariances among variables, but instead provides a means for testing models that reflect hypotheses about causal processes that might underlie the data. Some of the advantages of covariance modeling compared with simple regression include simultaneous estimation of all relationships among multiple exogenous (ie, variables transmitting an effect) and endogenous (ie, variables receiving and transmitting effects) variables; inclusion of manifest and latent variables; estimation of direct, indirect, and total effects; estimation of model parameters in the presence of missing data; and an omnibus test of the model for its fit to the data.

The model that we tested is in Figure 2. It included direct paths between (a) self-efficacy with physical, social, and self-evaluative outcome expectations, impediments, goals, and physical activity; (b) physical, social, and self-evaluative outcome expectations with goals and physical activity; (c) impediments with goals; and (d) goals with physical activity. Physical activity was modeled as a latent variable using scores from both the Godin Leisure-Time Exercise Questionnaire and the short-form of the International Physical Activity Questionnaire. Self-efficacy, outcome expectations, impediments, and goals were modeled as manifest variables using Exercise Self-efficacy Scale, Multidimensional Outcome Expectation for Exercise Scale, abbreviated Late-Life Function and Disability Inventory, and Exercise Goal-setting Scale scores, respectively. The indirect path coefficients were estimated using the INDIRECT programming option in *Mplus*.\(^ {36}\)

Overall model fit was assessed using the \( \chi^2 \), standardized root mean squared residual (SRMR), and comparative fit index (CFI). The \( \chi^2 \) provides a simultaneous test that all residuals in the specified versus obtained variance/covariance matrices are 0.\(^ {36}\) The SRMR is the average of the standardized residuals between the specified and obtained variance/covariance matrices.\(^ {37}\) The CFI tests the proportionate improvement in fit by comparing the target model with the independence model (ie, model with no correlations among observed variables). We based a good-model data fit on a nonsignificant chi-square value\(^ {37}\) and combinatory rules of SRMR \( \leq .08 \) and CFI \( \geq .95 \). We further inspected modification indices (ie, conceptualized as a \( \chi^2 \) with one degree of freedom for all fixed parameters indicating the drop in the overall \( \chi^2 \) if the parameter were freely estimated) for identifying possible changes in the parameterization of the model (ie, component analysis of model fit) that would improve model-data fit.\(^ {37}\)
Results

Sample Characteristics

The sample consisted of 197 women and 21 men with a mean age of 43.5 years (SD = 10.0). The mean duration of MS, defined as time since definite diagnosis, was 8.0 years (SD = 6.9). The sample was mostly Caucasian (91%), married (69%), employed (71%), and educated (24% had some college education and 62% were college graduates) with an annual household income of greater than $40,000 (71%). The median PDDS score was 1 (range = 0–6) and this corresponds with mild disability (ie, noticeable, but minor symptoms).

Descriptive Statistics and Correlations

The descriptive statistics for the variables are provided in Table 1. The correlations among the variables are in Table 2 and all correlations were statistically significant ($P < .05$).

Covariance Modeling

The model that we tested represented an acceptable overall fit for the data ($\chi^2 = 20.23, df = 9, P = .02, SRMR = 0.04, CFI = 0.98$), but inspection of the modification indices supported the addition of a direct path between impediments and physical activity (modification

<table>
<thead>
<tr>
<th>Measure</th>
<th>Mean score</th>
<th>Standard deviation</th>
<th>Actual range of scores</th>
</tr>
</thead>
<tbody>
<tr>
<td>EXSE</td>
<td>73.6</td>
<td>31.6</td>
<td>0–100</td>
</tr>
<tr>
<td>MOEES—physical</td>
<td>26.3</td>
<td>3.2</td>
<td>15–30</td>
</tr>
<tr>
<td>MOEES—social</td>
<td>12.1</td>
<td>3.3</td>
<td>4–20</td>
</tr>
<tr>
<td>MOEES—self-evaluative</td>
<td>21.0</td>
<td>3.1</td>
<td>9–25</td>
</tr>
<tr>
<td>LL-FDI—functional limitations</td>
<td>58.6</td>
<td>12.0</td>
<td>27–75</td>
</tr>
<tr>
<td>EGS</td>
<td>21.9</td>
<td>10.1</td>
<td>10–50</td>
</tr>
<tr>
<td>GLTEQ</td>
<td>23.8</td>
<td>20.4</td>
<td>0–119</td>
</tr>
<tr>
<td>IPAQ</td>
<td>33.9</td>
<td>22.0</td>
<td>0–107</td>
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</table>

Abbreviations: EXSE, Exercise Self-Efficacy Scale; MOEES, Multidimensional Outcomes Expectations for Exercise Scale; LL-FDI, abbreviated Late-Life Function and Disability Instrument; EGS, Exercise Goal-setting Scale; GLTEQ, Godin Leisure-Time Exercise Questionnaire; IPAQ, short-form of the International Physical Activity Questionnaire.

<table>
<thead>
<tr>
<th>Variable</th>
<th>1</th>
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<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
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<td>2. MOEES—physical</td>
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<td>3. MOEES—social</td>
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<td>.40</td>
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<tr>
<td>4. MOEES—self-evaluative</td>
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<td>.73</td>
<td>.42</td>
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<tr>
<td>5. LL-FDI—functional limitations</td>
<td>.48</td>
<td>.31</td>
<td>.16</td>
<td>.24</td>
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<td>6. EGS</td>
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<tr>
<td>7. GLTEQ</td>
<td>.34</td>
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<td>.22</td>
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<td>.52</td>
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<td>8. IPAQ</td>
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<td>.40</td>
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</table>

Note. All correlations are statistically significant ($P < .05$).

Abbreviations: EXSE, Exercise Self-Efficacy Scale; MOEES, Multidimensional Outcomes Expectations for Exercise Scale; LL-FDI, abbreviated Late-Life Function and Disability Instrument; EGS, Exercise Goal-setting Scale; GLTEQ, Godin Leisure-Time Exercise Questionnaire; IPAQ, short-form of the International Physical Activity Questionnaire.
The addition of this path was deemed appropriate because it was consistent with research among older adults.\textsuperscript{23} We then tested the model that included this additional path and the model provided an excellent overall fit for the data ($\chi^2 = 12.1$, df = 8, $P = .15$, SRMR = 0.03, CFI = .99), and there were no large modification indices that identified sources of mis specification for further changes in the model. The path coefficients for the final model are provided in Figure 3. Self-efficacy had statistically significant direct effects on physical (path coefficient = .36, $P < .0001$), social (path coefficient = .32, $P < .0001$), and self-evaluative (path coefficient = .37, $P < .0001$) outcome expectations, impediments (path coefficient = .49, $P < .0001$) and goals (path coefficient = .18), but not physical activity (path coefficient = .09, $P > .05$). Self-evaluative outcome expectations had statistically significant direct effects on goals (path coefficient = .29, $P < .0005$) and physical activity (path coefficient = .19, $P < .05$). Social outcome expectations had a statistically significant direct effect on goals (path coefficient = .16, $P < .01$), but not physical activity (path coefficient = .01, $P > .05$). Physical outcome expectations did not have direct effects on either goals (path coefficient = .09, $P > .05$) or physical activity (path coefficient = .13, $P > .05$). Impediments did not have a statistically significant effect on goals (path coefficient = .08, $P > .05$), but did have an effect on physical activity (path coefficient = .20, $P < .005$). Finally, goals had a statistically significant effect on physical activity (path coefficient = .48, $P < .0001$). Using the \textit{indirect} programming option in Mplus, self-efficacy had statistically significant indirect effects on physical activity by way of self-evaluative outcome expectations (path coefficient = .07, $P < .025$), impediments (path coefficient = .10, $P < .005$), and goals (path coefficient = .09, $P < .01$). The model explained 40\% of the variance in self-reported levels of physical activity among those with relapsing-remitting MS.

\textbf{Discussion}

There is substantial evidence that individuals with MS are physically inactive and sedentary\textsuperscript{11} prompting the search for modifiable variables derived from established theories that act as correlates of physical activity. Such variables would presumably represent targets for interventions designed to promote change in physical activity behavior among those with MS. To date, research has supported self-efficacy as a primary correlate of physical activity in the general population\textsuperscript{14,16} and persons with MS,\textsuperscript{18–20} but we are unaware of studies that have evaluated large parts of Bandura’s\textsuperscript{21} proposed pathways between self-efficacy and physical activity in persons with MS. Accordingly, the current study examined the relationship between self-efficacy and physical activity in persons with MS, and, based on the ideas offered by Bandura,\textsuperscript{21} we expected that self-efficacy would have both direct and indirect effects on physical activity.

\textbf{Figure 3} — Final model of the relationships among self-efficacy, outcome expectations, impediments, goals, and physical activity tested using covariance modeling in a sample of 218 individuals with relapsing-remitting multiple sclerosis. Note: Solid lines represent statistically significant path coefficients, whereas dashed lines represent nonsignificant path coefficients. Self-efficacy measured by Exercise Self-efficacy Scale. Outcome Expectations measured by Multidimensional Outcome Expectations for Exercise Scale. Impediments measured by functional limitations component of the Late-Life Function and Disability Inventory. Goals measured by Exercise Goal Scale. Physical Activity measured as a latent variable with the Godin Leisure-Time Exercise Questionnaire and short-form of the International Physical Activity Questionnaire as indicators.
relationships with physical activity, and the indirect relationship would operate through outcome expectations, impediments, and goals. The primary findings were that self-efficacy did not exhibit a direct relationship with physical activity, but self-efficacy did exhibit an indirect relationship with physical activity primarily by way of self-evaluative outcome expectations, impediments, and goal setting. Such findings suggest that individuals with MS who were more efficacious for being physically active reported more goal setting for physical activity, fewer impediments, and more favorable self-evaluative outcome expectations and, in turn, those who set more goals, reported fewer impediments, and had more favorable self-evaluative outcome expectations reported higher levels of physical activity behavior. The variables in the model explained 40% of variance in the self-reported physical activity behaviors of persons with relapsing-remitting MS.

The results of this study are, in part, consistent with the ideas proposed by Bandura.21 Indeed, self-efficacy had direct relationships with outcome expectations, impediments, and goals, and goals had a strong direct relationship with physical activity. This is consistent with the idea that self-regulatory strategies, such as goal setting, are important components for changing health behaviors.17 Another consistency is that self-evaluative outcome expectations had a direct effect on physical activity and an indirect effect via goal setting. Nevertheless, there were some inconsistencies between our results and the model proposed by Bandura.21 One inconsistency is that impediments did not have a direct relationship with goals, but rather had a direct relationship with physical activity. This might be explained by our operationalization of impediments as functional limitations using a measure that largely focused on lower extremity function (ie, ambulatory capacity). Ambulatory capacity would be expected to operate as a central influence of physical activity among persons with MS90 as has been similarly reported as a primary capacity). Ambulatory capacity would be expected to largely focus on lower extremity function (ie, ambulatory capacity). Ambulatory capacity would be expected to operate as a central influence of physical activity among persons with MS90 as has been similarly reported as a primary capacity.90 Another inconsistency is that self-efficacy did not have a direct relationship with physical activity, but rather an indirect relationship by way of self-evaluative outcome expectations, impediments, and goals. We note that this finding is consistent with previous research23 and does not undermine the importance of self-efficacy as a correlate, but rather supports the importance of considering other factors (ie, self-evaluative outcome expectations, impediments, and goals) when examining correlates of physical activity in those with relapsing-remitting MS. Another inconsistency is that only self-evaluative outcome expectations had an association with physical activity, whereas physical and social outcome expectations did not have direct associations with physical activity. This is important as Bandura21 has built a case for the importance of all 3 types of outcome expectations as correlates of health behaviors, and our results suggest that the outcome expectations associated with self-satisfaction and self-worth are most strongly associated with physical activity behavior in persons with relapsing-remitting MS.

The results of this study are in general agreement with previous research on healthy older adults22,23 and college-aged students.24 For example, previous research reported that self-efficacy had an indirect, rather than direct, effect on physical activity by way of self-regulatory strategies in samples of healthy older adults22 and college-aged students.24 We similarly reported that self-efficacy had an indirect association with physical activity by way of goal setting as a self-regulatory strategy in persons with MS. Another recent study reported an indirect path between self-efficacy and physical activity by way of functional limitations as an operationalization of impediments, but not outcome expectations, in healthy older adults.23 We too reported that self-efficacy was indirectly associated with physical activity by way of functional limitations, but not outcome expectations, in persons with MS. Importantly, previous research has either excluded impediments22,24 or self-regulatory strategies23 in the examination of the pathways between self-efficacy and physical activity, whereas we included both impediments and self-regulatory strategies in the current study of persons with MS. The analysis in the current study is more consistent with Bandura’s21 model and suggests that self-efficacy has an indirect relationship with physical activity by way of both self-regulatory strategies and impediments in persons with relapsing-remitting MS.

To our knowledge, this study represents one of the first attempts to identify the pathway between self-efficacy and physical activity in individuals with MS. Obviously there are several possible directions for future research in the study of physical activity and its correlates in individuals with MS. One direction involves additional theoretically-based studies of correlates of physical activity behavior. Such studies should continue to adopt Social Cognitive Theory given its longstanding history and support in understanding physical activity in the general population,49 but consider expanding the examination in a manner that concurrently includes both the sources of self-efficacy information and the pathways between self-efficacy and physical activity. This would not only expand our understanding of the relationship between self-efficacy and physical activity, but would further clarify the factors that could be targeted for changing self-efficacy as a means of promoting physical activity behavior among those with MS. As an example, there are 4 primary sources of efficacy information (ie, performance accomplishments, vicarious experience, verbal persuasion, and physiological/emotional states), and one previous study designed to enhance those sources of efficacy information was modestly effective (d = .47) in improving exercise adherence across a 12-week period among a small sample of adults with MS.49 The effect of such an intervention would seemingly be improved based on the contributions of the current study as well as subsequent research on sources of efficacy information in persons with MS. The current study identified intermediates (ie, self-evaluative outcome expectations, impediments, and goal setting) that could be targeted along with sources of self-efficacy for promoting physical activity.
Importantly, the current study does have limitations. We recognize that the cross-sectional design of the study precludes inferences about the direction of causality. Indeed, as Social Cognitive Theory would predict, given its foundation in reciprocal determinism, physical activity might just as easily influence self-efficacy or goal setting as self-efficacy or goal setting influence physical activity participation. An additional limitation is that our sample had minimal disability and our results should not be generalized among those with relapsing-remitting MS who have mobility impairments. Another limitation is the representativeness of the sample based on the demographic characteristics of the participants. Our sample primarily consisted of Caucasian women with relapsing-remitting MS, and this is marginally consistent with the demographics of MS. Future researchers would do well to use a more diverse sample that included a larger number of men, individuals with primary and secondary progressive MS, and minorities. This more diverse sample might be recruited through County Public Health services or media-based advertisements that target minority audiences. Another limitation is that we only tested 1 model for the data via covariance modeling, and future studies might consider comparing and contrasting alternative models for explaining physical activity in those with MS: we did not include assessments that would afford such a comparison in this study. We further note that we only measured impediments, but not facilitators, as the sociostructural aspect of Bandura’s model. The final limitation is that the measures were not originally developed for persons with MS. We do note, however, that most of the measures have some evidence supporting the psychometric properties in samples of persons with MS. Despite those limitations, we provide new and compelling support for variables within the pathway between self-efficacy and physical activity that could be targets for increasing participation in physical activity among those with relapsing-remitting MS.

In summary, the primary finding of this cross-sectional study was that self-efficacy was indirectly associated with physical activity by way of goals, impediments, and self-evaluative outcome expectations in a sample of persons with relapsing-remitting MS. Those social-cognitive variables are modifiable by a well-designed intervention and represent possible targets for increasing the level of participation in physical activity among those with MS. Future researchers would do well to further develop and test an intervention for increasing the physical activity behavior of those with MS that is designed around the enhancement of self-efficacy, self-evaluative outcome expectations, and goal setting and the reduction of impediments such as ambulatory status.

References


