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An Initial Investigation of the Reliability and Validity of the Compensatory Cognitive Strategies Scale

Heather Becker, Ph.D. [Research Scientist], Alexa K. Stuifbergen, R.N., PhD, FAAN [Dean], Ashley Henneghan, R.N., MSN [Graduate Research Assistant], Janet Morrison, R.N., MSN [Graduate Research Assistant], EunJin Seo [Graduate Research Assistant], and Wenhui Zhang, BSN [Graduate Research Assistant]

The University of Texas at Austin, School of Nursing, 1700 Red River Street, Austin, Texas 78701

Abstract

Although many cognitive performance tests and self-reported cognitive concerns scales have been used to evaluate cognitive functioning, fewer measures assess the use of compensatory cognitive strategies for daily activities among those experiencing mild levels of cognitive impairment. The Compensatory Cognitive Strategies Scale was developed to measure frequency of self-reported cognitive strategies to decrease distractions, organize and sequence activities, and to utilize newly available computer aids to assist memory among those with multiple sclerosis (MS). Cronbach's alpha, a measure of internal consistency reliability, was .89 and .90 in two different samples. Concurrent validity was supported by the total score's moderate correlation with the MMQ-Strategy Scale ($r_s = .67$) and by a statistically significant increase in total scores for those who had participated in an intervention designed to improve their cognitive abilities. Correlations were stronger with another strategy measure than with measures of other constructs such as health promoting behaviors, thus supporting the scales convergent versus divergent validity. These initial findings suggest that the Compensatory Cognitive Strategies Scale may be useful to both researchers and clinicians working to build compensatory strategies for day-to-day functioning among those with mild cognitive impairment.

Keywords

Cognitive strategies measure; multiple sclerosis

INTRODUCTION

Cognitive impairment is one of the most frequently reported and disabling conditions associated with multiple sclerosis (MS), affecting approximately half of those who have this disease (Benedict et al., 2006). It can occur at any point during the disease's progression, and it most often affects memory, attention, and processing speed (Shatil, Metzger, Horvitz, & Miller, 2010). Persons with MS have also been found to perform poorly on executive function tests (Arnett, et al., 1997; Drew, Tippet, Starkey, & Isler, 2008; Garcia, Plasencia, & Benito, 2015). Halper, et al. also proposed that the ability to grasp complex concepts, plan,

and adhere to a schedule can be affected (Halper, et al., 2003). Such impairments can seriously impact daily functioning, including one's employment (Rao et al., 1991). Effective timely assessment and management of cognitive impairments in MS are therefore critical for optimizing function in daily life. The aim of this study is to describe the development of a new instrument, the Compensatory Cognitive Strategies Scale, which was designed to assess self-reported use of compensatory strategies, and to present empirical data supporting its reliability and validity for people with MS.

Sullivan et al. (1990) reported little research focused on the types of strategies cognitively impaired individuals with MS use to compensate for their cognitive deficits. One of the few reported investigations of memory strategies among people with MS found that less than half the sample reported frequently using 12 of the 19 memory strategies listed on the Troyer and Rich MMQ Strategies Scale (Phillips and Stuifbergen, 2006).

A number of studies have attempted to build compensatory cognitive skills among people with MS who experience cognitive limitations (Flavia, Stampatori, Zanotti, Parrinello, & Captra, 2010; Hildebrandt, et al., 2007; Penner & Kappos, 2006; Stuifbergen, et al., 2012). Both self-reports and neurocognitive performance tests have been used to evaluate these psycho-educational cognitive interventions in persons with MS. Perhaps the most widely accepted neuropsychological assessment battery is the Minimal Assessment of Cognitive Function in Multiple Sclerosis, which consists of seven tests that cover the cognitive domains of memory, learning, language, spatial processing, working memory, executive function, and processing speed (Benedict et al., 2006). Among the psychometrically sound self-report measures of cognitive function used in persons with MS are the Multiple Sclerosis Neuropsychological Screening Questionnaire (Benedict et al., 2003), the cognitive functional subscale of the Multiple Sclerosis Quality of Life-54 (Julian, Merluzzi, & Mohr, 2007), the Perceived Deficits Questionnaire (Sullivan, Edgley, & Dehoux, 1990) and the Patient-Reported Outcomes Measurement Information System (PROMIS) Applied Cognitive Abilities and Cognitive Concerns Scales (Becker, Stuifbergen, & Morrison, 2012).

Although these measures assess cognitive functioning, fewer measures have been designed to assess changes in the use of compensatory cognitive strategies for daily activities, which are the focus of many cognitive rehabilitation interventions. One exception is the Memory Strategies Scale, included in the Multifactorial Memory Questionnaire (MMQ-Strategy; Troyer & Rich, 2002), which measures how often older adults use memory strategies. This scale has been validated in persons with MS (Stuifbergen et al., 2012), but although it assesses the use of memory strategies, it does not adequately capture compensatory tactics in other cognitive domains such as attention, processing speed, and executive functioning. Additionally, this instrument was developed more than a decade ago, so it does not consider the use of more recent technological aids such as smartphones or online calendar/email software. The Compensatory Cognitive Strategies Scale introduced here incorporates other cognitive strategies in addition to memory strategies, and it also addresses newly available computer aids. It is intended to assess the frequencies of using a range of self-reported cognitive strategies that can assist cognitive tasks in daily life, including those of the workplace. In this study, we examine the reliability of the Compensatory Cognitive

Strategies Scale among individuals with MS and consider the evidence for validity of the scale as a measure of self-reported utilization of cognitive strategies among people with MS.

METHODS

Instrument development

According to Kurtz (2011), compensatory strategies are “environmental modifications or behavioral strategies designed to bypass persistent impairment in attention, memory, executive-function, and/or other cognitive skills as a means to achieve desired rehabilitation goals” (p.657). The content of the Compensatory Cognitive Strategies Scale is informed by the literature on compensatory cognitive strategies (Demaree, Gaudino, & DeLuca, 2003; Fogler & Stern, 1994; Kessler, 2013; Sohlberg & Mateer, 2001) and an earlier pilot cognitive intervention study conducted with people with MS (Stuifbergen et al. 2012). Designed to complement the MMQ-Strategy instrument (Troyer & Rich, 2002), the scale addresses additional cognitive strategies such as ways to decrease distractions, organize and sequence activities (executive functioning), and capitalize on newly available computer technologies in order to assist memory. After developing an initial set of items, the first author reviewed the items with the other authors. On the basis of their feedback, the tool was shortened and some items were slightly reworded.

Expert review of the proposed 22 items was then conducted with three psychologists who have worked with people with cognitive limitations. Two of the reviewers had also conducted research with MS populations and/or had developed functional assessment measures. The third psychologist had conducted neuropsychological testing with adults with various disabling conditions. The reviewers were asked to indicate if each item represented a strategy that someone experiencing cognitive problems could use to improve cognitive functioning in daily activities. They were also asked to note any items that seemed unclear. These experts generally agreed that items were relevant to the construct of cognitive strategies. The reviewers did not recommend that any items be eliminated. Their few suggestions for change (such as making the item about prioritizing a “to do” list more specific, adding items about using a digital recorder to make reminder memos and establishing a routine for putting items in the same place) were integrated into the 24-item version of the scale.

Scale description

Respondents rate each of the 24 items on a 5-point frequency scale from 0 (*never*) to 4 (*all the time*) to indicate how frequently they use each strategy in their daily lives. Individual item ratings are summed to create a total score ranging from 0 to 96. Higher scores indicate more frequent use of the strategies.

Field tests of reliability and validity

Sample 1—This sample was drawn from the 19th year of an ongoing longitudinal survey study of health promotion and disease prevention among persons with MS. Individuals were originally recruited from mailing lists provided by two chapters of the National Multiple Sclerosis Society (Stuifbergen, Blozis, Harrison, & Becker, 2006). To be eligible,

participants needed to be community-residing adults who reported that their MS diagnosis had been confirmed by a physician. Self-reported cognitive impairment was not an inclusion criterion. Questionnaire packets have been mailed annually to those who continued to be eligible and were interested in participating in the study. In the first year of the longitudinal study, 621 individuals participated. Over time, this number has diminished, due to death, ineligibility due to institutionalization, or loss of contact. As expected, those no longer in the study pool were older and had greater functional limitations than those who remained in the study. In Year 19, usable questionnaires were returned by 245 of the 344 people who were mailed the survey packets, resulting in a 71% response rate. In addition to the Compensatory Cognitive Strategies Scale, the mailed survey questionnaire contained scales measuring health promoting behaviors (Health-Promoting Lifestyle Profile II [HPLP II]; Walker, Sechrist, & Pender, 1995), depressive symptoms (the 10-item version of the Center for Epidemiologic Studies-Depression Scale [CES-D-10]; Radloff, 1977), functional limitations (Incapacity Status Scale [ISS]; Kurtzke, 1981), and perceived cognitive abilities (PROMIS Applied Cognitive Abilities; Cella et al., 2007).

Sample 2—The second sample participated in a clinical trial of an intervention designed to build cognitive skills among people with MS who reported cognitive problems. Participants were recruited from three Texas cities through local neurologists and other community contacts, including the mailing list of the MS Society. Men and women between the ages of 18 and 60 years who self-reported cognitive limitations were recruited. Participants' physicians were asked to confirm that the participant had been diagnosed with MS for at least 6 months. To be included in this study, participants' had to be relapse free for 90 days, have home internet access, and the ability to speak and read English. Interested participants contacted the research office, and a staff member verified the inclusion criteria, including that the participant reported at least five problems listed on the Perceived Deficits Questionnaire (Sullivan, et al., 1990) "sometimes" or more often. The PDQ was developed to assess self-reported cognitive difficulties among people with MS. The developers reported acceptable internal consistency reliability and discriminated significantly between people with MS who have memory concerns and those without MS.

Eligible participants were then mailed a consent form (including a form allowing their physicians to release information about their MS diagnoses) and a questionnaire packet that included the Compensatory Cognitive Strategies Scale, the MMQ-Strategy subscale, the PROMIS Applied Cognitive Abilities Scale, the Expanded Disabilities Status Scale (EDSS; Kurtzke, 1983), and the CESD-10.

Half of Sample 2 were randomly assigned to an 8-week intervention designed to build self-efficacy for perceived cognitive abilities and improve cognitive function by combining facilitated group sessions with computerized brain training homework (see Stuijbergen et al., 2012, for a description of the intervention). In the group sessions, the participants discussed cognitive limitations common to people with MS, cognitive strategies, and other aspects of health promotion that can affect cognitive functioning, such as exercise and stress management. The facilitator reinforced them for using strategies to compensate for their perceived cognitive limitations. To further build their cognitive abilities, participants were

also asked to practice three times a week for 45 min each day on a computerized brain-training program.

Measures

Memory strategies—The MMQ-Strategy subscale asks respondents to rate how frequently they use strategies such as mentally elaborating on something or writing notes to remember (Troyer & Rich, 2002). Scores range from 0 to 76. Convergent validity is supported by a strong correlation ($r = .66$) between Strategy scores and the Mnemonics Subscale of the Memory Functioning Questionnaire (Gilewski, Zelinski, & Schaie, 1990). The internal consistency reliability ranged from .83 to .88 in an earlier study of people with MS (Stuifbergen et al., 2012).

Perceived cognitive abilities—The 8-item Cognitive Abilities Scale is derived from the PROMIS item bank that provides researchers with a common item repository to assess patient outcomes (Cella, et al., 2007). Respondents rate each item on a 5-point scale reflecting their perceived cognitive functioning during the past 7 days (www.nihpromis.org). Higher scores indicate greater perceived cognitive abilities. Norms are provided to facilitate comparison with a calibration sample. In a previous study of people with MS, the PROMIS Applied Cognitive Abilities Scale had a Cronbach's alpha of .94, and scores had small to moderate correlations with performance on the Symbol Digit Modalities Test, the Brief Visuospatial Memory Test, the Controlled Oral Word Association Test, and the 2-second Paced Auditory Serial Addition Test (Becker et al., 2012).

Neurocognitive test—The Symbol Digit Modalities Test (SDMT; Smith, 1982) assesses complex scanning/tracking. The number of correct responses in 90 seconds constitutes the score. A test/retest correlation coefficient of .76 was obtained over one month. In a previous study of people with MS, the correlation between the SDMT and the PROMIS Cognitive Abilities Scale was .27 (Becker, et al., 2012). The SDMT was administered by trained administrators under standard testing protocols to all individuals in Sample 2.

Health-promoting activities—The 52-item Health Promoting Lifestyle II (HPLP II) assesses the frequency with which individuals report engaging in activities to increase their level of health and well-being (Walker et al., 1995). Responses range from 1 (*never*) to 4 (*routinely*), with higher scores indicating more frequent practice of a health behavior. This instrument contains 6 subscales (physical activity, spiritual growth, health responsibility, interpersonal relations, nutrition, stress management). The reliability and validity of the HPLP II have been supported in psychometric testing with multiple samples including a sample of 712 community dwelling adults and among people with disabilities (Walker & Hill-Polerecky, 1996). Its reliability and validity have also been demonstrated among older adults (Callighan, 2006). In an earlier study of people with MS, the Cronbach's alpha ranged from .93 to .95 across four time points, and scores were sensitive to change over time in a health promotion intervention (Stuifbergen, Becker, Blozis, Timmerman, and Kullberg, 2003).

Incapacity status—The 16-item Incapacity Status Scale (ISS) assesses functional limitations among people with MS in areas such as bowel and bladder function, sensory or cognitive impairment, activities of daily living, and particular emphasis on mobility impairment (Kurtzke, 1981). Items are rated on 5 pt. scales ranging from 0=normal functioning to 4= complete inability. Scores can range from 0 to 64. The higher the score, the greater the reported impairment. Construct validity has been reported for people with MS (Kurtzke, 1981; LaRocca et al., 1984). In a previous study of people with MS, Cronbach's alpha for the ISS score was .88 (Stuifbergen, et al., 2006).

Functional limitations—Adapted from the physician-administered Expanded Disability Status Scale (EDSS) (Kurtzke, 1983), the EDSS-S (Bowen, Gibbons, Gianas, & Kraft, 2001) is a self-report questionnaire that addresses functional limitations in nine areas: mobility, strength, coordination, sensation, bowel and bladder function, speech, swallowing, and cognition. Scores range from 0 to 10. Higher scores represent greater impairment in people with MS. Bowen et al. reported a .89 intraclass correlation between patient- and physician-administered versions of the EDSS.

Depressive symptoms—The original CES-D (Radloff, 1977) was shortened to a 10-item summated rating scale by Andresen, Malmgren, Carter, and Patrick (1994). Higher scores reflect more self-reported depressive symptoms in the past week. High internal consistency reliability (alpha = .85) has been shown in a previous study of people with MS (Becker, Stuifbergen, Lee, & Kullberg, 2014), and good discriminant validity was demonstrated in previous research (Blalock, DeVellis, Brown, & Wallston, 1989). A cut-off score of 10 or more is used to identify individuals who may be depressed.

In addition, participants in both samples completed a background information sheet that solicited information about demographic and health-related characteristics.

Data Analysis

SPSS Version 23 was used for all data entry and data analysis except the IRT analysis. Data entry for a random sample of 10% of cases was re-checked. The error rate was less than 3%. For scales with data missing less than 15%, mean substitution using the average of the unmissed items for the missed items was used. If 15% or more of the data were missing, the individual was dropped from the analysis with that variable.

IRTPRO 3 (available at <http://www.ssicentral.com/irt/downloads.html>.) was used to detect items that did not discriminate well or violated the assumption of local independence. All IRT analyses were conducted with both samples. Graded model was used as a modeling methodology. Local independence was examined via Standardized LD χ^2 tests. For Differential Item Functioning (DIF) analyses, all twenty-four items were used as anchor items. Final item evaluation was conducted based on item discrimination, item location, item independence, and DIF results.

Following its development and expert review, the Compensatory Cognitive Strategies Scale was evaluated in community dwelling persons with MS who had been participating in an ongoing longitudinal study (Sample 1). Cronbach alpha was used to compute internal

consistency reliability. To explore the construct validity of the Compensatory Cognitive Strategies Scale, non-parametric correlational analyses were computed with scores from other health measures that might be related to it, such as reported frequency of health promoting behaviors and perceived cognitive abilities. Non-parametric tests are not generally as powerful as their parametric analogues, so the alpha level was set at $p < .10$. Because previous research among people with MS had established relationships among depression, perceived cognitive impairment, and neuropsychological performance (Julian, Merluzzi, and Mohr, 2007), the relationship between depressive symptoms and Compensatory Cognitive Strategies Scale scores was examined. Compensatory Cognitive Strategies Scale scores were also correlated with demographic variables to assess if the scale scores would differ for different demographic groups.

The internal consistency, test/retest reliability and validity were further assessed in a second sample from a cognitive intervention study in persons with MS (Sample 2). In this phase of the study, non-parametric correlational analyses were used to explore relationships with other demographic and health measures, the memory strategy measure, self-reported cognitive abilities, and neurocognitive test performance. Wilcoxon Signed Ranks Test was used to assess sensitivity to change over time following participation in a cognitive intervention. Data collection for both samples was approved by the institutional review board at The University of Texas at Austin.

RESULTS

Sample 1

Description—The predominantly White female sample had an average age of 63 years (range, 37–91); 60% reported some post-secondary education. They had been diagnosed for an average of 28 years. According to their self-report, half of the sample had relapsing/remitting MS (40%) or benign sensory MS (9%); 40% had some form of progressive MS (see Table 1). Seventy-eight percent were taking disease modifying drugs. Their average PROMIS Cognitive Abilities Score was 21.76, corresponding to a T-score of 42. The mean Incapacity Status Score was 17.8.

Scale description—The average score on the Compensatory Cognitive Strategies Scale was 43.43 ($SD \pm 16.06$, $n = 235$). The skewness was $-.02$, suggesting that the total score distribution did not deviate significantly from normality. The items with the lowest frequency of use were Item 20 (“Audio record meetings for later review”) and Item 21 (“Use a digital recorder to make short reminder memos to yourself, then review them later”). The items that respondents were most likely to endorse were Item 22 (“Establish a routine of always putting ‘key’ items in the same place”) and Item 24 (“Prioritize your ‘to do’ list to aid time management and organization”). A few respondents commented that because they were retired, they believed some items were not relevant to them.

Reliability—Cronbach’s alpha, a measure of internal consistency reliability, was .89. All item/total correlations were above .34.

Correlational analyses—As shown in Table 2, Compensatory Cognitive Strategies scores had very small negative relationships with PROMIS Applied Cognitive Abilities scores ($r_s = -.13$, NS) and ISS scores ($r = -.05$, NS). The correlation with the CES-D-10 was also negligible ($r_s = .05$, NS). The correlation with frequency of health promotion activities (HPLP-II) was somewhat stronger ($r_s = .24$, $p < .01$). All correlations with demographic characteristics accounted for less than 4% of variance.

Sample 2

Description—The predominantly female sample had an average age of 50 years (see Table 1). Seventy three percent had post-secondary education. This tri-ethnic/racial sample was 20% African American and 10% Hispanic. Thirty-two percent were working, but 39% indicated that they were unemployed due to disability. Sixty-seven percent reported that they had relapsing-remitting MS. They had been diagnosed with MS for 14 years on average, and 81% were on disease-modifying drugs. Their average PROMIS Applied Cognitive Abilities score was 22.45, which corresponds to a T-score of 43. The mean EDSS-S score was 5.4.

Reliability—The Cronbach alpha coefficient for the Compensatory Cognitive Strategies Scale was .90 ($n = 101$). All item/total correlations were above .23. Over approximately 2 months the correlation between pre- and posttest scores for those not receiving the cognitive intervention ($n=47$) was .75.

Correlational analyses—As shown in Table 2, cognitive strategies scores were strongly correlated with scores on the MMQ-Strategy Scale ($r_s = .67$, $p < .01$). There was also a small but significant negative correlation between Compensatory Cognitive Strategies total scores and the PROMIS Applied Cognitive Abilities score ($r_s = -.28$, $p < .01$) and an even smaller negative correlation with the SDMT ($r_s = -.11$, NS). (The MMQ-Strategy score was also negatively correlated with PROMIS Applied Cognitive Abilities at $r_s = -.28$). Cognitive strategies scores were not related to gender, age, years of education, employment status, time since diagnosis, or EDSS-S scores. Finally, there was also a negligible correlation between Compensatory Cognitive Strategies scores and the CES-D-10 ($r_s = .16$, NS).

Sensitivity to change over time—Pre- and posttest ratings and total scores were calculated for the subsample consisting of those who participated in the intervention designed to improve their cognitive functioning and completed data collection at both time periods ($n = 43$ out of 51 who were randomly assigned to the intervention condition). Using reminder functions on computers/personal devices and establishing routines for putting things in the same place were most frequently reported (see Table 3). Audio-recording of meetings and making digital recordings as reminder memos received the lowest ratings. The mean total score at baseline was 45.82 (S.D.=18.62) and the mean total score following exposure to the intervention was 49.20 (S.D.=13.04). There were increases in ratings for 18 of the 24 items, and the increase in total scores was statistically significant at $p < .10$ ($Z = 1.78$, 2-tailed).

IRT Analysis—Item response theory using a graded model was employed to determine whether the scale could be shortened by eliminating poor performing items. The assumption

of local independence was violated for three item pairs for Sample 1, but no item pairs in Sample 2. Item discrimination parameters were examined, and graphs used to inspect item location parameters for each item's four response categories. Items were also evaluated in terms of their content, because one objective of the scale construction was to present items representing a variety of cognitive strategies. Four items were eliminated based upon these considerations: Items 3 ("Ask others to review your work"), 4 ("Pace yourself to conserve energy"), 7 ("Give yourself extra time to do tasks"), and 20 ("Audio record meetings for later review"), thus creating a 20-item scale. At T1, the mean for the 20-item scale was 39.04 (S.D.=14.38, n=101). To determine the effects of eliminating these items on the psychometric characteristics of the scale, the reliability and key validity indicators were examined. Minimal changes were observed. For example, in Sample 1, the Cronbach alpha coefficient dropped from .89 to .88, while in Sample 2, the correlation coefficient with the Memory Strategies Scale remained the same (see Table 4). The Z value for the Wilcoxon Signed Rank Test associated with changes from before and after the cognitive intervention was -1.89, $p < .06$.

DISCUSSION

Results of this initial analysis of the Compensatory Cognitive Strategies Scale provide preliminary support for its reliability and validity for people with MS. The Cronbach's alpha coefficients for the scale were .89 for the first sample of individuals with MS and .90 for the second sample, supporting the internal consistency of scale scores. The correlation of .75 between scores over a 2-month period implies temporal consistency in a group who did not receive an intervention designed to improve cognitive functioning (Sample 2). There was a small increase in scores for those exposed to a cognitive intervention in Sample 2, suggesting that the Compensatory Cognitive Strategies Scale may be sensitive to change following treatments designed to build cognitive abilities.

The pattern of correlations suggests a strong relationship with the measure of memory strategies provided by the MMQ-Strategy instrument (Sample 2). Although the Compensatory Cognitive Strategies Scale and the MMQ-Strategy were strongly correlated, the fact that they were not more highly related suggests that they may be addressing somewhat different aspects of cognitive-related strategies.

There was a small but significant correlation with reported frequency of health promoting activities (i.e., HPLP II). It is to be expected that scores on the Compensatory Cognitive Strategies Scale would be more highly related to another measure of cognitive strategies than to a measure of other health behaviors. Thus, this pattern of findings supports the convergent/divert validity of the Compensatory Cognitive Strategies Scale. The small negative correlations with measures of functional limitations were expected because the content of both the ISS and the EDSS are more heavily weighted toward mobility impairment than toward cognitive problems.

The small negative correlations with perceived cognitive abilities for both the Compensatory Cognitive Strategies Scale and the MMQ-Strategy scale in Sample 2 suggests that those who feel that their cognitive abilities are weaker may be slightly more likely to employ

compensatory strategies than those who perceive fewer cognitive problems. If future research finds stronger relationships between self-reported cognitive abilities and this scale, then using the Compensatory Cognitive Strategies Scale as a screening mechanism may be a way to identify those who will be most amenable to interventions designed to teach people how to improve their day-to-day cognitive functioning.

In Sample 2, Compensatory Cognitive Strategies Scores were more strongly related to perceived cognitive abilities than neurocognitive test performance ($r_s = -.28, p < .01$ versus $r_s = -.11, NS$). The former correlation may be higher because the two measures share the same self-report methodology. Or, possibly those who perceive themselves to have less cognitive abilities, as opposed to those who perform more poorly on a neurocognitive test, are more likely to attempt compensatory strategies. Future research should investigate whether those who may lack insight about their cognitive functioning are more or less likely to utilize compensatory cognitive strategies. Van der Hiele and colleagues (2012) suggested that those who lack insight into their impaired cognitive abilities may be less involved in cognitively challenging tasks, thus leading to overestimation of their cognitive abilities, whereas those who underestimate their cognitive abilities may exhibit psychological distress. Either situation may make it difficult for individuals to capitalize on the cognitive strategies assessed here.

The small correlations between Compensatory Cognitive Strategies scores and demographic characteristics such as gender, age, or education suggests that the scale does not perform differently in different population subgroups, at least among the subgroups represented in the two samples studied here. However, since the majority of both samples had postsecondary education, future studies should examine correlations between Compensatory Cognitive Strategies scores and educational level in a sample with a wider range in educational attainment.

Although individuals in the first sample were not recruited on the basis of self-reported cognitive concerns, their average age (64 years) put them at risk for developing cognitive problems, and so they may have been more likely than young adults to think about using cognitive strategies to compensate for perceived cognitive deficits. The second sample was younger (average age 50 years) and included more working adults (30%), but everyone in this sample had reported cognitive concerns. Self-reported PROMIS Applied Cognitive Abilities scores for both samples were slightly more than .5 SD below the calibration group's mean score, suggesting that, on average, respondents in both samples may have been experiencing mild cognitive impairment. Westervelt (2015) has called for additional research on the occurrence of dementia among those with MS. We would expect that those with MS who are experiencing dementia will find it difficult to carry out many of the strategies on the Compensatory Cognitive Strategies Scale, but future research should investigate the usefulness of this measure with MS patients who differ in type of MS or level of cognitive impairment.

Because both samples were convenience samples, sample selection bias represents a threat to the validity of the results. Although the Compensatory Cognitive Strategies Scale was investigated in two different groups of people with MS, these samples most likely

represented well-educated people with MS who were interested in health and well-being, and who had been living with MS for a number of years. Particularly in the second sample, respondents were most likely to have relapsing/remitting MS. The two samples included individuals from various racial and ethnic groups, but future research should investigate the psychometric properties of the Compensatory Cognitive Strategies Scale in more diverse samples, including those diagnosed with MS more recently. Compared with adults 30 years or older in the North American Research Committee On Multiple Sclerosis (NARCOMS) data base, the samples in this study are slightly more likely to be female, somewhat better educated, older and less likely to be employed (Enders & Brandt, 2007).

The IRT analysis identified 4 items that exhibited lower discrimination and/or local dependence. Dropping these four items did not adversely affect the reliability and validity data available in this study, and results in a more parsimonious measure. Therefore, we recommend using the 20-item version. Future research could contribute to understanding the validity of the Compensatory Cognitive Strategies Scale by comparing scores with measures of other constructs that might be theoretically related to the construct of cognitive strategies, such as enhanced social role performance or use of other resources designed to build cognitive skills (e.g., memory training activities, on-line resources). It will also be important to examine the environmental supports that individuals have available to enhance their use of compensatory cognitive strategies.

Although the Compensatory Cognitive Strategies Scale was tested in people with MS, people whose cognitive limitations result from other conditions associated with mild cognitive impairment might also find these strategies useful. Therefore, future research should be conducted to test the psychometric properties of the Compensatory Cognitive Strategies Scale with other patient groups.

Implications for practice

Using the total score has many advantages for research purposes, but it may also be helpful to examine individual item ratings in clinical situations. Because the items are drawn from the literature on strategies that are often recommended in treatments designed to build compensatory strategies, the items themselves may serve to educate people about cognitive strategies they might consider. In addition to strategies related to memory functioning, the Compensatory Cognitive Strategies Scale includes items related to executive functioning strategies, such as avoiding multitasking or breaking down complex tasks into smaller steps. Because previous research has noted deficits in executive functioning in people with MS, such strategies are important to address.

Both samples tested in this study tended to use some of these strategies more than others, and providers might want to draw people's attention to strategies that might be less familiar to them, such as asking others to interrupt them less often, using a digital recorder to make short reminder memos, or requesting accommodations at the workplace. The relatively short number of items on the scale makes it feasible for teaching patients about compensatory memory strategies in clinical settings.

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Table 1

MS Sample Characteristics

Characteristic	Categories	Sample 1 Total (%) (n=245)	Sample 2 Total (%) (n=107)
Gender	Male	31 (13%)	17 (16%)
	Female	214 (87%)	90 (84%)
Age	20–35 years	--	5 (4.7%)
	35–50 years	16 (6.5%)	44 (41.1%)
	51–65 years	119 (48.6%)	58 (54.2%)
	>65 years	110 (44.9%)	---
Average Age		63.38 (9.40)	50.14 (7.73)
Education	<High School	3 (1.2%)	1 (0.9%)
	High School Grad	97 (38.8%)	27 (25.2%)
	Associate Degree	39 (15.9%)	15 (14.0%)
	Bachelors Degree	71 (29.0%)	51 (47.7%)
	Graduate Degree	37 (15.1%)	12 (11.2%)
Race	White	221 (90.2%)	77 (72.0%)
	African American	--	21 (19.6%)
	Other/Multiple	16 (6.5%)	7 (7.4%)
Ethnicity	Hispanic	5 (2.0%)	11 (10.3%)
	Non-Hispanic	227 (92.7%)	96 (89.7%)
Employment Status	Full-time	24 (9.8%)	28 (26.2%)
	Part-time	14 (5.7%)	6 (5.6%)
	Unemployed-Disability	64 (26.1%)	42 (39.3%)
	Home Maker	31 (12.6%)	10 (9.3%)
	Fired/Laid Off	3 (1.2%)	3 (2.8%)
	Retired	107 (43.2%)	13 (12.1%)
MS Type	Benign sensory	23 (9.4%)	2 (1.9%)
	Relapsing-Remitting	99 (40.4%)	72 (67.3%)
	Primary Progressive	38 (15.5%)	5 (4.7%)
	Secondary-Progressive	50 (20.4%)	16 (15.0%)
	Progressive-Relapsing	9 (3.7%)	1 (0.9%)
	Unable to Say	23 (9.4%)	10 (9.3%)
Depressed ^a		126 (45%)	68 (63%)
Yrs. Since Diagnosis		28.36 ±6.50	13.82 ±8.17
On Disease Modifying Rx		190 (77.6%)	87 (81.3%)

^aRepresents the number of individuals whose scores are above the cut-off to be assessed further for depression

Table 2

Spearman Correlations Between Compensatory Cognitive Strategies Scale and Other Self-Reported Measures of Health and Demographic Characteristics

	Compensatory Strategy Sample 1 (n=235)	Compensatory Strategy Sample 2 (n=107)
Perceived Cognitive Abilities	-.13 ⁺	-.28 ^{**}
Memory Strategies Score	NA	.67 ^{**}
Symbol Digit Modalities Test	NA	-.11
CESD Depressive Symptoms	.05	.16
Health Promoting Lifestyle Total	.24 ^{**}	NA
Incapacity Status Score	-.05	NA
EDSS-S Score	NA	.12
Age	-.15 [*]	.01
Years since diagnosis	-.17 [*]	-.06
Gender	.11 ⁺	.03
Years of School	.05	.02

⁺ p<.10

^{*} p<.05;

^{**} p<.01

NA = Data not available in this sample.

Table 3

Pre and Post Compensatory Cognitive Strategies Ratings (n=43)

	Pre	Post
Use reminder functions on computer or personal electronic device (e.g., Smart Phone, tablets)	2.86	3.09
Break down complex tasks into smaller steps	2.28	2.43
Ask others to review work	1.95	2.16
Pace/conserve energy	2.19	2.32
Organize to do the most challenging tasks at best (i.e., most energetic) time of day	2.51	2.49
Minimize distractions in your work space by closing the door, etc.	1.88	2.19
Take extra time to do tasks	2.49	2.81
Slow the pace of communication in meetings	1.32	1.74
Confirm what others say by repeating the "gist" back to them	1.77	2.05
Take notes while listening to or viewing presentations to organize/reinforce information	2.44	2.14
Recheck work after taking a break	2.42	2.65
Do one thing at a time rather than multitasking	2.30	2.21
Write out notes (in advance) to help verbally relay a sequence of events	2.19	2.17
Request accommodations as needed (e.g., extra time to complete assignments)	1.26	1.55
Use personal electronic devices record written documents	1.67	1.88
Minimize the number of open tabs/windows when on the internet	1.48	1.62
Log off of email periodically to limit distractions	1.36	1.64
Request agenda and/or meeting notes	1.50	1.71
Ask others to minimize the number of interruptions when working	1.21	1.53
Audio record meetings for later review	.76	.52
Use a digital recorder to make short reminder memos and review them later	.60	.40
Establish a routine of always putting "key" items in the same place in house or workspace	2.79	3.02
Slow down; avoid situations that require fast reaction time	2.10	2.33
Prioritize "to do" list to aid time management and organization	2.40	2.69
Total Compensatory Cognitive Strategies Score	45.82	49.20

Items rated on 5-pt. scale from 0 = Never to 4 = All of the time

Table 4

Spearman Correlations Between 20-Item Compensatory Cognitive Strategies Scale and Other Self-Reported Measures of Health and Demographic Characteristics

	Compensatory StrategySample 1 (n=235)	Compensatory StrategySample 2 (n=107)
Perceived Cognitive Abilities	-.14 *	-.27 **
Memory Strategies Score	NA	.67 **
Symbol Digit Modalities Test	NA	-.09
CESD Depressive Symptoms	.06	.16
Health Promoting Lifestyle Total	.23 **	NA
Incapacity Status Score	-.06	NA
EDSS-S Score	NA	.09
Age	-.16 *	.01
Years since diagnosis	-.16 *	-.07
Gender	.10	.03
Years of School	.07	.02

⁺ p<.10

* p<.05;

** p<.01

NA = Data not available in this sample.