The relationship of gender to pain, pain behavior, and disability in osteoarthritis patients: the role of catastrophizing

Francis J. Keefe a,*, John C. Lefebvre a, Jennifer R. Egert b, Glenn Affleck c, Michael J. Sullivan d, David S. Caldwell a

a Duke University Medical Center, Durham, NC, USA
b SUNY Syracuse Health Science Center, Syracuse, NY, USA
c University of Connecticut School of Medicine, New Haven, CT, USA
d Dalhousie University, Halifax, NS, Canada

Received 20 August 1999; received in revised form 15 March 2000; accepted 17 March 2000

Abstract

One hundred and sixty-eight patients with osteoarthritis (OA) of the knees participated in this study. Of the participants, 72 were men and 96 were women. All participants completed the Arthritis Impact Measurement Scales (AIMS), underwent a 10 min standardized observation session to assess their pain behavior, and completed the Catastrophizing Scale of the Coping Strategies Questionnaire (CSQ) and the Depression Scale of the Symptom Checklist 90 Revised (SCL-90R). The study found that there were significant differences in pain, pain behavior, and physical disability in men and women having OA. Women had significantly higher levels of pain and physical disability, and exhibited more pain behavior during an observation session than men. Further analyses revealed that catastrophizing mediated the relationship between gender and pain-related outcomes. Once catastrophizing was entered into the analyses, the previously significant effects of gender were no longer found. Interestingly, catastrophizing still mediated the gender–pain relationship even after controlling for depression. These findings underscore the importance of both gender and catastrophizing in understanding the OA pain experience and may have important implications for pain assessment and treatment. © 2000 International Association for the Study of Pain. Published by Elsevier Science B.V. All rights reserved.

Keywords: Gender; Pain behavior; Disability in osteoarthritis patients; Catastrophizing

1. Introduction

Recently, there has been growing interest in gender differences in pain and disability, and heightened recognition of the role that gender can play in influencing the pain experience and treatment response. The National Institutes of Health (NIH), for example, recently issued a request for applications to study sex- and gender-related differences in pain and analgesic response (RFA-DE-97-003). The NIH has also recently sponsored a conference entitled ‘Gender and pain: a focus on how pain impacts women differently than men’ (7 and 8 April 1998, Bethesda, MD).

In a recent influential review of the gender and pain literature, Unruh (1996) identified a number of reasons why one might expect there to be gender differences in the pain experience. First, there are differences in the socialization of men and women with regard to the expression and report of pain. Socialization experiences begin early in childhood and can affect how boys and girls respond to pain. Fearon et al. (1996), for example, observed pre-schoolers and school age children and found that girls were much more likely to react to pain by crying, screaming, or showing anger. Social and cultural norms may lead boys and men to be stoic, minimizing and enduring pain. Indeed, there is evidence that men who score high on a masculinity measure (the Sex Role Inventory; Bem, 1974) have much higher thresholds for experimental pain stimuli (Otto and Dougher, 1985). Second, women and men may differ in their emotional responses to pain. Studies have shown that, when responding to pain, girls and women show more of an emotional response and tend to be more worried and irritated about pain (Unruh, 1996). Finally, expectations regarding social roles may alter how women and men respond to pain. Women often have multiple roles (e.g.
caring for children or older adults, household and work responsibilities) and may attend to pain sooner so as to reduce its impact (Unruh, 1996.)

Osteoarthritis (OA) provides a particularly good model in which to examine the relationship of gender to the pain experience. There are several reasons for this. First, pain is the most common symptom of OA and a major concern of patients and their physicians (Brandt et al., 1998). Second, OA is a very common degenerative disease affecting up to 70% of adults over the age of 65 years (Felson, 1998). Third, women are more likely to report OA pain than men (Davis, 1981; Cooper and Dennison, 1998; Felson, 1998).

Although gender has received some attention in prior studies of OA, most of these studies have focused on the effects of gender on the prevalence or intensity of OA pain (Verbrugge et al., 1991; Brandt and Slemenda, 1993; Cooper and Dennison, 1998; Felson, 1998). There is growing recognition, however, that persistent pain due to chronic diseases such as OA is a complex phenomenon (Turk et al., 1983; Gatchel and Turk, 1996; Robinson et al., 1998). To fully understand the relationship of gender to the OA pain experience, one must not only consider how gender relates to the presence or the intensity of pain, but also how gender relates to pain-related behaviors and physical disability. Individuals who have pain engage in behaviors that serve to communicate their pain to others (Fordyce, 1976). In persons having OA, there may well be gender differences in the display of overt motor behaviors, such as facial grimacing, guarded movement, or rubbing of the painful area, and these gender differences may affect how others perceive and respond to the individual’s pain. There may also be gender differences in the physical disability of persons having OA pain. OA of the knees can be quite disabling due to the fact that the knee joint is involved in so many activities of daily living (e.g. walking, standing, climbing stairs, and transferring from one position to another) (Brandt and Slemenda, 1993). Clinical observations suggest that individuals with OA of the knees vary substantially in their physical disability (Davis, 1981; Keefe et al., 1987; Brandt and Slemenda, 1993), and gender may be important in explaining these variations.

Prior studies of OA also have failed to examine psychological responses to pain that might mediate the relation between gender and OA pain. One response that has been understudied, but that may be particularly important in explaining gender differences, is catastrophizing. Catastrophizing has been defined as an individual’s tendency to focus on and exaggerate the threat value of painful stimuli and negatively evaluate one’s ability to deal with pain (Rosenstiel and Keefe, 1983; Keefe et al., 1989; Sullivan et al., 1995). Several investigations have revealed that women engage in pain catastrophizing to a greater extent than men. A relation between gender and catastrophizing has been observed in both clinical and experimental research, using a variety of assessment instruments. For example, in a sample of patients with musculoskeletal pain, Jensen et al. (1994) reported that women scored higher than men on the catastrophizing subscale of the Coping Strategies Questionnaire (CSQ; Rosenstiel and Keefe, 1983). In two studies using a cold pressor procedure with undergraduate students and varsity athletes, Sullivan et al. (2000a) found that women scored higher than men on the Pain Catastrophizing Scale (PCS; Sullivan et al., 1995). Bedard et al. (1997) examined gender differences in catastrophizing in a sample of junior high school students (grades 7–9). On the basis of cut-off scores on the Pain Coping Questionnaire (Reid et al., 1994, 1998), more young women than men were classified as catastrophizers. The latter finding suggests that gender differences in catastrophizing emerge at a young age. A relation between gender and catastrophizing has been observed even when subjects are not currently experiencing pain. For example, in a survey study of asymptomatic undergraduates, Sullivan et al. (1995) found that women scored higher than men on the total score of the PCS.

To our knowledge, however, no studies have examined whether catastrophizing mediates the relationship of gender to pain-related outcomes in individuals having OA. However, a recent study of pain-free volunteers (Sullivan et al., 2000a) is interesting in that it examined the role of catastrophizing as a mediator of gender differences in response to a laboratory pain stimulus. Participants, 42 female and 38 male pain-free individuals, completed a standardized measure of catastrophizing and were then exposed to an experimental pain procedure in which they immersed their arm in ice water for 1 min. Trained raters observed videotapes of the experimental sessions and rated the pain behaviors exhibited by the participants. Results indicated that women reported more intense pain, showed more pain behavior than men did, and obtained higher scores than men on the catastrophizing measure. Interestingly, when scores on the catastrophizing measure were statistically controlled, gender was no longer a significant predictor of pain and pain behavior. Taken together, these findings suggest that, in pain-free individuals, catastrophizing mediated the relation of gender to the perception of a laboratory pain stimulus.

The primary goal of the current study was to examine the relation of gender to a clinical pain experience (i.e. OA pain). Using pre-treatment data collected from individuals having OA of the knees who had participated in treatment outcome studies conducted in our lab (Keefe et al., 1996, 1999), we conducted analyses designed (1) to examine gender differences in pain, pain behavior, and physical disability in men and women having OA, and (2) to determine whether catastrophizing mediated the relationship of gender to pain, pain behavior, and disability. We hypothesized that higher levels of pain, pain behavior, and physical disability would be found in women versus men and that catastrophizing would mediate the relationship of gender to pain, pain behavior, and physical disability.
2. Methods

2.1. Participants

Data presented in this manuscript were collected as part of a pre-treatment evaluation in two randomized clinical treatment outcome studies conducted in our laboratory. The study sample included 168 married individuals diagnosed as having OA of the knees. The sample included 72 men and 96 women. The mean age of the sample was 61.1 years (SD 10.6) with a mean disease duration of 11.4 years (SD 10.7). All participants were volunteers who were recruited from rheumatology clinics, public posters, and newspaper advertisements. To be included, all participants had to (1) have been diagnosed by a rheumatologist as having OA, (2) have no other arthritic disorder other than OA, and (3) have no other disease that would significantly affect function (e.g. chronic obstructive pulmonary disease).

2.2. Procedure

Measures of pain and physical disability were collected using the Arthritis Impact Measurement Scales (AIMS; Meenan et al., 1980). Pain behavior was assessed using a 10 min standardized observation protocol developed in our laboratory (Keefe and Block, 1982; Keefe and Williams, 1992). Catastrophizing was assessed using the Catastrophizing Scale of the Coping Strategies Questionnaire (CSQ; Rosenstiel and Keefe, 1983). Depression was assessed using the Depression Scale from the SCL-90R (Derogatis, 1983). The rationale for incorporating depression into this study was that the hypothesized relationships between catastrophizing and the pain-related outcomes might be confounded by depression. Depression has been shown to be related to most of the major variables in this study: gender (Affleck et al., 1992), as well as catastrophizing, pain, and pain behavior (Keefe et al., 1986; Sullivan et al., 2000a,b). To assess each participant’s level of depression, we examined their score on the Depression Scale of the SCL-90R (Derogatis, 1983). This scale was chosen from all the scales on the SCL-90R, because one would expect on conceptual and empirical grounds that while they perform a sequence of eight different tasks. These tasks include sitting for a period of 1 min and again for 2 min, standing for a period of 1 min and again for 2 min, reclining for 1 min (repeated twice), and walking for 1 min (repeated twice). The sequence in which the tasks were performed was randomly ordered for each participant. Trained observers watched the videotaped protocol and recorded the occurrence and non-occurrence of five different pain behaviors using ongoing 20 s observation and 10 s recording periods. The pain behaviors recorded were guarding (abnormally slow, stiff, interrupted or rigid movement), active rubbing of the knee(s) (hands moving or holding affected knee(s)), unloading joint (shifting weight from one leg to the other while standing), rigidity (excessive stiffness of the affected knee(s) during activities other than walking), and joint flexion (flexing the affected knee(s) while in a static position). A total pain behavior score was obtained by adding the frequency of occurrence for each of the five pain behaviors. To assess interobserver reliability, two observers independently coded 1/3 of the videotapes. Interobserver reliability was assessed using the $\kappa$-statistic and found to be high (average $\kappa = 0.93$).

2.2.3. Catastrophizing

The tendency to use catastrophizing was assessed using the Catastrophizing Scale from the Coping Strategies Questionnaire (CSQ; Rosenstiel and Keefe, 1983). This scale is composed of six items which assess participants’ negative thoughts related to pain as well as catastrophic thoughts and ideations about pain. Participants are asked to rate the frequency they have these thoughts when they feel pain using a seven-point scale ranging from 0 (never) to 6 (always). The six items on the CSQ Catastrophizing Scale include (1) it is terrible and I feel it is never going to get any better, (2) it is awful and I feel it overwhelms me, (3) I feel my life isn’t worth living, (4) I worry all the time about whether it will end, (5) I feel I can’t stand it anymore, and (6) I feel like I can’t go on. The CSQ Catastrophizing Scale has been shown to have good internal reliability (Rosenstiel and Keefe, 1983) as well as a high degree of stability over time (Keefe et al., 1989). For the current study, a Cronbach $\alpha$ analysis revealed that the scale had good internal reliability ($\alpha = 0.84$).

2.2.4. Depression

The rationale for incorporating depression into this study was that the hypothesized relationships between catastrophizing and the pain-related outcomes might be confounded by depression. Depression has been shown to be related to most of the major variables in this study: gender (Affleck et al., 1992), as well as catastrophizing, pain, and pain behavior (Keefe et al., 1986; Sullivan et al., 2000a,b). To assess each participant’s level of depression, we examined their score on the Depression Scale of the SCL-90R (Derogatis, 1983). This scale was chosen from all the scales on the SCL-90R, because one would expect on conceptual and empirical grounds that...
depression would show the strongest association with gender, catastrophizing, and pain-related outcomes. The SCL-90R Depression Scale is composed of 13 symptoms that reflect a broad range of both cognitive and somatic correlates of depression. Participants are asked to rate the degree of discomfort they have experienced because of the symptom over the past week on a five-point scale from 0 (not at all) to 4 (extremely). In past research, the SCL-90R Depression Scale has been shown to have good internal and test–retest reliability, as well as validity (Derogatis, 1983). For the current study, the depression scale was found to have very good internal reliability with a Cronbach $\alpha$ of 0.88.

2.2.5. Demographic and medical status measures
Each participant was also asked to indicate their age, ethnic background, income, education level, and number of years it has been since they had been diagnosed with osteoarthritis. Each participant also saw a rheumatologist who recorded whether their OA was localized to the knee(s) or was more generalized and whether or not the patient was receiving disability and financial compensation for OA.

3. Results
3.1. Descriptive analyses
Table 1 presents the means and standard deviations for men and women for measures of pain, physical disability, and pain behavior.

A series of one-way analyses of variance was conducted to assess if there were any significant differences between men and women in pain and physical disability. The results of these analyses indicated that there was a significant effect for gender on pain ($F(1,166) = 4.41, P < 0.05$) and physical disability ($F(1,165) = 11.51, P < 0.001$). As can be seen in Fig. 1a,b, women having OA reported higher levels of pain and physical disability compared to men with OA. An additional one-way ANOVA was conducted to assess gender differences in total pain behavior. The results of this analysis of variance showed a significant effect for gender on total pain behavior ($F(1,162) = 5.54, P < 0.05$). As can be seen in Fig. 1c, women with OA displayed more pain behaviors during the pain observation protocol compared to men with OA.

A series of comparisons was conducted to compare males and females on a variety of demographic and medical status measures (Table 2). Analysis of the demographic measures revealed that there were no significant differences in age ($t(166) = 1.81, P = 0.07$), education ($t(156) = -1.49, P = 0.14$), ethnic background ($\chi^2(1) = 0.20, P = 0.64$), or income level ($\chi^2(4) = 5.65, P = 0.23$). In terms of medical status measures, there were no significant differences in disease duration ($t(165) = -0.85, P = 0.40$), or whether the disease was localized or generalized ($\chi^2(1) = 3.32, P = 0.07$). Also, there were no gender differences in the number of patients receiving disability or financial compensation payments because of their osteoarthritis ($\chi^2(2) = 0.66, P = 0.72$).

3.2. Mediational analyses
To examine the hypothesis that catastrophizing mediates the relation between gender and pain intensity, pain behaviors, and physical disability, we followed the structural equation modeling procedure recommended by Holmbeck (1997) for assessing mediation. For these analyses, a latent dependent variable was constructed, with the three pain-related outcomes as indicators. This measurement model fit the data well ($\chi^2 = 0.98, P = 0.32; NFI = 0.98; CFI = 1.00$).

According to Holmbeck (1997), testing the significance of a mediated effect relies on meeting three criteria. First, there needs to be a significant unmediated relationship between gender and the pain-related outcome measures. Second, with the path between gender and the pain-related outcomes set to zero, the paths between gender and catastrophizing and from catastrophizing to the pain-related outcome measures need to be found to be significant. Finally, in order for the demonstration of a mediated effect, the model is then assessed when the path between gender and the pain-related outcomes is no longer set to zero. This third model needs to show that the unmediated path is no longer significantly related to pain-related outcomes.

As is portrayed in Fig. 2, model A, the first criterion for mediation was met; gender was a significant predictor of pain-related outcomes, and this unmediated relation fit the data well ($\chi^2 = 1.70, P = 0.19; NFI = 0.99; CFI = 0.99$).

<table>
<thead>
<tr>
<th>Variable</th>
<th>Sample</th>
<th>Men</th>
<th>Women</th>
<th>Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pain-related outcomes</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>AIMS – pain</td>
<td>5.09 (1.93)</td>
<td>4.74 (1.94)</td>
<td>5.36 (1.88)</td>
<td>0–10.00</td>
</tr>
<tr>
<td>AIMS – physical disability</td>
<td>1.74 (0.98)</td>
<td>1.45 (0.87)</td>
<td>1.95 (1.00)</td>
<td>0–5.63</td>
</tr>
<tr>
<td>Total pain behavior</td>
<td>8.40 (5.76)</td>
<td>7.22 (4.91)</td>
<td>9.33 (6.21)</td>
<td>0–29</td>
</tr>
<tr>
<td>Catastrophizing</td>
<td>5.34 (6.31)</td>
<td>3.08 (4.48)</td>
<td>7.01 (6.95)</td>
<td>0–29</td>
</tr>
<tr>
<td>Depression</td>
<td>0.53 (0.48)</td>
<td>0.42 (0.41)</td>
<td>0.61 (0.52)</td>
<td>0–2.54</td>
</tr>
</tbody>
</table>
A test of the mediational model, as depicted in Fig. 2, model B, met the second criterion for mediation. With the path between gender and pain-related outcomes set to zero, the paths between gender and catastrophizing and between catastrophizing and pain-related outcomes were statistically significant, and this model also fit the data well ($\chi^2 = 3.39, P = 0.34; \text{NFI} = 0.98; \text{CFI} = 1.00$). The third step in demonstrating mediation fit a model in which the path was freed between gender and pain-related outcomes (see Fig. 2, model C). Because the mediational paths remained significant, the path between gender and pain-related outcomes was not significant, and model C did not fit the data better than model B (the $\chi^2$ difference was 0.10, $P = 0.82$), the third criterion for mediation was also met.

3.3. Mediational analyses: impact of controlling for depression

We then proceeded to test for mediation while adjusting for the possible confounding effects of depression on the relations between gender, catastrophizing, and pain-related outcomes. This was accomplished by modifying path diagrams B and C in Fig. 2 to model the covariance between gender and depression and by freeing paths between depression and catastrophizing and between depression and pain-related outcomes. Even under these stricter conditions, the three criteria for mediation were still fulfilled. As is portrayed in Fig. 3, model A, the first criterion for mediation was met; gender was a significant predictor of pain-related outcomes, and this unmediated relation fit the data well ($\chi^2 = 1.70, P = 0.19; \text{NFI} = 0.99; \text{CFI} = 0.99$). A test of the depression-adjusted mediational model, as depicted in Fig. 3, model B, met the second criterion for mediation. With the path between gender and pain-related outcomes set to zero, the paths between gender and catastrophizing and between catastrophizing and pain-related outcomes were statistically significant, and this model also fit the data well ($\chi^2 = 5.70, P = 0.46; \text{NFI} = 0.97; \text{CFI} = 1.00$). The third step in demonstrating mediation fit a depression-adjusted model in which the path was freed between gender and pain-related outcomes (see Fig. 3, model C). Once again, because the mediational paths remained significant, the path between gender and pain-related outcomes was not significant, and model C did not fit the data better than model B (the $\chi^2$ difference was 1.77, $P = 0.18$), the third criterion for mediation was also met. Hence, the results
suggest that catastrophizing mediates the relationship of gender to pain and pain-related outcomes, and this mediation is not due to variance shared with depression.

4. Discussion

This study found that there were significant gender differences in pain, pain behavior, and physical disability between men and women having OA. Women had significantly higher levels of OA pain and physical disability, and exhibited more pain behavior during an observation session compared to men. Furthermore, catastrophizing appeared to mediate the relationship between gender and OA pain-related outcomes. Interestingly, this study also found that the effects of catastrophizing continued to mediate the gender–pain relationship even after controlling for depression. The present study found that women having OA of the knees reported significantly more pain than men having OA. This finding agrees with prior epidemiological studies of

![Diagram](image)

Fig. 2. (A–C) Structural equation models testing the mediational role of catastrophizing in the relation between gender and pain. Path coefficients with asterisks are significant at $P < 0.05$. 

<table>
<thead>
<tr>
<th>Variable</th>
<th>Sample</th>
<th>Men</th>
<th>Women</th>
<th>Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gender</td>
<td>168</td>
<td>72</td>
<td>96</td>
<td></td>
</tr>
<tr>
<td>Age (years)</td>
<td>60.88 (10.75)</td>
<td>62.60 (10.90)</td>
<td>59.58 (10.52)</td>
<td>27–83</td>
</tr>
<tr>
<td>Years of education</td>
<td>14.88 (3.09)</td>
<td>15.29 (3.72)</td>
<td>14.55 (2.47)</td>
<td>2–25</td>
</tr>
<tr>
<td>Duration of disease (years)</td>
<td>11.45 (10.69)</td>
<td>10.63 (9.01)</td>
<td>12.05 (11.78)</td>
<td>0.25–75</td>
</tr>
<tr>
<td>Ethnicity</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Caucasian</td>
<td>156</td>
<td>68</td>
<td>88</td>
<td></td>
</tr>
<tr>
<td>Other</td>
<td>11</td>
<td>4</td>
<td>7</td>
<td></td>
</tr>
<tr>
<td>Missing</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Income ($)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5000–10000</td>
<td>3</td>
<td>2</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>10000–15000</td>
<td>8</td>
<td>2</td>
<td>6</td>
<td></td>
</tr>
<tr>
<td>15000–20000</td>
<td>7</td>
<td>5</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>20000–25000</td>
<td>12</td>
<td>3</td>
<td>9</td>
<td></td>
</tr>
<tr>
<td>&gt;25000</td>
<td>127</td>
<td>55</td>
<td>72</td>
<td></td>
</tr>
<tr>
<td>Missing</td>
<td>11</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Disease distribution</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Localized</td>
<td>75</td>
<td>28</td>
<td>47</td>
<td></td>
</tr>
<tr>
<td>Generalized</td>
<td>81</td>
<td>42</td>
<td>39</td>
<td></td>
</tr>
<tr>
<td>Missing</td>
<td>12</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Disability/financial compensation payments</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>None</td>
<td>159</td>
<td>67</td>
<td>92</td>
<td></td>
</tr>
<tr>
<td>Pending</td>
<td>2</td>
<td>1</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Receiving</td>
<td>7</td>
<td>4</td>
<td>3</td>
<td></td>
</tr>
</tbody>
</table>
OA (Davis, 1981; Cooper and Dennison, 1998; Felson, 1998), as well as the results of prior research on other pain-related conditions such as migraine headache and musculoskeletal pain (Anderson et al., 1993; Hasvold and Johnsen, 1993; Rasmussen, 1993; Rasmussen and Brslau, 1993). Taken together, these findings suggest that women who have chronically painful conditions are likely to report heightened pain compared to men.

Interestingly, the present study found that gender differences were not only evident in reports of OA pain, but also in overt pain behavior. Women in this study were much more likely to exhibit pain behaviors such as guarded movement, rubbing and flexing of the knee(s), and joint rigidity. These pain behaviors are potentially quite important from the standpoint of social communication. The results of this study suggest that women having OA engage in behaviors that signal pain more often than men do. Although pain behaviors such as excessively guarded movement may be maladaptive (increased tension may increase pain), they may also provide a means of eliciting needed help from significant others, such as a spouse or family member. Future research needs to examine OA patient–spouse interaction patterns to examine gender differences in the display of pain behavior and gender differences in the spouse’s responses to pain behavior.

Cognitive behavioral theorists have argued that, although some individuals may respond to pain by catastrophizing, others do not (Turk et al., 1983; Sullivan and D’Eon, 1990; Sullivan et al., 2000a,b). In fact, one of the major arguments for studying catastrophizing is that it might help explain why, when challenged by an equivalent level of pain, some individuals have much more emotional distress and physical disability. That catastrophizing mediated the effects of gender on OA pain-related outcomes suggests that women may experience higher levels of OA pain than men because they are more likely to respond to pain by catastrophizing.

Why are women more likely than men to catastrophize in response to OA pain? Social learning models have been invoked to account for the development of catastrophizing. It has been suggested that as a function of negative experiences involving pain, some individuals may develop pain schema which lead them to be excessively vigilant to pain-related stimuli, to focus excessively on pain sensations, and to expect that aversive stimuli will result in experiences of heightened pain (Turk and Rudy, 1992; Sullivan et al., 1997). There are indications that gender differences in catastrophizing may emerge at a young age. Bedard et al. (1997) surveyed a large sample of high school students on how they managed everyday pain (e.g. headaches, stomach, muscle and joint pain, etc). Catastrophizing was associated with a higher frequency of pain episodes, and more intense pain experience. Catastrophizers were also more likely to self-medicate to control their pain. Consistent with literature on adult populations, girls catastrophized more than boys. Since the study of catastrophizing has relied primarily on self-report, studies with young children have not been conducted. Nevertheless, there are indications that pain responses may be socialized differently in boys and girls, favoring the development of a catastrophic style in girls (Bedard et al., 1997). In an observational study of daycare children, Fearon et al. (1996) reported that while male and female children did not differ in the rate or severity of pain-causing incidents, female children expressed more intense distress than male children in response to pain. Of interest is that adult caregivers were also more likely to respond differentially to male and female children, providing more physical comfort to female children who were expressing

---

**Fig. 3.** (A–C) Structural equation models testing the depression-adjusted mediating role of catastrophizing in the relation between gender and pain. Path coefficients with asterisks are significant at $P < 0.05$. 

(A) Gender $\rightarrow$ Pain-related Outcomes

(B) Gender $\rightarrow$ Catastrophizing $\rightarrow$ Pain-related Outcomes

(C) Gender $\rightarrow$ Catastrophizing $\rightarrow$ Pain-related Outcomes
distress. The increased attention females receive during painful situations may form the basis for the development of a more ‘catastrophic’ orientation to pain, and a preference for coping with distress within a social or communal context. Although the ability to solicit support from caregivers may initially have stress reducing properties, the ensuing development of a catastrophic cognitive style may unfortunately increase the aversive nature of subsequent pain experiences.

The fact that catastrophizing mediated gender–pain relationships even after controlling for depression is interesting for several reasons. First, this finding suggests that there may be unique effects of catastrophizing that are not explained by depression. Catastrophizing is sometimes viewed simply as a byproduct of depression (Sullivan and D’Eon, 1990). Our results suggest that there is something distinct about catastrophizing that is not explained by self-reports of depression. Second, gender differences in depression did not obscure the important effects of catastrophizing as a mediator of gender–pain relationships. These results suggest that it is the unique variance of catastrophizing (apart from the shared variance with depression) that may mediate the observed gender differences in OA pain, pain behavior, and physical disability. Third, interventions (e.g. pharmacological treatments) focused solely on the treatment of depression, without attention to catastrophizing, may not be sufficient. In fact, an interesting direction for future research would be to examine how interventions aimed at reducing catastrophizing influence depression and pain.

The results of this study may have important implications for the management of pain. First, clinicians need to recognize that there may be important gender differences in the experience of pain, the display of pain behaviors, and physical disability in OA patients. One might need to be aware that interventions have somewhat different effects on pain and pain-related outcomes if one is treating men versus women having OA. For example, given that we found that women are more likely to catastrophize than men, it is possible that interventions designed to reduce catastrophizing, such as cognitive restructuring (Beck et al., 1979), may have a greater impact on decreasing pain, pain behavior, and physical disability in women than in men suffering from OA. On the other hand, one could argue that cognitive restructuring may be particularly appropriate for men who catastrophize, since this response to OA pain seems to be gender-atypical. Further research is needed to determine whether cognitive restructuring or other cognitive therapy interventions have differential effects on men and women having OA pain. At this point, it is reasonable to propose that these interventions are most likely to have a greater impact on OA patients who catastrophize, whether they are men or women (we would like to thank the anonymous reviewer for his/her suggestions regarding the possible differential effects of cognitive restructuring and cognitive therapy interventions in men and women having osteoarthritis).

Second, studies of coping skills training interventions have shown that improvements in psychological variables related to catastrophizing (e.g. one’s sense of control over pain and self-efficacy) are associated with short- and long-term reductions in pain in patients suffering from arthritis (Parker et al., 1988; Keefe et al., 1990a,b). An important direction for future research is examining whether cognitive-behavioral protocols that are specifically designed to help patients identify and alter catastrophizing are more effective in reducing OA pain than more conventional cognitive-behavioral pain management protocols that provide training in a wide range of coping skills.

Before intervening, however, clinicians need to consider the social context of catastrophizing and OA pain. In some circumstances, catastrophizing may have important and potentially desirable interpersonal consequences. As discussed above, women and/or men who catastrophize may be signaling their distress to others and seeking help in coping with pain. These individuals may prefer an interpersonal approach to coping and catastrophizing may play an important role in communicating their need for assistance. In such circumstances, an interpersonal approach to pain management, such as spouse-assisted coping skills training (Keefe et al., 1996), may be particularly helpful in understanding the role of catastrophizing and developing alternative interpersonal approaches to pain control.

The current study had several limitations. First, all of the participants in this study had volunteered for a behaviorally-oriented treatment outcome study. It is possible that selection factors might have influenced their participation in the study. Patients, for example, might have chosen to participate because they hoped to receive treatment. Alternatively, health care professionals might have referred patients who they thought might be having problems coping with pain (e.g. who might have been catastrophizing) and thus benefit from the treatment program. We should point out that the potential for selection bias is not unique to this study and, in fact, is inherent in any treatment outcome study that recruits participants through a process of informed consent. Additional research is needed to determine whether the findings obtained in the current sample can be generalized to other samples of individuals having osteoarthritis.

Second, the level of pain and disability experienced by this sample of patients was in the moderate range. Thus, our findings may not generalize to individuals who report higher levels of pain and disability (e.g. patients typically seen in specialized pain clinics or pain management programs). Patients who are severely disabled by pain are particularly prone to have high levels of pain behavior, psychological disability, and physical disability (Keefe et al., 1989). It is possible that gender may have less of an effect on pain and pain-related outcomes in such highly disabled populations compared to the population examined in the current study. Future studies need to examine the degree to which our findings regarding gender and OA pain are generalizable to other populations of individuals suffering from persistent pain.
Third, our findings are correlational in nature; thus, causality can not be determined between catastrophizing and pain. Catastrophizing may produce higher levels of pain or be a consequence of severe pain. There are both conceptual and empirical reasons, however, to argue that catastrophizing and pain are separate, but related constructs. Conceptually, catastrophizing refers to a tendency to ruminate, magnify, or feel helpless about pain. As one would predict, there is a moderate correlation between catastrophizing and pain (Keefe et al., 1989). More importantly, however, several studies have shown that when there are controls for pain, catastrophizing still explains important outcomes. For example, there are longitudinal data showing that when one controls for the initial pain level, catastrophizing still predicts subsequent increases in pain (Keefe et al., 1989). In addition, Affleck et al. (1992), in a study of rheumatoid arthritis patients, found that catastrophizing predicted emotional distress even after controlling for pain intensity. Furthermore, in a study examining the degree to which catastrophizing, state anxiety, and trait anxiety predicted disability, Sullivan et al. (1998) found that only catastrophizing predicted unique variance in disability and that it still predicted a significant proportion of variance when the current level of pain was controlled for statistically. Thus, catastrophizing has been shown to predict future pain, emotional distress, and disability after controlling for current levels of pain intensity. If catastrophizing was indistinguishable from pain, the effect of controlling for current pain should have made the contribution of catastrophizing statistically non-significant.

Future studies also need to explore how gender differences influence pain-related biological processes. Current theorizing suggests that catastrophizing may exert effects on pain perception by altering the processing of pain signals. According to the Gate Control Theory of Pain (Melzack and Wall, 1984), centers in the brain exert a powerful influence over pain perception by providing input to a spinal gating mechanism. Activity in the brain may open the gating mechanism and increase pain or close the gating mechanism and decrease pain. Thus, gender differences in catastrophizing may influence the transmission of pain by altering the transmission of pain signals at the spinal cord level. Research could be carried out to examine the relation of gender differences in catastrophizing to measures of descending (brain) control over pain transmission. The nociception reflex response provides an non-invasive measure of descending control over pain and we are currently conducting studies in OA patients to examine how this measure relates to gender differences in catastrophizing (we would like to thank Christopher R. France, PhD, for his comments and suggestions on this matter) (Page and France, 1997).

In sum, the results of the present study suggest that there are significant gender differences in pain, pain behavior, and physical disability. Our findings also suggest that catastrophizing may mediate the relationship of gender to pain, pain behavior, and physical disability in this population. These findings underscore the importance of both gender and catastrophizing in understanding the OA pain experience and may have important implications for pain assessment and treatment.

Acknowledgements

Supported by grants from the National Institute of Arthritis and Musculoskeletal and Skin Diseases (AR 35270 and AR 46305).

References


Deroogatis LR. SCL–90R: administration, scoring, and procedures manual II, Towson, MD: Clinical Psychology Research, 1983.


