

A Randomized-controlled Trial of Using a Book of Metaphors to Reconceptualize Pain and Decrease Catastrophizing in People With Chronic Pain

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Objectives: Reconceptualization of pain and reduction of pain-related catastrophizing are primary objectives in chronic pain rehabilitation. Teaching people about the underlying biology of pain has been shown to facilitate these objectives. The objective of this study was to investigate whether written metaphor and story can be used to increase knowledge of the biology of pain and reduce pain-related catastrophizing.

Methods: In this randomized single-blind partial cross-over controlled trial, 79 people with chronic pain received either a booklet of metaphors and stories conveying key pain biology concepts or a booklet containing advice on how to manage chronic pain according to established cognitive-behavioral principles. The primary outcome variables, pain biology knowledge and catastrophizing, were measured before randomization, at 3 weeks and at 3 months, at which time the control group was crossed over to receive the metaphors and stories booklet. Pain and disability were secondary outcome variables.

Results: The Metaphors group showed larger changes in both variables (time \times group interactions: $P < 0.01$, effect size Cohen $d = 0.7$ for catastrophizing and 1.7 for pain biology knowledge). Gains were maintained for at least 3 months. Changes were replicated in the Advice group when crossed over. There was no change in pain or self-reported disability in either group.

Discussion: We conclude that providing educational material through metaphor and story can assist patients to reconceptualize pain and reduce catastrophizing. Metaphor and story could be used as a precursor to other interventions that target functional capacity.

Key Words: education, rehabilitation, reconceptualization, cognitive schema

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Randomized-controlled clinical trials have shown that reconceptualizing pain by teaching people about the biological processes that underpin chronic pain can produce

a range of positive effects. Documented effects include increasing the pain threshold during physical tasks,¹ normalizing pain beliefs and attitudes,¹ and improving pain and disability outcomes of multimodal therapeutic interventions.² Pain reconceptualization has also been shown to reduce catastrophizing, a key variable in the development and maintenance of chronic pain. Catastrophizing is related to a heightened pain experience across a wide range of groups including those with postsurgery pain, chronic pain, burns, rheumatoid arthritis, whiplash, low back pain, and dental procedures (see Sullivan et al.³ for review). Catastrophizing is positively related to disability^{4–6} and a range of pain and illness behaviors, including preoccupation with symptom management, high use of analgesics, increased visits to health care professionals, and increased hospital admissions.³

The case for pain reconceptualization is a compelling one, but optimal methods for delivering key concepts remain to be determined. Face-to-face education is time consuming and is probably highly dependent on the skills of the educator. On the basis of a large number of investigations of the impact of providing pain biology-related information to patients in an interactive manner (see Moseley,⁷ for review), we have been interested in whether shifts in knowledge and catastrophizing can be effected by providing the information in written form. Extensive clinical experience, however, tells us that simply providing a patient with material covering pain biology is usually of limited benefit. This result would be predicted on the basis of a large amount of literature concerning the provision of health-related information in written form only: the major barriers to knowledge transfer are that patients do not find the material interesting, easy to understand, or easy to read.⁸

An alternative strategy that has long been given an important place in understanding and learning is metaphors.^{9,10} Metaphors can be described as “understanding and experiencing one kind of thing in terms of another.”¹¹ Metaphors are often novel or surprising, and emotionally engaging⁹; they can provide a degree of imagination and visualization of abstract ideas and they involve transference of the properties of that idea to the target idea through verbal relating of events.^{9,12} Although metaphors can still be met with resistance, their abstraction from the targeted concept may help reduce cognitive resistance to the concept that is being introduced. Metaphors can provoke contemplation and increase the potential for reorganization of previous meanings.^{13–15}

The cortical mechanisms that are engaged by metaphors are not known, although one might predict that brain structures that are associated with emotion, and which interact extensively with structures associated with learning—memory, attention, and decision making, for example the amygdala—are important.^{16,17} Regardless of the cortical mechanisms, the fact that metaphors are integrated within

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emerging therapies for chronic pain offers some support for their role. For example, metaphors are involved with acceptance and commitment therapy,¹⁸ which has been used for chronic pain for some time, and dialectical-behavioral therapy,¹⁹ which has recently been applied to chronic pain.

This single-blind, randomized-controlled, partial cross-over trial, aimed to determine the cognitive effects and the clinical utility of presenting key concepts about the biology of pain through metaphors. We hypothesized that delivering key concepts of pain biology using metaphors would increase knowledge of the biology of pain and decrease catastrophic thought processes about pain and injury. On the grounds that change in knowledge and pain-related beliefs is larger than, and precedes changes in pain and disability,^{1,20,21} the current study was underpowered and the study period was too short to detect changes in pain and disability.

METHODS

Design

A single-blind randomized-controlled trial with control group crossover and repeated measures (Fig. 1).

Participants

People aged between 18 and 75 years, with pain that had been sufficient to disrupt their activities of daily living for more than the previous 3 months, were eligible. Exclusion criteria included inability to read English, and scheduled to undergo surgery in the next 3 months. Ninety patients randomly selected from the waiting list (n = 140) for multidisciplinary pain management were advised of the project by a telephone call. All were informed that it would not affect their eligibility for the program or their waiting time. Eighty-nine participants were contacted. Eighty-four volunteered. Three were excluded because they had impending surgery and 2 could not read English. Seventy-nine participants entered the study.

Primary Outcome Variables

Pain Biology Questionnaire (PBQ)²²

PBQ included a 19-item questionnaire that has good reliability in patient and nonpatient groups, and 20 true/false items about the biological mechanisms that underpin pain and the changes that occur in the nervous system when pain persists. The higher the PBQ score, the more accurate the participant's understanding of pain biology. The PBQ score increases with pain biology education.¹

Pain Catastrophizing Scale (PCS)²³

PCS included 13 likert items relating to catastrophic thought processes about pain. Higher scores reflect more catastrophic interpretations of pain.

Secondary Outcome Variables

Pain

Participants completed an 11-point numerical rating scale (DRS) where 0 = no pain and 10 = worst pain, in response to this question: "How would you rate your average pain over the last two days?"

Disability

Disability was assessed using the patient-specific functional scale, originally established for use in patients with neck pain,²⁴ but also used in patients with knee pain²⁵ and general pain.²⁶⁻²⁸ Participants selected 5 tasks or activities that they were not able to perform normally because of their pain. They then rated each activity on an 11-point, NRS where 0 = completely unable to perform and 10 = completely able to perform.

Protocol

After volunteering to participate, demographic and clinical data were collected and then volunteers completed the PBQ, PCS, pain, and disability assessments. They were then allocated to 1 of 2 interventions by concealed randomization using a random numbers table. Both interventions were booklets that were given to the patient with the following instructions: "Please read this book. We will phone and email you in three weeks. We will ask you to complete the same questionnaires as you have just completed."

Booklet 1 (Active Treatment): Metaphors and Stories to Help Understand the Biology of Pain²⁹

Booklet 1 consisted of 80 pages divided into 11 sections. Each section was a short story. After each story, there was an interpretation of the story as a metaphor for a key concept in pain biology. In each case, the interpretation was about 150 words long. The concepts are presented as on-line material (Supplementary Table S1, Supplemental Digital Content 1, <http://links.lww.com/CJP/A33>). The readability of the material, according to the Gunning Fog Index,²⁰ was 7, which means that the reading ability required would equate to about 7 years of formal education. The booklet included different types of metaphors and stories, which may engage different cognitive mechanisms. No attempt was made to investigate the processes by which effects occurred.

Booklet 2 (Control): Advice About Managing Pain

Booklet 2 also consisted of 80 pages divided into 11 sections. Each section focused on a key concept in cognitive-behavioral pain management and drew heavily on

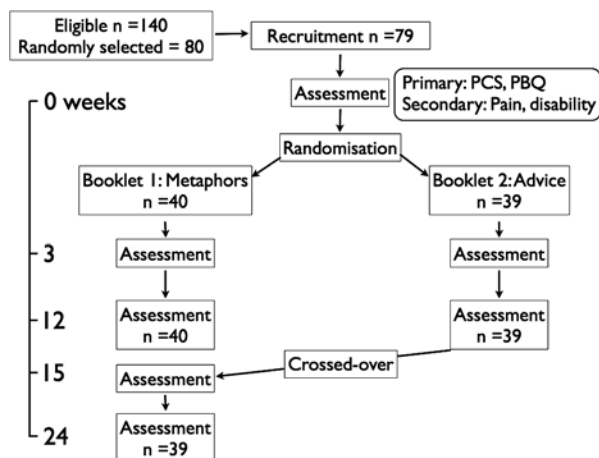


FIGURE 1. Trial plan: primary and secondary assessments were undertaken before concealed randomization. The Advice group was crossed over to the metaphors booklet after the 3-month follow-up. There were no drop-outs or withdrawals. PBQ indicates Pain Biology Questionnaire; PCS, Pain Catastrophizing Scale.

material found in *The Back Book*³⁰ and in *Manage Your Pain*.²¹ It covered general advice about how to deal with chronic pain and introduction to strategies such as pacing and relaxation. It contained no information about the biology of acute or chronic pain. The material was rated as requiring 8 years of education, according to the Gunning Fog Index.²⁰

All participants were emailed after 3 weeks and requested to complete the questionnaires again by a web-link. Participants who had not responded within 3 days were phoned and given the option of mailed questionnaires. This process was repeated 2 months later.

Once all follow-up data were obtained, participants in the Advice group were sent the Metaphors booklet in the post, with this instruction: "Please read this book. We will email and phone you in three weeks. We will ask you to complete the same questionnaires one last time."

All participants were emailed after 3 weeks and asked to complete the questionnaires by a web-link. Those who had not responded in 3 days were phoned and given the option of mailed questionnaires. All data were collated and analyzed by an investigator who was blinded to the group. All procedures were approved by the Institutional Ethics Committee.

Methodological Checks

At the second assessment, participants were asked how many sections of the book they had read. To compare retention of the material, participants were asked a question about each section that, according to their report, they would have read. They were then asked whether they thought they had been allocated to the active treatment or the control treatment.

Analysis

All statistics were undertaken in PASW Statistics 18.0. To test the hypothesis that metaphors would increase knowledge of the biology of pain and decrease catastrophic thought processes about pain and injury, we undertook 2 repeated measures analyses of variance, on PBQ scores and on PCS scores. The within-subjects variable was time (3 levels—initial assessment, 3 wk, and 12 wk). The between-subjects variable was group (Metaphors or Advice). The covariate was years of formal education. We corrected for undertaking 2 primary analysis of variance (ANOVA), by halving our criterion for significance to $\alpha = 0.025$. To verify any effects that were detected between groups using the cross-over data from the Advice group, we undertook a repeated measures ANOVA on the data from the Advice group only: factor time (4 levels—initial assessment, 3 wk, 12 wk, 15 wk). Effect size was calculated using Cohen *d* on mean and standard deviation change in PCS and PBQ.

In secondary, exploratory analyses, we investigated whether the interventions had any effect on pain or disability, using ANOVAs on Pain and Disability measures. Notably, the study was not powered to detect an effect on pain or disability; however, we hoped to gain information on which to base future work. To compare how much of each booklet participants read, we used an analysis of covariance using years of formal education as a cofactor. To compare retention of the material, we undertook a *t* test for independent samples. Finally, to determine whether the amount of the booklet that was read had any effect on the outcome over and above allocation, we undertook a stepwise regression with PCS or PBQ as the dependent

variable and the percentage of booklet read and allocation as independent variables. We did not correct for multiple measures when undertaking the exploratory analyses or the methodological checks.

RESULTS

Forty people (26 females) were randomly allocated to the Metaphors group and 39 people (22 females) to the Advice group. Participant characteristics according to group are presented in Table 1. There were no pretreatment differences in demographic variables between the groups (not significant). The hypothesis that metaphors would increase knowledge of the biology of pain and decrease catastrophic thought processes about pain and injury was tested.

Knowledge About Pain Biology

There was an increase in knowledge about pain biology in the Metaphors group but not in the Advice group [time \times group interaction: $F(2,154) = 46.9$, $P < 0.01$]. In the Metaphors group, the PBQ score moved from 12.1 ± 4.0 at the initial assessment to 17.0 ± 3.1 at the second assessment, and 17.0 ± 3.4 at the 3-month follow-up (effect size Cohen $d = 1.7$). In contrast, in the Advice group, the PBQ score was 13.1 ± 4.6 at the initial assessment, 13.5 ± 4.6 at the second assessment, and 13.5 ± 4.6 at the 3-month follow-up. PBQ scores were no higher overall in the Metaphors group than they were in the Advice group [no main effect of group: $F(1,77) = 5.2$, $P = 0.026$], and although there was a main effect of time [$F(2,154) = 53.7$, $P < 0.01$], this seemed to be a result of the very strong interaction (Fig. 2).

Catastrophic Thoughts About Pain

There was a larger decrease in PCS in the Metaphors group than in the Advice group [time \times group interaction: $F(2,154) = 39.0$, $P < 0.01$]. In the Metaphors group, the PCS score moved from 13.8 ± 4.1 at the initial assessment, to 11.7 ± 3.9 at the second assessment and 10.1 ± 3.0 at the 3-month follow-up. In contrast, in the Advice group, the PCS score was 15.4 ± 5.8 at the initial assessment, 14.4 ± 5.6 at the second assessment, and 14.5 ± 5.5 at the 3-month follow-up (effect size Cohen $d = 0.7$). PCS scores were lower overall in the Metaphor group than they were in the Advice group (main effect of group: $F(1,77) = 7.8$, $P = 0.01$), and lower at the second and third assessments

TABLE 1. Participant Characteristics

	Metaphors n = 40	Advice n = 39
Age (y)	42 \pm 11	45 \pm 11
Duration of pain (months)	25 \pm 19	31 \pm 20
Years formal education	13 \pm 4	12 \pm 5
Not working	60%	72%
Reduced duties and hours	30%	15%
Reduced hours normal duties	10%	13%
Disability compensation	70%	72%
Initial Pain Biology Questionnaire score (/20)	12 \pm 4	13 \pm 5
Initial Pain Catastrophizing score (/39)	14 \pm 4	15 \pm 6
Initial average pain over the last two days (/10)	6 \pm 1	7 \pm 1
Initial patient-specific functional scale (/10)	2 \pm 1	2 \pm 1

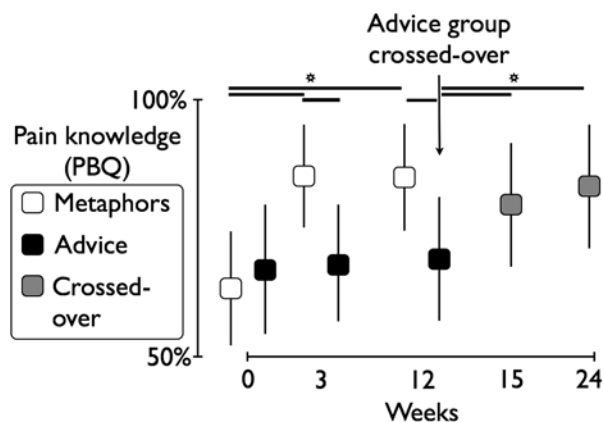


FIGURE 2. Mean (squares) and SD (error bars) scores on the Pain Biology Questionnaire (PBQ) before (0 wk) being given the metaphors booklet (open squares) or an advice booklet (filled squares), and again 3 and 12 weeks later. Pain knowledge was reassessed in the advice group only 3 weeks (15) and 12 weeks (24) after they had been given the metaphors booklet (gray squares). *Significance at $P < 0.025$.

than they were at the first assessment (main effect of time: $F(2,154) = 39.7, P < 0.01$), but these main effects seemed to be a result of the very strong interaction (Fig. 3).

Crossing Over the Advice Group

When the Advice group was crossed over, they demonstrated changes in knowledge about pain biology and in catastrophizing, which were similar to those observed in the Metaphors group. That is, the PBQ score increased to 14.4 ± 4.0 3 weeks after receiving the Metaphors booklet and 16.6 ± 3.4 at 3 months [main effect of time: $F(3,114) = 9.3, P = 0.01$] (Fig. 2). Similarly, the PCS score dropped to 10.0 ± 4.0 three weeks after receiving the Metaphor booklet and 9.9 ± 3.2 at 3 months [main effect of time: $F(3,114) = 31.1, P < 0.01$] (Fig. 3).

Is There any Effect on Pain and Disability?

Secondary analyses revealed that although both groups improved over time [main effect of time: $F(2,154) = 21.5, P < 0.01$], there was no differential effect on pain of

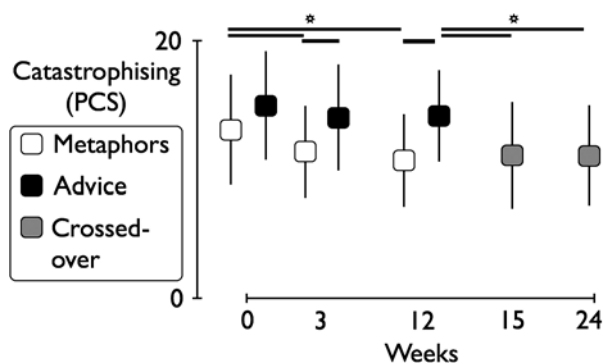


FIGURE 3. Mean (squares) and standard deviation (error bars) scores on the Pain Catastrophizing Scale (PCS) before (0 weeks) being given the metaphors booklet (open squares) or an advice booklet (filled squares), and again 3 and 12 weeks later. Pain knowledge was reassessed in the advice group only 3 weeks (15) and 12 weeks (24) after they had been given the metaphors booklet (gray squares). *Significance at $P < 0.025$.

receiving one booklet over the other (main effect of group, not significant; time \times group interaction, not significant). A similar pattern was observed for disability—both groups improved over time [main effect of time: $F(2,154) = 201.9, P < 0.01$], but there was no differential effect on disability of receiving 1 booklet over the other (main effect of group, not significant; time \times group interaction $P = 0.07$).

Methodological Checks

Thirty-three (83%) of the Metaphors group and 38 (97%) of the Advice group reported that they thought they were allocated to active treatment. On average, the Metaphors group reported that they read $82\% \pm 17\%$ of their booklet. On average, the Advice group reported that they read $47\% \pm 26\%$ of their booklet [$F(2,76) = 4.34, P = 0.04$]. The Metaphors had more correct responses (mean \pm SD = $73\% \pm 19\%$) to the section-specific questions than the Advice group ($43\% \pm 25\%$; $P < 0.01$). Finally, regression on PBQ result at the second assessment was significant ($r^2 = 0.164, P < 0.01$), but percentage of booklet read did not contribute anything over and above treatment allocation ($P = 0.251$). Regression on PCS yielded a similar result, albeit a much weaker relation ($r^2 = 0.07, P = 0.018$; contribution of percentage of booklet read— $P = 0.19$).

DISCUSSION

We hypothesized that metaphors would increase knowledge of the biology of pain and decrease catastrophic thought processes about pain and injury. Our results support the following hypothesis: there was a larger increase in knowledge about the biology of pain and greater reduction in catastrophic pain cognitions in participants who were asked to read the metaphor booklet than in those who were asked to read the advice booklet. At postintervention, the Metaphor group demonstrated higher scores in the PBQ²² and lower scores in the PCS²³ than the Advice group. Moreover, when the Advice group were crossed over to the metaphor booklet, they demonstrated improvements in knowledge about pain biology and catastrophizing that were similar to those first observed in the other group.

Although previous studies have shown that delivery methods such as booklet and face-to-face pain biology education are effective in altering pain beliefs^{31,32} and decreasing catastrophizing,^{1,33} this is the first study that has investigated the utility of metaphor for altering either catastrophizing or pain-related knowledge. Currently, it is recognized that patients who engage less in catastrophic thoughts about pain and who believe they have greater control tend to respond better to treatment.³⁴ Despite this, the variables that are most likely to lead to behavioral change in people with chronic pain remain unclear and require further investigation.³⁴ Given that the majority of data clearly shows that most people in chronic pain conceptualize pain as a measure of tissue damage, our study was designed to directly target both pain-related knowledge and catastrophizing as a precursor to behavioral change. This was based on the assumption that appropriate behavioral advice, for example “move despite pain” and “hurt does not equal harm” may seem irrational to someone who strongly endorses the idea that pain is a measure of tissue damage (see Moseley,³⁵ for review). That the current method induced an important shift in both pain-related knowledge and catastrophizing seems promising in terms of designing interventions that are capable of directly shifting critical conceptualizations about pain and injury.

An important finding from this study is the high percentage of people who reported reading the content of the metaphor and story-based booklet. On average, participants reported reading $82\% \pm 17\%$ of the metaphors booklet but only $47\% \pm 26\%$ of the advice booklet. Moreover, when asked a specific question about each of the sections that the participant had indicated reading, the metaphor and story-based group were substantially more accurate (73% vs. 43%). Whether patients participate in a treatment is clearly important in the treatment's effect; yet this is an often overlooked consideration.³⁶ For example, there may be very strong evidence that a particular analgesic decreases pain, but simply prescribing that analgesic may not decrease pain because the patient does not take it in the appropriate dose or manner. Such a disconnect is well recognized in other fields—the World Health Organization estimates that around 50% of patients with chronic diseases follow prescribed treatment recommendations (see World Health Organisation,³⁷ for review). It is reasonable to suggest that a treatment will only ever be as good as its uptake and our data suggest that the uptake on a metaphors booklet is substantially better than more conventional education material. We therefore contend that rather than confound our results, our pragmatic approach to testing this booklet, by replicating what would happen in the real world, enhances the generalizability of our findings.

This study provides the first evidence that knowledge about pain biology and catastrophic thought processes can be shifted using metaphor and story as a therapeutic intervention. We did not power the study to detect an effect on pain or disability, but our results suggest that reading the metaphor booklet in isolation would probably not be sufficient to lower levels of pain or disability. On the basis of the current thought in conceptual change and learning theory, this is not altogether surprising. We might instead predict that metaphor and story may be best utilized at the initial point of contact to loosen existing concepts, making them more amenable to change,^{38–40} and to pave the way for other more explicit interventions that are known to reduce pain levels and disability in people with chronic pain: for example (1) Cognitive-Behavioral Therapy approaches,^{41,42} (2) face-to-face pain biology education using theoretical explanations and literal and diagrammatic delivery methods,^{1,33} (3) combined physiotherapy and pain biology education approaches,² and (4) graded exposure to sensory discrimination or muscle tasks.⁴³ Although our study does not permit conclusions about whether metaphor and story would improve outcomes of these interventions, it does lend itself to that prediction.

Given the emerging evidence to suggest that understanding the biological processes underpinning pain can improve therapeutic outcomes of other evidence-based treatments,^{2,44} the utility of metaphor as an educational tool to target key biological concepts appears promising. Metaphors and stories have several advantages over explicit education such as instructional booklets and advice. When teaching people about pain biology, the concepts that are presented often threaten or challenge individual's current conceptualization—aneccdotally, clinicians find that hearing the patient respond with “so your saying it is all in my head” is both common and dreadful. The abstraction of metaphors from the target concept may assist in the acceptance and assimilation of new knowledge by reducing cognitive resistance and facilitating conceptual change.³⁸ Moreover, emerging themes from neurobiology indicate a

strong relationship between emotion and cognitive components of memory, attention, and decision making.^{16,17} The fact that metaphors explicitly engage emotional responses⁹ would seem relevant in the potential of metaphors to also engage attention, memory, and learning. In addition, metaphors often require a degree of imagination and are often novel or surprising,^{9,12} thus provoking focused attention and reorganization of previous meanings, a shift that is necessary in conceptual change processes.¹² Importantly, however, it seems possible that, because we used different types of metaphors, they might have involved different mechanisms. We are not able to draw conclusions about the processes that underpin the effect on the basis of the current study, although further investigation appears warranted.

The fact that we used the gold-standard blinded randomized-controlled partial cross-over trial is a clear strength of the current work. Both groups were relatively homogeneous with no identified pretreatment differences. The treatment effect was unlikely to be due to patient expectation: 83% of the Metaphors group, but 97% of the advice group, thought they had been allocated to active treatment. However, the current study also has several limitations. The primary endpoints were self-report measures, which are associated with the potential of reporter bias, although there seems no more dependable method to evaluate knowledge or catastrophizing. In addition, the booklets provided to participants require a reading age of 7 years' education. This clearly limits the generalizability of the results to such a group. Moreover, we did not measure the reading age of participants and it is possible, although we would contend unlikely, that the 2 groups were different in this regard. Still, we would then predict that the crossed over group would not respond to either booklet, which we did not see. Also relevant to the generalizability of our data is that PCS scores were lower than those reported in some previous studies (for example see Sullivan et al⁶), although they were comparable to previous studies using a similar population (for example see Moseley³³). That is, the mean PCS for our sample was about 14, whereas many studies with pain patients report PCS scores closer to 20. Finally, the interventions required people to be able to read and understand written English, which again limits the generalizability of our findings.

In summary, we found that written material that used metaphor to explain key biological concepts increased knowledge of pain biology and decreased catastrophic thought processes about pain and injury when compared with written material that presented biopsychosocial advice for pain management. Our results showed that people are very likely to read much of the material, which is an important although often overlooked consideration. We contend that these results suggest a useful role for metaphor in a therapeutic context. Finally, we suggest that metaphors may have particular utility when used in advance of other evidence-based interventions that target reduction of pain and disability.

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