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Changes after Multidisciplinary Pain Treatment in Patient Pain Beliefs and Coping Are Associated with Concurrent Changes in Patient Functioning

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Abstract

Little is known about how patient functioning changes after completion of multidisciplinary pain programs, and what factors are associated with such changes when they occur; for example, whether improvement or deterioration in functioning corresponds to changes in patient beliefs and coping during this period. The objective of this study was to examine the extent to which changes in patient pain and functioning were associated with changes in beliefs and coping after multidisciplinary pain treatment. Patients with chronic pain ($N = 141$) completed outcome (pain, functioning) and process (beliefs, catastrophizing, coping) measures at the end of multidisciplinary pain treatment and 12 months posttreatment. On average, patients reported similar levels of pain at both times, but showed a small worsening in disability and depression outcomes between posttreatment and follow-up, which were associated significantly with concurrent changes in the process measures. In particular, increased belief in oneself as disabled by pain, catastrophizing, and increased use of resting, guarding and asking for assistance in response to pain were linked with increased disability and depression. Decreased perceived control over pain was also consistently associated with worsening of these outcomes. The results highlight the potential importance of specific pain-related beliefs and coping responses in long-term patient pain and adjustment. Research is needed to determine whether booster interventions after the end of intensive multidisciplinary treatment that target these beliefs and coping responses improve long-term outcomes.

1. Introduction

Consistent with cognitive-behavioral models of chronic pain, patients who receive multidisciplinary pain treatment demonstrate pre- to post-treatment as well as pretreatment to follow-up changes in pain beliefs and coping that are associated with changes in pain and functioning (Tota-Faucette et al., 1993; Jensen et al., 1994a; Turner et al., 1995; Burns et al., 1998; Jensen et al., 2001). This research has been useful for identifying beliefs and coping

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strategies that are most strongly and consistently associated with treatment outcome, and that therefore could be potential mechanisms of treatment efficacy.

Although experts have emphasized the importance of including relapse prevention strategies in multidisciplinary pain treatment programs in order to increase the likelihood of maintained (or even increased) gains after treatment (Turk, 2002), little research has examined the process of change in patient pain and functioning following multidisciplinary pain treatment. Information about the correlates of maintained gains/continued improvement, as well as of deterioration in functioning posttreatment, could serve several important functions. First, this information would provide another critical test of cognitive-behavioral models of chronic pain (e.g., Turk, 2002), which posit that changes in patient functioning are associated with changes in patient beliefs and coping responses. Second, identification of specific beliefs and coping responses that are most closely linked to change in functioning during this critical period could be useful to clinicians when deciding which beliefs and coping responses to target during treatment and during follow-up sessions, in order to maximize maintenance of gains. This information would also be useful to researchers interested in testing models of causal relationships between specific beliefs, coping responses, and adjustment to chronic pain, as it could identify beliefs and coping strategies that have the highest likelihood of impacting outcome, and that therefore warrant testing in experimental studies.

The purpose of this study was to examine the associations between changes in beliefs and coping and changes in pain, physical disability, and depressive symptoms during the time period post-multidisciplinary pain treatment to 12-month follow-up. We previously examined changes in patient beliefs, coping, and outcome from pre-multidisciplinary pain treatment to posttreatment and follow-up (Jensen et al., 2001). For the current report, we used data from this study to examine changes from posttreatment to 12-month follow-up. We hypothesized that posttreatment to 12-month follow-up changes in pain-related beliefs and coping would be significantly associated with concurrent changes in pain, disability, and depression. We planned subsequent exploratory analyses, if the primary study hypothesis was supported, to identify the specific beliefs and coping responses most strongly and consistently linked to changes in outcome during the year after multidisciplinary pain treatment.

2. Methods

2.1. Participants

We analyzed data from 141 patients who participated in the University of Washington (Seattle, WA) outpatient multidisciplinary pain program, enrolled in a study of pain treatment process (Jensen et al., 2001), and provided posttreatment and 12-month follow-up data. During the study enrollment period, 283 patients participated in the pain program. Of these, 197 (70%) agreed to participate, and of these, 141 (72%) provided posttreatment and 12-month follow-up data. About half (51%) of the participants were female and most were Caucasian (90%). Mean (SD) age was 44.7 (10.7) years (range, 21 - 78 years) and median pain duration was 3.2 years (range, 4 months - 48 years). The primary site of pain varied and included the low back (34%), neck (18%), shoulder or arm (13%), leg (12%), head (9%), and other sites (14%). Twenty-nine percent of the study participants were working either full time (18%) or part time (11%), 60% were receiving pain-related disability compensation, and 12% had litigation pending regarding their pain problem at the time of study enrollment.

2.2. Measures

2.2.1. Process measures

2.2.1.1. Beliefs The study participants completed the Survey of Pain Attitudes (SOPA; Jensen et al., 1994b; for the SOPA items used in this study, see DeGood and Tait, 2001, pp. 338-339)

and the Pain Beliefs and Perceptions Inventory (PBAPI; Williams and Thorn, 1989). The SOPA includes seven scales that assess beliefs that: (1) one has control over pain (Pain Control), (2) one is unable to function because of pain (Disability), (3) pain signifies damage and activity should be avoided (Harm), (4) emotions influence pain (Emotion), (5) medications are an appropriate treatment for chronic pain (Medication), (6) others should respond solicitously to pain behaviors (Solicitude), and (7) a medical cure exists for one's pain (Medical Cure). The scales have been demonstrated to have adequate test-retest stability, criterion validity, and internal consistency (Jensen and Karoly, 1992; Strong et al., 1992; Jensen et al., 1994b).

The PBAPI has 16 items that were originally grouped into three scales: Pain as a Mystery (pain is mysterious/poorly understood), Time (pain is enduring), and Self-Blame (pain is caused or maintained by the patient) (Williams and Thorn, 1989). However, other investigators have not replicated the original factor structure and have proposed four scales. Williams and colleagues (Williams et al., 1994) described a scoring method for the PBAPI that yields four scales: Mystery, Self-Blame, Pain Permanence, and Pain Constancy (belief that the pain is constant and pervasive). This scoring system was used in the current study. A subsequent study found that these subscales had excellent internal consistency (Morley and Wilkinson, 1995).

2.2.1.2. Catastrophizing Study participants completed the 6-item Catastrophizing scale from the Coping Strategies Questionnaire (CSQ; Rosenstiel and Keefe, 1983). This scale has demonstrated validity (Boothby et al., 1999; Sullivan et al., 2001) and good to excellent internal consistency (Rosenstiel and Keefe, 1983; Robinson et al., 1997; Keefe et al., 1999) and test-retest stability (Keefe et al., 1999; Stewart et al., 2001).

2.2.1.3. Coping The study participants completed the Chronic Pain Coping Inventory (CPCI; Jensen et al., 1995) and the CSQ to assess pain coping responses. The 65-item CPCI assesses eight coping strategies often targeted for change in pain management programs (Guarding, Resting, Asking for Assistance, Relaxation, Task Persistence, Exercise/Stretch, Seek Support, and Coping Self-Statements; Jensen et al., 1995) and has demonstrated reliability and validity in numerous samples of patients with chronic pain (Jensen et al., 1995; Hadjistavropoulos et al., 1999; Tan et al., 2001, 2005).

In addition to the subscale that assesses catastrophizing, the Coping Strategies Questionnaire (CSQ; Rosenstiel and Keefe, 1983) assesses the frequency of use of six pain coping strategies: (1) Diverting Attention, (2) Reinterpreting Pain Sensations, (3) Ignoring Pain, (4) Praying and Hoping, (5) Coping Self-Statements, and (6) Increasing Behavioral Activities. The CSQ scales have demonstrated excellent internal consistency (Rosenstiel and Keefe, 1983; Keefe et al., 1989) and have been shown to be associated with various measures of patient functioning in a number of patient populations (Keefe et al., 1987, 1989; Jensen and Karoly, 1991; Dozois et al., 1996; Martin et al., 1996).

2.2.2. Outcome measures

2.2.2.1. Depressive symptoms Depressive symptom severity was assessed by the 20-item Center for Epidemiological Studies-Depression Scale (CES-D; Radloff, 1977). This measure has been shown to have high internal consistency, adequate test-retest reliability, and validity (Radloff, 1977). It has also been shown to be a valid screening instrument for depression in patients with chronic pain (Turk and Okifuji, 1994; Geisser et al., 1997).

2.2.2.2. Physical disability The 24-item Roland-Morris Disability Questionnaire (RMDQ; Roland and Morris, 1983) was used to assess physical disability. Research has supported the reliability and validity of the scale not only for persons with low back pain (Deyo and Centor,

1986; Lanier and Stockton, 1988), but also for patients with diverse chronic pain problems (Jensen et al., 1992).

2.2.2.3. Pain intensity The study participants were asked to rate their average, least, and worst pain intensity (over the past week) on 0 - 10 scales, with 0 = "No pain" and 10 = "Pain as intense as you could imagine." Such scales have been shown to be valid and sensitive to change (Jensen and Karoly, 2001). These measures were averaged into a single index of pain intensity (cf. Jensen et al., 1999).

2.3. Procedure

Patients who were accepted into the University of Washington Pain Center treatment program were approached to participate in a process study of multidisciplinary pain treatment. The study was approved by the University of Washington institutional review board and all participants provided written informed consent. Study eligibility criteria and enrollment rates were reported previously (Jensen et al., 2001). Study participants were administered all of the study measures via telephone interviews at the end of treatment and at a follow-up assessment 12 months after treatment ended. The pain treatment program was a 3-week (5.5 days per week) outpatient program aimed at improving patient pain management skills and physical and psychological functioning. It included physical therapy, occupational therapy, individual cognitive-behavioral psychotherapy, vocational counseling (if indicated), group pain education and coping skills training, and the tapering of opioid and sedative-hypnotic medications (when indicated).

Treatment was focused on (1) increasing strength, flexibility, endurance, and sitting and standing times; (2) assisting the patient in returning to customary work, household, and avocational activities; (3) instruction in and practice of specific pain coping strategies thought to be adaptive (use of regular exercise, pacing, coping self-statements, and task persistence); (4) decreasing use of coping strategies and responses thought to be maladaptive (guarding, resting, asking for assistance, catastrophizing); (5) medication management, with a focus on decreasing and eliminating the use of sedative and opioid medications; and (6) encouraging a shift in cognitions from those thought to be maladaptive (e.g., that one is necessarily disabled by pain, that hurt necessarily means that damage is occurring and that activities associated with increased pain should be avoided) towards cognitions thought to be adaptive (e.g., that one can control pain and its impact). Patients' family members (usually spouses) were asked to participate with the patient during the last two days of treatment in order to (1) observe patient functioning and how program staff encouraged patient functioning and (2) meet with the program psychologist to discuss how they can best support the treatment gains made by the patient.

2.4. Data analysis

We first performed paired t-test analyses to examine change in each outcome and process measure from posttreatment to 12 months. Posttreatment to 12-month change scores were then computed for each of the outcome (pain intensity, physical disability, and depression) and process (beliefs, catastrophizing, and coping) measures. To reduce the number of belief and coping measures analyzed in the planned regression analyses, change scores on these measures were then subjected to principal components analyses (PCA) (one PCA for the belief measure change scores and one for the coping measure change scores). Because we anticipated that the factors would be correlated, factors that emerged from the PCA were rotated using an oblique rotation (Tabachnick and Fidell, 1996). We calculated Pearson correlation coefficients between each possible pair of the belief and coping factors to test for possible multicollinearity that would be problematic in regression analyses. The coefficients ranged from -.27 to .37, indicating that substantial multicollinearity was not present (Katz, 2003). We then performed

three linear regression analyses to determine the extent to which changes in the process variables (catastrophizing and the belief and coping factors) were associated with posttreatment to 12-month changes in each of the three outcome measures (dependent variables), by entering the process variable change scores as a block in a single step.

Two sets of analyses were used to help understand any significant associations found in the regression analyses. First, we divided the sample into subgroups of participants who improved (by ≥ 0.5 SD), stayed the same (within plus or minus 0.5 SD), or worsened (by ≥ 0.5 SD) on each outcome measure from post-treatment to follow-up. To further clarify the process measures most closely linked to outcome, and to determine the types of changes in the process variables associated with getting worse, staying the same, or improving, the change scores in each process measure were compared across the three improvement groups (for each outcome variable) using a series of oneway ANOVAs; follow-up analyses comparing pairs of improvement groups using the Least Square Difference (LSD) method were performed to better understand any significant group effect that emerged. We then calculated the Pearson correlation coefficients between the posttreatment-to-follow-up change scores of the individual belief, catastrophizing, and coping measures and the change scores for the outcome variables. We used a Bonferroni correction (.05/26 tests per criterion = .002) to control for potential Type 1 errors in both the oneway ANOVAs and correlational analyses. All analyses were performed using SPSS software version 12.0 for Windows (released 4 September, 2003).

3. Results

3.1. Post-treatment to follow-up changes in outcome and process variables

The posttreatment and 12-month follow-up means of the outcome and process measures are presented in Table 1. As can be seen, there was a slight, but statistically significant, posttreatment to follow-up increase in physical disability and depression, but no significant change in pain intensity, in the sample on average. Many, but not all, of the process variables evidenced significant change during the 12 months after treatment. When significant change was observed, beliefs and coping strategies presumed to be adaptive tended to decrease, and beliefs and coping strategies believed to be maladaptive tended to increase.

3.2. Data reduction

Beliefs—Four factors emerged from the PCA of the posttreatment to 12-month follow-up belief change scores. We labeled the factors as Change in Pain as Illness Beliefs (negative loadings on the SOPA Control and Emotion change scores and positive loadings on the SOPA Disability and Harm scale change scores), Change in Medical Focus (positive loadings on the SOPA Cure, Solicitude, and Medication change scores), Change in Permanence and Mystery Beliefs (positive loadings on the PBAPI Permanence and Mystery change scores), and Change in Self-Blame and Constancy Beliefs (negative loading on the PBAPI Self-Blame scale change score and positive loading on the PBAPI Constancy scale change score).

Coping—Four factors also emerged from the PCA of the posttreatment to 12-month follow-up change scores in the coping measures. We labeled these as Change in Cognitive Coping and Increasing Activities (positive loadings on the CSQ Self-Statements, Ignore Pain, Reinterpret Pain, Diverting Attention, and Increase Activities scale change scores), Change in Passive Coping (positive loadings on the CPCI Guarding, Resting, Asking for Assistance, and Seek Support scale change scores), Change in Prayer and Persistence Coping (negative loading on the CSQ Pray and Hope scale change score, and positive loading on the CPCI Task Persistence change score), and Change in Active Coping (negative loadings on the CPCI Coping Self-Statements, CPCI Relaxation, and CPCI Exercise/stretch change scores).

3.3. Associations of changes in functioning with changes in beliefs, catastrophizing, and coping

The results of the regression analyses predicting change in outcome from change in the process factor scores are presented in Table 2. As can be seen, process measure change factors accounted for 47%, 41%, and 39% of the variance in change in physical disability, depressive symptoms, and pain intensity, respectively (Table 2). Among the process variables, the Change in Passive Coping factor (highest loadings on CPCI Guarding, Resting, Asking for Assistance, and Seek Support scales) accounted for the greatest amount of unique variance in change in physical disability, when controlling for the other process variable change scores. Change in Medical Focus and Change in Permanence and Mystery Beliefs also accounted for a small but statistically significant amount of variance in change in physical disability. Change in catastrophizing cognitions was the process variable most strongly associated with change in depressive symptoms. However change in Passive Coping also made a statistically significant contribution to the prediction of this outcome. The change in Pain as Illness Beliefs factor, Change in Passive Coping, Change in Active Coping, and Change in Self-Blame and Constancy Beliefs all made statistically significant unique contributions in the multivariate model for change in pain intensity.

3.4. Subgroup analyses: patients who worsened, stayed the same, or improved

Consistent with the findings that a small but statistically significant worsening in depressive symptoms and disability occurred from posttreatment to 12-month follow-up, more patients were classified as increasing (52, or 37%) than as decreasing (28, 20%) in depressive symptom severity; 61 (43%) showed little change. Similarly, more patients were classified as increasing (57, or 40%) than as decreasing (26, or 18%) in disability. More patients showed increases (43, or 30%) than decreases (30, or 21%) in pain intensity as well.

The results of the oneway ANOVAs testing for differences between the three improvement groups on the change scores of the process measures showed significant (Bonferroni-corrected, $P < .002$) effects for change in SOPA Control, SOPA Disability, CPCI Guarding, CPCI Resting, and CSQ Catastrophizing for improvement classification (improved, no change, worsened) for all three outcomes (see Table 3). Change in CPCI Asking for Assistance showed a significant group effect for change in physical disability and change in depressive symptoms, and change in CSQ Ignore Pain and PBAPI Constancy showed a significant group effect for change in physical disability and change in pain intensity. Change in CPCI Seek Support was significant for change in pain intensity.

In each case, the patterns of the findings were consistent with previous classifications of the process variable as “adaptive” or “maladaptive” (e.g., Jensen et al., 1994a). Patients who got worse posttreatment to follow-up showed concurrent increases in presumed maladaptive and decreases in presumed adaptive belief and coping responses. Patients who tended to stay the same showed either minimal changes in belief and coping responses, or small decreases in adaptive and increases in maladaptive responses that did not reach the level seen in patients who worsened. The patients who reported posttreatment to 12-month follow-up improvement in outcome tended to either show minimal change in process variables, or increases in adaptive and decreases in maladaptive responses. The largest effects that emerged in these analyses were associations of increases in CPCI Guarding with increases in pain and disability, and the association of increased catastrophizing with increased depressive symptoms.

3.5. Correlations between changes in individual process measures and changes in outcomes

The (Bonferroni-corrected) correlations between each of the individual process measures (changes in beliefs, catastrophizing, and coping) and changes in outcome are presented in Table 4. In these analyses, as with the group comparisons, the directions of all of the significant

relationships were consistent with previous classifications of the process variable as “adaptive” or “maladaptive.” “Adaptive” process variables (e.g., belief in control over pain and use of ignoring pain) were associated positively and “maladaptive” process variables (e.g., belief that one is disabled, guarding, and catastrophizing) were associated negatively with improvement in pain, disability, and depressive symptoms. Seven of the process measures showed a moderate (absolute value of $r = .30$) or stronger association with changes on all three outcome measures: the SOPA Control, SOPA Disability, CPCI Guarding, CPCI Resting, CPCI Asking for Assistance, CSQ Catastrophizing, and CSQ Ignoring Pain scales.

4. Discussion

In the sample on average, depressive symptoms and disability increased between the end of pain treatment and the 12-month follow-up. This deterioration was associated with a decrease in cognitions and use of coping strategies previously identified as adaptive, and with an increase in cognitions and use of coping strategies previously identified as maladaptive. Approximately one-third of the patients (30% - 40%, depending on the outcome) worsened; 41% - 48% did not change substantially and 18% - 21% improved. Patients who worsened generally showed decreases in perceived ability to control pain and increases in beliefs they were disabled and in guarding, resting, and catastrophizing. These findings are consistent with the prediction based on cognitive-behavioral theory that patients' outcomes after treatment will be influenced by such beliefs and behaviors after treatment. However, given the correlational nature of the study and the covariance of the outcome and process measures, it is also possible that the observed changes in beliefs and coping were consequences of changes on the outcome variables, or that beliefs, coping, and outcomes covaried as a result of other factors. Further research is needed to elucidate these relationships.

Although correlational analyses cannot be used to prove causality, they can distinguish variables that are more versus less likely to have a causal impact on functioning; consistently large and significant associations indicate that causal relationships remain possible, whereas consistently weak associations suggest the lack of causal relationships. Given the large number of process variables that could potentially impact functioning, correlational studies are useful for identifying process variables that (1) should be examined more closely in future studies and (2) are unlikely to play an important role in outcomes.

Substantial research, including the current findings, demonstrates that the beliefs that one can control one's pain, disability beliefs, catastrophizing cognitions, and guarding responses to pain are strongly and consistently related to patient functioning (cf. Jensen and Karoly, 1991; Jensen et al., 1994a, 1994b; 1995; Tait and Chibnall, 1997; Hadjistavropoulos et al., 1999; Engel et al., 2000; Turner et al., 2000; Jensen et al., 2001; Ektor-Anderson et al., 2002; but see Nielson and Jensen, 2004, for data suggesting that guarding responses may play a limited role in adjustment to fibromyalgia), and would be ideal candidates to examine further in experimental studies designed to determine their impact on outcome. The results of such studies could provide clinicians direction in determining which process variables to emphasize during treatment as well as during follow-up visits.

In the current study, guarding, in particular, emerged as a potentially maladaptive coping response. However, the CPCI Guarding scale items (e.g., ‘avoided using part of my body,’ ‘limited my walking,’ ‘limited my standing time’) are similar in content to items on the measure of physical disability (RMDQ) (e.g., ‘I only stand for short periods of time,’ ‘I only walk short distances.’) and thus the two measures, at least partially, may assess the same construct. The overlap in content between other process and outcome measures and the related issue of shared method variance could explain some of the associations found among other measures. For example, the SOPA Disability scale contains items such as ‘My pain would stop anyone from

leading an active life' and 'I consider myself disabled.' Patients who view themselves as disabled by pain would likely endorse such beliefs and also indicate their perceived high level of disability on physical disability measures such as the RMDQ. This problem of content overlap is less of an issue for the depressive symptoms and the pain intensity measures used in this study. The weak and nonsignificant associations found between some variables also provides evidence that shared method variance does not entirely explain the findings.

A growing body of research suggests that coping strategies that have previously been hypothesized to play an important role in patient outcomes may, in fact, have no or only a limited impact on outcomes. Pain coping strategies that show consistently weak associations with patient outcomes include use of exercise (Jensen et al., 1995;Engel et al., 2000;Jensen et al., 2001;Ektor-Anderson et al., 2002), distraction (Engel et al., 2000), increasing activities (Engel et al. 2000), and relaxation (Jensen et al., 1995;Turner et al., in press). However, it is possible that these strategies are important, but are not being assessed adequately by the available measures. For example, to achieve a high score on the CPCI Relaxation scale, a patient must endorse use of different types of relaxation strategies (e.g., imagery, muscle relaxation, meditation, deep breathing). It is possible that it is more important that a patient identify and apply regularly a single relaxation method. Use of only one strategy, even if daily, would result in a low score on the CPCI Relaxation scale. The CPCI Exercise/Stretch scale has similar characteristics, and it is possible that regular use of just one or two exercises is quite important, but another measure may be needed to adequately capture the critical aspects of exercise important to improving pain and disability. On the other hand, replication of the weak relationships found in this study using other coping measures or sources of assessment other than the patient would suggest that treatments designed to modify these coping responses may have limited long-term impact on patient outcomes.

The present findings concerning changes in outcome from posttreatment to follow-up can be compared to previously reported changes in functioning from pre-treatment to post-treatment and follow-up in the same patient sample (Jensen et al., 2001). In both studies, increased guarding, resting, catastrophizing, and believing in oneself as disabled and that pain signals harm were found to be associated positively, and belief in control over pain was found to be associated negatively, with increased dysfunction over time. On the other hand, process variables found to be linked to change in outcomes in the current study that were not identified in the previous study include the maladaptive coping strategy of asking for assistance and the adaptive coping strategy of ignoring pain. These differences in findings raise the possibility that the factors important in improvement during treatment may differ from those important in change on outcome variables after treatment. For example, in a treatment program such as the one in the current study, in which patients live apart from their family and friends, it may not be important to target asking for assistance during the program but very important to work with patients and family to decrease this behavior after treatment. Previous research from our group has demonstrated the association of solicitous responses to patient pain behaviors with patient dysfunction (Romano et., 1995,2000), consistent with behavioral theory. If patients are asking significant others for more assistance and receiving solicitous responses from family and friends following treatment, this may play a role in worsening disability over time.

Although we attempted to include the most common measures of beliefs and coping in this study, patients hold a large number of beliefs about their pain and use a variety of coping strategies to deal with pain. Many of these beliefs and coping responses were not examined in this study. For example, mindfulness meditation and self-hypnosis have been taught to patients for many years and 'acceptance' cognitions are being increasingly examined as possible adaptive coping responses to chronic pain (Kabat-Zinn et al., 1985;Creamer et al., 2000;Wolsko et al., 2004;McCracken et al., 2004). Additional work is needed to examine the

associations between these, and other, beliefs and coping responses, and concurrent and longitudinal adjustment to chronic pain.

In summary, the current results support cognitive-behavioral models of chronic pain that posit an important role for pain-related beliefs and coping responses in patient adjustment to chronic pain in the time period following multidisciplinary pain treatment. Although the study design does not allow for conclusions regarding causal relationships, the findings suggest beliefs and coping responses that may be more and less likely to impact patient functioning and maintenance of treatment gains over time. Based on the current and previous (i.e., Jensen et al., 2001) findings, the beliefs and coping strategies most consistently and strongly associated with important patient outcomes are the adaptive belief in control over pain, and the maladaptive responses of guarding, resting, and catastrophizing. Experimental research examining the effects of coping and beliefs on patient functioning seems an important next step (cf. Ehde and Jensen, 2004).

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Table 1

Post-treatment and 12-month follow-up scores on outcome (pain intensity, disability, and depression) and process (catastrophizing, coping, and belief) measures.

[[Measure]]	[[Post-treatment Mean (SD)]]	12-month follow-up Mean (SD)	[[t (df)]]	P-value
[[Outcome variables]]	[[[]]]	[[[]]]	[[[]]]	[[[]]]
[[Pain intensity]]	[[5.49 (1.65)]]	[[5.46 (2.15)]]	[[0.22 (140)]]	[[NS]]
[[Physical disability (RMDQ)]]	[[9.21 (5.73)]]	[[10.93 (6.61)]]	[[3.88 (140)]]	[[< .001]]
[[Depressive symptoms (CES-D)]]	[[16.47 (10.88)]]	[[19.34 (11.48)]]	[[2.99 (140)]]	[[< .01]]
[[Process variable: Catastrophizing]]	[[[]]]	[[[]]]	[[[]]]	[[[]]]
[[CSQ Catastrophizing]]	[[1.48 (1.37)]]	[[1.73 (1.45)]]	[[2.24 (140)]]	[[< .05]]
[[Process variables: Beliefs]]	[[[]]]	[[[]]]	[[[]]]	[[[]]]
[[SOPA Control]]	[[2.72 (0.85)]]	[[2.29 (1.00)]]	[[5.78 (140)]]	[[< .001]]
[[SOPA Disability]]	[[1.69 (0.83)]]	[[2.05 (1.00)]]	[[5.57 (140)]]	[[< .001]]
[[SOPA Harm]]	[[0.82 (0.61)]]	[[1.26 (0.79)]]	[[8.06 (140)]]	[[< .001]]
[[SOPA Emotion]]	[[2.23 (1.04)]]	[[2.03 (0.77)]]	[[5.33 (140)]]	[[< .001]]
[[SOPA Medication]]	[[1.50 (0.98)]]	[[2.23 (0.65)]]	[[8.47 (140)]]	[[< .001]]
[[SOPA Solicitude]]	[[0.98 (0.80)]]	[[1.02 (0.89)]]	[[0.57 (140)]]	[[NS]]
[[SOPA Medical Cure]]	[[1.19 (0.78)]]	[[1.33 (0.83)]]	[[2.06 (140)]]	[[< .05]]
[[PBAPI Mystery]]	[[−0.22 (1.01)]]	[[−0.27 (1.08)]]	[[0.57 (140)]]	[[NS]]
[[PBAPI Permanence]]	[[0.54 (0.91)]]	[[0.65 (0.92)]]	[[1.50 (140)]]	[[NS]]
[[PBAPI Constancy]]	[[0.79 (1.03)]]	[[0.94 (1.00)]]	[[1.75 (140)]]	[[NS]]
[[PBAPI Self-Blame]]	[[−1.15 (0.89)]]	[[−1.20 (0.90)]]	[[0.57 (140)]]	[[NS]]
[[Process variables: Coping]]	[[[]]]	[[[]]]	[[[]]]	[[[]]]
[[CPCI Guard]]	[[2.02 (1.87)]]	[[2.73 (2.18)]]	[[4.62 (140)]]	[[< .001]]
[[CPCI Rest]]	[[2.83 (1.75)]]	[[2.73 (1.97)]]	[[0.62 (140)]]	[[NS]]
[[CPCI Ask for Assistance]]	[[1.20 (1.73)]]	[[2.04 (2.06)]]	[[5.22 (140)]]	[[< .001]]
[[CPCI Relaxation]]	[[4.72 (1.30)]]	[[3.10 (1.57)]]	[[12.36 (140)]]	[[< .001]]
[[CPCI Task Persistence]]	[[5.34 (1.44)]]	[[4.97 (1.77)]]	[[2.40 (140)]]	[[< .05]]
[[CPCI Exercise]]	[[6.26 (1.01)]]	[[4.59 (1.83)]]	[[10.56 (140)]]	[[< .001]]
[[CPCI Seek Support]]	[[3.48 (1.54)]]	[[2.27 (1.73)]]	[[7.11 (140)]]	[[< .001]]
[[CPCI Coping Self-Statements]]	[[4.73 (1.58)]]	[[3.39 (1.98)]]	[[9.21 (140)]]	[[< .001]]
[[CSQ Divert Attention]]	[[3.60 (1.33)]]	[[3.07 (1.48)]]	[[4.67 (140)]]	[[< .001]]
[[CSQ Reinterpret Pain]]	[[1.74 (1.60)]]	[[1.70 (1.71)]]	[[0.35 (140)]]	[[NS]]
[[CSQ Ignore Pain]]	[[3.04 (1.52)]]	[[2.97 (1.58)]]	[[0.53 (140)]]	[[NS]]
[[CSQ Hope/Pray]]	[[2.89 (1.67)]]	[[2.43 (1.58)]]	[[4.03 (140)]]	[[< .001]]
[[CSQ Coping Self-Statements]]	[[4.50 (1.08)]]	[[3.96 (1.22)]]	[[6.23 (140)]]	[[< .001]]
[[CSQ Increase Activities]]	[[3.71 (1.10)]]	[[3.28 (1.17)]]	[[4.12 (140)]]	[[< .001]]

Note: N = 141. RMDQ = Roland-Morris Disability Questionnaire. CES-D = Center for Epidemiologic Studies - Depression scale. SOPA = Survey of Pain Attitudes. PBAPI = Pain Beliefs and Perceptions Inventory. CPCI = Chronic Pain Coping Inventory. CSQ = Coping Strategies Questionnaire.

Table 2

Multiple regression analyses predicting posttreatment to 12-month follow-up outcome measure changes from changes in belief factors, catastrophizing, and coping factors

[[Variables]]	R ²	F change	[[Standardized Beta]]
Change in physical disability (RMDQ)			
[[Cognitions and Coping]]	[[.47]]	[[12.85]] ***	[[[]]]
Change in Pain as Illness Beliefs	[[[]]]	[[[]]]	[[.17]] *
Change in Medical Focus	[[[]]]	[[[]]]	[[.18]] *
Change in Permanence and Mystery Beliefs	[[[]]]	[[[]]]	[[.17]] *
Change in Self-Blame and Constancy Beliefs	[[[]]]	[[[]]]	[[.12]]
[[Change in Catastrophizing]]	[[[]]]	[[[]]]	[[.04]]
Change in Cognitive Coping and Increasing Activities	[[[]]]	[[[]]]	[[-.17]] ***
Change in Passive Coping	[[[]]]	[[[]]]	[[.50]]
Change in Prayer and Persistence Coping	[[[]]]	[[[]]]	[[-.08]]
Change in Active Coping	[[[]]]	[[[]]]	[[.01]]
Change in depressive symptoms (CES-D)			
[[Cognitions and Coping]]	[[.41]]	[[9.90]] ***	[[[]]]
Change in Pain as Illness Beliefs	[[[]]]	[[[]]]	[[.02]]
Change in Medical Focus	[[[]]]	[[[]]]	[[.15]]
Change in Permanence and Mystery Beliefs	[[[]]]	[[[]]]	[[.13]]
Change in Self-Blame and Constancy Beliefs	[[[]]]	[[[]]]	[[.06]] ***
[[Change in Catastrophizing]]	[[[]]]	[[[]]]	[[.39]]
Change in Cognitive Coping and Increasing Activities	[[[]]]	[[[]]]	[[-.13]] *
Change in Passive Coping	[[[]]]	[[[]]]	[[.19]]
Change in Prayer and Persistence Coping	[[[]]]	[[[]]]	[[-.05]]
Change in Active Coping	[[[]]]	[[[]]]	[[-.01]]
Change in pain intensity (composite of NRS ratings)			
[[Cognitions and Coping]]	[[.39]]	[[9.40]] ***	[[[]]]
Change in Pain as Illness Beliefs	[[[]]]	[[[]]]	[[.25]] **
Change in Medical Focus	[[[]]]	[[[]]]	[[.09]]
Change in Permanence and Mystery Beliefs	[[[]]]	[[[]]]	[[.12]] *
Change in Self-Blame and Constancy Beliefs	[[[]]]	[[[]]]	[[.18]]
[[Change in Catastrophizing]]	[[[]]]	[[[]]]	[[.02]]
Change in Cognitive Coping and Increasing Activities	[[[]]]	[[[]]]	[[-.08]] **
Change in Passive Coping	[[[]]]	[[[]]]	[[.43]]
Change in Prayer and Persistence Coping	[[[]]]	[[[]]]	[[-.12]] **
Change in Active Coping	[[[]]]	[[[]]]	[[-.24]] **

Note: N = 141. RMDQ = Roland-Morris Disability Questionnaire. CES-D = Center for Epidemiologic Studies - Depression scale. NRS = Numerical Pain Rating. The regression analyses reported in this table were also performed by entering (controlling for) the changes in other outcome variables to identify the process variables that predict unique variance in each outcome independent of the other outcomes; the pattern of findings in both analyses were generally the same.

* $P < .05$

** $P < .01$

*** $P < .001$

Table 3

Significant differences in changes in process measures among patients who improved, stayed the same, or worsened on the outcome measures from posttreatment to 12 months.

[[Process Variable]]	Mean (SD) change in process variable in patients who...			
	[[Became worse]]	[[Stayed the same]]	[[Improved]]	[[F (df)]]
Outcome domain: Physical Disability (RMDQ)				
[[SOPA Control]]	.76 _a (0.92)	.31 _b (0.73)	-.03 _b (0.86)	[[8.92 (2,138)]] *
[[SOPA Disability]]	-.70 _a (0.78)	-.21 _b (0.63)	.08 _b (0.64)	[[13.14 (2,138)]] *
[[CPCI Guarding]]	-1.82 _a (1.71)	-.44 _b (1.16)	1.14 _c (1.52)	[[37.71 (2,138)]] *
[[CPCI Resting]]	-.71 _a (1.67)	.25 _b (1.78)	1.55 _c (1.65)	[[15.99 (2,138)]] *
CPCI Asking for Assistance	-1.48 _a (1.97)	-.74 _b (1.89)	.29 _c (1.34)	[[8.48 (2,138)]] *
[[CSQ Catastrophizing]]	-.82 _a (1.40)	-.10 _b (1.11)	.67 _c (0.92)	[[14.44 (2,138)]] *
[[CSQ Ignore Pain]]	.52 _a (1.71)	.09 _a (1.39)	-.96 _b (1.45)	[[8.96 (2,138)]] *
[[PBAPI Constancy]]	-.51 _a (0.82)	-.05 _b (0.89)	.46 _c (1.10)	[[10.93 (2,138)]] *
Outcome domain: Depressive Symptoms (CES-D)				
[[SOPA Control]]	.82 _a (0.92)	.28 _b (0.69)	.03 _b (0.92)	[[10.03 (2,138)]] *
[[SOPA Disability]]	-.75 _a (0.74)	-.13 _b (0.68)	-.10 _b (0.66)	[[13.46 (2,138)]] *
[[CPCI Guarding]]	-1.54 _a (1.89)	-.44 _b (1.45)	.26 _b (1.79)	[[11.64 (2,138)]] *
[[CPCI Resting]]	-.63 _a (1.89)	.45 _b (1.80)	.68 _b (1.67)	[[6.90 (2,138)]] *
CPCI Asking for Assistance	-1.63 _a (2.24)	-.52 _b (1.37)	-.13 _b (1.94)	[[7.68 (2,138)]] *
[[CSQ Catastrophizing]]	-1.06 _a (1.47)	.08 _b (0.85)	.55 _b (1.06)	[[21.97 (2,138)]] *
Outcome domain: Pain Intensity				
[[SOPA Control]]	.84 _a (0.95)	.40 _b (0.82)	-.10 _b (0.59)	[[11.37 (2,138)]] *
[[SOPA Disability]]	-.72 _a (0.68)	-.33 _b (0.74)	-.12 _b (0.65)	[[13.00 (2,138)]] *
[[SOPA Harm]]	-.74 _a (0.71)	-.44 _b (0.57)	.00 _b (0.43)	[[13.81 (2,138)]] *
[[CPCI Guarding]]	-1.90 _a (1.85)	-.53 _b (1.47)	.60 _b (1.42)	[[22.71 (2,138)]] *
[[CPCI Resting]]	-.81 _a (1.73)	.11 _b (1.82)	1.37 _b (1.53)	[[13.97 (2,138)]] *
[[CPCI Seek Support]]	.61 _a (2.00)	1.02 _b (1.85)	2.50 _b (1.93)	[[9.22 (2,138)]] *
[[CSQ Catastrophizing]]	-.74 _a (1.47)	-.26 _b (1.31)	.48 _b (0.65)	[[8.42 (2,138)]] *
[[CSQ Ignore Pain]]	.61 _a (1.47)	.16 _a (1.47)	-.91 _b (1.46)	[[9.69 (2,138)]] *
[[PBAPI Constancy]]	-.63 _a (0.79)	-.14 _b (0.84)	-.14 _c (0.97)	[[15.76 (2,138)]] *

Note: SOPA = Survey of Pain Attitudes. PBAPI = Pain Beliefs and Perceptions Inventory. CPCI = Chronic Pain Coping Inventory. A negative value in the difference score indicates a posttreatment to follow-up *increase* and a positive value indicates a posttreatment to follow-up *decrease* in the process variable. Values with different subscripts are significantly ($p < .05$) different from one another.

* $P < .002$ (level of statistical significance after Bonferroni correction)

Table 4

Pearson correlations between changes in outcome measures and changes in process measures.

[[Process Measure]]	[[Pain Intensity]]	[[Physical Disability (RMDQ)]]	[[Depressive Symptoms (CES-D)]]
[[Beliefs]]	[[[]]]	[[[]]]	[[[]]]
[[SOPA Control]]	[[-.37]] *	[[-.42]] *	[[-.36]] *
[[SOPA Disability]]	[[.40]] *	[[.52]] *	[[.39]] *
[[SOPA Harm]]	[[.35]] *	[[.24]]	[[.16]]
[[SOPA Emotion]]	[[-.03]]	[[.00]]	[[.11]]
[[SOPA Medication]]	[[.13]]	[[.29]] *	[[.25]] *
[[SOPA Solicitude]]	[[.10]]	[[.22]]	[[.28]]
[[SOPA Medical Cure]]	[[.11]]	[[.08]]	[[.09]]
[[PBAPI Self-Blame]]	[[.09]]	[[.05]]	[[.06]]
[[PBAPI Mystery]]	[[.18]]	[[.20]]	[[.23]]
[[PBAPI Permanency]]	[[.05]]	[[.01]]	[[.08]] *
[[PBAPI Constancy]]	[[.50]] *	[[.42]] *	[[.33]] *
[[Catastrophizing]]	[[[]]]	[[[]]]	[[[]]]
[[CSQ Catastrophizing]]	[[.33]] *	[[.43]] *	[[.58]] *
[[Coping]]	[[[]]]	[[[]]]	[[[]]]
[[CPCI Guarding]]	[[.55]] *	[[.65]] *	[[.43]] *
[[CPCI Resting]]	[[.42]] *	[[.45]] *	[[.31]] *
[[CPCI Asking for Assistance]]	[[.26]] *	[[.37]] *	[[.23]]
[[CPCI Seek Support]]	[[.31]] *	[[.25]]	[[.13]]
[[CPCI Relax]]	[[.29]] *	[[.12]]	[[.08]]
[[CPCI Task Persistence]]	[[-.07]]	[[.23]]	[[.29]] *
[[CPCI Exercise/Stretch]]	[[.10]]	[[-.04]]	[[.02]]
[[CPCI Coping Self-Statements]]	[[.14]]	[[-.02]]	[[-.05]]
[[CSQ Divert Attention]]	[[-.01]]	[[-.06]]	[[-.09]]
[[CSQ Reinterpret Pain]]	[[-.11]]	[[-.18]] *	[[-.19]] *
[[CSQ Ignore Pain]]	[[-.36]] *	[[-.35]] *	[[-.34]] *
[[CSQ Pray/Hope]]	[[.22]]	[[.16]]	[[.18]]
[[CSQ Coping Self-Statements]]	[[-.16]]	[[-.26]] *	[[-.30]]
[[CSQ Increase Activities]]	[[-.06]]	[[-.17]]	[[-.13]]

Note: SOPA = Survey of Pain Attitudes. PBAPI = Pain Beliefs and Perceptions Inventory. CPCI = Chronic Pain Coping Inventory.

* $P < .002$ (level of statistical significance after Bonferroni correction)