

Mindfulness-Based Stress Reduction and Sense of Coherence Among Women With Fibromyalgia

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Sense of Coherence (SOC) is conceptualized as a disposition to experience life as meaningful and manageable. Research suggests a protective effect of SOC on psychological health in stressful circumstances. This study assessed the capacity of SOC to buffer the effect of illness symptoms on psychological distress among patients with fibromyalgia. Self-reported changes in SOC after participation in a Mindfulness-Based Stress Reduction (MBSR) program were also examined. Ninety-one women with fibromyalgia provided baseline data pertaining to illness symptoms, perceived stress, and depression prior to participation in a randomized trial of MBSR. SOC and fibromyalgia symptoms were independently related to perceived stress and depression at baseline. SOC was not a statistically significant moderator of symptom effects on psychological distress. In comparison with wait-listed controls, program participants reported a significant increase in SOC after MBSR participation. These results provide the first demonstration from a randomized trial that SOC may be enhanced via intervention.

KEY WORDS: fibromyalgia; chronic pain; meditation; Sense of Coherence; depression.

INTRODUCTION

Fibromyalgia syndrome is a chronic rheumatic pain disorder diagnosed on the basis of soft-tissue pain, widespread tenderness, and nonrestorative sleep (Wallace, 1997). Fibromyalgia is currently among the top four most common reasons for rheumatology referral in the United States (Wallace, 1997). Approximately 2% of the U.S. population is reported to suffer from fibromyalgia, and 73–88% of patients are female (Boissevain & McCain, 1991). Associated symptoms include fatigue, disturbed sleep,

morning stiffness, numbness or tingling, and cognitive impairment. The disabling nature of the illness is apparent in statistics showing that only 60% of patients with fibromyalgia work full-time, 55% report impaired job performance (Wolfe et al., 1995), and up to 25% receive federal disability payments (Bennett, 1996). The diagnosis of fibromyalgia is based on the patient's positive response to pressure tests for tenderness at 11 of 18 soft tissue sites. Although definitive longitudinal studies are not yet available, it appears that fibromyalgia symptoms may persist for years after onset, with periodic unpredictable remissions and exacerbations (Masi & Yunus, 1986). There is currently no cure. Recommended therapies include mild exercise, physical therapy, and medication, chiefly anti-inflammatory and antidepressants (Rosy et al., 1999).

Fibromyalgia has been characterized as a "stress-related" disorder because symptom onset and symptom flare-ups tend to occur concomitant with episodes of psychological or physical stress (Crofford & Demitrack, 1996; Lazarus & Folkman, 1984; Urrows, Affleck, Tennen, & Higgins, 1994; Wolfe, 1997).

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Because of its disabling nature (Bennett, 1996) and poor response to medical treatment, the diagnosis itself may be a source of stress (Crofford & Demitrack, 1996). In addition, because fibromyalgia syndrome has only recently been identified and the diagnosis has not met with widespread acceptance, patients often face potentially demeaning skepticism about the validity of their condition.

Populations that experience chronic stress or pain are often reported to have elevated levels of depression and mood disturbance (Blackburn-Munro & Blackburn-Munro, 2001; Fishbain, Cutler, Rosomoff, & Rosomoff, 1997), and patients with fibromyalgia are no exception (Wallace, 1997). Depression and dysthymia are common among patients with fibromyalgia (Epstein et al., 1999), with current major depression reported in 18% and lifetime prevalence rates ranging from 58 to 69% (Epstein et al., 1999; Wallace, 1997). Symptoms of depression are associated with greater physical impairment (Epstein et al., 1999) and increased pain intensity (Doan & Wadden, 1989; Parmelee, Katz, & Lawton, 1991).

Having a tendency to perceive the world as manageable and understandable, and to view life as “making sense,” has been defined as having a “Sense of Coherence” (SOC, Antonovsky, 1987b, 1993). This way of viewing the world has been shown to ameliorate the psychological impact of difficult life circumstances, including illness. Stemming from his initial research on survivors of concentration camp interment, Antonovsky became interested in factors that help individuals stay as healthy as possible despite severe stress. Using the Latin and Greek for “well-being” and “origin,” he coined the term *salutogenesis* in contrast to *pathogenesis*, which is prevalent in current models of illness (Antonovsky, 1987a). Salutogenic factors among concentration camp survivors included having a view of life marked by a sense of meaning, and having personal integrity in the face of catastrophic stress. Consistent with other established theoretical perspectives on stress and coping (e.g., Lazarus & Folkman, 1984), Antonovsky asserts that positive cognitive appraisal and flexible coping are important moderators in determining the impact of stress on the individual (Antonovsky, 1987b). Viewed through the filter of a strong SOC, stressors may be perceived as more manageable and nonthreatening. Having a greater SOC may also engender a flexible *response* to stress that makes good use of coping resources (Antonovsky, 1987b).

The SOC model has generated more than 200 studies, supporting several of Antonovsky’s premises

(Bengel, Strittmatter, & Willmann, 1999). Results suggest that SOC ameliorates the perception of stress (Bishop, 1993; Flannery, Perry, Penk, & Flannery, 1994) and facilitates adaptive coping in difficult life situations (Bengel et al., 1999). For example, among participants with high SOC, subjective responses to an induced stressor were dampened and assessments of coping abilities were elevated in one laboratory study (McSherry & Holm, 1994). Conversely, low SOC has been linked with depression among students (Bowman, 1996) and among individuals who witnessed a natural disaster (Kaiser, Sattler, Bellack, & Dersin, 1996).

Possibly because it provides a structure of meaning that can reduce the experience of stress and illness, SOC may play an important role in promoting health (Antonovsky, 1993). A study conducted in Singapore found a positive association between stress and illness only among participants who were low in SOC as opposed to those with high SOC (Bishop, 1993). The authors concluded that SOC may buffer the effects of life stress on physical illness (Bishop, 1993). In contrast, another study conducted in Canadian college students did not find evidence that SOC moderates the effects of stress on physical symptoms (Korotkov, 1993).

Several studies of diverse patient populations have found positive associations of SOC with mental and physical health (Bowman, 1996; Sammallahti, Holi, Komulainen, & Aalberg, 1996). Among caregivers of patients with Alzheimer’s disease (Bias, 1998) as well as among patients with rheumatoid arthritis (Callahan & Pincus, 1995; Hawley, Wolfe, & Cathey, 1992), SOC serves a protective function against depression and perceived stress associated with facing a chronic illness. Greater SOC has been associated with better adaptation to disability (Rena, Moshe, & Abraham, 1996) and stronger subjective assessments of health among Canadian adults (Hood, Beaudet, & Catlin, 1996). SOC has also been linked with better psychological adjustment in patients with fibromyalgia (Soderberg, Lundman, & Norberg, 1997) and patients with cancer (Forsberg & Bjorvell, 1996). In psychotherapy patients, SOC was negatively correlated with self-report measures of perceived stress, trait anxiety, and current depression (Frenz, Carey, & Jorgensen, 1993). As a whole these findings suggest that individuals with a high SOC perceive less stress and experience less psychological disturbance in the context of challenging life events. This may be due in part to their perception of stressors as a challenge rather than as a strain, and their more rapid

recovery after a challenge (Bengel et al., 1999). Importantly, SOC may help patients adapt to the stressful circumstances associated with chronic illness.

Although SOC has been characterized as a relatively stable personality trait (Schnyder, Buechi, Sensky, & Klaghofer, 2000), some evidence supports the notion that SOC may vary with life circumstances. Among patients with cancer, lower SOC was noted in those with more serious disease (Post-White, 1998) and arthritis sufferers have been shown to have a lower SOC than the general population (Germano, Misajon, & Cummins, 2001). Given the associations of SOC with health (Rena et al., 1996), perceived stress and depression (Frenz et al., 1993), it is reasonable to propose that interventions targeted at improving psychological adjustment could enhance SOC. Data supporting this are provided by two nonrandomized nursing intervention studies that have demonstrated increases in SOC after intervention among individuals with cancer who received a home visit from nurses (Delbar & Benor, 2001) and among Chinese immigrants who attended an 8-week course aimed at increasing communication skills and cross-cultural development (Ying, 1999). These data provide a foundation for more rigorous psychologically based intervention studies designed to enhance SOC as a means of improving quality of life and alleviating some of the suffering associated with chronic illness. This approach appears to be warranted in patients with fibromyalgia because they have been shown to respond positively to psychological interventions in both specific studies (Bradley, 1996; Keefe, Dunsmore, & Burnett, 1992; Nicassio et al., 1997) and in a recent meta-analysis of treatments for fibromyalgia (Rossey et al., 1999).

Rossey et al. (1999) have recommended that psychosocial interventions for fibromyalgia should teach stress management skills, and help patients manage psychological symptoms such as depression. Some successful approaches have included combinations of psychotherapy or symptom management skills training paired with relaxation and/or exercise training (Buckelew et al., 1998; Creamer, Singh, Hochberg, & Berman, 2000; Hakinnen, Hakinen, Hannonen, & Alen, 2001; Keel, Bodoky, Gerhard, & Muller, 1998), electroacupuncture (Deluze, Bosia, Zirbs, Chantraine, & Vischer, 1992; Worrel, Krahn, Kletten, & Pond, 2001), and mindfulness meditation (Kaplan, Goldenberg, & Galvin-Nadeau, 1993).

The Mindfulness-Based Stress Reduction (MBSR) program developed by Kabat-Zinn and colleagues (Kabat-Zinn, 1982, 1990; Kabat-Zinn,

Lipworth, & Burney, 1985) may be of particular relevance with regard to fostering SOC. Mindfulness has been described by Kabat-Zinn as a "way of being" that emphasizes living in an open, highly involved manner, and facilitates responding (rather than simply reacting) to the challenges of life (Kabat-Zinn, 1990). SOC has been described as viewing the world as manageable and understandable, and mindfulness may promote a sense of manageability of the world by fostering more adaptive responses to stress. Mindfulness practice could also enhance SOC because moment-to-moment awareness may facilitate openness and making sense of experiences. Mindfulness may promote a sense of life meaning by simply allowing space for the exploration of meaning. Defined in such terms, mindfulness may bear a striking similarity to SOC, and systematic mindfulness practice might be expected to enhance SOC.

This study investigated the impact of SOC on psychological adjustment to illness as characterized by perceived stress and depression in a group of 91 women diagnosed with fibromyalgia. We hypothesized that SOC would be associated with adjustment in two ways: First, that higher SOC would be associated with better adjustment, and second, that SOC would buffer the effects of fibromyalgia symptoms (e.g., pain, impairment, fatigue, and stiffness) on psychological distress. Last, we explored the capacity of an 8-week Mindfulness Meditation program to enhance SOC in a randomized controlled trial.

METHOD

Participants

Ninety-one women with fibromyalgia were recruited for a randomized prospective study of the effects of an MBSR program on illness symptoms. Participants were recruited primarily from two appearances by the investigators on a local television morning news broadcast and two newspaper advertisements. A total of 324 women showed initial interest in the study, 173 (53%) scheduled an initial intake interview, and 91 (28.1%) attended the intake interview and provided complete baseline data. Demographic characteristics of the sample are presented in Table I.

Women were eligible for the study if they met American College of Rheumatology diagnostic criteria for fibromyalgia (Wolfe et al., 1990) as verified by

their physician, were 18 years or older, were English-speaking with sufficient proficiency to participate in a group setting, provided informed consent, and were currently able to attend and provide their own transportation to a weekly group meeting. Potential participants were excluded if they were acutely at risk of physical harm to self or to others or if they were determined to be psychotic on the basis of a Structured Clinical Interview for *DSM-III-R* diagnosis (Spitzer, Williams, Gibbon, & First, 1992). Physician referral forms verifying a diagnosis of fibromyalgia were provided by 66% of program participants. This study was approved by the Human Studies Committee of the University of Louisville.

Materials

Assessment measures included basic demographic information and the following self-report instruments measuring SOC, fibromyalgia symptoms, perceived stress, and symptoms of depression:

The Orientation to Life Questionnaire (OLQ)

The OLQ is a well-established measure of SOC consisting of 29 items that are answered using 7-point Likert scales (Antonovsky, 1983). Three subscales assess comprehensibility, manageability, and meaningfulness. The OLQ was developed by analyzing statements regarding general attitudes toward life that were expressed by 51 individuals who coped well despite severe trauma. The three subscales were not clearly confirmed by factor analysis, and it has been suggested that SOC can be better captured by assuming one general factor (Antonovsky, 1993; Frenz et al., 1993). The OLQ has acceptable psychometric properties including internal consistency (Cronbach's $\alpha = .82$ and higher), test-retest reliability at time intervals from 7 to 30 days, and internal product-moment coefficients of $r = .92$ and higher (Antonovsky, 1993; Rimann & Udris, 1998).

The Fibromyalgia Impact Questionnaire (FIQ)

The FIQ is a 10-item self-report instrument that assesses physical, psychological, social, and global well-being dimensions (Burckhardt, Clark, & Bennett, 1991). Physical function is assessed with 10 items that measure the ability to perform different

large muscle tasks. Responses are given on 4-point Likert scales ranging from 0 (*always able to do*) to 3 (*never able to do*). The mean response on these 10 items was used to indicate *physical function*. The last seven items are visual analog scales that may be characterized as measures of symptom severity examining workplace impairment, pain, fatigue, morning tiredness, stiffness, anxiety, and depression. The two items assessing anxiety and depression were omitted, and the mean response on the remaining five items was used as a measure of *symptom severity* in the analyses. This was done to avoid potentially confounding predictor and criterion variables causing inflated estimates of the relationship between psychological distress and fibromyalgia symptoms. The instrument demonstrates sufficient validity and reliability (Burckhardt et al., 1991). Test-retest reliability correlations ranged from .56 for pain to .95 for physical functioning (Burckhardt et al., 1991).

The Perceived Stress Scale (PSS)

The PSS is a 10-item self-report measure that assesses the amount of perceived psychological stress over the last month (e.g., "How often have you felt that you were unable to control the important things in your life?"; Cohen, Kamarck, & Mermelstein, 1983). Answers are given on a 5-point scale ranging from *never* to *very often*. The scale has an internal consistency of .75 and demonstrated construct validity (Cohen et al., 1983).

The Beck Depression Inventory (BDI)

The BDI is a 21-item questionnaire that is routinely used to assess affective, cognitive, motivational, behavioral, and biological symptoms of depression and has acceptable psychometric properties (Beck, Steer, & Garbin, 1988).

Procedure

After completion of informed consent procedures and collection of baseline self-report data, patients were randomly assigned either to an immediate treatment group ($n = 51$), who participated in an 8-week MBSR program, or to a delayed treatment control group ($n = 40$), who placed on a "wait-list" to receive the MBSR program 4 months later. Patient

reports of SOC were again collected from both the treatment and control groups at the end of the 8-week program period. To maintain a manageable group size, two separate treatment groups of 25–26 patients each were conducted. Of the 91 patients who entered the study, 85 provided baseline data on SOC (38 in the control group and 47 in the treatment group). Thirty-seven patients in the immediate treatment group and 25 patients in the wait-list control group provided SOC data at follow-up (21 and 34% attrition, respectively). The overall completion rate of 75% is similar to a previous study employing MBSR with patients with fibromyalgia, which reported 77% completion (Kaplan et al., 1993).

Intervention

The MBSR program is an 8-week outpatient intervention intended to provide participants with a systematic introduction to the practice of mindfulness meditation. Program participants met weekly for 2.5 hr per session and were expected to develop a daily meditation practice (6 days per week out of 7) between sessions based on the techniques taught in the program. Three techniques comprise the foundation of the program, all of which involve the systematic allocation of attention in the context of a relaxed, yet alert state of mind. First, in the body scan technique, attention is directed throughout the body (from toes to head) while participants are lying down in a relaxed state with instruction to take note of sensations that may be present. Second, a series of simple yoga positions is taught as a means of encouraging relaxed and focused movement. Third, sitting meditation teaches participants to direct attention systematically, beginning with movement of the breath and proceeding to awareness of other immediate sensory and cognitive experiences. These techniques are augmented with other cognitive exercises and home practice assignments in which program participants learn to be more responsive and less reactive in the face of challenging stressful situations (Bishop, 2002; Kabat-Zinn, 1990).

RESULTS

Sample Demographics

Study participants ranged in age from 23 to 74 years with an average of 48.03 years ($SD = 10.09$). Additional sociodemographic characteristics of the sample, including educational background, annual

Table 1. Sample Sociodemographic Information ($N = 91$)

Variable	<i>N</i>	%
Years of education		
Less than high school (<12 years)	1	1.1
High school (12 years)	30	32.0
AA/technical school (14 years)	26	28.5
College degree (16 years)	18	19.8
Master's degree (18 years)	14	15.4
Doctoral training (20 years)	1	1.1
No response	1	1.1
Income		
Less than \$20,000	13	14.3
\$20,000–39,999	26	28.6
\$40,000–59,999	15	16.5
\$60,000–79,999	19	20.9
\$80,000–99,999	4	4.4
\$100,000 and greater	10	11.0
No response	4	4.4
Ethnicity		
White/Caucasian	85	93.4
African American	4	4.4
Native American	2	2.2
Marital status		
Married	55	60.4
Divorced	22	24.2
Never married	9	9.9
Widowed	4	4.4
Separated	1	1.1
Religious affiliation		
Protestant	35	38.5
Other	27	29.7
Catholic	21	23.1
None	4	4.4
Jewish	3	3.3
No response	1	1.1
Currently employed		
Yes	60	65.9
No	31	34.1

household income, ethnicity, religious affiliation, and employment status, are presented in Table 1.

Randomization Check

To assess the success of the randomization procedure, demographic and major outcome measures (including SOC, fibromyalgia symptoms, depression, and distress) were compared for the treatment and control groups at baseline using *t* tests and chi-square statistics. No significant differences between groups emerged on any of these measures.

Differential Attrition

Baseline differences in demographics as well as in predictor and outcome variables were compared for participants who provided follow-up data versus

Table II. Two-Tailed Pearson Correlations of the Relationships Between Sense of Coherence and Fibromyalgia Symptoms, Perceived Stress, and Depression

	Sense of coherence		
	<i>N</i>	<i>r</i>	<i>p</i>
Fibromyalgia symptoms (FIQ)	84	-.12	.288
Physical functioning (FIQ)	85	-.06	.567
Perceived stress (PSS)	85	-.64	<.001
Depression (BDI)	84	-.65	<.001

those who did not using *t* tests and chi-square statistics with Yates' Correction. Participants with more severe physical impairment, $t(89) = -3.12$, $p = .002$, and more fibromyalgia symptoms, $t(88) = -2.37$, $p = .020$, as measured by the FIQ, were less likely to provide follow-up data. A subsequent two-way factorial ANOVA showed that the effect did not differ across the treatment and control groups.

Statistical Relationship Between Outcome Measures

To examine relationships between SOC, FMS symptoms, and psychological distress, a series of Pearson product-moment correlations were conducted. As shown in Table II, SOC was not statistically related to fibromyalgia symptoms or physical functioning; however, higher SOC was significantly correlated with both lower levels of perceived stress ($r = -.64$, $p < .01$) and depression ($r = -.65$, $p < .01$).

Examination of the Sense of Coherence Buffering Hypothesis

To examine the hypothesis that SOC moderates the influence of fibromyalgia symptomatology on

psychological adjustment, two hierarchical regression analyses were conducted following recommendations described by Baron and Kenny (1986) for testing moderation. Using data collected at baseline, the models were tested using perceived stress and depressive symptoms as criterion variables (see Table III). The FIQ symptom severity score and SOC were entered in the first step, and the interaction of the two variables was entered in the second step. Prior to entry into the model, predictor variables were centered to reduce collinearity with the interaction term (Aiken & West, 1991).

In the first step of the perceived stress model, less fibromyalgia symptomatology and higher SOC predicted lower perceived stress; however, the interaction term entered in the second step neither reached statistical significance nor resulted in a significant increase in explanatory power ($\Delta R^2 = .01$). However, the overall model remained statistically significant for perceived stress, $R^2 = .46$; $F(3, 80) = 22.32$, $p < .001$.

Similar results were found for the model using depressive symptomatology as the criterion variable. In the initial step fibromyalgia symptoms and SOC predicted depressive symptoms, such that more severe fibromyalgia symptoms and lower SOC were associated with greater depressive symptomatology (see Table III). However, the interaction term entered in the second step to test the hypothesized buffering effect of SOC did not result in a significant change in ΔR^2 (.01). Again, the overall model remained statistically significant following the addition of the interaction term on the second step, $R^2 = .47$; $F(3, 79) = 23.05$, $p < .001$, but the criteria to establish an SOC moderation effect were not met.

Table III. Summary of Hierarchical Multiple Regression Models of the Sense of Coherence Buffering Hypothesis ($N \sim 83$)

Variable	<i>B</i>	<i>SE B</i>	β	R^2	ΔR^2	<i>p</i> of ΔR^2
<i>Model of perceived stress</i>						
Step 1				.45	.45	<.001
Fibromyalgia symptoms (FS)	.08	.04	.18*			
Sense of coherence (SOC)	-.16	.02	-.62***			
Step 2				.46	.01	.613
FS \times SOC interaction	.001	.002	.05			
<i>Model of depressive symptoms</i>						
Step 1				.46	.46	<.001
Fibromyalgia symptoms (FS)	.09	.04	.23*			
Sense of coherence (SOC)	-.17	.02	-.63***			
Step 2				.47	.01	.249
FS \times SOC interaction	-.002	.002	-.10			

Note. Overall Model Statistics for Perceived Stress, $F(3, 80) = 22.32$, $p < .001$, $R^2 = .46$. Overall Model Statistics for Depressive Symptoms, $F(3, 79) = 23.05$, $p < .001$, $R^2 = .47$.

* $p < .05$. *** $p < .001$.

Table IV. Repeated Measures Analysis of Variance for Sense of Coherence

Source	<i>df</i>	<i>F</i>	Partial η	<i>p</i>
Between participants				
Condition (C)	1	0.39	.01	.533
C between-group error	59	(1055.92)		
Within participants				
Time (T)	1	2.21	.04	.143
T \times C	1	6.40	.10	.014
T within-group error	59	(147.71)		

Note. Values enclosed in parentheses represent mean square errors.

As shown in Table III, both models examining the SOC buffering hypothesis demonstrated equally consistent results, in terms of failing to identify a buffering or moderating role of SOC on the impact of fibromyalgia symptoms on indices of psychological distress in a cross-sectional analysis of baseline data.

MBSR Group Effect on SOC

To examine the hypothesis that participation in MBSR altered SOC, a repeated measures analysis of variance was conducted (RMANOVA) using baseline

and postintervention SOC data. Mean baseline SOC was 130.51 ($SD = 27.40$) for the MBSR group and 132.42 ($SD = 25.51$) for the wait-list control group. Postintervention mean SOC was 139.54 ($SD = 21.34$) for the MBSR group and 130.08 ($SD = 23.42$) for the wait-list control group. As displayed in Table IV and Fig. 1, there was a significant time by treatment condition interaction, showing that participation in the MBSR condition was associated with a significant increase in SOC while the wait-list control participants maintained a stable SOC.

Predicting Change in SOC

To explore potential predictors of change in SOC (baseline to postintervention), a hierarchical regression model was tested using baseline SOC as a covariate in the first step of the analysis and sociodemographic variables as well as treatment dose in the second step. Treatment dose was calculated using the percentage of sessions attended by each member of the MBSR group, and wait-list control participants were given a score of 0. Results of the analysis are depicted in Table V. After accounting for baseline levels of SOC, the variable set entered in the second step

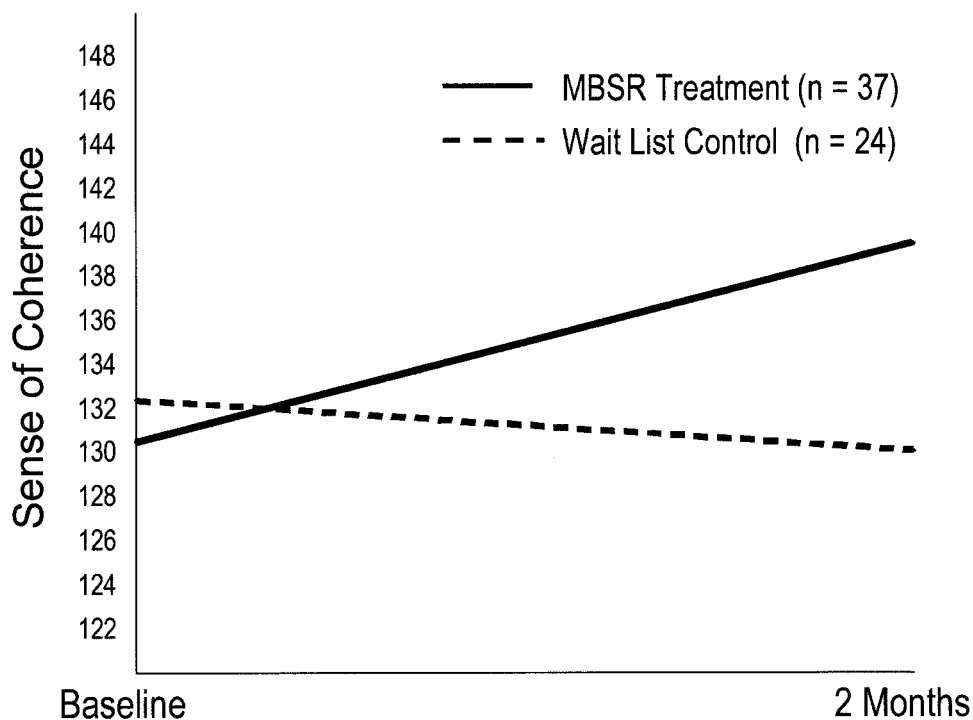


Fig. 1. SOC in the treatment and control groups at baseline vs. 2-month follow-up.

Table V. Summary of the Hierarchical Multiple Regression Model of Change in Sense of Coherence

Variable	<i>B</i>	<i>SE B</i>	β	R^2	ΔR^2	<i>p</i> of ΔR^2
Step 1				.26	.26	<.001
Baseline sense of coherence (SOC)	-0.34	0.08	-0.49**			
Step 2				.38	.12	.034
Age	-0.04	0.20	-0.03			
Income	-0.95	1.31	-0.08			
Treatment dose	14.99	4.92	0.34*			

Note. Overall Model Statistics, $F(4, 52) = 7.84$, $p < .001$, $R^2 = .38$.

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

demonstrated a significant increase in explained variance ($\Delta R^2 = .12$). Inspection of the individual variables showed that age and income were unrelated to change in SOC, whereas treatment dose was positively associated with increases in SOC.

DISCUSSION

The results of this study support previous findings suggesting a positive association between SOC and adjustment to illness. Fibromyalgia patients with stronger SOC reported lower levels of perceived stress, and less depression. Analyses failed to reveal a significant association between physical functioning and SOC. These results are consistent with other studies showing that SOC is more strongly related to psychological disturbance than to physiological functioning (Bengel et al., 1999).

The second hypothesis that SOC would buffer the effects of fibromyalgia symptoms on psychological disturbance was not supported. The models used to test this hypothesis approached significance but none fully supported SOC as a moderating factor. It is possible that SOC simply may not exert a buffering effect upon psychological distress associated with symptoms of illness but there are other possible explanations as well. For example, our ability to detect a buffering effect may have been limited by the relatively small sample size and concomitant levels of statistical power to identify small effects. Furthermore, the cross-sectional nature of this data may also have hampered our ability to detect such an effect. Finally, the psychological adjustment of patients with fibromyalgia may be substantially driven by factors other than current severity of illness symptoms. Thus, the beneficial role of SOC in buffering the effects of stressors on adjustment might have emerged had the analysis examined other variables that may contribute to adjustment (e.g., social support, objective life events). Future studies should also examine the mechanisms

by which SOC may alleviate psychological distress using longitudinal data.

In light of the general acceptance of SOC as a relatively stable trait variable, it is quite interesting that SOC increased so markedly in the MBSR treatment group. Antonovsky viewed SOC as an enduring attitude that is developed between childhood and age 30, and is less likely to change thereafter (Antonovsky, 1979). He theorized that only a profound change in social or cultural influences or living conditions, such as emigration, the birth of a child, changes in marital status or employment, would be likely to alter SOC (Antonovsky, 1979). Concerning psychotherapy, he stated that "... it is utopian to expect that an encounter, or even a series of encounters, between client and clinician can significantly change the SOC" (Antonovsky, 1979). In contrast, the results of other studies belie the suggested stability of SOC. Several studies provide evidence that SOC may change over time, for example, with increasing age (Callahan & Pincus, 1995; Frenz et al., 1993; Larsson & Kallenberg, 1996).

A criticism of the construct of SOC has been its strong association with trait anxiety. Indeed, some of our results could have been affected by the negative association between SOC and trait anxiety noted elsewhere (Bengel et al., 1999). Certainly, perceived stress and depression are likely to be higher among patients who tend to be anxious. However, because it was found that SOC increased quite significantly with MBSR treatment, it cannot be assumed that this construct is entirely explained by trait anxiety or any other trait variable.

The majority of research on SOC to date has employed correlational designs, which makes it difficult to infer causal relationships (Bengel et al., 1999). Although the current study benefited from a longitudinal design, one limitation is that follow-up data were only collected on 75% of participants. This rate is similar to a previous study employing MBSR in patients with fibromyalgia (Kaplan et al., 1993) with

a completion rate of 77%, and better than the rate observed in a study of MBSR in an inner-city setting with a completion rate of 53% (Roth & Creaser, 1997). Conversely, the follow-up rate in this study was somewhat lower than that reported in studies of students and patients with anxiety disorders (Kabat-Zinn et al., 1992; Shapiro, Schwartz, & Bonner, 1998). The limitations and stressors imposed by a chronic illness such as fibromyalgia may make it more challenging to obtain follow-up data from this population. Indeed we found that greater physical impairment and higher severity of fibromyalgia symptoms predicted loss to follow-up.

Antonovsky stated that experiences marked by unpredictability, uncontrollability, and uncertainty would weaken SOC (Antonovsky, 1987b), and it is plausible that a disease such as fibromyalgia would involve such experiences. On the other hand, participation in a support group, irrespective of specific skills being taught, might lessen those feelings of uncertainty and thus enhance SOC. The hypothesized benefit of mindfulness rests not only on social support but also on the assumption that learning to focus attention in the present enables one to respond more effectively to difficult circumstances and minimizes the tendency toward unproductive and potentially stressful worry. A distinction should be made between mindfulness as a relaxation technique (shared with many other clinical practices) and as a more general lifestyle pattern emphasizing present moment awareness and focused attention in the context of more responsive and less reactive behavior patterns. In keeping with other meditative and relaxation techniques, mindfulness meditation appears to counter behavioral urgency associated with high levels of stress with a state of relative calm and more measured behavioral responsiveness. According to Kabat-Zinn, Skillings, and Salmon (unpublished manuscript), it is intended to provide an *attitudinal* frame marked by "... present moment awareness, psychological stability, and perceptual clarity, to be maintained... even within the context of highly stressful events." According to this interpretation, mindfulness is intended to foster a high level of psychological adaptation useful in a variety of stressful circumstances, much like SOC.

Our longitudinal analysis of demographic factors and exposure to treatment (attendance at MBSR sessions) as predictors of change in SOC also suggest that there may be a dose-response relationship between the practice of mindfulness and enhanced SOC. These results are also consistent with previous studies that have failed to relate demographic factors to chronic

pain intervention program attendance and treatment success (Funch & Gale, 1986; Worrel et al., 2001).

This study is unique as the first randomized prospective trial to demonstrate an enhancement of SOC with a psychosocial intervention. Given the relationship between SOC and adjustment to chronic illness reported here and elsewhere, results of this study suggest that SOC could be the focus of clinical interventions intended to alleviate some of the suffering associated with chronic illness. It is an important finding that the practice of mindfulness meditation, which advocates the cultivation of moment-to-moment awareness and measured responsiveness to stressful events, appears to have this effect in women with fibromyalgia. Greater coherence may, at least in part, reflect a state of psychological equilibrium resulting from the systematic practice of quieting and focusing busy, agitated minds.

REFERENCES

- Aiken, L. S., & West, S. G. (1991). *Multiple regression: Testing and interpreting interactions*. Thousand Oaks, CA: Sage.
- Antonovsky, A. (1979). *Health, stress, and coping: New perspectives on mental and physical well-being*. San Francisco: Jossey-Bass.
- Antonovsky, A. (1983). The sense of coherence: Development of a research instrument. In W. S. Schwartz (Ed.), *Newsletter and research reports* (Vol. 1, pp. 1–11). Tel Aviv: Tel Aviv University, Research Center for Behavioral Medicine.
- Antonovsky, A. (1987a). The salutogenic perspective: Toward a new view of health and illness. *Advances*, 4, 47–55.
- Antonovsky, A. (1987b). *Unraveling the mystery of health: How people manage stress and stay well*. San Francisco: Jossey-Bass.
- Antonovsky, A. (1993). The structure and properties of the sense of coherence scale. *Social Science and Medicine*, 36, 725–733.
- Baron, R. M., & Kenny, D. A. (1986). The moderator-mediator variable distinction in social psychological research: Conceptual, strategic, and statistical considerations. *Journal of Personality and Social Psychology*, 51, 1173–1182.
- Beck, A. T., Steer, R. A., & Garbin, M. G. (1988). Psychometric properties of the Beck Depression Inventory: Twenty-five years of evaluation. *Clinical Psychology Review*, 8, 77–100.
- Bengel, J., Strittmatter, R., & Willmann, H. (1999). *What keeps people healthy? The current state of discussion and the relevance of Antonovsky's salutogenic model of health* (4th ed.). Cologne, Germany: Federal Centre for Health Education (FCHE).
- Bennett, R. M. (1996). Fibromyalgia and the disability dilemma. A new era in understanding a complex, multidimensional pain syndrome. *Arthritis and Rheumatism*, 39, 1627–1634.
- Bias, E. S. (1998). Mediating the stress-outcome relationship in Alzheimer's caregiving: The reciprocal influences of sense of coherence, coping, and boundary ambiguity. *Dissertation Abstracts International: Section B: The Sciences and Engineering*, 59(6-B), 3046.
- Bishop, G. D. (1993). The sense of coherence as a resource in dealing with stress. *Psychologia*, 36, 259–263.
- Bishop, S. R. (2002). What do we really know about mindfulness-based stress reduction? *Psychosomatic Medicine*, 64, 71–84.

- Blackburn-Munro, G., & Blackburn-Munro, R. E. (2001). Chronic pain, chronic stress and depression: Coincidence or consequence? *Journal of Neuroendocrinology*, *13*, 1009–1023.
- Boissevain, M. D., & McCain, G. A. (1991). Toward an integrated understanding of fibromyalgia syndrome. I: Medical and pathophysiological aspects. *Pain*, *45*, 227–238.
- Bowman, B. J. (1996). Cross-cultural validation of Antonovsky's Sense Of Coherence Scale. *Journal of Clinical Psychology*, *52*, 547–549.
- Bradley, L. A. (1996). Cognitive-behavioral therapy for chronic pain. In R. J. Gatchel & D. C. Turk (Eds.), *Psychological approaches to pain management: A practitioner's handbook* (pp. 131–147). New York: Guilford.
- Buckelew, S. P., Conway, R., Parker, J., Deuser, W. E., Read, J., Witty, T. E., et al. (1998). Biofeedback/relaxation training and exercise interventions for fibromyalgia: A prospective trial. *Arthritis Care and Research*, *11*, 196–209.
- Burckhardt, C. S., Clark, S. R., & Bennett, R. M. (1991). The fibromyalgia impact questionnaire: Development and validation. *Journal of Rheumatology*, *18*, 728–733.
- Callahan, L. F., & Pincus, T. (1995). The sense of coherence scale in patients with rheumatoid arthritis. *Arthritis Care and Research*, *8*, 28–35.
- Cohen, S., Kamarck, T., & Mermelstein, R. (1983). A global measure of perceived stress. *Journal of Health and Social Behavior*, *24*, 385–396.
- Creamer, P., Singh, B. B., Hochberg, M. C., & Berman, B. M. (2000). Sustained improvement produced by nonpharmacologic intervention in fibromyalgia: Results of a pilot study. *Arthritis Care and Research*, *13*, 198–204.
- Crofford, L. J., & Demitrack, M. A. (1996). Evidence that abnormalities of central neurohormonal systems are key to understanding fibromyalgia and chronic fatigue syndrome. *Rheumatic Diseases Clinics of North America*, *22*, 267–284.
- Delbar, V., & Benor, D. E. (2001). Impact of nursing intervention on cancer patients' ability to cope. *Journal of Psychosocial Oncology*, *19*, 57–75.
- Deluze, C., Bosia, L., Zirbs, A., Chantraine, A., & Vischer, T. L. (1992). Electroacupuncture in fibromyalgia: Results of a controlled trial. *BMJ*, *305*, 1249–1252.
- Doan, B. D., & Wadden, N. P. (1989). Relationships between depressive symptoms and descriptions of chronic pain. *Pain*, *36*, 75–84.
- Epstein, S., Kay, G., Clauw, D., Heaton, R., Klein, D., Krupp, L., et al. (1999). Psychiatric disorders in patients with fibromyalgia: A multicenter investigation. *Psychosomatics*, *40*, 57–63.
- Fishbain, D. A., Cutler, R., Rosomoff, H. L., & Rosomoff, R. S. (1997). Chronic pain-associated depression: Antecedent or consequence of chronic pain? A review. *Clinical Journal of Pain*, *13*, 116–137.
- Flannery, R. B., Jr., Perry, J. C., Penk, W. E., & Flannery, G. J. (1994). Validating Antonovsky's Sense of Coherence Scale. *Journal of Clinical Psychology*, *50*, 575–577.
- Forsberg, C., & Bjorvell, H. (1996). Living with cancer: Perceptions of well-being. *Scandinavian Journal of Caring Sciences*, *10*, 109–115.
- Frenz, A. W., Carey, M. P., & Jorgensen, R. S. (1993). Psychometric evaluation of Antonovsky's Sense of Coherence Scale. *Psychological Assessment*, *5*, 145–153.
- Funch, D. P., & Gale, E. N. (1986). Predicting treatment completion in a behavioral therapy program for chronic temporomandibular pain. *Journal of Psychosomatic Research*, *30*, 57–62.
- Germano, D., Misajon, R., & Cummins, R. A. (2001). Quality of life and sense of coherence in people with arthritis. *Journal of Clinical Psychology in Medical Settings*, *8*, 253–261.
- Hakinnen, A., Hakkinen, K., Hannonen, P., & Alen, M. (2001). Strength training induced adaptations in neuromuscular function of premenopausal women with fibromyalgia: Comparison with healthy women. *Annals of Rheumatic Disease*, *60*, 21–26.
- Hawley, D. J., Wolfe, F., & Cathey, M. A. (1992). The sense of coherence questionnaire in patients with rheumatic disorders. *Journal of Rheumatology*, *19*, 1912–1918.
- Hood, S. C., Beaudet, M. P., & Catlin, G. (1996). A healthy outlook. *Health Reports*, *7*, 25–35.
- Kabat-Zinn, J. (1982). An outpatient program in behavioral medicine for chronic pain patients based on the practice of mindfulness meditation: Theoretical considerations and preliminary results. *General Hospital Psychiatry*, *4*, 33–47.
- Kabat-Zinn, J. (1990). *Full catastrophe living: Using the wisdom of your body and mind to face stress, pain, and illness*. New York: Delacorte Press.
- Kabat-Zinn, J., Lipworth, L., & Burney, R. (1985). The clinical use of mindfulness meditation for the self-regulation of chronic pain. *Journal Behavioral Medicine*, *8*, 163–190.
- Kabat-Zinn, J., Massion, A. O., Kristeller, J., Peterson, L. G., Fletcher, K. E., Pbert, L., et al. (1992). Effectiveness of a meditation-based stress reduction program in the treatment of anxiety disorders. *American Journal of Psychiatry*, *149*, 936–943.
- Kabat-Zinn, J., Skillings, A., & Salmon, P. (unpublished manuscript). The effect of mindfulness meditation-based stress reduction training on stress mediating trait measures in medical patients: Short and long-term observations.
- Kaiser, C. F., Sattler, D. N., Bellack, D. R., & Dersin, J. (1996). A conservation of resources approach to a natural disaster: Sense of coherence and psychological distress. *Journal of Social Behavior and Personality*, *11*, 459–476.
- Kaplan, K. H., Goldenberg, D. L., & Galvin-Nadeau, M. (1993). The impact of a meditation-based stress reduction program on fibromyalgia. *General Hospital Psychiatry*, *15*, 284–289.
- Keefe, F. J., Dunsmore, J., & Burnett, R. (1992). Behavioral and cognitive-behavioral approaches to chronic pain: Recent advances and future directions. *Journal of Consulting and Clinical Psychology*, *60*, 528–536.
- Keel, P. J., Bodoky, C., Gerhard, U., & Muller, W. (1998). Comparison of integrated group therapy and group relaxation training for fibromyalgia. *Clinical Journal of Pain*, *14*, 232–238.
- Korotkov, D. L. (1993). An assessment of the (short-form) sense of coherence personality measure: Issues of validity and well-being. *Personality and Individual Differences*, *14*, 538–575.
- Larsson, G., & Kallenberg, K. O. (1996). Sense of coherence, socioeconomic conditions and health. *European Journal of Public Health*, *6*, 175–180.
- Lazarus, R. S., & Folkman, S. (1984). *Stress, appraisal, and coping*. New York: Springer.
- Masi, A. T., & Yunus, M. B. (1986). Concepts of illness in populations as applied to fibromyalgia syndromes. *American Journal of Medicine*, *81*, 19–25.
- McSherry, W. C., & Holm, J. E. (1994). Sense of coherence: Its effects on psychological and physiological processes prior to, during, and after a stressful situation. *Journal of Clinical Psychology*, *50*, 476–487.
- Nicassio, P. M., Radojevic, V., Weisman, M. H., Schuman, C., Kim, J., Schoenfeld-Smith, K., et al. (1997). A comparison of behavioral and educational interventions for fibromyalgia. *Journal of Rheumatology*, *24*, 2000–2007.
- Parmelee, P. A., Katz, I. R., & Lawton, M. P. (1991). The relation of pain to depression among institutionalized aged. *Journals of Gerontology*, *46*, 15–21.
- Post-White, J. (1998). The role of sense of coherence in mediating the effects of mental imagery on immune function, cancer outcome, and quality of life. In H. I. McCubbin & E. A. Thompson (Eds.), *Stress, coping, and health in families: Sense of coherence and resiliency* (Vol. 1, pp. 279–291). Thousand Oaks, CA: Sage.
- Rena, F., Moshe, S., & Abraham, O. (1996). Couples' adjustment to one partner's disability: The relationship between sense of

- coherence and adjustment. *Social Science and Medicine*, 43, 163–171.
- Rimann, M., & Udris, I. (1998). “Kohärenzerleben” (sense of coherence): Zentraler Bestandteil von Gesundheit oder Gesundheitsressource? In W. Schüffel (Ed.), *Handbuch der Salutogenese. Konzept und Praxis*. Wiesbaden, Germany: Ullstein & Mosby.
- Rossy, L. A., Buckelew, S. P., Dorr, N., Hagglund, K. J., Thayer, J. F., McIntosh, M. J., et al. (1999). A meta-analysis of fibromyalgia treatment interventions. *Annals of Behavioral Medicine*, 21, 180–191.
- Roth, B., & Creaser, T. (1997). Mindfulness meditation-based stress reduction: Experience with a bilingual inner-city program. *Nurse Practitioner*, 22, 150–157.
- Sammallahti, P. R., Holi, M. J., Komulainen, E. J., & Aalberg, V. A. (1996). Comparing two self-report measures of coping—The Sense of Coherence Scale and the Defense Style Questionnaire. *Journal of Clinical Psychology*, 52, 517–524.
- Schnyder, U., Buechi, S., Sensky, T., & Klaghofer, R. (2000). Antonovsky’s Sense of Coherence: Trait or state? *Psychotherapy and Psychosomatics*, 69, 296–302.
- Shapiro, S. L., Schwartz, G. E., & Bonner, G. (1998). Effects of mindfulness-based stress reduction on medical and premedical students. *Journal of Behavioral Medicine*, 21, 581–599.
- Soderberg, S., Lundman, B., & Norberg, A. (1997). Living with fibromyalgia: Sense of coherence, perception of well-being, and stress in daily life. *Research in Nursing Health*, 20, 495–503.
- Spitzer, R. L., Williams, J. B., Gibbon, M., & First, M. B. (1992). The Structured Clinical Interview for DSM-III-R (SCID). I: History, rationale, and description. *Archives of General Psychiatry*, 49, 624–629.
- Urrows, S., Affleck, G., Tennen, H., & Higgins, P. (1994). Unique clinical and psychological correlates of fibromyalgia tender points and joint tenderness in rheumatoid arthritis. *Arthritis and Rheumatism*, 37, 1513–1520.
- Wallace, D. J. (1997). The fibromyalgia syndrome. *Annals of Medicine*, 29, 9–21.
- Wolfe, F. (1997). The relation between tender points and fibromyalgia symptom variables: Evidence that fibromyalgia is not a discrete disorder in the clinic. *Annals of the Rheumatic Diseases*, 56, 268–71.
- Wolfe, F., Aarflot, T., Bruusgaard, D., Henriksson, K. G., Littlejohn, G., Moldofsky, H., et al. (1995). Fibromyalgia and disability (Report of the Moss International Working Group on medicolegal aspects of chronic widespread musculoskeletal pain complaints and fibromyalgia). *Scandinavian Journal of Rheumatology*, 24, 112–118.
- Wolfe, F., Smythe, H. A., Yunus, M. B., Bennett, R. M., Bombardier, C., Goldenberg, D. L., et al. (1990). The American College of Rheumatology 1990 Criteria for the Classification of Fibromyalgia (Report of the Multicenter Criteria Committee). *Arthritis and Rheumatism*, 33, 160–172.
- Worrel, L., Krahn, L., Kletten, C., & Pond, G. (2001). Treating fibromyalgia with a brief interdisciplinary program: Initial outcomes and predictors of response. *Mayo Clinic Proceedings*, 76, 384–390.
- Ying, Y. W. (1999). Strengthening intergenerational/intercultural ties in migrant families: A new intervention for parents. *Journal of Community Psychology*, 27, 89–96.