

# Outcome Moderators of a Fatigue Management Program for People With Multiple Sclerosis

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## KEY WORDS

- age factors
- fatigue
- mobility limitation
- multiple sclerosis
- outcome assessment (health care)
- sex factors

**OBJECTIVE.** We determined whether age, gender, work status, or impairment moderated fatigue management program outcomes for people with multiple sclerosis (MS).

**METHOD.** We conducted a secondary analysis of longitudinal data from a randomized controlled trial using mixed-effects models ( $N = 181$ ) and examined outcomes of fatigue impact, mental health, physical health, and self-efficacy. Measures were collected before and immediately after intervention and at 6 wk, 3 mo, and 6 mo postintervention.

**RESULTS.** Younger participants experienced greater reductions in fatigue impact and greater improvements in self-efficacy over time than did older participants, but we found no age differences in physical or mental health. Participants with less impairment experienced greater mental health gains and were more likely to retain these gains over time than were participants with greater impairment. Although women experienced greater fatigue impact benefits, men experienced greater mental health benefits. Work status did not moderate outcomes.

**CONCLUSION.** Fatigue management program outcomes for people with MS are moderated by age, gender, and impairment.

Finlayson, M., Preissner, K., & Cho, C. (2012). Outcome moderators of a fatigue management program for people with multiple sclerosis. *American Journal of Occupational Therapy*, 66, 187–197. <http://dx.doi.org/10.5014/ajot.2012.003160>

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Fatigue is a common symptom for people with multiple sclerosis (MS) that can severely limit their ability to participate in everyday activities. Fatigue can be *primary* (the result of disease-related inflammation and neurotransmission changes) or *secondary* in nature (Kos, Kerckhofs, Nagels, D'hooghe, & Ilsbrouckx, 2008). *Secondary fatigue* is a result of non-disease-specific factors such as deconditioning, medication side effects, sleep problems, poor nutrition, and inefficient or overly demanding personal routines and habits. Both types of fatigue contribute to functional limitations.

Researchers from several disciplines, including occupational therapy, have been testing interventions to reduce the impact of fatigue on the everyday lives of people with MS. Several options have been identified over the past 10 yr as having the potential to reduce the severity and impact of fatigue experienced by people with MS (Lee, Newell, Ziegler, & Topping, 2008). Pharmaceutical agents (Brown, Howard, & Kemp, 2010; Gillson, Richard, Smith, & Wright, 2002; Wingerchuk et al., 2005) tend to target primary fatigue, whereas other interventions are more focused on secondary fatigue (Kos et al., 2008). Examples include cardiovascular and strengthening exercises (Dalgas et al., 2010; Motl & Gosney, 2008), cognitive-behavioral therapy (Twomey & Robinson, 2010; van Kessel et al., 2008), and energy management education (Mathiowetz, Finlayson, Matuska, Chen, & Luo, 2005).

The evidence supporting the efficacy and effectiveness of energy management education has grown substantially since 2000. Face-to-face (Kos, Duportail, D'hooghe, Nagels, & Kerckhofs, 2007; Mathiowetz, Matuska, Finlayson, Luo, &

Chen, 2007; Sauter, Zebenholzer, Hisakawa, Zeithofer, & Vass, 2008; Twomey & Robinson, 2010), teleconference (Finlayson, Preissner, Cho, & Plow, 2011), self-study module (Lamb, Finlayson, Mathiowetz, & Chen, 2005), and online education (Ghahari, Leigh Packer, & Passmore, 2010) formats have all been used. Compared with other delivery methods, the online format produced fewer positive outcomes, but the results were most likely a function of small sample size (Ghahari et al., 2010).

Energy management education involves teaching people to identify and develop modifications to their activities to reduce the impact of fatigue on daily life (Multiple Sclerosis Council for Clinical Practice Guidelines, 1998). Through the educational process, people with MS develop knowledge, skills, and attitudes that enable them to evaluate their rest-activity ratios, examine how they use their available energy, plan for and modify activities to reduce energy demands, use their bodies more efficiently, and make active choices about energy use on the basis of personal values and goals. Occupational therapy is well recognized in the MS literature as the primary profession to deliver energy management education, and occupational therapists have been referred to as the “energy experts” (Schapiro, 2003).

To date, the research on energy management education among people with MS has focused on determining whether this intervention can reduce fatigue impact and improve quality of life. These basic questions have been addressed through studies of community-dwelling people with MS who vary in age, disability level, educational attainment, and employment status. Despite the number of studies that have been conducted and the positive findings across this body of work, one key question has not been addressed: Does energy management education work better for some people with MS than for others? Answering this question is critical for translating research into clinical practice and supporting the clinical reasoning of therapists when they set goals and develop treatment plans to address MS fatigue.

## Method

Using a secondary analysis of existing data, our purpose in this study was to determine whether energy management education works better for some people with MS than for others. The original study was a randomly allocated two-group time-series design with a wait-list control group; therefore, everyone eventually received treatment (Finlayson et al., 2011). Data were collected from participants before and immediately after the intervention and at 6 wk,

3 mo, and 6 mo postintervention. As a result, this secondary analysis is best described as a longitudinal study examining changes over time in a group of people receiving treatment.

### Participant Recruitment

The sample size for the original study was determined using the Fatigue Impact Scale Physical Subscale effect size from the pilot study ( $d = 0.51$ ; Finlayson, 2005), an  $\alpha$  level of .05, a power of 80%, and an assumed attrition rate of 12% over the duration of the study. Calculations indicated that 140 participants would be required to detect significant differences in outcomes.

Recruitment involved the distribution of advertising through the MS Society and to Illinois residents participating in the North American Research Committee on Multiple Sclerosis volunteer MS patient registry. People interested in participating in the study contacted the study office. A trained research assistant conducted a telephone screening to determine eligibility on the basis of these inclusion criteria: living in the state of Illinois; self-reported diagnosis of MS;  $\geq 18$  yr old; functional English literacy (i.e., able to read course materials and carry on telephone conversations in English); a Fatigue Severity Scale score of  $\geq 4$  (i.e., moderate to severe fatigue; Krupp, LaRocca, Muir-Nash, & Steinberg, 1989); and weighted score of  $\geq 12$  on the short version of the Blessed Orientation Memory Concentration test (Katzman et al., 1983). People meeting the criteria were mailed a study information sheet, the informed consent documents, and a demographics form. Once they returned the signed consent to the office, the research assistant contacted them to make arrangements regarding intervention initiation.

### Intervention

The intervention used was a modified version of *Managing Fatigue* (Packer, Brink, & Sauriol, 1995), a community-based, face-to-face group program. The program addresses 14 energy management strategies such as changing the location of tools and equipment, delegating part or all of a task to others, planning activities and schedules, and using rest strategically. The largest and most rigorous evaluation to date of the Managing Fatigue program was conducted by Mathiowetz et al. (2005). Although the results of their study offered strong support for the program's efficacy and effectiveness in reducing fatigue impact and improving some aspects of quality of life, the program was not accessible to some people with MS because of transportation problems, mobility limitations, or both.

In response, the program was modified and pilot tested to permit delivery through group-based telephone

teleconferencing (Finlayson, 2005). We used this modified version in the current study. As with the original program, the teleconference version was delivered once a week for 6 wk. Participants dialed into a toll-free teleconference line for 70-min sessions facilitated by a licensed occupational therapist who had received training from the principal investigator (Marcia Finlayson).

Approximately 1 wk before beginning the program, each participant received a cordless telephone, headset, and participant manual. The participant manual was divided into six sections, one for each session. Each section contained the session outline, information hand-outs on the session topic, and practice activities that were to be completed between sessions. All materials were designed to minimize the need to write in case participants had fine motor symptoms. The facilitators had a companion manual that included the same content as the participant manual as well as more detailed information and tips for facilitating the sessions (e.g., examples to promote discussion, answers to commonly asked questions).

Each session involved teaching content and facilitated discussions. The focus of each session was as follows: (1) fatigue in MS and the strategic use of rest; (2) communicating to others about fatigue and strategies for obtaining useful assistance; (3) use of body mechanics and environmental modifications to manage energy expenditures during everyday tasks; (4) activity analysis and modification; (5) setting priorities for energy expenditures, making active decisions, and living a balanced lifestyle; and (6) goal setting for the future.

Group size was kept small ( $\leq 7$  participants) to maximize opportunities for interaction, social learning, peer support, and development of self-management skills (e.g., problem-solving, self-monitoring, active decision making). Each session also included an explanation of the practice activities, which provided participants with opportunities to apply what they learned to their individual life situations. Each subsequent session began with a review and discussion of how the between-session practice activities went. These discussions provided participants with opportunities for problem solving, vicarious learning, and peer role modeling, particularly when they themselves had not experienced success with a particular strategy.

### *Outcome Measures*

Although several primary and secondary outcome measures were used for the main trial, the current analysis used only the ones described next. All tools were administered by telephone by a trained research assistant who was not involved in the delivery of the intervention. As previously noted, data were collected before and immediately after

the intervention and at 6 wk, 3 mo, and 6 mo postintervention.

The Fatigue Impact Scale (Fisk et al., 1994) is a 40-item scale that measures the perceived impact of fatigue on everyday life. Respondents rate each statement using a 5-point Likert-type scale ranging from 0 (*no problem*) to 4 (*extreme problem*). A total score and three subscale scores (Physical, Social, Cognitive) can be produced from participants' responses. Higher scores reflect greater fatigue impact. The scale is valid and reliable for use with people with MS (Fisk et al., 1994; Mathiowetz, 2003). The subscale scores were used for this study.

The SF-36 (Ware & Sherbourne, 1992) is a generic measure of health-related quality of life. It includes eight subscales that can be combined into two composite measures, one capturing physical health (functioning and ability to perform physical activity) and one capturing mental health (psychological distress, social and role functioning, vitality). Scores were calculated using the algorithm provided in the Multiple Sclerosis Functional Composite user manual (Fischer, Jak, Kniker, Rudick, & Cutter, 2001). Scores are norm based and range from 0 to 100. Higher scores indicate better health. Although some questions have been raised about the use of the SF-36 with people with MS, it is considered valid and reliable for samples with MS (Hobart, Freeman, Lamping, Fitzpatrick, & Thompson, 2001; Nortvedt, Riise, Myhr, & Nyland, 2000).

The Self-Efficacy for Energy Conservation Questionnaire (Liepold & Mathiowetz, 2006) was designed specifically to address the 14 fatigue management strategies addressed in the *Managing Fatigue* program (Packer et al., 1995). For each item, participants are asked to rate their level of confidence (ranging from 1 to 10) in their ability to use the specific strategies. Responses are summed and averaged, so that higher scores indicate greater confidence in performing strategies. The scale has documented reliability in a sample with MS (Liepold & Mathiowetz, 2006).

Demographic information was also collected from participants for the purposes of description and statistical control. Items included age, sex, educational level, Patient Determined Disease Steps Scale (self-reported severity of MS-related physical impairment; Hohol, Orav, & Weiner, 1995), current medications, and involvement in any other rehabilitation programs.

### *Theoretical Rationale and Associated Hypotheses*

The primary question guiding this secondary analysis was, "Does energy management education work better for some people with MS than for others?" Four baseline

variables (age, employment, gender, impairment level) were examined as potential moderators because it would be logistically possible to plan, organize, and implement energy management education groups on the basis of these characteristics (e.g., a group for women, a group for workers).

Several theoretical perspectives were synthesized to develop the hypotheses to guide the analysis, including general concepts from occupational therapy theory and health behavior models. First, occupational therapy theories (e.g., Model of Human Occupation [Kielhofner, 2008], Canadian Model of Occupational Performance and Engagement [Townsend & Polatajko, 2007]) suggest that developmental stage (e.g., age), life roles (e.g., employment), sociocultural expectations (e.g., gender roles), and physical capacity (e.g., impairment) influence a person's occupational choices, habits, and routines. Because the outcomes of energy management education are dependent on a participant's ability to apply the principles and make modifications to his or her choices, habits, and routines, it is reasonable to expect that each of these factors (e.g., age, employment, gender, impairment) could moderate the intervention's effectiveness.

Second, health behavior models (e.g., Health Belief Model, Transtheoretical Model, Social Cognitive Theory) offer explanations about why people take (or do not take) steps to manage, protect, or promote their own health and well-being (Redding, Rossi, Rossi, Velicer, & Prochaska, 2000). Across these models are several overlapping concepts, including perceived susceptibility (e.g., impairment) and contextual demands that motivate action (e.g., age, employment; Redding et al., 2000). The models also suggest that health behavior change is positively influenced by access to role models who are similar to oneself (e.g., women are more likely to be positively influenced by other women than by men). On the basis of this theoretical knowledge, the following three hypotheses were set:

1. Because older people and people with higher levels of impairment are likely to have more experience managing fatigue before the intervention, they will experience fewer benefits than younger people and people with lesser levels of impairment, respectively, as a consequence of the intervention.
2. Because the groups have more women than men, the women have more opportunities for similar role models; therefore, women will experience greater and longer lasting improvements than will men.
3. Because the demands of employment could be expected to motivate the use of the intervention content, participants who are employed will experience greater

and longer lasting improvements than will people who are not employed.

### Data Analysis

An intent-to-treat analysis with all available cases was performed using mixed-effects model methods (Chakraborty & Gu, 2009). For longitudinal data, mixed-effects models are preferred over simple regression models because the latter require that observations be independent and identically distributed, which is rarely the case for repeated measures. Mixed-effects models allow for the specification of random effects (participant-specific intercept or trend across time), variance-covariance structure (correlation of repeated measures across time within subjects), and a combination of both (Hedeker & Gibbons, 2006). For this analysis, mixed-effects models with a combination of random effects (intercept, linear, and curvilinear time trend) and variance-covariance structures (compound symmetry, Toeplitz band of size 4 and unstructured) were tested to determine the best-fitting model.

The likelihood ratio test (for nested models) and Akaike information criterion (AIC) score (Burnham & Anderson, 2002) were used to determine the best model. When comparing two or more models, the better model is indicated by lower AIC score. The sample size for this analysis was 181 participants, the number of participants who provided data for at least one measurement.

Consistent with the stated hypotheses, the moderators considered participant age, sex, employment status before the intervention, and impairment status as measured by the Patient Determined Disease Step (PDDS;  $PDDS \leq 4$  or  $PDDS > 4$ ; Hohol et al., 1995). In addition, the models included a time variable, coded with integers from 1 to 5, to indicate when the outcome measure was obtained (preintervention; postintervention; or 6-wk, 3-mo, or 6-mo follow-up). Because the primary analysis for the main study showed that changes in the outcomes over time occurred in a quadratic fashion (Finlayson et al., 2011), a quadratic time trend was also included for the analysis. A quadratic time trend is able to capture sharp changes (improvement) immediately after the intervention, followed by stabilization over time, as well as convex- or concave-shaped changes across time (initial improvement followed by gradual regression toward baseline).

### Results

Table 1 summarizes the baseline characteristics of the 181 study participants. The proportions for race, gender, and

**Table 1. Distribution of Baseline Characteristics (N = 181)**

Characteristics	Mean	Standard Deviation
Age, yr	55.52	8.88
Yr since symptoms started	19.99	11.07
Yr since diagnosis	14.57	9.36
	<i>n</i>	%
Gender		
Female	143	79.01
Male	38	20.99
Ethnicity		
White	159	89.33
African-American	18	10.11
Other	1	0.56
Type of multiple sclerosis		
Relapsing–remitting	95	53.37
Secondary progressive	39	21.91
Primary progressive	16	8.99
Progressive relapsing	11	6.18
Unknown	17	9.55
Impairment		
PDDS ≤ 4	121	66.85
PDDS > 4	60	33.15
Education, yr		
>15	89	49.17
12–15	88	48.62
≤12	4	2.21
Employment status		
Employed	66	36.67
Not employed	114	63.33

Note. Missing responses are not included. PDDS = Patient Determined Disease Step.

type of MS are consistent with those for the general population of people with MS.

Table 2 provides a summary of the best-fitting models for each of the outcomes under consideration. In this table, the outcome variables are provided in the left column. The best-fitting models are shown in the right column. When these models include a variable for Time and Time<sup>2</sup>, the outcome displayed a quadratic curve over time (i.e., steep improvement immediately after the intervention followed

by a leveling-off period). In these models, any time a Time × covariate term occurs, it indicates that the covariate is functioning as a moderator on the outcome. These moderating effects are described next, by hypothesis. (Readers interested in the full statistical tables for each of these six models should contact the corresponding author, Marcia Finlayson.)

### Hypothesis 1: Differences in Program Benefits by Age

Consistent with the first hypothesis, results indicated age-related differences in program benefit for the Fatigue Impact Scale (FIS) Cognitive and Social subscales, the mental health composite of the SF-36, and the Self-Efficacy for Performing Energy Conservation Strategies scale. Although younger participants tended to have higher (worse) FIS Cognitive and Social subscale scores at the start of the study, they also tended to exhibit the greatest improvement after the intervention. Although, on average, everyone improved over time, the greater improvement among the younger participants meant that by the 6-mo follow-up, the overall difference between the older and younger participants had become marginal.

For the self-efficacy analysis, the older participants tended to have higher (better) scores at the beginning of the study than their younger counterparts, but after intervention, the score differences were reduced because younger participants exhibited greater overall improvement.

For the SF-36 mental health composite, age was a significant factor in distinguishing participants' scores before the intervention, but it was not associated with the extent of benefit after the intervention. Specifically, older participants tended to have higher (better) scores at baseline than younger participants, and this significant difference continued through to the end of the intervention. Thus, although both groups experienced benefits from the course, neither group experienced significantly greater benefit than the other.

**Table 2. Summary of the Best-Fitting Final Models (With Moderators) for Each of the Outcomes of Interest**

Outcome	Model
Fatigue Impact Scale	
Cognitive	Time + Time <sup>2</sup> + Age + Work + Gender + (Time × Age) + (Time × Gender) <sup>a</sup>
Physical	Time + Time <sup>2</sup> + Work + Gender + (Time × Gender) <sup>a</sup>
Social	Time + Time <sup>2</sup> + Age + Work + Gender + (Time × Age) + (Time × Gender) <sup>b</sup>
SF-36	
Physical Health composite	Time + Time <sup>2</sup> + Work + Impairment <sup>a</sup>
Mental Health composite	Time + Time <sup>2</sup> + Age + Gender + Impairment + (Time × Gender) + (Time × Impairment) <sup>c</sup>
Self-Efficacy for Performing Energy Conservation Strategies scale	Time + Time <sup>2</sup> + Age + Impairment + (Time × Age) + (Time × Impairment) + (Time <sup>2</sup> × Age) + (Time <sup>2</sup> × Impairment) <sup>d</sup>

<sup>a</sup>Random intercept and Time. <sup>b</sup>Random intercept, Time, and Time<sup>2</sup>. <sup>c</sup>Random intercept and Toeplitz (4) variance–covariance structure. <sup>d</sup>Unstructured variance covariance structure.

### Hypothesis 1: Differences in Program Benefits by Level of Physical Impairment

Findings indicated that the only differences in extent of program benefit by level of impairment were observed for the SF-36 mental health composite and the self-efficacy scale. For the SF-36 mental health composite, participants with less impairment (PDDS  $\leq 4$ ) started the study with significantly lower (worse) mental health composite scores than people who were more impaired, but by the end of the study, their positions reversed. Moreover, although participants with greater impairment showed significant improvement immediately after the intervention and up to 6 wk after the course, their improvement regressed as more time passed since the intervention. At the end of the 6-mo follow-up, participants with greater impairment were essentially at the same point as when they started (i.e., all gains made had been lost).

Although participants with less impairment exhibited improvement in mental health scores up to the 3-mo follow-up, their scores did show a decline by 6 mo. Nevertheless, these scores were still significantly better than they had been at baseline.

On average, all participants significantly improved in their self-efficacy scores after the intervention. Although participants with less impairment were able to maintain their improvements throughout the study, the participants with greater impairment were not. They exhibited a decreasing trend after the second postintervention measurement (Figure 1).

For the SF-36 physical health composite, participants with less impairment started the study with significantly higher scores than the participants with greater impairment. This difference was maintained throughout the study, even as both groups exhibited significant improvement after participating in the intervention. Thus, both groups received similar benefits from the intervention in terms of the physical health composite.

### Hypothesis 2

Consistent with Hypothesis 2, women experienced significantly greater gains than men for all three FIS subscales (Figure 2), but the men experienced greater gains than the women for the SF-36 mental health composite score. Specifically, the women started the study with higher (worse) FIS Cognitive subscale scores than their male counterparts, but the women exhibited significantly greater gains after the intervention than the men. By the 6-wk follow-up, the women had caught up with the men for the FIS Cognitive subscale score. By the 3-mo follow-up, the women had eclipsed the men. Although, on average, the men exhibited improvements immediately after the program for the FIS Cognitive subscale, by the 6-mo follow-up their scores returned to levels very similar to where they started. For the FIS Physical and FIS Social subscales, the women started off slightly better than the men, but these differences grew significantly larger immediately after the program and at subsequent follow-ups. This growing difference was found even though the men

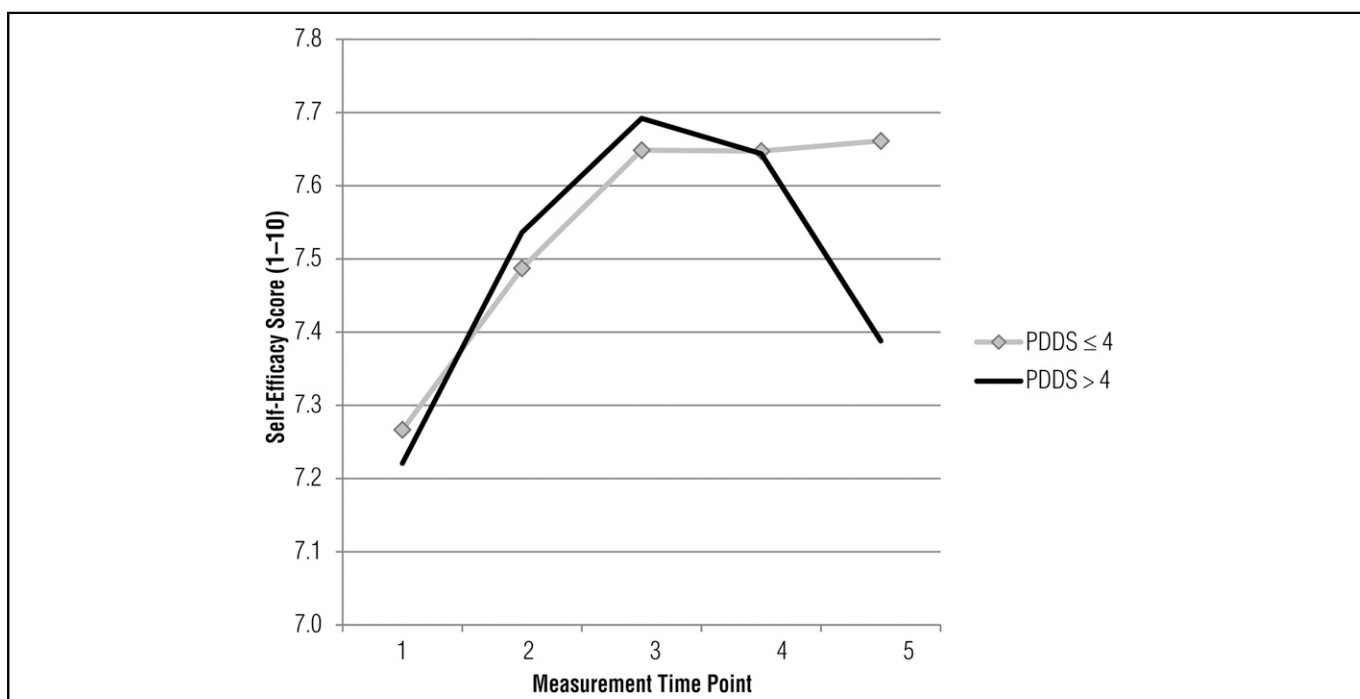
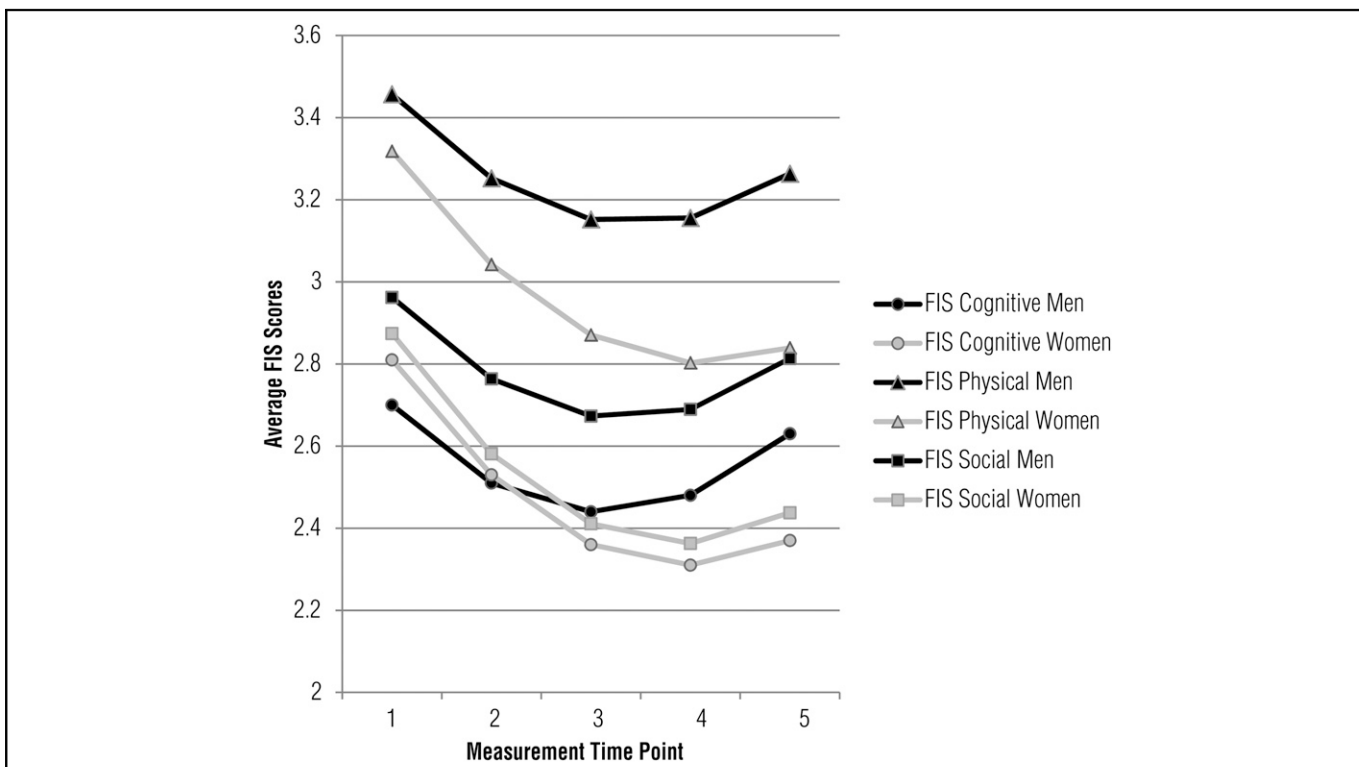


Figure 1. Self-efficacy by impairment, over time.

Note. PDDS = Patient Determined Disease Step.



**Figure 2.** Fatigue Impact Scale (FIS) subscale scores by gender, over time.

responded positively after the program and exhibited significant improvement. In other words, both men and women benefited, but the level of benefit was greater for the women.

For the SF-36 mental health composite scores, women began the study with better scores than the men, but this difference appeared minimal by the 6-mo follow-up. In other words, although the women improved significantly across time, the men exhibited even greater improvement and thus narrowed the difference between the groups.

### *Hypothesis 3*

Analysis indicated that the outcome measures showed differences across time between workers and nonworkers, but the two groups did not experience differential effects from the intervention. For all three FIS subscales, participants who were working at the beginning of the study tended to have significantly better (lower) scores than participants who were not working. This difference continued throughout the study, even as both groups improved across time. In addition, the participants who were working at the start of the study tended to have significantly higher (better) SF-36 physical health composite scores than the participants who were not working, and this difference also continued throughout the study

even though both groups experienced significant improvement in their physical health scores.

## Discussion

The purpose of this study was to determine whether age, gender, physical impairment, and employment status moderated the outcome effects of a teleconference-delivered fatigue management program among people with MS. Although previous studies have indicated that fatigue management education is both effective and efficacious for people with MS (Kos et al., 2007; Mathiowetz, Matuska, & Murphy, 2001; Mathiowetz et al., 2005, 2007; Sauter et al., 2008; Twomey & Robinson, 2010; Vanage, Gilbertson, & Mathiowetz, 2003), the findings from this study show a more nuanced perspective.

In comparison with older participants, younger participants experienced greater reductions in fatigue impact (Cognitive and Social subscales) and greater improvements in self-efficacy over time, but no age differences were found in terms of changes in physical or mental health. Compared with participants with higher levels of impairment, participants with less impairment experienced greater mental health gains after the intervention and were more likely to retain these gains over time. Additional differences were seen between women and men, with women experiencing greater benefits from the

intervention than men across all components of fatigue impact. Yet, the men experienced greater benefit than the women in terms of mental health. Finally, work status did not differentiate the extent of benefits gained as a consequence of the intervention. These findings have several potential explanations.

First, age-related variations in outcomes may reflect differences in occupational repertoires and life course experience (Canadian Association of Occupational Therapists, 1997) or life roles and habits (Kielhofner, 2008). Developmentally, younger people often have roles that older people do not (e.g., worker, parent of young children, student). Consequently, younger participants may have had more opportunities to apply and generalize the intervention strategies taught in the program, which, in turn, may have contributed to greater benefits. In addition, because younger participants had typically been living with the disease for less time, they may possibly have started the program with less knowledge of and experience with energy management strategies, which would be consistent with a life course experience perspective. As a result, their greater gains may simply reflect that they had more room for change.

The findings regarding the moderating effects of impairment and gender on mental health may be an artifact of the measurement tool used (SF-36 composite). Although the SF-36 has many positive features (e.g., norm-based scores, generic measure), it is not without limitations. Specifically, although a two-component model (physical and mental) is supported psychometrically, the calculation of composite measures results in a loss of information relative to the separate subscales (Hobart et al., 2001). In addition, some authors have suggested that the composite score underestimates the mental health impact in MS (Nortvedt et al., 2000). Nevertheless, other authors have shown that without intervention, the SF-36 composite scores are remarkably stable over time among people with MS (Hopman et al., 2009). Despite the limitations of the SF-36, we can be reasonably confident that the intervention did have an influence on mental health, and if anything, the moderating influences of impairment and gender may be underestimated.

The importance of similar social models in facilitating and supporting behavior change is emphasized in several health behavior change models (Redding et al., 2000). Although the sample in this study corresponded well to the general population with MS, the intervention groups did have more women than men. Also, more people in each group experienced the minimal to moderate levels of disability typical of relapsing–remitting MS rather than the more severe disability associated with progressive forms of the disease. Consequently, women and people

with less impairment had a greater chance than men and people with greater impairment of finding a social model among their peers in the teleconference group. Because social support, peer mentoring, and vicarious learning can support self-efficacy and behavior change (Redding et al., 2000), lack of similar social models for some study participants may explain the findings regarding the moderating effects of gender and impairment. For the men in particular, having mostly female peers and a female facilitator may have further limited opportunities for social connections.

Similarly, the nature of the examples used in the program to illustrate concepts may have further contributed to the moderating effects of gender and impairment. Although every effort was made to provide gender- and disability-neutral examples of the application of energy management strategies in the participant manual, many of the examples discussed during the individual sessions were dependent on the issues and concerns brought up by the group members. Therefore, the examples raised by most members were at times not relevant to other members of the group.

Although the lack of findings related to work status was surprising, several factors may have contributed. First, although people may have been working, whether they had disclosed their diagnosis to their employers or requested accommodations to help manage their fatigue is unknown. The invisible nature of MS fatigue may also have made it difficult for working participants to request accommodations, or they may have decided that other accommodations for visible symptoms were more important. These explanations are consistent with the employment literature in MS (Johnson et al., 2004; Yorkston et al., 2003)

### *Implications for Occupational Therapy Practice*

The differences in outcomes across subgroups of people with MS that were uncovered through this analysis have many implications for occupational therapy practitioners in relation to goal writing, treatment planning, and discharge follow-up. For goal writing, the findings suggest that therapists may want to write more ambitious goals (i.e., reflect greater change) for younger clients with MS with respect to declines in fatigue impact after energy management education. Therapists may want to consider including goals that aim to address strategy use across a variety of areas of occupation. In contrast, fatigue management goals for older clients with MS could perhaps focus on identifying effective strategies that are already in use by the client and working toward refining and generalizing them to other or new occupations.



In terms of treatment delivery, this study is based on findings from a group-delivered program. To date, group delivery has dominated the evidence in MS fatigue management (Kos et al., 2007; Mathiowetz et al., 2005; Sauter et al., 2008; Vanage et al., 2003). Together with the current findings about the moderating effects of gender and impairment, the literature suggests that serious consideration must be given to the role of social learning and peer mentoring in fatigue management outcomes. On the basis of the evidence to date and available theory, occupational therapists need to find ways to deliver energy management interventions in groups and examine whether homogeneous intervention groups result in better outcomes than heterogeneous ones. Finally, for both older and younger clients, 3 mo post-intervention marked the beginning of loss of gains, suggesting that the allocation of treatment time should allow for a booster or follow-up session at about this point.

In summary, the key points for practice are as follows:

- For younger clients with MS, therapists should consider writing more ambitious energy management goals (e.g., greater decline in fatigue impact, strategy use across a wider range of occupations).
- For older clients with MS, therapists should consider writing goals that focus on identifying, refining, and generalizing energy management strategies that clients are already using.
- Therapists who are delivering group-based energy management education should consider creating homogeneous groups of clients, because doing so may facilitate social learning and peer mentoring among group participants.
- Follow-up visits to reinforce learning from energy management education should be considered at 3 mo, because this appears to be the point at which program benefits begin to wane.

### Limitations

In addition to the limitations of using the SF-36 composite scores, which have already been discussed, this study is also limited by the measures of physical impairment (PDDS) and work status (employed or not employed). Although the PDDS is a valid and reliable instrument (Hohol et al., 1995), it primarily focuses on mobility impairments. Other research (Holberg & Finlayson, 2007) has suggested that cognitive impairments also play an important role in the extent to which people with MS are able to use energy management strategies. This study, however, only screened for cognitive impairment; it did not include an objective measure. In

terms of work status, the measure used was simplistic and did not capture type of work, work tasks, number of hours, or disability disclosure status. These other work-related variables may have a role as potential moderators. Finally, this study did not provide data on the strategies that people used to manage fatigue in the context of specific occupations, roles, and routines. This information would also be useful to help customize energy management programs.

### Conclusion

Previous studies have supported the efficacy and effectiveness of energy management education for people with MS. This study extends previous findings by illustrating that age, gender, and impairment moderate the degree to which outcomes are achieved and the extent to which they can be maintained over time. The findings provide direction for occupational therapists as they consider implementing energy management groups. ▲

### Acknowledgments

We thank the research assistants who collected data for this study (Kara Stout, Dan Diaz, Christin Goetz, MaryAnn Halpin, Rose Duffy, and Maggie Rezac) and the occupational therapists who delivered the intervention (Robin Newman, Alisa Lamb, Jennifer Garcia, Maria Seymour, Elena Espiritu, and Julie Frakes). This work was funded by National Institute of Disability and Rehabilitation Research Grant H133G070006. Ethics approval was received from the University of Illinois at Chicago Institutional Review Board (2007-0461). The project is registered with ClinicalTrials.gov (NCT00591721).

### References

- Brown, J. N., Howard, C. A., & Kemp, D. W. (2010). Modafinil for the treatment of multiple sclerosis-related fatigue. *Annals of Pharmacotherapy*, *44*, 1098–1103. <http://dx.doi.org/10.1345/aph.1M705>
- Burnham, K. P., & Anderson, D. R. (2002). *Model selection and multimodel inference: A practical information-theoretic approach*. New York: Springer.
- Canadian Association of Occupational Therapists. (1997). *Enabling occupation: An occupational therapy perspective*. Ottawa: CAOT Publications.
- Chakraborty, H., & Gu, H. (2009). *A mixed model approach for intent-to-treat analysis in longitudinal clinical trials with missing values* (RTI Press Pub. MR-0009-0903). Research Triangle Park, NC: RTI International.
- Dalgas, U., Stenager, E., Jakobsen, J., Petersen, T., Hansen, H. J., Knudsen, C., et al. (2010). Fatigue, mood and quality of life improve in MS patients after progressive resistance

- training. *Multiple Sclerosis*, 16, 480–490. <http://dx.doi.org/10.1177/1352458509360040>
- Finlayson, M. (2005). Pilot study of an energy conservation education program delivered by telephone conference call to people with multiple sclerosis. *NeuroRehabilitation*, 20, 257–277.
- Finlayson, M. L., Preissner, K., Cho, C. C., & Plow, M. A. (2011). Randomized trial of a teleconference-delivered fatigue management program for people with multiple sclerosis. *Multiple Sclerosis*, 17, 1130–1140.
- Fischer, J. S., Jak, A. J., Kniker, J. E., Rudick, R. A., & Cutter, G. (2001). *Multiple Sclerosis Functional Composite administration and scoring manual*. New York: National Multiple Sclerosis Society.
- Fisk, J. D., Ritvo, P. G., Ross, L., Haase, D. A., Marrie, T. J., & Schlech, W. F. (1994). Measuring the functional impact of fatigue: Initial validation of the Fatigue Impact Scale. *Clinical Infectious Diseases*, 18(Suppl. 1), S79–S83. [http://dx.doi.org/10.1093/clinids/18.Supplement\\_1.S79](http://dx.doi.org/10.1093/clinids/18.Supplement_1.S79)
- Ghahari, S., Leigh Packer, T., & Passmore, A. E. (2010). Effectiveness of an online fatigue self-management programme for people with chronic neurological conditions: A randomized controlled trial. *Clinical Rehabilitation*, 24, 727–744. <http://dx.doi.org/10.1177/0269215509360648>
- Gillson, G., Richard, T. L., Smith, R. B., & Wright, J. V. (2002). A double-blind pilot study of the effect of Prokarin on fatigue in multiple sclerosis. *Multiple Sclerosis*, 8, 30–35.
- Hedeker, D., & Gibbons, R. D. (2006). *Longitudinal data analysis*. Hoboken, NJ: Wiley-Interscience.
- Hobart, J., Freeman, J., Lamping, D., Fitzpatrick, R., & Thompson, A. (2001). The SF-36 in multiple sclerosis: Why basic assumptions must be tested. *Journal of Neurology, Neurosurgery, and Psychiatry*, 71, 363–370. <http://dx.doi.org/10.1136/jnnp.71.3.363>
- Hohol, M. J., Orav, E. J., & Weiner, H. L. (1995). Disease steps in multiple sclerosis: A simple approach to evaluate disease progression. *Neurology*, 45, 251–255.
- Holberg, C., & Finlayson, M. (2007). Factors influencing the use of energy conservation strategies by persons with multiple sclerosis. *American Journal of Occupational Therapy*, 61, 96–107. <http://dx.doi.org/10.5014/ajot.61.1.96>
- Hopman, W. M., Coo, H., Pavlov, A., Day, A. G., Edgar, C. M., McBride, E. V., et al. (2009). Multiple sclerosis: Change in health-related quality of life over two years. *Canadian Journal of Neurological Sciences*, 36, 554–561.
- Johnson, K. L., Yorkston, K. M., Klasner, E. R., Kuehn, C. M., Johnson, E., & Amtmann, D. (2004). The cost and benefits of employment: A qualitative study of experiences of persons with multiple sclerosis. *Archives of Physical Medicine and Rehabilitation*, 85, 201–209. [http://dx.doi.org/10.1016/S0003-9993\(03\)00614-2](http://dx.doi.org/10.1016/S0003-9993(03)00614-2)
- Katzman, R., Brown, T., Fuld, P., Peck, A., Schechter, R., & Schimmel, H. (1983). Validation of a short Orientation–Memory–Concentration Test of cognitive impairment. *American Journal of Psychiatry*, 140, 734–739.
- Kielhofner, G. (2008). *Model of Human Occupation* (4th ed.). Philadelphia: Lippincott Williams & Wilkins.
- Kos, D., Dupontail, M., D’hooghe, M., Nagels, G., & Kerckhofs, E. (2007). Multidisciplinary fatigue management programme in multiple sclerosis: A randomized clinical trial. *Multiple Sclerosis*, 13, 996–1003. <http://dx.doi.org/10.1177/1352458507078392>
- Kos, D., Kerckhofs, E., Nagels, G., D’hooghe, M. B., & Ilsbrouckx, S. (2008). Origin of fatigue in multiple sclerosis: Review of the literature. *Neurorehabilitation and Neural Repair*, 22, 91–100. <http://dx.doi.org/10.1177/1545968306298934>
- Krupp, L. B., LaRocca, N. G., Muir-Nash, J., & Steinberg, A. D. (1989). The Fatigue Severity Scale: Application to patients with multiple sclerosis and systemic lupus erythematosus. *Archives of Neurology*, 46, 1121–1123.
- Lamb, A. L., Finlayson, M., Mathiowetz, V., & Chen, H. Y. (2005). The outcomes of using self-study modules in energy conservation education for people with multiple sclerosis. *Clinical Rehabilitation*, 19, 475–481. <http://dx.doi.org/10.1191/0269215505cr851oa>
- Lee, D., Newell, R., Ziegler, L., & Topping, A. (2008). Treatment of fatigue in multiple sclerosis: A systematic review of the literature. *International Journal of Nursing Practice*, 14, 81–93. <http://dx.doi.org/10.1111/j.1440-172X.2008.00670.x>
- Liebold, A., & Mathiowetz, V. (2005). Reliability and validity of the Self-Efficacy for Performing Energy Conservation Strategies Assessment for persons with multiple sclerosis. *Occupational Therapy International*, 12, 234–249. <http://dx.doi.org/10.1002/oti.5>
- Mathiowetz, V. (2003). Test–retest reliability and convergent validity of the Fatigue Impact Scale for persons with multiple sclerosis. *American Journal of Occupational Therapy*, 57, 389–395. <http://dx.doi.org/10.5014/ajot.57.4.389>
- Mathiowetz, V., Finlayson, M., Matuska, K., Chen, H. Y., & Luo, P. (2005). A randomized trial of energy conservation for persons with multiple sclerosis. *Multiple Sclerosis*, 11, 592–601. <http://dx.doi.org/10.1191/1352458505ms1198oa>
- Mathiowetz, V. G., Matuska, K. M., Finlayson, M. L., Luo, P., & Chen, H. Y. (2007). One-year follow-up to a randomized controlled trial of an energy conservation course for persons with multiple sclerosis. *International Journal of Rehabilitation Research*, 30, 305–313.
- Mathiowetz, V., Matuska, K. M., & Murphy, M. E. (2001). Efficacy of an energy conservation course for persons with multiple sclerosis. *Archives of Physical Medicine and Rehabilitation*, 82, 449–456.
- Motl, R. W., & Gosney, J. L. (2008). Effect of exercise training on quality of life in multiple sclerosis: A meta-analysis. *Multiple Sclerosis*, 14, 129–135. <http://dx.doi.org/10.1177/1352458507080464>
- Multiple Sclerosis Council for Clinical Practice Guidelines. (1998). *Fatigue and multiple sclerosis: Evidence-based management strategies for fatigue in multiple sclerosis*. Washington, DC: Paralyzed Veterans of America.
- Nortvedt, M. W., Riise, T., Myhr, K. M., & Nyland, H. I. (2000). Performance of the SF-36, SF-12, and RAND-36 summary scales in a multiple sclerosis population. *Medical Care*, 38, 1022–1028. <http://dx.doi.org/10.1097/00005650-200010000-00006>

- Packer, T. L., Brink, N., & Sauriol, A. (1995). *Managing fatigue: A six-week course for energy conservation*. Tucson, AZ: Therapy Skill Builders.
- Redding, C. A., Rossi, J. S., Rossi, S. R., Velicer, W. F., & Prochaska, J. O. (2000). Health behavior models. *International Electronic Journal of Health Education*, *3*, 180–193.
- Sauter, C., Zebenholzer, K., Hisakawa, J., Zeitlhofer, J., & Vass, K. (2008). A longitudinal study on effects of a six-week course for energy conservation for multiple sclerosis patients. *Multiple Sclerosis*, *14*, 500–505. <http://dx.doi.org/10.1177/1352458507084649>
- Schapiro, R. T. (2003). *Managing the symptoms of multiple sclerosis* (4th ed.). New York: Demos Medical.
- Townsend, E., & Polatajko, H. (2007). *Enabling occupation II: Advancing an occupational therapy vision for health, well-being and justice through occupation*. Ottawa, Ontario: Canadian Association of Occupational Therapists.
- Twomey, F., & Robinson, K. (2010). Pilot study of participating in a fatigue management programme for clients with multiple sclerosis. *Disability and Rehabilitation*, *32*, 791–800. <http://dx.doi.org/10.3109/09638281003656578>
- Vanage, S. M., Gilbertson, K. K., & Mathiowetz, V. (2003). Effects of an energy conservation course on fatigue impact for persons with progressive multiple sclerosis. *American Journal of Occupational Therapy*, *57*, 315–323. <http://dx.doi.org/10.5014/ajot.57.3.315>
- van Kessel, K., Moss-Morris, R., Willoughby, E., Chalder, T., Johnson, M. H., & Robinson, E. (2008). A randomized controlled trial of cognitive behavior therapy for multiple sclerosis fatigue. *Psychosomatic Medicine*, *70*, 205–213. <http://dx.doi.org/10.1097/PSY.0b013e3181643065>
- Ware, J. E., Jr., & Sherbourne, C. D. (1992). The MOS 36-item Short-Form Health Survey (SF-36): I. Conceptual framework and item selection. *Medical Care*, *30*, 473–483. <http://dx.doi.org/10.1097/00005650-199206000-00002>
- Wingerchuk, D. M., Benarroch, E. E., O'Brien, P. C., Keegan, B. M., Lucchinetti, C. F., Noseworthy, J. H., et al. (2005). A randomized controlled crossover trial of aspirin for fatigue in multiple sclerosis. *Neurology*, *64*, 1267–1269. <http://dx.doi.org/10.1212/01.WNL.0000156803.23698.9A>
- Yorkston, K. M., Johnson, K., Klasner, E. R., Amtmann, D., Kuehn, C. M., & Dudgeon, B. (2003). Getting the work done: A qualitative study of individuals with multiple sclerosis. *Disability and Rehabilitation*, *25*, 369–379. <http://dx.doi.org/10.1080/0963828031000090506>