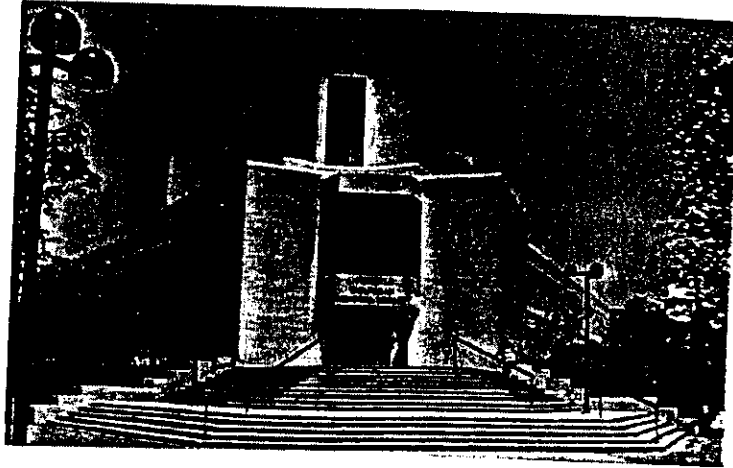


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Journal Title: The Clinical neuropsychologist.

Volume: 16 **Issue:** 3

Month/Year: 2002 **Pages:** 341-355

Article Author:

Article Title: ; Relationship between coping, cognitive dysfunction and depression in multiple sclerosis.

Imprint: Lisse, The Netherlands ; Swets Pub. Serv

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Relationship Between Coping, Cognitive Dysfunction and Depression in Multiple Sclerosis

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ABSTRACT

Given its relatively high prevalence, one possible source of stress for patients with multiple sclerosis (MS) is cognitive dysfunction. The authors' study was guided by a new theoretical model suggesting that cognitive dysfunction in MS may be most likely to lead to depression when patients use high levels of avoidance coping and/or low levels of active coping. To test this model, 55 patients with definite MS were administered a neuropsychological battery and measures of depression and coping. Consistent with predictions, regression analyses showed that coping significantly moderated the relationship between cognitive dysfunction and depression. Specifically, cognitive dysfunction was most likely to be associated with depression when patients used either high levels of avoidance or low levels of active coping. Implications of these data for clinical applications and for our theoretical conceptualization are discussed and limitations of the model explored.

A high number and intensity of stressful events has been shown to precede the onset of first symptoms in multiple sclerosis (MS; Grant et al., 1989; Warren, Greenhill, & Warren, 1982), a chronic and common autoimmune disease that results in the destruction of myelin in the central nervous system (Sibley & Alter, 1989). Additionally, patients experiencing more distressing events are more likely to have an exacerbation of the disease than patients not experiencing such events (Franklin, Nelson, Heaton, Burks, & Thompson, 1988). Because of the possible impact of stressful events on MS disease onset and exacerbation, understanding factors that mitigate or exacerbate stress in MS, such as coping strategies, appears critical. Patients who cope better with stress may experience less disease activity, whereas those who employ less effective strategies may show more activity. Additionally, better coping in

response to stress is sure to result in better quality of life for MS patients.

Certain types of coping strategies have been shown to be associated with better or worse adjustment (typically operationalized as depression or distress) in MS (Aikens, Fischer, Namey, & Rudick, 1993; Foley, Bedell, LaRocca, Scheinberg, & Reznikoff, 1987; Jean, Paul, & Beatty, 1999; Pakenham, 1999; Pakenham, Stewart, & Rogers, 1997; Schwartz, 1999; Warren, Warren, & Cockerill, 1991). Additionally, although significant cognitive dysfunction is present in about 50% of MS patients (Brassington & Marsh, 1998), and this dysfunction has been shown to be highly associated with deficits in everyday functioning (Higginson, Arnett, & Voss, 2000; Rao et al., 1991), little research has been devoted to understanding how cognitive dysfunction might be related to coping. Given its relatively high

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Accepted for publication: August 13, 2002.

prevalence and impact on everyday life, cognitive dysfunction may be a significant source of stress for MS patients. The present study was guided by a new theoretical model suggesting that cognitive dysfunction in MS may be most likely to lead to adaptive and/or low levels of adaptive coping strategies. Maladaptive coping was defined broadly as avoidance coping involving high levels of denial and behavioral/mental disengagement. Adaptive coping was defined broadly as active coping involving high levels of active coping, planning, and suppression of competing activities. Coping theorists have traditionally identified at least two broad ways of coping with stressors: problem-focused and emotion-focused. Problem-focused strategies are directed at altering the source of stress, whereas emotion-focused strategies are directed at reducing the emotional distress elicited by the stressful situation (Lazarus, 1993). It has also been shown that emotion-focused strategies tend to be relied upon more once problem-focused strategies have been tried and failed (Tennen, Affleck, Arnett, & Carney, 2000). There have been many studies in the chronic illness literature demonstrating that high levels of depression are associated with emotion-focused coping (e.g., Revenson & Felton, 1989; Thompson, Gil, Abrams, & Phillips, 1992). In contrast, problem-focused coping has been shown to be associated with lower levels of depression in chronic illness (e.g., Revenson & Felton, 1989). Findings in the MS literature are generally consistent with this broader chronic illness literature, but the emotion-focused coping and depression association (e.g., Aikens et al., 1993; Foley et al., 1987; Jean et al., 1999; Pakenham, 1999; Pakenham et al., 1991) has been replicated more consistently than the inverse association between depression and problem-focused coping (Aikens et al., 1997; Warren et al.; Wineman, Durand, & Steiner, 1994). Although the problem-focused/emotion-focused distinction has provided a useful heuristic for the field of coping, some investigators have suggested that these broad categories of coping contain subtypes of coping that are not necessa-

only correlated, or are even inversely correlated with one another (Carver, Scheier, & Weintraub, 1989). One goal of the present study will be to evaluate the possibility that elevated use of a subset of maladaptive emotion-focused coping strategies involving avoidance is associated with high levels of depression in MS. Additionally, the possibility that less use of a subset of adaptive problem-focused coping strategies involving active coping is associated with high levels of depression will be evaluated. The reason we have chosen these subsets for analysis is that both represent relatively unitary factors of coping (unlike the traditional emotion-focused versus problem-focused distinctions). Additionally, Carver et al. (1989) found that, among different coping factors considered, the avoidance coping scales were inversely related to desirable personality qualities (like self-esteem, optimism, and internal locus of control) and positively associated with less desirable personality qualities (e.g., anxiety). In contrast, the active coping scales were positively related to desirable and more functional qualities and inversely related to less desirable and functional qualities. The assumption here is that MS patients using fewer functional avoidance coping strategies will be more likely to display depression, whereas those patients using more functional active strategies will be resistant to depression.

One possible contributor to depression in MS may be the cognitive difficulties commonly seen in this disease. Approximately 50% of patients display significant cognitive impairments (Brassington & Marsh, 1998). It may be that the cognitive difficulties patients experience are a source of stress that puts them at risk for depression. There is evidence in the MS literature that cognitive impairments occur both with (Arnett, Higginson, Voss, Bender, et al., 1999; Arnett, Higginson, Voss, Wright, et al., 1999; Arnett, Higginson, & Randolph, 2001; Beatty, 1998; Gilchrist and Creed, 1994) and without (Fischer et al., 1994; Schiffer & Caine, 1991; Good, Clark, Oger, Paly, & Klionoff, 1992; Krupp, Slivinski, Masur, Friedberg, & Coyle, 1994) depression, raising the possibility that some other factor may influence whether they are associated with depression. These inconsistent findings indicate

an ideal situation exists of Kennedy (1988) are typically predicted by and characterized by dysfunction literature to a moderate and active consistent relationship. We are by cognitive dysfunction in depression in high levels of adaptive coping as those involved active coping adaptive coping may become dysfunctional coping strategies that coping strategies another goal examine the and/or active between cognitive MS. In particular dysfunction in MS in patient coping, but not this type of cognitive dysfunction with stated with d levels of active high levels of Evaluating important in MS be understanding in MS but also that are associated can be identified that target the episodes of depression. The measurement of problem- and other in MS and other the Ways of C.

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an ideal situation for examining the possible existence of moderators because, as Baron and Kenny (1986, p. 1178) note, moderator variables are typically introduced when there is an unexpectedly weak or inconsistent relation between a predictor and a criterion variable. This statement characterizes the relationship between cognitive dysfunction and depression reported in the MS literature to date. It may be that consideration of moderator variables, such as avoidance coping and active coping, will help clarify this inconsistent relationship found in the literature.

We are hypothesizing for the present study that cognitive dysfunction will be associated with depression in MS only when patients also use high levels of maladaptive coping strategies, such as those involving avoidance, and/or low levels of adaptive coping strategies, such as those involving active coping. Stated another way, patients may become depressed in reaction to cognitive dysfunction only when they under-utilize coping strategies that are effective and/or over-utilize coping strategies that are ineffective. Thus, another goal of the present study will be to examine the possibility that avoidance coping and/or active coping moderate the relationship between cognitive dysfunction and depression in MS. In particular, it is predicted that cognitive dysfunction will be associated with depression in MS in patients who use high levels of avoidance coping, but not in patients who use low levels of this type of maladaptive coping. Furthermore, cognitive dysfunction is predicted to be associated with depression in patients who use low levels of active coping, but not in patients who use high levels of this type of more adaptive coping.

Evaluating coping might be especially important in MS because of implications not only for understanding mechanisms underlying depression in MS but also for treatment. If coping variables that are associated with depression in MS patients can be identified, psychotherapeutic treatments that target them for change could be developed that might provide long-term resistance to future episodes of depression as well.

The measure most commonly used to assess problem- and emotion-focused coping strategies in MS and other chronic illness patients has been the Ways of Coping Checklist (WCCL; Folkman

& Lazarus, 1980, 1985) and the related Ways of Coping Questionnaire (WCQ; Folkman & Lazarus, 1988). These measures consist of items that describe a variety of strategies that people use to deal with stressful events. The WCQ has eight subscales, most of which have been conceptualized as falling within either problem-focused coping or emotion-focused coping domains.

Despite their widespread usage, the Ways of Coping measures contain items that are often ambiguous and thus difficult for examinees to interpret. Additionally, subscales making up the emotion-focused dimension vary widely in the constructs that they are measuring; empirically many have been found to be inversely correlated (Scheier, Weintraub, & Carver, 1986). Because of these limitations in the Ways of Coping measures, in the current study we used a theoretically derived measure of coping known as the COPE (Carver et al., 1989) that consists of several homogeneous subscales that reflect a variety of coping strategies. Many of these subscales are statistically independent of one another; however, at both a conceptual and empirical level, three subscales are generally associated with positive adaptation and three are associated with maladaptive functioning. An adaptive cluster of coping strategies identified by Carver et al. is comprised of the Active Coping, Planning, and Suppression of Competing Activities subscales. These scales all loaded on one factor in Carver et al.'s validation study and are collectively characterized as Active Coping. A maladaptive cluster of coping strategies identified by Carver et al. is comprised of the subscales involving Denial, Behavioral Disengagement, and Mental Disengagement. These scales also loaded on the same factor in Carver et al.'s study and were collectively termed Avoidance Coping. Another goal of the present study will be to attempt to replicate this factor structure within our MS sample.

To summarize, we had three sets of hypotheses. Our first prediction was that, consistent with Carver et al.'s (1989) study, the three Active Coping COPE subscales would load on one factor, and the three Avoidance Coping COPE subscales would load on another factor. Second, we predicted that depression in MS would be associated with greater use of Avoidance Coping but less use

according to institutional guidelines, and were treated in accordance with the ethical standards of the APA.

Depression Conceptualization

A growing number of investigators (e.g., Huber & Rao, 1993; Nyenhuis et al., 1998; Randolph, 2000; et al., Atkens et al., 1999) have asserted that some vegetative symptoms of depression may be confounded with MS symptoms, making the application of commonly used instruments like the Beck Depression Inventory (BDI; Beck & Steer, 1987) and Diagnostic and Statistical Manual of Mental Disorders, Fourth Edition (DSM-IV; American Psychiatric Association, 1994) criteria for major depressive episode (MDE) to MS less than optimal. Perusal of the BDI reveals that at least 7 of the 21 items relate to vegetative/somatic symptoms of depression and at least 5 of these 7 (difficulty getting going/extra effort required to do things, sleep disturbance, fatigue, health concerns, and sexual dysfunction) are common symptoms of MS that do not necessarily reflect depression. Mohr et al. (1997) note that four of the nine symptoms included in the DSM-IV criteria for MDE are common in MS. These include fatigue, psychomotor retardation, decreased concentration, and insomnia or hypersomnia.

Because of the potential confound involved in including vegetative symptoms of depression when diagnosing depression in MS, following the suggestion of Nyenhuis et al. (1998) and the precedent set with our previous studies on depression and cognitive functioning in MS (e.g., Arnett, Higginson, Voss, Bender, et al., 1999; Arnett, Higginson, Voss, Wright, et al., 1999; Arnett et al., 2001), we used the mood subscale from Nyenhuis et al.'s (1995) Chicago Multiscale Depression Inventory (CMDI) as part of our definition of depression in the present study. Additionally, because negative self-evaluative symptoms are considered core characteristics of depression (Beck & Steer, 1987) but are not confounded with MS symptomatology, we further defined depression by combining the evaluative scale from Nyenhuis et al.'s (1995) study to the mood subscale.

With our focus on using mood and evaluative symptoms to identify depressed MS patients, we do not mean to imply that there is a consensus in the literature regarding the best approach for measuring depression in MS. This is currently a hotly debated issue that we will leave for future studies to resolve. For our purposes, our previously published empirical data (e.g., Arnett, Higginson, Voss, Bender, et al., 1999; Arnett, Higginson, Voss, Wright, et al., 1999; Arnett et al., 2001) support the use of mood items to identify depressed MS patients who are most likely to show cognitive impairment, a relationship that is integral to the model we are exploring in the present study.

of Active Coping coping strategies. Last, we predicted that coping strategies would moderate the relationship between cognitive dysfunction and depression in MS. Cognitive dysfunction in the present study will be defined according to patients' performance on a summary index consisting of speeded attentional, working memory, and planning tasks. We selected only those cognitive tasks that have been shown to be most sensitive to depression in MS (Arnett et al., 2001; Thornton & Raz, 1997) to determine whether the variance they explain in depression can be better accounted for when the moderator effects of the proposed coping variables are taken into account.

METHOD

Participants

A subset of 55 of the 79 MS participants described in detail in Arnett, Higginson, Voss, Wright, et al. (1999) was administered and had valid data for all of the measures used in the current study. The majority of the original participants not included in the present data analyses ($n = 16$) were excluded because they were not administered the Tower of London used for the current study (see Arnett et al., 2001). Participants were recruited from neurologists and a local chapter of the National MS Society in the Northwestern United States. Participants were excluded if they: (a) had a history of substance abuse or nervous system disorder other than MS; (b) had severe motor or visual impairment that might interfere with cognitive testing; (c) had a premorbid history of a learning disability; (d) could not easily be evaluated at our university because of severe physical/neurological impairment; or (e) did not live reasonably close to our testing centers.

All participants received an extensive neuropsychological evaluation as part of a study of cognitive and emotional functioning in MS. Each MS participant was diagnosed as having definite or probable MS based on Poser et al. (1983) criteria by a board-certified neurologist who also determined disease course using Lublin and Reingold (1996) criteria. Duration of illness from symptom onset and from diagnosis, and neurological disability (Kurtzke Expanded Disability Status Scale [EDSS], 1983) were also assessed. None of the patients included in the current study were experiencing a clinical exacerbation at the time of the evaluation. All participants were provided with a written neuropsychological screening evaluation and verbal feedback in return for their participation, gave informed consent

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The CMDI is a self-report questionnaire that was specifically designed for use in MS and other medical patient groups and has vegetative, mood, and evaluative subscales consisting of 14 items each. Examinees are asked to rate on a scale of 1-5 the extent to which each word or phrase (e.g., sad, glum, low, for the mood subscale; worthless, a failure, unwanted, for the evaluative subscale) describes them during the past week, including today, where 1 is Not at All and 5 is Extremely.

Because the CMDI is a relatively new measure, we assessed depression in two other ways to demonstrate the validity of the CMDI by: (a) having participants complete the BDI; and (b) having participants' significant others, when available, rate the participants on the BDI items. Although, as noted earlier, these methods for diagnosing depression in MS may reflect symptoms of MS, we included them to provide a reference point for the less frequently used combined CMDI mood and evaluative scale.

Measures

COPE

The COPE (Carver et al., 1989) is a 52-item scale designed to measure a variety of coping styles used in response to stressful events. It can be used to measure situational or dispositional coping tendencies.² Because we were interested in how patients generally respond to stress, we used it to measure the latter. The COPE is divided into 4-item clusters comprising 13 conceptually distinct scales. To explore our hypotheses, we divided the COPE inventory into adaptive (Active Coping) and maladaptive (Avoidance Coping) clusters. The Active Coping index combined the Active Coping, Planning, and Suppression of Competing Activities subscales. The Avoidance Coping index included the subscales for Mental Disengagement, Behavioral Disengagement, and Denial.

Cognitive Task Index (Combined Speeded Attentional, Working Memory, and Planning Task Indices)

Because a central goal of our study was to examine whether the relationship between cognitive dysfunction and depression in MS was moderated by coping

²As Lazarus (1993) notes, some coping strategies are applied consistently and are, therefore, more likely to reflect dispositional approaches to coping. Other strategies show less consistency and appear to be more situation-specific. By having patients rate what they generally do and feel in response to stressful events, we hoped to elicit more dispositional-type responses.

strategies, we developed an index of cognitive dysfunction comprised of tests shown to be most associated with depression in MS from prior work (e.g., Arnett et al., 2001; Thornton & Raz, 1997). One of the tasks, the Reading Span test (Arnett, Higginson, Voss, Bender, et al., 1999), is a measure of working memory capacity. The three speeded attentional tasks also shown to be performed poorly by depressed MS patients included total correct combined across the 3- and 2-s versions of the Paced Auditory Serial Addition Test (PASAT; Rao, Leo, Houghton, St. Aubin-Faubert, & Bernardin, 1989), total correct in 90s on the Oral Form of the Symbol Digit Modalities Test (SDMT; Smith, 1982), and total time per switch on the Visual Elevator subtest from the Test of Everyday Attention (TEA; Robertson, Ward, Ridgeway, & Nimmo-Smith, 1994). Visual Elevator is a test designed to be an ecologically valid measure of speeded attention, cognitive flexibility, and working memory. It is described in more detail in Arnett, Higginson, Voss, Bender, et al. (1999). Finally, the time per trial and moves per trial indices from the Tower of London, an executive measure of planning ability described in more detail by Arnett et al. (2001), were included. To simplify our data analyses, we converted all six capacity-demanding test indices to z scores (using the total MS sample as a reference point for these calculations), then calculated a mean z score to create a cognitive task index.

Premorbid Intellectual Functioning

An estimate of premorbid Full Scale WAIS-R (Wechsler, 1981) intellectual functioning was derived from Barona and Chastain's (1986) demographically-based formula.

Current Estimate of Intellectual Functioning

Current intellectual functioning was estimated from the Vocabulary subscale of the Shipley Institute of Living Scale (Zachary, 1986).

Medication Measures

Sweet, Newman, and Bell (1992) note that failure to control for medication use can serve as a confound in studies of depression in neuropsychological assessment. Thus, the possible influence of medications participants were taking was evaluated by tallying the total number of medications that patients were taking that could potentially have a significant influence on depression and correlating this with our depression measure. The drug categories considered for this analysis included: Antispasmodics/muscle relaxants, tricyclic antidepressants, anticholinergics, and benzodiazepines. Only those medications within these categories with known effects on mood were included,

Table 1. S

Variable	n
CNDI mood	
CNDI vegs	
BDI	
BDI (signifi)	
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Coping Index. In both cases, per guidelines outlined by Baron and Kenny (1986), the interaction term was used as the test of the moderation hypothesis. We entered the Cognitive Task Index into the regressions first because a central goal of the present study was to explain variance in depression beyond what we had explained with cognitive variables alone in our previous studies (Arnett, Higginson, Voss, Bender, et al., 1999; Arnett, Higginson, Voss, Wright, et al., 1999; Arnett et al., 2001). By entering the Coping Index main effect and then the interaction term after the entry of the Cognitive Task Index in each equation, we could more clearly address the independent contribution of these new variables.

RESULTS

Preliminary Analyses
Participant characteristics of the sample are outlined in Table 1. None of the participant characteristics correlated significantly ($p < .05$) with the depression index. Therefore, no statistical control of these variables in the data analyses was necessary.

Primary Analyses
Our first set of analyses involved evaluating the integrity of the Avoidance Coping and Active Coping composite scales to be used in our next set of hypothesis-testing analyses. We conducted a principal components analysis of the subscales making up both the Avoidance Coping and Active Coping COPE scales to evaluate whether the subscales loaded as expected. For the principal components analysis, the Kaiser-Meyer-Olkin measure of sampling adequacy was .73; values $> .7$ are considered adequate and thus our obtained value indicates that the distribution of values on the COPE indices were adequate for conducting principal components analysis. The Bartlett's Test of Sphericity $\chi^2(15) = 88.8$, $p < .001$; this test assesses the multivariate normality of the set of distributions of test indices. Any p -value $< .05$ indicates that the data are multivariate normal and acceptable for principal components analysis. Consistent with predictions and as illustrated in Table 2, principal components analysis revealed two factors with eigenvalues > 1.0 . Varimax rotation revealed that the three Active Coping subscales loaded on one factor and

and were classified as such by a board-certified psychiatrist.

Procedure

Participants completed the measures described in addition to a larger battery of neuropsychological tests as part of a study of cognitive and emotional changes in MS. A brief psychosocial interview was conducted on the same day, and prior to, the cognitive testing and administration of depression questionnaires. The COPE was mailed to participants for completion a few days before the testing day.

Data Analytic Strategy

The possible influence of participant characteristics on the data was examined by correlating these characteristics with the depression index. We planned to control for any characteristic showing a significant correlation with this index in the regression analyses to follow. To evaluate the first hypothesis, that the three Active Coping COPE subscales would load on one factor, and the three Avoidance Coping COPE subscales would load on another factor, a principal components analysis involving a varimax rotation was conducted. To evaluate our second hypothesis that depression in MS would be associated with greater use of Avoidance Coping but less use of Active Coping coping strategies, the depression index was correlated with these two indices. Finally, to evaluate our third hypothesis that coping strategies would moderate the relationship between cognitive dysfunction and depression in MS, we conducted hierarchical regression analyses. In both analyses, the criterion variable was the CNDI depression index. In the first analysis, predictor variables were entered in the following order: Cognitive Task Index, Avoidance Coping Index, Interaction term for Cognitive Task Index \times Avoidance Coping Index. In the second analysis, predictor variables were entered as follows: Cognitive Task Index, Active Coping Index, Interaction term for Cognitive Task Index \times Active Coping Index.

The following specific drugs were included in each of the medication categories: Antispasmodics/muscle relaxants: Baclofen, Oxycodone, Cyclobenzaprine, Lorazepam, and Chlorzoxazone. Tricyclic antidepressants: Nortriptyline, Doxepin, and Elavil. Anticholinergics: Bethanechol, Dicyclomine, Hyocyanine, and Dicyclo-amine. Benzodiazepines: Diazepam, Clonazepam, Mecizine, Klonopin, Lorazepam, and Temazepam. Regarding our selection of benzodiazepines as a category of concern for possible effects on depression, we included them because recent research has indicated that their use can lead to depression (e.g., Bosworth, Hays, George, & Steffens, 2002; Breggin, 1998).

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Table 1. Summary of Participant Characteristics.

Variable		
<i>n</i>		55
CMDI mood and evaluative scale combined		41.22 (13.81)
CMDI vegetative scale		36.24 (10.92)
BDI		10.71 (8.07)
BDI (significant other rating of subject) ^a		11.46 (7.92)
Age		45.91 (7.48)
Education		15.25 (3.27)
Premorbid IQ estimate		109.06 (6.24)
ShIPLEY Vocabulary		107.16 (9.62)
Total medications with cognitive effects		1.05 (1.01)
Kurtzke (1983) EDSS		4.72 (1.56)
Symptom duration (yrs)		13.62 (9.61)
Diagnosis duration (yrs)		6.98 (4.72)
Sex	<i>n</i>	Percent
Males	10	18
Females	45	82
Diagnostic category		
Clinically definite	50	91
Laboratory definite	2	4
Clinically probable	3	6
Clinical course		
Relapsing-remitting	30	55
Primary progressive	7	13
Secondary progressive	16	29
Progressive relapsing	2	4

Note. Unless otherwise specified, values represent means (standard deviation). MS = multiple sclerosis; CMDI = Chicago Multiscale Depression Inventory; BDI = Beck Depression Inventory; EDSS = Expanded Disability Status Scale.

^aFor this score, $n = 39$.

the three Avoidance Coping subscales loaded most highly on the other. The only exception to this symmetry is that the Behavioral Disengagement scale, in addition to having a positive loading on the Avoidance Coping factor, had a negative loading on the Active Coping factor. These results show that the subscales comprising Active and Avoidance Coping indices are measuring relatively homogeneous dimensions, but that patients displaying high levels of behavioral disengagement are also likely to show low levels of active coping generally.

Test of our second set of hypotheses revealed that the depression index was positively correlated with the Avoidance Coping index, $r(55) = .62$, $p < .001$, and there was a trend for

it to be negatively correlated with the Active Coping index, $r(55) = -.25$, $p < .10$. Thus, there was robust support for the first prediction and marginal support for the second.

Regression analyses for the final set of hypothesis-testing analyses revealed support for both moderation predictions. Table 3 provides descriptive data on the sample for the cognitive and coping variables used in these analyses. As Table 4 illustrates, for the Avoidance Coping analyses, the interaction term entered into the analysis after the main effects for the Cognitive Task and Avoidance Coping Indices were entered still accounted for 8% of the variance in depression ($p < .005$). Analogously for the Active Coping analyses, the interaction term entered into the

Table 4. Hierarchical Regression Analyses for Cognitive Task and Coping Indices Predicting Depression.

Variable	<i>B</i>	<i>SEB</i>	β	R^2	Adj R^2	Δr^2	ΔF	<i>p</i> -level
Cognitive Task Index and Avoidance Coping Index Predicting Depression								
Step 1								
Cognitive Task Index	-10.24	2.16	-0.55	.30	.28	.30	22.44	< .001
Step 2								
Avoidance Coping Index	1.39	0.28	0.50	.52	.51	.22	24.60	< .001
Step 3								
Interaction Term	-1.06	0.32	-1.36	.60	.58	.08	10.87	< .005
Cognitive Task Index and Active Coping Index Predicting Depression								
Step 1								
Cognitive Task Index	-10.24	2.16	-0.55	.30	.28	.30	22.44	< .001
Step 2								
Active Coping Index	-0.41	0.26	-0.18	.33	.30	.03	2.49	ns
Step 3								
Interaction Term	1.82	0.42	3.25	.51	.48	.18	18.98	< .001

Note. *B* = unstandardized beta coefficient; *SEB* = standard error of *B*; β = standardized beta coefficient; R^2 = multiple R^2 ; Adj R^2 = adjusted R^2 , a value that represents an estimate of the amount of shrinkage in R^2 likely to occur upon cross-validation; Δr^2 = change in r^2 ; ΔF = change in *F*-value; *p*-level = significance level of ΔF . *n* = 55.

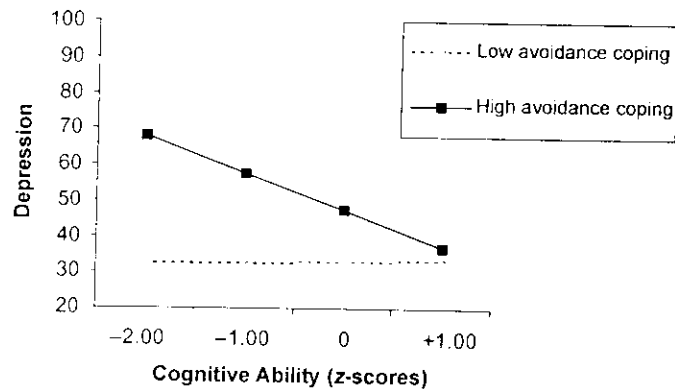


Fig. 1. Depression as a function of cognitive ability for low and high levels of avoidance coping. Values on the x-axis for cognitive ability only extend to +1.0 because no participant scored higher than +1.11 on the Cognitive Task Index used. Depression scores represent values for the combined Evaluative and Mood subscales from the Chicago Multiscale Depression Inventory.

buffer the potential depressive effects of lowered cognitive functioning. Together, these two figures illustrate that cognitive deficits are most likely to predict depression when patients use low active coping and high avoidance coping. When patients use more active strategies, cognitive functioning has a negligible impact on depression.

We conducted a final regression analysis in order to evaluate the total independent variance in

depression accounted for by the variables in our study. All three main effects (Avoidance Coping, Active Coping, and Cognitive task indices) were entered at step 1, both two-way interactions at step 2, and the three-way interaction at step 3. Although the three-way interaction was not significant, $r^2 = .001$, $F(1, 48) < 1.0$, *ns*, the combined r^2 of the main effects and two-way interactions was .67. Thus, our data explain 67%

oping Dimensions

Factor 2
-.27
-.17
.03
.51
.84
.69
1.14
18.94

Impaired	
<i>n</i>	%

12	22
10	18
7	13
20	36

of the PASAT indices refers to scaled scores et al.'s (1994) norms. Impaired column is f 80 or a scaled score

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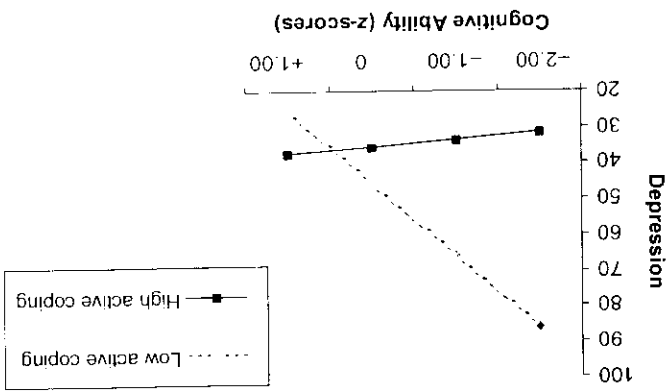


Fig. 2. Depression as a function of cognitive ability at low and high levels of active coping. Values on the x-axis for cognitive ability only extend to +1.0 because no participant scored higher than +1.11 on the Cognitive Task Index used. Depression scores represent values for the combined Evaluative and Mood subscales from the Chicago Multiscale Depression Inventory.

of the variance in depression with the combination of coping variables, cognitive index, and their interactions with one another.

DISCUSSION

The present study was conducted to examine the relationship between depression, coping, and cognitive functioning in MS patients. Consistent with hypotheses and similar to what has been found in nonneurological populations, the active coping COPE subscales had substantial positive loadings on one factor (labeled Active Coping) and the avoidance coping COPE subscales had substantial positive loadings on a second factor (labeled Avoidance Coping). We also found that one of the avoidance coping subscales, Behavioral Disengagement, had a moderately high negative loading on the Active Coping factor suggesting that patients using high levels of behavioral disengagement coping strategies are likely to use low levels of active coping strategies and vice-versa. Although not predicted a priori, such a finding seems sensible in that the use of active coping strategies would seem to be incompatible with the use of those involving behavioral disengagement.

Also consistent with hypotheses, depression was found to be associated with the use of high levels of avoidance coping. Although the relationship between active coping and depression was in the predicted negative direction, whereby high levels of active coping were associated with low levels of depression, the effect was relatively weak ($p > .10$). These findings mirror the literature on emotion-focused and problem-focused coping in MS where emotion-focused coping (of which avoidance coping is a subset) has been shown to be more robustly and consistently associated with depression than problem-focused coping (of which active coping is a subset).

The most provocative findings from the study concerned the moderation results. Consistent with predictions, avoidance coping and active coping both moderated the relationship between cognitive functioning and depression. Patients with cognitive difficulties were much more likely to display depression when they also reported using either high levels of avoidance coping or low levels of active coping. Conversely, patients with cognitive difficulties did not show depression when they reported using either low levels of avoidance coping or high levels of active coping.

Although the cross-sectional nature of our data preclude making causal statements, one way of conceptualizing the data is that cognitive difficulties may lead to depression only when patients also use high levels of avoidance and/or low levels of active coping strategies. In contrast, the use of low levels of avoidance and/or high levels of active coping strategies may make patients resistant to depression.

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depression. Thus, the use of particular coping strategies may serve either as risk factors or protective factors for experiencing depression. Theoretically, such a model provides an explanation for why some MS patients may experience depression in response to cognitive difficulties and others may not, and may further explain why inconsistencies for this relationship have been reported in the literature (e.g., Arnett et al., 2001; cf. Krupp et al., 1994). From an applied point of view, the results suggest that interventions for depression in MS might involve helping patients develop more active coping strategies while at the same time helping them to reduce their reliance on the use of those involving avoidance.

One applied limitation of this theoretical model is that, given the cognitive demands associated with many types of active coping, the cognitive impairments some MS patients experience may be significant enough such that they interfere with patients' ability to employ such strategies. However, it is important to highlight that examination of our interaction effects clearly showed that patients with impaired Cognitive Task Index scores (up to 2 *SD* below the mean of the sample) still used active coping strategies (see Fig. 2) and reported minimal depression. This finding suggests that even significant cognitive difficulties do not preclude the use of active coping strategies.

An alternative formulation of the data is that depression may lead to cognitive dysfunction in MS when patients use high levels of avoidance coping and/or low levels of active coping. Such a formulation is less appealing, however, because it is less clear how the use of certain types of coping strategies would exacerbate cognitive difficulties depressed MS patients experience. Nevertheless, a better way to tease out the causal relationships among these variables would be to conduct a longitudinal study. A treatment study could also help clarify causal issues.

The pattern of greater use of avoidance and less use of active coping being associated with greater depression in MS patients may either be a manifestation or a cause of poor adjustment in MS patients. One causal possibility is that excessive reliance on avoidance and less reliance on active coping strategies is symptomatic of depression.

Once individuals with MS become depressed, they may become behaviorally and mentally disengaged and rely on denial of stressful situations to cope. This may occur because the apathy, fatigue, and low motivation characterizing depression makes it difficult for depressed patients to do much else and also makes it difficult for them to use coping strategies involving active coping effectively. An alternative causal possibility is that these coping patterns represent a risk factor for depression in MS; greater use of avoidance strategies and less use of active strategies may be ineffective ways of coping with stress for MS patients and lead to depression.

A final conceptual consideration concerns the possibility that the associations observed are the result of a third variable, in particular, the extent and location of lesion damage in the brain. Disruption in frontal and subcortical systems commonly affected in MS has been shown to be associated with depression in non-MS depressed samples (e.g., Davidson, 1992; Kennedy et al., 2001). Additionally, disruption in frontal systems has been shown to be associated with working memory (Smith & Jonides, 1997), and performance on planning tasks like the Tower of London has been shown to be associated with increased left-frontal activation. Furthermore, performance on speeded tasks has been shown to be compromised in patients with subcortical dysfunction (e.g., Moser et al., 2001; Turner, Moran, & Kopelman, 2002). Finally, damage to frontal/subcortical structures has been shown to be associated with apathy (e.g., Lezak, 1995, p. 94), something that may get manifested in maladaptive coping strategies such as avoidance. Taking these considerations in mind, it is possible that the associations we observed are due to the fact that the brain areas affected by the participants' MS resulted in depression, cognitive impairment, and maladaptive coping. Only a future study utilizing MRI can address this causal possibility.

There are limitations to our study that should be highlighted. A criticism often leveled at the use of coping measures like ours that ask participants how they cope with stress in general is that these measures can be difficult to interpret. In particular, because individuals may apply different

Clearly a follow-up study is warranted that would allow for an examination of the specificity of our findings to depression in particular rather than emotional distress in general.

In summary, our study shows that avoidance and active coping appear to be relatively unitary clusters of coping in MS patients when derived from subscales on the COPE. Additionally, we found that avoidance coping was highly and positively associated with depression in our MS sample. There was a marginal, negative association between active coping and depression in this sample, an effect that was weaker than we anticipated. Most significantly, we found clear evidence for the moderating effect of coping on the relationship between cognitive dysfunction and depression. Cognitive dysfunction was most likely to be associated with depression when patients used either high levels of avoidance or low levels of active coping. Conceptually, it may be that cognitive dysfunction in MS is a common stressor that leads to depression only when patients rely on avoidance coping and use relatively less active coping strategies. If this conceptualization is accurate, interventions that help patients increase their use of active coping strategies and decrease their use of avoidance strategies may be an effective way of mitigating the effects of patients' cognitive difficulties on their emotional functioning.

This study presents a new model of coping in MS that attempts to integrate cognitive difficulties, depression, and coping strategies at both a theoretical and empirical level. Future research using longitudinal and treatment outcome designs will be needed to explore the validity of such a conceptualization and will help to frame the clinical significance and utility of these data. Beyond deepening our understanding into the nature of depression in MS, clarifying the factors that help or hinder individuals with MS cope with the sequelae of the disease will surely have applied implications. Additionally, given the possible association between stress and exacerbations of the disease, teaching MS patients better coping skills may provide them with a noninvasive way of mitigating the impact of this devastating neurological disease as well as improve their quality of life.

coping strategies to different stressful situations, the type of stressful situations they are considering when responding to such measures is unclear (Lazarus, 1993). This is a valid criticism of our approach, but we chose it because we wanted to evaluate more trait-level approaches to coping. Additionally, as Beatty et al. (1998) have noted, having MS patients rate themselves in response to specific stressors is problematic because different patients typically identify and respond to widely varying types of stressors that may have little in common in terms of how one might cope with them. One way of circumventing some of these limitations might be to have participants in a future study describe coping strategies to clearly-defined disease-related stressors, as suggested by Beatty et al. (1998). This could be supplemented by also having participants describe coping strategies to general stressors. Jean et al. (1997) found that, compared with non-MS controls, MS patients endorsed more emotion-focused strategies in response to disease-related stressors but not in response to general stressors. Employing such a design in a future study would make it possible to explore the hypothesis that, in our study, depression was associated with more avoidance coping strategies because patients with greater levels of depression focus their attention more on disease-related stressors compared with patients experiencing lower levels of depression.

A final limitation to the present study concerns our measurement of depression. Rather than comparing clinically diagnosed depressed MS patients with nondepressed patients, we used a continuous measure of depression. Although such an approach has advantages in that it allows for consideration of the proposed relationships across the whole range of depression scores, it is likely to provide a less specific measure of depression than categorical approaches. In particular, self-report measures of depression, in addition to measuring depression, measure generalized emotional distress (e.g., Coyne & Schwenk, 1997) and thus are often nonspecific to depression. With these considerations in mind, it may be more accurate to suggest that our study explains depression, as well as generalized emotional distress, in MS.

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ACKNOWLEDGMENTS

The data published in this article were taken from the same sample of multiple sclerosis participants discussed in P.A. Arnett, C.I. Higginson, W.D. Voss, B. Wright, W.I. Bender, J.M. Wurst, and J.M. Tippin. 1999. Depressed Mood in Multiple Sclerosis: Relationship to Capacity-Demanding Memory and Attentional Functioning. *Neuropsychology*, 13, 434-446. Presented in part at the 26th annual meeting of the International Neuropsychological Society, Honolulu, HI, February, 1998.

Special thanks to the many neurologists in the Inland Northwest, particularly Drs. William Bender, Jon Tippin, and John Wurst, who contributed their time to verifying MS diagnoses and ratings of course for the MS participants in the project. We would also like to thank Doreen Evans, Diane Wicks, and Lorri Bays for their help with the project in the Spokane area. Additionally, we thank William Porter, Bruce Wright, Jennifer Geier, Jan Kusch, Eman Ziada, and Cindy Eason for their help with various aspects of the project. Also, special thanks to Dr. Jeffrey Parker who provided invaluable input on earlier drafts of this manuscript. Finally, we especially express our gratitude to the MS participants and their significant others who generously contributed their time to helping us better understand the nature of multiple sclerosis.

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