

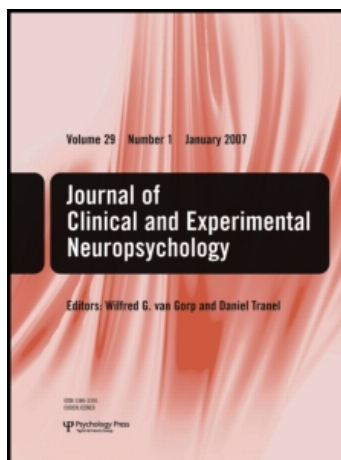
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Access details: Access Details: [subscription number 909302546]

Publisher Psychology Press

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## Journal of Clinical and Experimental Neuropsychology

Publication details, including instructions for authors and subscription information:

<http://www.informaworld.com/smpp/title-content=t713657736>

### Clinical correlates of generalized worry in multiple sclerosis

Jared M. Bruce<sup>a</sup>; Peter Arnett<sup>b</sup>

<sup>a</sup> The University of Missouri-Kansas City, Kansas City, MO, USA <sup>b</sup> The Pennsylvania State University, PA, USA

First Published on: 23 December 2008

**To cite this Article** Bruce, Jared M. and Arnett, Peter(2008)'Clinical correlates of generalized worry in multiple sclerosis',Journal of Clinical and Experimental Neuropsychology,31:6,698 — 705

**To link to this Article:** DOI: 10.1080/13803390802484789

**URL:** <http://dx.doi.org/10.1080/13803390802484789>

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# Clinical correlates of generalized worry in multiple sclerosis

Jared M. Bruce<sup>1</sup> and Peter Arnett<sup>2</sup>

<sup>1</sup>The University of Missouri–Kansas City, Kansas City, MO, USA

<sup>2</sup>The Pennsylvania State University, PA, USA

Anxiety disorders are common in multiple sclerosis (MS). Chronic worry is the defining feature of generalized anxiety. Despite this, only one study has examined the impact of chronic worry in MS. The present investigation explored the relationship between excessive worry and common physical, emotional, and neuropsychological symptoms in a community-based sample of 50 patients with relapsing–remitting and secondary progressive MS. As expected, MS patients reported significantly more worry than a group of 45 healthy controls. Correlational analyses revealed that MS patients' elevated worry was associated with fatigue, sleep disturbance, problem-solving deficits, pain, and disability status. Follow-up analyses indicated that worry and anxiety may represent related but distinct constructs. Clinicians are urged to regularly monitor and treat pathological worry in MS.

**Keywords:** Multiple sclerosis; Worry; Anxiety; Pain; Fatigue; Sleep; Cognition; Neuropsychology.

## INTRODUCTION

Most patients with multiple sclerosis (MS) experience neuropsychiatric complications during the course of their illness. The majority of research in this area has been devoted to understanding the clinical correlates of mood disorders, particularly depression (Rao, 1990). Despite a significant association with psychosocial difficulties and a possible link with disease progression (G. W. Brown et al., 2006; R. F. Brown et al., 2006; Mohr, 2007), a relative paucity of research has examined the clinical correlates of anxiety in MS. Research that has been conducted suggests that the most common anxiety-related disorder in MS is generalized anxiety disorder (GAD). Nearly 20% of MS patients experience GAD at some point during the course of their illness, more than three times the rate found in the general population (Korostil & Feinstein, 2007).

GAD is characterized by a prolonged period of muscle tension, sleep disturbance, restlessness, fatigue, and/or irritability (American Psychiatric Association, 1994). However, the hallmark of

GAD is excessive, uncontrollable worry. Though related to what is commonly called anxiety, worry is often considered a separable, unitary construct (Andrews & Borkovec, 1988; Davey & Tallis, 1994; Gana, Martin, & Canouet, 2001; Starcevic & Berle, 2006; Zebb & Beck, 1998). It can be defined as a perseverative future-oriented thinking pattern that typically consists of internal self-talk and planning for some real or imagined negative event (Borkovec, 2002). In contrast, anxiety is a multidimensional construct that may incorporate physiological (e.g., muscle tension, heart palpitations, nausea, stomach upset) and psychological (e.g., fear, obsession, apprehension, worry) components. Research suggests that chronic worrying is an inefficient and ineffective way to cope with potential life stressors. People with excessive worry are hypervigilant to threatening environmental cues and display reduced adaptive autonomic reactivity to potential stressors (Hoehn-Saric, McLeod, & Zimmerli, 1989; Mathews & MacLeod, 1994). Chronic worry is also associated with the inception and maintenance of anxiety, depression, sleep disturbance,

Address correspondence to Jared M. Bruce, 4825 Troost Building, Suite 111-G, University of Missouri–Kansas City College of Arts and Sciences, 5100 Rockhill Road, Kansas City, MO 64110, USA (E-mail: Brucejm@umkc.edu).

chronic pain, and various social difficulties (Aldrich, Eccleston, & Crombez, 2000; Borkovec, 1979; Borkovec, Ray, & Stober, 1998; Segerstrom, Alden, & Craske, 2000).

Nevertheless, chronic worriers often view their worry as useful (Borkovec & Roemer, 1995). To them, worrying is a way to effectively plan for inherently chaotic and uncertain catastrophes. Indeed, the very nature of MS may create an optimal environment for excessive worry. The clinical course of MS is frequently chaotic and uncertain. MS patients must face the future with knowledge that they have little control over whether they will have a benign or malignant course of the disease. Moreover, physical, cognitive, and sensory difficulties may contribute to feelings of uncertainty in everyday situations. Some MS patients must awaken each morning not knowing whether a restaurant will be wheelchair accessible, whether an exacerbation will prevent a vacation, or whether sudden-onset visual disturbances will make a trip to the grocery store nearly impossible. In short, MS patients may have more to legitimately worry about than people in the general population.

Despite high rates of GAD and a chaotic disease course, only one study has examined chronic worry in MS (Thornton, Tedman, Rigby, Bashforth, & Young, 2006). A group of 39 MS patients reported significantly more health-related worry than did community-based normal controls. No difference was found between MS patients and controls on a measure of generalized worry. Elevated worry was associated with high levels of depression/anxiety and a decreased sense of self-efficacy. Typical worries included concerns about the disease's potential impact on aspects of physical and social functioning. No studies to date have systematically examined common physical, emotional, and neuropsychological correlates of excessive worry in MS. The identification of factors associated with chronic worry in MS may lead to a stronger understanding of the interaction between neuropsychiatric and physical manifestations of the disease. The primary aim of the present exploratory study was to examine the clinical and demographic correlates of chronic worry among a sample of patients with relapsing–remitting and secondary progressive MS. Consistent with findings from the GAD literature, the secondary aim of the study was to confirm that worry and anxiety constitute separable psychological constructs in MS by demonstrating that excessive worry accounts for unique variance in the presentation of common clinical symptoms.

## METHOD

### Participants and procedure

#### *MS group*

A total of 50 patients with definite or probable MS were recruited from an advertisement placed in a newsletter distributed to individuals with MS in Western Pennsylvania, MS support groups in the Central Pennsylvania Region, and flyers distributed in the State College, Pennsylvania community. Patients who contacted the study team were subsequently administered a telephone screening interview to rule out exclusionary criteria (see below). Those participants not excluded were then scheduled for testing. Diagnoses and MS course types were assigned by board-certified neurologists based on established guidelines for research protocols in MS (Lublin & Reingold, 1996; Poser et al., 1983). None of the patients included in the current study were experiencing a clinical exacerbation at the time of the evaluation. Participants were not included in the study if they had a history of: (a) neurological disease other than MS, (b) drug or alcohol abuse, (c) developmental learning disability, or (d) visual or motor impairments that would significantly alter test administration procedures. After establishing informed consent, graduate students trained by a clinical neuropsychologist (P.A.), administered a variety of measures assessing physical, cognitive, and emotional functioning. In return for their participation, all participants were paid \$100 and were provided with a written neuropsychological screening evaluation and verbal feedback.

#### *Healthy control group*

To determine whether MS patients endorse significantly elevated worry, a comparison group of 45 neurologically healthy community-based controls was recruited. An attempt was made to match controls with the MS participants on demographic factors (i.e., age, education, and gender) as closely as possible. The same relevant inclusionary criteria as those employed with the MS patients were used. Control participants were recruited by posting advertisements in public places in Central Pennsylvania and also via a university newswire. Controls were also paid \$100 for their participation. All participants gave informed consent according to institutional guidelines and were treated in accordance with ethical standards of the American Psychological Association. The study was approved by the Institutional Review Board at Penn State University.

## Measures

### Emotion measures

(Higher scores reflect more psychopathology.)

*Pennsylvania State Worry Questionnaire (PSWQ; Molina & Borkovec, 1994).* The most commonly used measure to assess pathological worry, the PSWQ is a reliable and valid 15-item self-report measure that has been shown to successfully differentiate patients with GAD and normal controls (Behar, Alcaine, Zeullig, & Borkovec, 2003). Possible scores on the PSWQ range from 0 to 90. The PSWQ has been translated into numerous languages. It has been used to study normal worry, medical, and psychiatric disorders in children, adults, and geriatric populations. Sample questions include, "My worries overwhelm me" and "Once I start worrying, I can't stop."

*Chicago Multiscale Depression Inventory (CMDI; Nyenhuis et al., 1998).* Because more traditional measures may overestimate depression in neurological samples (Nyenhuus et al., 1995), the CMDI was used to assess depressive symptomatology in this study. The CMDI has been shown to be a reliable and valid measure of depression (Nyenhuus et al., 1998). The CMDI is a 42-item self-report measure that includes Mood (sad, glum), Evaluative (hated, useless), and Vegetative (sluggish, unable to concentrate) subscales. Consistent with Nyenhuus et al.'s (1995) recommendation and the precedent set by our prior work (Bruce & Arnett, 2004, 2005; Bruce, Polen, & Arnett, 2007), the vegetative subscale was not included in analyses. Possible scores on this version of the CMDI range from 28 to 140.

*State-Trait Anxiety Inventory (STAI; Spielberger, 1983).* The STAI was used as a general measure of anxiety in this study. It is a 40-item self-report measure composed of state and trait subscales. The STAI has shown good reliability and validity in numerous patient populations (Novy, Nelson, Goodwin, & Rowzee, 1993). Because we were interested in stable aspects of worry and anxiety, the trait subscale was the primary measure of anxiety used in this study. Possible scores on the state and trait subscales range from 20 to 80.

### Medical measures

(Higher scores reflect worse physical functioning.)

*Expanded Disability Status Scale (EDSS; Kurtzke, 1983).* The EDSS is a measure of MS disease progression and neurological impairment. It is

commonly used in both clinical practice and MS research. Participants were asked to rate their functional abilities in a number of different physical domains. Self-report EDSS scales have been found to be highly correlated with neurologists' independent ratings (Solari et al., 1993).

*Fatigue Impact Scale (FIS; Fisk, Pontefract, Ritvo, Archibald, & Murray, 1994).* The FIS is a reliable and valid 40-item self-report measure of fatigue that is commonly used in MS. It is composed of three subscales measuring physical, social, and cognitive fatigue.

*Brief Pain Inventory (BPI; Cleeland & Ryan, 1994; Daut, Cleeland, & Flannery 1983).* The BPI is an 11-item self-report instrument that assesses patients' pain intensity and pain-mediated interference with daily activities. It has good test-retest reliability and has been validated in pain treatment trials in various patient populations (Tan, Jensen, Thornby, & Shanti, 2004).

*Sleep disturbance.* As a rough estimate of sleep disturbance, MS patients were asked to report how many nights per week they had difficulty sleeping.

### Neuropsychological measures

(Higher scores reflect better cognitive functioning.)

*Shipley Institute of Living Scale (Zachary, 1986).* A measure of word knowledge, the Vocabulary subscale of the Shipley Institute of Living Scale was used to estimate current intellectual functioning. In addition, the total number of correct solutions from the Abstraction subscale was used as a separate measure of reasoning and problem solving.

*Selective Reminding Test (SRT; Strauss, Sherman, & Spreen 2006).* The Long-Term Storage (LTS) and Consistent Long-Term Retrieval (CLTR) indices from the SRT were used as measures of learning and memory. During this task, the examiner read a list of 12 words, and the patient was asked to recall as many words as possible. Words that the patient was unable to recall were repeated over five additional trials.

*Symbol Digit Modalities Test (SDMT; Smith, 1982).* The oral version of the SDMT was used as a measure of attention and information-processing speed. During this task, participants use a key to match symbols with numbers. The dependent variable was the total number of correct responses in 90 seconds.

The Visual Elevator subtest from the Test of Everyday Attention (Robertson, Ward, Ridgeway, & Nimmo-Smith, 1994). The Visual Elevator task is designed to be an ecologically valid measure of information-processing speed and mental flexibility. During the Visual Elevator test, examinees are shown a series of elevators on a stimulus sheet. Interspersed among the elevators, an occasional arrow points up or down to indicate the direction in which the elevator is traveling. Participants are asked to quickly count the elevators to indicate which floor they are on; when they come upon a "down" arrow they must reverse count, and when they come upon an "up" arrow they must count forward consecutively. There are a total of 40 switches of directions across 10 trials. The variable of interest for the present study is the average time per correct switch.

## Data analysis

Descriptive and exploratory analyses were conducted with SPSS 15; *t* tests were used to evaluate whether worry differed by group, sex, or disease course. Among patients with MS, Pearson product moment correlations and scatter plots were used to examine the relationship between worry and emotional, physical, and neuropsychological functioning. If violations for the use of parametric statistics were observed using standard criteria, subsequent nonparametric Spearman correlations were also conducted. For variables that showed a significant relationship with worry ( $p < .05$ ), follow-up partial correlations controlling for trait anxiety were run to determine whether worry accounted for unique variance above that accounted for by trait anxiety alone. Similarly, when clinical variables were significantly associated with trait anxiety, follow-up partial correlations controlling for worry were run to determine whether trait anxiety accounted for unique variance above that accounted for by worry alone. Next, stepwise regression was conducted to determine which clinical variables were associated with unique variance in worry. Entrance criteria were set at  $p = .05$ , and exit criteria were set at  $p = .1$ . Finally, partial correlations controlling for overall disability status were conducted to determine whether worry accounted for unique variance independent of disease progression.

## RESULTS

### Preliminary analyses

A total of 39 patients with relapsing–remitting and 11 patients with secondary progressive MS were included in the study. MS patients in this study

were Caucasian and predominantly female (84%). The mean age ( $\pm SD$ ) was  $46.2 \pm 9.03$  years with  $14.52 \pm 1.72$  years of education. The mean symptom duration ( $\pm SD$ ) was  $14.54 \pm 9.45$  years, and the mean EDSS was  $4.14 \pm 1.49$ . Among MS patients, self-reported worry, state anxiety, and trait anxiety were not significantly associated with age, sex, education, symptom duration, or disease course.

A total of 45 controls were included in this study. Controls were Caucasian and predominantly female (84%). The mean age ( $\pm SD$ ) was  $45.22 \pm 10.59$  years with  $15.78 \pm 2.43$  years of education. No significant gender or age differences were observed between MS patients and controls. Controls had a history of higher education,  $t(78.25) = 2.88$ ,  $p < .01$ . However, this was not thought to be problematic as self-reported worry, anxiety, and depression were not significantly associated with education.

### Between-group analyses

As expected, MS patients endorsed significantly more worry ( $40.14 \pm 15.28$ , range 5–82) than did controls ( $31.42 \pm 16.29$ , range 0–68),  $t(93) = 2.69$ ,  $p < .01$ . MS patients also reported more trait anxiety ( $37.68 \pm 9.25$ , range 22–58) and depression ( $40.94 \pm 14.08$ , range 28–83) than did controls ( $31.93 \pm 8.41$ , range 20–54, and  $34.07 \pm 8.13$ , range 28–68, respectively);  $t(93) = 3.15$ ,  $p < .01$ , and  $t(93) = 2.87$ ,  $p < .01$ , respectively. MS patients ( $32.92 \pm 8.20$ , range 20–56) and controls ( $31.38 \pm 7.62$ , range 20–53) did not report significantly different levels of state anxiety.

### MS patient clinical analyses

#### Clinical correlates of worry

A total of 36% of MS patients endorsed levels of worry in the elevated range ( $>45$ ; Behar et al., 2003). Table 1 shows descriptive statistics for emotional, physical, and neuropsychological variables of interest. As seen in Table 2, elevated worry was associated with more depression ( $r = .55$ ,  $p < .001$ ), trait anxiety ( $r = .64$ ,  $p < .001$ ), and state anxiety ( $r = .46$ ,  $p < .01$ ). A follow-up partial correlation controlling for trait anxiety revealed no significant unique relationship between worry and depression. In contrast, worry accounted for unique variance in self-reported depression when controlling for state anxiety ( $r = .46$ ,  $p < .01$ ).

Excessive worry was associated with more disability ( $r = .30$ ,  $p < .05$ ), sleep disturbance ( $r = .45$ ,

**TABLE 1**  
MS patient descriptive statistics for select clinical variables

	<i>Mean</i>	<i>SD</i>	<i>Median</i>	<i>Range</i>
Worry	40.14	15.28	41	5–82
Trait Anxiety	37.68	9.25	36	22–58
State Anxiety	32.92	8.20	31.5	20–56
Depression	40.94	14.08	36	28–83
Sleep disturbance	3.02	2.40	3	0–7
ShIPLEY Abstraction	29.36	5.47	30	16–40
WAIS–R est.	105.88	6.62	106	92–122
Pain Interference	15.96	15.78	13	0–51
Pain Intensity	8.7	7.45	8	0–26
FIS Total	60.68	28.36	54.5	12–122
FIS Social	27.08	13.99	26	3–61

*Note.* MS = multiple sclerosis. Worry = Pennsylvania State University Worry Questionnaire. Trait Anxiety = Trait subscale of the State–Trait Anxiety Inventory. State Anxiety = State subscale of the State–Trait Anxiety Inventory. Depression = the Evaluative and Mood subscales of the Chicago Multiscale Depression Inventory. Sleep disturbance = number of days on average that patients reported having difficulty sleeping each week. ShIPLEY Abstraction = the Abstraction subscale of the ShIPLEY Institute of Living Scale. WAIS–R est. = Wechsler Adult Intelligence Scale–Revised estimate, which was calculated from the Vocabulary subscale of the ShIPLEY Institute of Living Scale. Pain Interference and Pain Intensity subscales are from the Brief Pain Inventory. FIS = Fatigue Impact Scale.

$p < .01$ ), social fatigue ( $r = .40$ ,  $p < .01$ ), and pain-related interference in everyday activities ( $r = .42$ ,  $p < .01$ ). A nonsignificant trend was found suggesting that chronic worriers also endorse more intense pain ( $r = .26$ ,  $p < .10$ ). Follow-up analyses controlling for trait and then state anxiety revealed

significant, unique relationships between worry and sleep disturbance ( $r = .43$ ,  $p < .01$ , and  $r = .42$ ,  $p < .01$ , respectively), social fatigue ( $r = .30$ ,  $p < .05$ , and  $r = .32$ ,  $p < .05$ , respectively), and worry and pain-related interference in everyday activities ( $r = .44$ ,  $p < .01$ , and  $r = .42$ ,  $p < .01$ , respectively). Partial correlation controlling for trait anxiety revealed a nonsignificant trend between worry and disability ( $r = .23$ ,  $p = .1$ ). In contrast, partial correlation controlling for state anxiety revealed a unique relationship between worry and disability ( $r = .36$ ,  $p < .05$ ).

Elevated worry was associated with poorer performance on the Abstraction subscale of the ShIPLEY Institute of Living Scale, a measure of reasoning and problem solving ( $r = -.44$ ,  $p < .01$ ). When controlling for variance associated with trait and then state anxiety, worry remained significantly associated with performance on the scale ( $r = -.58$ ,  $p < .001$ , and  $r = -.49$ ,  $p < .001$ , respectively). Worry was not significantly associated with other measures of neuropsychological functioning.

Stepwise regression was conducted to determine which variables accounted for unique variance in self-reported worry after accounting for variance associated with anxiety. Trait and state anxiety were entered in the first block, and clinical variables with significant partial correlations were entered stepwise in the second block. After removing variance associated with anxiety, the Abstraction subscale ( $\Delta R^2 = .20$ ,  $F = 24.35$ ,  $p < .001$ ), sleep disturbance ( $\Delta R^2 = .06$ ,  $F = 8.98$ ,  $p < .01$ ), and pain-related interference in daily activities ( $\Delta R^2 = .03$ ,  $F = 4.13$ ,  $p < .05$ ), respectively, were associated

**TABLE 2**  
Clinical association between worry and select clinical variables

	<i>Worry</i>	<i>Trait Anxiety</i>	<i>State Anxiety</i>	<i>Depression</i>	<i>EDSS</i>	<i>Sleep</i>	<i>ShIPLEY Abstraction</i>	<i>Pain Interference</i>	<i>Pain Intensity</i>	<i>FIS Total</i>	<i>FIS Social</i>
Worry	1	.64**	.46**	.55**	.30*	.45**	-.44**	.42**	.26	.30*	.40**
Trait Anxiety		1	.54**	.73**	.19	.21	.01	.14	.01	.22	.28*
State Anxiety			1	.37**	-.05	.20	.01	.12	.06	.25	.26
Depression				1	.14	.19	-.19	.18	.11	.23	.28*
EDSS					1	.17	-.31*	.34*	.35*	.52**	.53**
Sleep						1	-.15	.21	.35*	.33*	.30*
ShIPLEY Abstraction							1	-.32*	-.22	-.29*	-.35*
Pain Interference								1	.84**	.45**	.45**
Pain Intensity									1	-.43**	.40**
FIS Total										1	.97**
FIS Social											1

*Note.* Worry = Pennsylvania State University Worry Questionnaire. Trait Anxiety = Trait subscale of the State–Trait Anxiety Inventory. State Anxiety = State subscale of the State–Trait Anxiety Inventory. Depression = the Evaluative and Mood subscales of the Chicago Multiscale Depression Inventory. EDSS = Expanded Disability Status Scale. Pain Interference and Pain Intensity subscales are from the Brief Pain Inventory. Sleep = number of days on average that patients reported having difficulty sleeping each week. FIS = Fatigue Impact Scale. ShIPLEY Abstraction = the Abstraction subscale of the ShIPLEY Institute of Living Scale.

\* $p < .05$ . \*\* $p < .01$ .

with unique variance in worry. Taken together, anxiety and clinical variables included in the model accounted for 72% of the variance in self-reported worry.

Finally, in order to determine whether overall disability level contributed to the obtained findings between worry and other clinical variables, partial correlations controlling for EDSS were conducted. When removing variance associated with EDSS, worry continued to predict unique variance in sleep disturbance ( $r = .43, p < .01$ ), problem solving ( $r = -.38, p < .01$ ), pain-related interference in activities ( $r = .36, p < .05$ ), and social fatigue ( $r = .30, p < .05$ ).

### **Clinical correlates of anxiety**

People who reported more trait anxiety on the STAI also reported more depressive symptoms ( $r = .73, p < .001$ ). Trait anxiety continued to be significantly associated with depression when controlling for worry ( $r = .59, p < .001$ ). No significant relationships were found between trait anxiety and disability level, overall fatigue, sleep disturbance, pain, and neuropsychological functioning. State anxiety was also correlated with self-reported depression ( $r = .37, p < .01$ ). State anxiety did not correlate with depression when controlling for self-reported worry. No significant relationships were found between state anxiety and disability level, fatigue, sleep disturbance, pain, and neuropsychological functioning.

## **DISCUSSION**

Consistent with research suggesting a high prevalence of GAD in MS, MS patients endorsed significantly more worry than did controls. Moreover, 36% of the MS patients in this study endorsed clinically elevated, chronic worry. A previous study found similar levels of worry in MS, but no significant difference between 39 MS patients and 38 matched controls on the PSWQ (Thornton et al., 2006). Of note, a portion of the normal controls in the previous study appeared to endorse levels of worry and anxiety above those typically found in the general population. Though additional studies with larger samples of MS patients and normal controls will be needed to definitively characterize the nature of worry in MS, present results indicate that MS patients tend to worry more than people in the general population.

Consistent with findings from the anxiety disorders literature (Andrews & Borkovec, 1988; Davey & Tallis, 1994; Gana et al., 2001; Starcevic & Berle, 2006; Zebb & Beck, 1998), results supported

previous findings suggesting that worry is an independent psychological construct. Though excessive worry was associated with increased anxiety, it was also associated with unique variance in a host of clinical variables, including pain, social fatigue, sleep disturbance, and problem-solving skills. In contrast, state and trait anxiety showed little relationship with the clinical variables employed in this study. These findings show that worry may represent a related but distinct emotional/cognitive construct in MS. Worry also predicted unique variance in MS symptoms when controlling for overall disability status. As such, clinicians should be aware of the potential role that chronic worry may play in MS symptom presentation.

Worry showed a clinically significant correlation with sleep disturbance and social fatigue, two debilitating symptoms that are common to both MS and GAD. Though the correlational nature of these findings limits possible causal attributions, most research suggests that excessive worry interrupts sleep and, therefore, contributes to fatigue (Harvey, 2002). Therefore, it seems plausible that cognitive/behavioral and pharmacologic therapies designed to reduce worry could improve sleep and social fatigue in MS.

Elevated worry was also significantly associated with more pain-related interference in daily activities and marginally associated with more self-reported pain intensity. According to gate theory (Melzack, 1993), higher order brain systems impact pain perception and management. Worry represents one means by which cognitive and emotional functions can influence the experience of pain. Patients with pain may worry as a means of anticipating and solving pain-related problems. However, for patients with intractable, chronic pain, excessive worry may represent an inefficient and ineffective method of coping. Indeed, it has been suggested that chronic worry increases vigilance to pain cues and may eventually lead to isolation and generalized feelings of inadequacy (Aldrich et al., 2000).

This is the first study to find a direct relationship between elevated worry and increased self-reported pain in MS. Future studies should employ longitudinal designs to more fully examine the causal nature of this relationship. It may be that excessive worry causes heightened vigilance for threatening cues; an increase in threatening pain cues, in turn, may prevent people with pain from engaging in everyday activities. Pain and worry-based treatment studies may prove beneficial in dissecting the causal nature of the pain/worry relationship. To test this possibility, future studies may wish to examine whether treatment of chronic worry

reduces pain-related interference in everyday activities. The impact of pain reduction on chronic worry should also be explored.

A similar relationship was observed between worry and disability status. People with high levels of worry tended to report more physical disability. It may be that people with more disability have more legitimate worries. It is likely that significantly disabled MS patients are confronted with a host of everyday difficulties that require constant vigilance and legitimate planning. However, it is also plausible that chronic worriers fear possible negative outcomes related to their disability status. Consequently, they may engage in fewer physically demanding activities. For instance, imagine two people with comparable levels of physical disability, one who is a chronic worrier and one who is not. The chronic worrier may fear negative outcomes and avoid situations that require strenuous activity. Moreover, the chronic worrier may rely more heavily on a cane, walker, or wheelchair due to the fear of falls. This could lead to subsequent deconditioning and more disability.

As an extension and generalization of these findings, it is feasible that MS patients engage in chronic worry when they have significant difficulty adapting to and planning for novel situations. In support of this notion, higher levels of worry were associated with worse performance on a test of problem-solving skills. MS patients with poor problem-solving skills may experience frequent negative outcomes that lead to expectations of failure and chronic worry. This fear of failure may impede MS patients' ability to engage in formerly enjoyable activities. The resulting isolation may lead to more worry and an increased fear of failure. Alternatively, as seen in GAD, MS patients with problem-solving difficulties may perceive their chronic worry as compensatory and functional. Of note, worry showed no significant relationship with other neuropsychological variables employed in this study. In particular, worry does not appear to be strongly related to estimated global IQ, attention, memory, or speed of information-processing deficits. The strong relationship between worry and problem-solving abilities should be explored further with additional tests of executive functioning that emphasize planning abilities and set shifting.

The purpose of this study was to provide an introductory and exploratory examination of clinical correlates of generalized worry in MS. Consequently, this study has several limitations that leave room for future research. Future studies should recruit a larger sample of MS patients and employ a formal diagnostic interview for anxiety disorders. Given the correlational nature of the

present study, future research should employ statistical, treatment-based, and longitudinal designs to more fully appreciate potential causal relationships between chronic worry and the presentation of MS symptoms. Furthermore, the identification of a third, unrelated variable contributing to the obtained findings should be explored. For instance, lesion load or lesion location may contribute to both chronic worry and pain intensity or poor problem-solving skills. Strengths of the present study include the use of well-validated measures of worry, anxiety, depression, fatigue, pain, disability, and neuropsychological functioning.

In conclusion, results of this study suggest high levels of worry among MS patients. Excessive worry was associated with sleep disturbance, pain, disability status, fatigue, and poor problem-solving abilities. Consistent with research in other patient populations, worry and anxiety were shown to be unique, but related, psychological constructs. Moreover, worry accounted for variance in clinical symptom presentation independent of overall disability level. The continued study of chronic worry may provide additional insight into the complex interplay between emotional, physical, and cognitive factors influencing symptom presentation in MS. Though additional research is needed, successful pharmacologic or psychotherapeutic treatment of chronic worry has the potential to ameliorate a variety of common MS symptoms.

Original manuscript received 17 April 2008

Revised manuscript accepted 12 September 2008

First published online 23 December 2008

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