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Catastrophic thinking and increased risk for prescription opioid misuse in patients with chronic pain

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Abstract

Background—As a consequence of the substantial rise in the prescription of opioids for the treatment of chronic noncancer pain, greater attention has been paid to the factors that may be associated with an increased risk for prescription opioid misuse. Recently, a growing number of studies have shown that patients with high levels of catastrophizing are at increased risk for prescription opioid misuse.

Objective—The primary objective of this study was to examine the variables that might underlie the association between catastrophizing and risk for prescription opioid misuse in patients with chronic pain.

Methods—Patients with chronic musculoskeletal pain (n = 115) were asked to complete the SOAPP-R, a validated self-report questionnaire designed to identify patients at risk for prescription opioid misuse. Patients were also asked to complete self-report measures of pain intensity, catastrophizing, anxiety, and depression.

Results—Consistent with previous research, we found that catastrophizing was associated with an increased risk for prescription opioid misuse. Results also revealed that the association between catastrophizing and risk for opioid misuse was partially mediated by patients' levels of anxiety. Follow-up analyses, however, indicated that catastrophizing remained a significant 'unique' predictor of risk for opioid misuse even when controlling for patients' levels of pain severity, anxiety and depressive symptoms.

Discussion—Discussion addresses the factors that might place patients with high levels of catastrophizing at increased risk for prescription opioid misuse. The implications of our findings for the management of patients considered for opioid therapy are also discussed.

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Contributors

RR Edwards designed the study. MO Martel conducted statistical analyses, interpreted study data, and wrote the major part of the manuscript. RR Edwards, AD Wasan, and RN Jamison all contributed to data interpretation. They also contributed and approved the final manuscript.

Conflict of Interest

The authors have no financial interests in the results of this research, and all authors declare that they have no conflicts of interest.

Keywords

Prescription opioid misuse; catastrophizing; anxiety; depression; chronic pain

1. INTRODUCTION

Over the past decade, there has been a substantial rise in the use of opioids for the treatment of chronic noncancer pain. Despite the potential benefits of opioid therapy, long-term opioid use may lead to a number of adverse outcomes, including prescription opioid misuse and addiction (Ballantyne, 2010; Banta-Green et al., 2009a; Compton et al., 2008; Edlund, 2011; Jamison et al., 2010; Morasco et al., 2013; Sullivan et al., 2010). Prescription opioid misuse, which broadly refers to the use of opioids in a manner other than prescribed, has become a significant concern for clinicians prescribing opioids (Banta-Green et al., 2009b; Compton et al., 2008; Jamison et al., 2011; Sehgal et al., 2012). Because of these concerns, many investigators have turned their attention to the factors that may be associated with an increased risk for prescription opioid misuse in patients with chronic pain.

A number of demographic and background variables have been found to be associated with an increased risk for prescription opioid misuse in patients with chronic pain, including young age and history of substance abuse (Edlund et al., 2007a; Michna et al., 2004; Ives et al., 2006; Morasco et al., 2008, 2013; Schieffer et al., 2005). Pain-related variables, such as self-reports of pain severity, have also been found to be associated with an increased risk for prescription opioid misuse, with patients reporting high levels of pain being at greater risk for opioid misuse than patients reporting low levels of pain (Adams et al., 2004; Grattan et al., 2012; Jamison et al., 2009; Morasco et al., 2013). In a recent study, it has also been found that patients with high levels of experimental pain sensitivity (i.e., hyperalgesic patients) are at greater risk for prescription opioid misuse than patients with low levels of pain sensitivity (Edwards et al., 2011a).

Associations have also been found between psychological factors and risk for prescription opioid misuse. For example, several studies have found that patients with psychiatric disorders are at greater risk for prescription opioid misuse (Dersh et al., 2008; Grattan et al., 2012; Turk et al., 2008; Wasan et al., 2007). Patients scoring high on measures of negative affect such as anxiety (Edlund et al., 2007b; Morasco et al., 2013; Schieffer et al., 2005; Wasan et al., 2007; Wilsey et al., 2008) and depression (Edlund et al., 2007a; Grattan et al., 2012; Morasco et al., 2013; Wasan et al., 2007) have also been found to be at increased risk for prescription opioid misuse. Finally, an increasing number of studies have shown that patients high in pain catastrophizing, a negative and pessimistic orientation toward pain, are at increased risk for prescription opioid misuse (Edwards et al., 2011a; Ferrari et al., 2012; Jamison et al., 2009; Morasco et al., 2013). Patients who are high in catastrophizing tend to ruminate about pain, to magnify the threat value of pain, and to experience feelings of helplessness when in pain (Edwards et al., 2006; Keefe et al., 2000; Sullivan et al., 2001). In a recent study conducted among patients with chronic pain, Morasco et al. (2013) found that pain catastrophizing was associated with an increased risk for prescription opioid misuse even after controlling for patients' demographic variables, substance use disorder (SUD) status, and depressive symptoms.

To date, little is known on the specific mechanisms by which catastrophizing may lead to an increased risk for prescription opioid misuse. One possibility is that patients with high levels of catastrophizing are at increased risk for prescription opioid misuse because they experience high levels of clinical pain. Another possibility is that patients with high levels of catastrophizing are at increased risk for prescription opioid misuse due to heightened basal

pain sensitivity, or alterations in central pain processing. Finally, it is possible that high catastrophizers are at increased risk for prescription opioid misuse due to high levels of negative affect. Past research has shown that catastrophizing is associated with heightened levels of pain severity (for a review, see Sullivan et al., 2001), pain sensitivity (for a review, see Quartana et al., 2009), and negative affect (for a review, see Edwards et al., 2011b).

The primary purpose of the present study was to examine the mechanisms that might underlie the association between catastrophizing and risk for prescription opioid misuse in patients with chronic pain. In this study, a sample of patients with chronic musculoskeletal pain were asked to complete the SOAPP-R (Butler et al., 2008), a self-report questionnaire designed to identify patients at risk for prescription opioid misuse. Analyses examined the potential role of patients' pain severity, pain sensitivity, and negative affect as mediators of the association between catastrophizing and risk for prescription opioid misuse. Follow-up analyses examined the unique (i.e, independent) influence of catastrophizing on risk for prescription opioid misuse.

2. METHODS

2.1. Participants

Participants were 115 patients recruited from the Pain Management Center at Brigham and Women's Hospital (BWH). Patients with a diagnosis of spinal pain, with or without radicular symptoms, and who had been experiencing pain for at least 6 months were invited to participate. Patients were excluded if they had a diagnosis of cancer or other malignant disease, or had cognitive limitations that precluded providing self-report data. Patients were also excluded if they had any active substance use disorder (SUD). Patients with an active SUD were excluded given current clinical practice guidelines and principles at the BWH Pain Center regarding the management of patients with an active SUD. Patients with an active SUD are generally referred to a local addiction treatment facility before undergoing pain treatment at the Pain Center, and before being eligible for study participation.

2.2. Procedure and measures

All procedures were approved by the Partners Institutional Review Board at BWH. Upon arrival at the laboratory, participants signed a consent form, provided demographic information, and reported whether or not they were currently taking any prescription opioid medication. Patients' reports of medication were verified by a research assistant after the study session using the electronic medical record system. In addition to providing demographic and medication use information, participants were asked to complete self-report questionnaires (see below) prior to undergoing a series of standardized psychophysical pain testing procedures.

2.2.1. Screener and Opioid Assessment for Patients with Pain-Revised—The SOAPP-R (Butler et al., 2008) is a 24-item screening questionnaire validated for patients with chronic pain, and designed to assess patients' risk for prescription opioid misuse. SOAPP-R items are rated from 0 (never) to 4 (very often) (e.g., *How often have you felt consumed by the need to get pain medication?*). The SOAPP-R has been shown to have good reliability and predictive validity. The SOAPP-R has been shown to be a significant predictor of prescription opioid misuse outcomes derived on the basis of other instruments, such as the Prescription Drug Use Questionnaire (PDUQ) and the Prescription Opioid Therapy Questionnaire (POTQ) (Butler et al., 2008, 2009). Multi-center prospective studies have also shown that the SOAPP-R is a significant predictor of patients who will actually turn out to misuse opioid medication, as measured by physicians' ratings of opioid misuse or by urine toxicology screens (Akbik et al., 2006; Butler et al., 2004, 2008, 2009).

2.2.2. Brief Pain Inventory—The Brief Pain Inventory (BPI; Tan et al., 2004) was used as a measure of pain severity associated with patients' musculoskeletal pain condition. On the BPI, patients are asked to rate their current level of pain on a numeric rating scale (NRS) with the endpoints 0 (no pain) and 10 (extreme pain). Patients are also asked to rate the degree to which pain interferes with their physical and emotional functioning on a NRS, with the endpoints 0 (does not interfere) and 10 (completely interferes). The BPI has been shown to be a reliable and valid measure of pain severity and pain interference among patients with chronic pain (Jamison et al., 2009; Tan et al., 2004; Wasan et al., 2009).

2.2.3. Pain Anxiety Symptoms Scale—The Pain Anxiety Symptoms Scale (PASS; McCracken et al., 2002) was used as a measure of pain-related anxiety. The PASS is a 20-item self-report questionnaire in which participants make ratings about anxiety on a six-point Likert scale ranging from 0 (never) to 5 (always). The PASS has been shown to be a reliable and valid measure of pain-related anxiety in patients with chronic pain (McCracken et al., 1992, 2002; Roelofs et al., 2004).

2.2.4. Beck Depression Inventory—The Beck Depression Inventory (BDI-II; Beck et al., 1996) was used as a measure of depressive symptomatology. The BDI consists of 21 items describing various symptoms of depression, and respondents choose statements that describe how they have been feeling over the past two weeks. Responses are summed to yield an overall index of depressive symptoms. The BDI has been shown to be a reliable and valid index of depressive symptoms in patients with pain (Poole et al., 2006; Sullivan et al., 2003; Vowles et al., 2004).

2.2.5. Pain Catastrophizing Scale—The Pain Catastrophizing Scale (PCS; Sullivan et al., 1995) was used as a measure of catastrophic thinking about pain. The PCS contains 13 items describing different thoughts and feelings that individuals may experience when they are in pain. Participants are asked to reflect on past painful experiences and to indicate the degree to which they experienced each of 13 thoughts or feelings when experiencing pain, on a 5-point scale from (0) not at all to (4) all the time. Responses are summed, and higher scores reflect higher levels of pain catastrophizing. Several studies in patients with pain have supported the reliability and the validity of the PCS as a measure of catastrophic thinking (Edwards et al., 2006; Keefe et al., 2003; Peters et al., 2005; Sullivan et al., 2001). In patients with pain, high scores on the PCS have been found to be associated with a wide range of negative pain-related outcomes, including heightened pain severity (Edwards et al., 2006; Sullivan et al., 2001), post-surgical pain intensity (Khan et al., 2009; Sullivan et al., 2009), and pain-related disability (Edwards et al., 2011b; Keefe et al., 2000; Sullivan et al., 2001).

2.2.6. Pain sensitivity—Pain sensitivity was assessed using quantitative sensory testing (QST). In the laboratory, QST typically involves the administration of calibrated noxious stimuli and the assessment of participants' pain responses using a visual analogue scale (VAS). QST methods are commonly used to assess inter-individual differences in somatosensory function and pain sensitivity (Arendt-Nielsen et al., 2009; Edwards et al., 2005a; Fillingim and Lautenbacher, 2004; Greenspan et al., 2011; Yarnitsky and Pud, 2004).

During the QST session, patients were seated comfortably in a reclining chair for approximately 30 minutes while they underwent brief thermal pain threshold assessment. Thermal stimuli were delivered using a contact thermode (Medoc Advanced Medical Systems, Ramat Yishai, Israel). Thermal assessment included sampling of warmth and cool thresholds, followed by heat pain thresholds (HPThs) and cold pain thresholds (CPThs). Consistent with previous studies (Edwards et al., 2008, 2011a; Fillingim et al., 2004),

thermal stimuli were delivered on the ventral forearm using an ascending method of limits, with a rate of temperature change of .5°C/Sec. Patients were instructed to verbally report when the thermal stimulus first became painful (i.e., pain threshold). Patients' pain thresholds were recorded by the experimenter, who was sat next to patients throughout the QST session.

2.3. Data reduction and analysis

Descriptive data for continuous variables were analyzed using Independent samples t-tests, and descriptive data for categorical variables were analyzed using chi-square tests.

For the purposes of the present study, thermal pain thresholds (TPThs) were used as an index of pain sensitivity. To create this index, HPThs and CPThs were standardized to produce a normal distribution, and CPThs were reversed because CPThs and HPThs are opposite in their directionality (i.e., lower HPThs represent greater pain sensitivity, and higher CPThs represent greater pain sensitivity). CPThs and HPThs were then averaged to derive a composite index of thermal pain thresholds (TPThs), with lower scores on this index reflecting greater pain sensitivity (Diatchenko et al., 2005; Edwards et al., 2011a).

Associations between measures of pain severity (BPI), pain sensitivity (TPThs), negative affect (PASS, BDI), catastrophizing (PCS), and risk for opioid misuse (SOAPP-R) were assessed using Pearson correlations. The potential mediators of the association between catastrophizing and risk for opioid misuse were examined based on the procedure described by Baron and Kenny (1986). First, variables that showed significant zero-order correlations, both with the PCS and SOAPP-R, were considered as potential mediators. A series of multiple regression analyses were then conducted to determine whether preconditions for mediation were met, separately for each potential mediator. When preconditions for mediation were met, a hierarchichal multiple regression analysis and a Sobel test were conducted to test the significance of the mediation effect. Mediation was supported if the association between the predictor (i.e., PCS) and the dependent variable (i.e., SOAPP-R) was no longer significant after controlling for the potential mediator (full mediation), or if the association between PCS and SOAPP-R was significantly decreased (partial mediation). Following these mediational analyses, a hierarchical multiple regression analysis was conducted to examine the unique (i.e, independent) influence of catastrophizing on risk for opioid misuse (SOAPP-R).

3. RESULTS

3.1. Descriptive statistics

Descriptive statistics for all study measures are presented in Table 1, separately for men and women. Analyses revealed no significant sex differences in age, self-reported pain severity (BPI), pain interference (BPI), pain sensitivity (TPThs), pain-related anxiety (PASS), depression (BDI), catastrophizing (PCS), or risk for prescription opioid misuse (SOAPP-R) (all p's > .05). Men and women did not differ significantly in the use of opioids, X^2 (1) = . 38, ns.

Independent samples t-tests were conducted to examine differences between patients who were taking opioids and patients who were not taking opioids on study variables. Results indicated that patients who were taking opioids reported significantly higher levels of pain than patients who were not taking opioids, $t(113) = -2.9$, $p < .05$. These two groups, however, did not differ significantly on any other study variable (i.e., age, TPThs, BPI, PASS, BDI, PCS, SOAPP-R) (all p's > .05).

3.2. Correlations among measures

Table 2 shows the correlations between measures of pain severity (BPI), pain sensitivity (TPThs), negative affect (PASS, BDI), and catastrophizing (PCS). The BPI was significantly correlated with the PASS ($r = .43$, $p < .01$), BDI ($r = .39$, $p < .01$), and PCS ($r = .55$, $p < .01$). Significant inter-correlations were also found between the PASS, BDI, and PCS (all p's < .01).

Correlational analyses revealed a significant negative correlation between thermal pain thresholds (TPThs) and the PCS ($r = -.19$, $p < .05$). In other words, higher TPThs were associated with lower levels of catastrophizing. TPThs were not significantly correlated with the BPI, PASS or BDI.

Table 2 also shows the correlations between measures of pain, negative affect, and risk for opioid misuse (SOAPP-R). Analyses revealed a significant positive correlation between the BPI and SOAPP-R ($r = .19$, $p < .05$), and a significant negative correlation between TPThs and the SOAPP-R ($r = -.19$, $p < .05$). The SOAPP-R was significantly correlated with the PASS ($r = .44$, $p < .01$), BDI ($r = .34$, $p < .01$), and PCS ($r = .45$, $p < .01$).

3.3. Mediators of the association between catastrophizing and risk for opioid misuse

The potential mediating role of pain severity (BPI), pain sensitivity (TPThs), negative affect (PASS, BDI) in the association between catastrophizing and risk for opioid misuse was examined using a series of hierarchical multiple regression analyses, as proposed by Baron and Kenny (1986). For these analyses, patients' age, gender, and opioid status were used as covariates because prior research has indicated that these variables may be associated with an increased risk for prescription opioid misuse (Chabal et al., 1997; Edwards et al., 2011a; Ives et al., 2006; Michna et al., 2004). Given that the BPI and TPThs were not significantly associated with either the dependent variable (i.e., SOAPP-R) or the predictor (i.e., PCS) after adjusting for these covariates, preconditions for further mediation testing were not met and these variables were no longer considered as potential mediators (Baron and Kenny, 1986; Holmbeck, 1997).

Table 3 presents the results of hierarchical multiple regression analyses examining the role of pain-related anxiety as mediator of the association between catastrophizing and risk for opioid misuse. In the first regression analysis (regression 1a), the PCS accounted for 21 % of the variance in SOAPP-R scores after controlling for patients' sex, age, and opioid status, F_{change} (1, 110) = 29.4, $p < .01$. In the second regression analysis (regression 1b), the PASS accounted for 19 % of the variance in SOAPP-R scores after controlling for patients' sex, age, and opioid status, F_{change} (1, 110) = 26.1, $p < .01$. The PCS was entered in the last step of the analysis and accounted for 5 % of the variance in SOAPP-R scores, F_{change} (1, 109) = 7.0, $p < .05$. After controlling for the PASS, the contribution of PCS to the prediction of SOAPP-R scores remained significant, but decreased from 21 % (Beta = .47) to 5 % (Beta = .31), suggesting a potential partial mediation effect of the PASS on the association between PCS and SOAPP-R (see Figure 1). Results of a Sobel test revealed that the partial mediation effect of the PASS was significant, Z = 2.1, $p < .05$.

As shown in Table 4, hierarchical multiple regression analyses were also conducted to examine the role of depression as mediator of the association between catastrophizing and risk for opioid misuse. In the first regression analysis (regression 1a), the PCS accounted for 21 % of the variance in SOAPP-R scores after controlling for patients' sex, age, and opioid status, F_{change} (1, 110) = 29.4, $p < .01$. In the second regression analysis (regression 1b), the BDI accounted for 11 % of the variance in SOAPP-R scores after controlling for patients' sex, age, and opioid status, F_{change} (1, 110) = 14.2, $p < .01$. The PCS was entered in the last step of the analysis and accounted for 10 % of the variance in SOAPP-R scores, F_{change} (1,

109) = 15.6, p < .01. After controlling for the BDI, the contribution of PCS to the prediction of SOAPP-R scores remained significant, but decreased from 21 % (Beta = .47) to 10 % (Beta = .39), suggesting a potential partial mediation effect of the BDI in the association between PCS and SOAPP-R. Results of a Sobel test, however, revealed that the partial mediation effect of the BDI was not significant, Z = 1.4, ns.

3.4. Hierarchical multiple regression analysis examining the unique influence of catastrophizing on risk for opioid misuse

Table 5 shows the results of a hierarchical multiple regression analysis examining the unique (i.e., independent) influence of catastrophizing on risk for opioid misuse. In this analysis, patients' sex, age, and opioid status were entered as covariates in the first step of the analysis but failed to contribute significantly to the prediction of SOAPP-R scores, R = .01, F (3, 111) = .41, ns. Measures of pain severity and pain sensitivity were entered in the second step of the analysis and contributed significant variance to the prediction of SOAPP-R scores, R^2 change = .08, F (2, 109) = 4.5, p < .05. Measures of negative affect were entered in the third step of the analysis and contributed significant variance to the prediction of SOAPP-R scores, R^2 change = .16, F (2, 107) = 11.0, p < .01. Catastrophizing (PCS) was entered in the final step of the analysis and contributed significant 'unique' variance to the prediction of SOAPP-R scores, R^2 change = .04, F (1, 106) = 5.4, p < .05.

4. DISCUSSION

The primary purpose of the present study was to examine the factors that underlie the association between catastrophizing and heightened risk for prescription opioid misuse in patients with chronic pain. Consistent with previous research (Edwards et al., 2011a; Ferrari et al., 2012; Jamison et al., 2009; Morasco et al., 2013), we found that higher levels of catastrophizing were associated with higher scores on the SOAPP-R, a self-report questionnaire designed to identify patients at risk for prescription opioid misuse.

In the present study, we found a significant association between patients' self-reports of pain severity and SOAPP-R scores. Patients who reported higher levels of pain scored higher on the SOAPP-R, which is consistent with the results of previous studies conducted among patients with chronic pain (Adams et al., 2004; Grattan et al., 2012; Jamison et al., 2009). It has been suggested that patients who report high levels of pain may, in an attempt to seek pain relief, inadvertently exhibit behaviors that fall within the spectrum of medication misuse or abuse (Jamison et al., 2011; Park et al., 2010).

Another finding consistent with previous studies is that heightened pain sensitivity (i.e., low pain thresholds) was associated with higher scores on the SOAPP-R. This finding corroborates the work of Edwards et al. (2011), who also found a significant association between pain sensitivity and SOAPP-R scores. Research suggests that heightened pain sensitivity might result from dysfunctions in peripheral or central pain processing, or from dysfunctions in opioid-mediated endogenous pain inhibitory systems (Bruehl et al., 2009; Edwards et al., 2005b; Millan, 1986; Pertovaara et al., 2006). Interestingly, dysfunctions in endogenous opioidergic activity have been found to play a role in the experience of craving among patients with various forms of substance use problems (Gianoulakis and deWaele, 1994; Koob and Le Moal, 2001; Williams et al., 2007, 2009; Zubieta et al., 1996). Applied to the context of pain, it is thus possible that dysfunctions in endogenous opioid systems may, at least in some patients, increase the risk of opioid craving, which in turn might increase the risk for prescription opioid misuse.

In the present study, we found that higher levels of negative affect (i.e., pain-related anxiety, depressive symptoms) were associated with higher scores on the SOAPP-R. The association

between measures of negative affect and risk for prescription opioid misuse is well documented, and has been reported in patients with a variety of chronic pain conditions (Becker et al., 2008; Grattan et al., 2012; Morasco et al., 2013; Trafton et al., 2011; Turk et al., 2008; Wilsey et al., 2008). This finding parallels those from the addiction literature showing that negative affect is associated with an increased likelihood of drug abuse (for reviews, see Conner et al., 2007, 2008; Conway et al., 2006; Grant et al., 2004; Sinha, 2001).

Of particular interest in the present study was to examine the factors that might underlie the association between catastrophizing and heightened risk for prescription opioid misuse. In our study, higher levels of catastrophizing were associated with higher levels of self-reported pain severity, pain sensitivity, pain-related anxiety, and depressive symptoms. A series of mediational analyses were conducted to examine the potential role of these variables in mediating the association between catastrophizing and risk for opioid misuse. Analyses revealed that patients' levels of pain severity, pain sensitivity, and depressive symptoms were not significant mediators of the PCS-SOAPP-R association. Analyses, however, revealed that patients' levels of pain-related anxiety partially mediated the association between the PCS and SOAPP-R. These results suggest that anxiety might represent one of the mechanisms by which catastrophizing confers increased risk for prescription opioid misuse. It has been argued that anxiety may alter patients' beliefs about their medication needs, which may result in opioid misuse or abuse (Scheiffer et al., 2005). It has also been argued that patients with high levels of anxiety may tend to overuse opioid medication as a way to control or alleviate their psychological distress (Ballantyne and LaForge, 2007; Hasin et al., 2002; Jamison et al., 2011; Passik et al., 2011; Wasan et al., 2007).

Interestingly, results of a hierarchical multiple regression analysis revealed that catastrophizing contributed significant 'unique' variance to the prediction of SOAPP-R scores, even after controlling for patient demographics, the BPI, TPThs, and measures of negative affect (i.e., PASS, BDI). This set of findings parallel those of Morasco et al (2013), who found that catastrophizing was a significant unique predictor of risk for prescription opioid misuse in patients with pain, even after controlling for a number of demographic, pain, and psychological variables. Our results, together with those of Morasco et al. (2013), raise further questions concerning the factors that might place high catastrophizers at increased risk for prescription opioid misuse. Although speculative, it is possible that high catastrophizers present certain psychological characteristics independent of negative affect that increase their risk for prescription opioid misuse. For example, studies have shown that catastrophizing is associated with low self-efficacy beliefs and poor pain coping skills (Keefe et al., 1997, 2004; Nicholas et al., 2007; Shelby et al., 2008; Sullivan et al., 2001), two variables that have been found to be associated with reduced medication compliance in patients with other health-related conditions (Catz et al., 2000; Heckman et al., 2004; Vyavaharkar et al., 2007). Low self-efficacy beliefs and poor coping skills might decrease catastrophizers' ability to cope with pain without the use of medication, and might place them at increased risk for prescription opioid misuse. Similarly, it is possible that high catastrophizers hold preexisting personality traits that are associated with an increased risk for opioid misuse. For example, catastrophizing has been associated with heightened impulsivity and sensation seeking (D'Acremont and Van der Linden, 2007), two personality traits that have been associated with an increased likelihood of substance abuse in patients with substance use problems (Ball et al., 1994; Franques et al., 2003; McKay et al., 1999; Moeller et al., 2002; Rosenthal et al., 1990).

A number of limitations must be considered when interpreting the findings of the present study. First, the cross-sectional nature of our study design precludes any firm conclusions

regarding the directionality of associations between study variables. Second, we did not assess important medication use variables such as the duration of opioid therapy or the specific types and/or doses of opioid analgesics taken by patients. In our study, patients who were taking opioids did not differ significantly from patients who were not taking opioids in terms of pain interference and negative affect, which contrasts with some previous studies in this area (e.g., Braden et al., 2009; Sullivan et al., 2005; Webster et al., 2007). This might be due, in part, to the specific types and/or doses of opioid analgesics taken by patients. Third, patients with SUDs were excluded from the present study; future research is needed to examine whether our findings are generalizable to sub-populations of patients presenting with chronic pain and a comorbid SUD. Finally, the SOAPP-R was not designed to assess patients' actual misuse of opioids and, as such, high scores on the SOAPP-R are not necessarily indicative of ongoing opioid misuse.

Despite these limitations, our study provides new insights into the mechanisms that might underlie the association between catastrophizing and heightened risk for prescription opioid misuse. Our findings suggest that catastrophizing might confer an increased risk for opioid misuse due, in part, to patients' heightened levels of pain-related anxiety. Perhaps the most important finding of our study, however, is that catastrophizing remained significantly associated with an increased risk for opioid misuse even when controlling for patients' levels of pain severity, pain sensitivity, and measures of negative affect such as anxiety and depressive symptoms. Taken together, these findings might have implications for the management of patients who are being considered for opioid therapy. Our findings suggest that complementary interventions designed to reduce patients' levels of anxiety and catastrophizing might contribute to decreasing risks for prescription opioid misuse in patients with chronic pain. Further research will be needed to examine the psychological factors that are associated with an increased risk for prescription opioid misuse among patients with chronic pain conditions. Advances in this domain could ultimately lead to more effective management of patients who are being prescribed opioid analgesics, and to reduced rates of prescription opioid misuse in patients with chronic pain.

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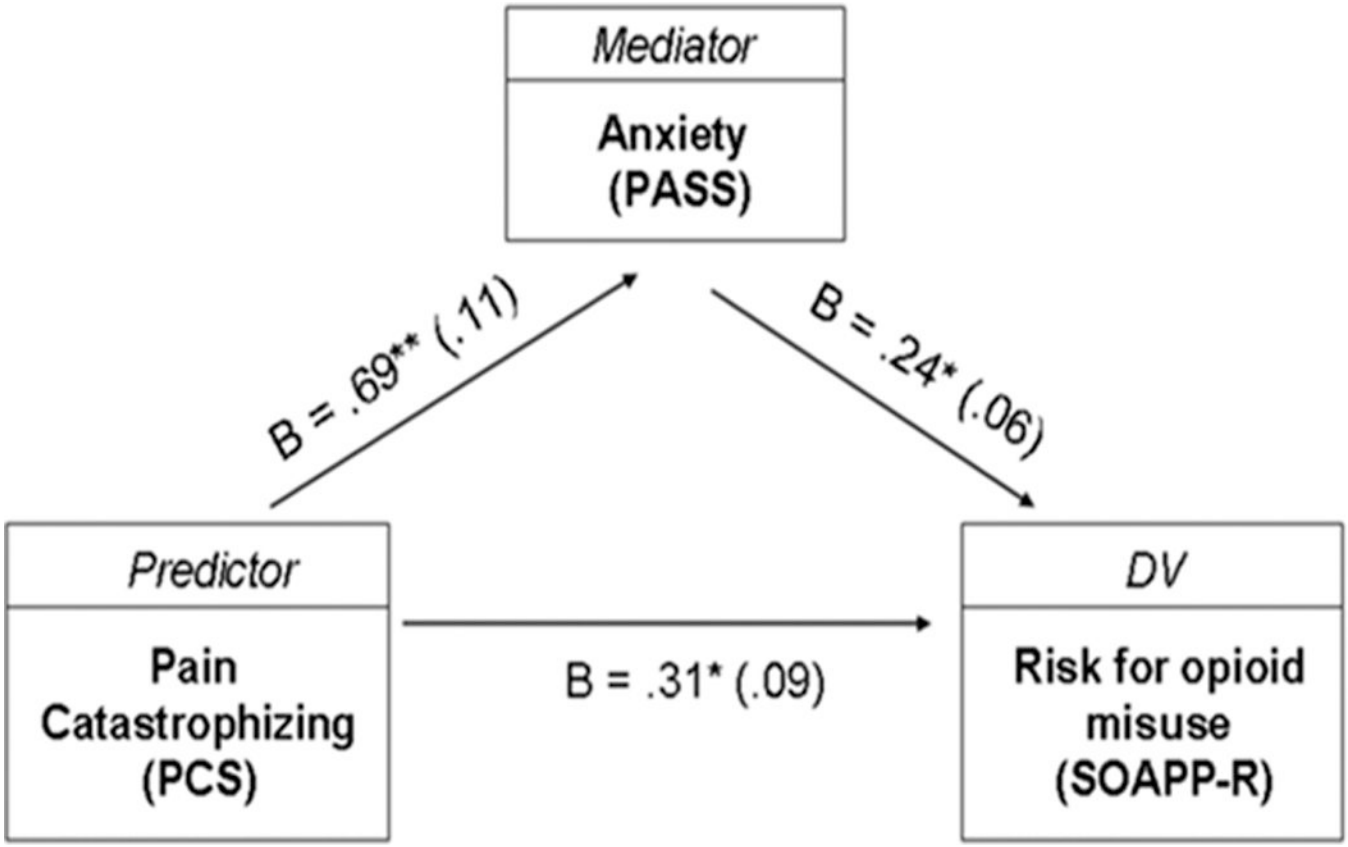

Figure 1.
Partial mediation effect of anxiety on the association between catastrophizing and risk for prescription opioid misuse

Table 1

Descriptive data for study measures

	Men (n=48)	**Women (n=67)**	***p***
Opioid status	52.1 %	46.3 %	.54
Age	46.0 (11.6)	48.3 (10.3)	.25
Pain interference (BPI)	3.1 (1.6)	3.7 (2.0)	.06
Pain severity (BPI)	4.9 (2.0)	5.7 (2.1)	.06
Pain sensitivity (TPThs)	0.22 (0.8)	−0.10 (0.9)	.06
Pain catastrophizing (PCS)	20.9 (10.0)	24.1 (12.7)	.15
Depression (BDI)	12.7 (9.3)	14.6 (8.9)	.27
Anxiety (PASS)	38.9 (20.7)	41.8 (17.3)	.42
Risk for opioid misuse (SOAPP-R)	20.4 (8.6)	19.6 (10.9)	.69

Note. Opioid status refers to the % of patients currently taking opioids

Table 2

Correlations among measures

	1	2	3	4	5	6
1. BPI-PS	-	−.02	.43**	.39**	.55**	.19*
2. TPThs		-	−.13	−.16	−.19*	−.19*
3. PASS			-	.47**	.69**	.44**
4. BDI				-	.51**	.34**
5. PCS					-	.45**
6. SOAPP-R						-

Note. BPI-PS, Brief Pain Inventory-Pain severity index; TPThs, Thermal Pain thresholds; PASS. Pain Anxiety Symptoms Scale; BDI, Beck Depression Inventory; PCS, Pain Catastrophizing Scale; SOAPP-R. Screener and Opioid Assessment for Pain Patients-Revised

* $p < .05$

** $p < .01$

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Table 3

Hierarchical multiple regression analyses examining the role of anxiety as mediator of the association between catastrophizing and risk for opioid misuse

	B	R^2 change	F change
Regression 1a: Catastrophizing predicting risk for opioid misuse (SOAPP-R)			
Step 1		01	.41
Sex	.03		
Age	−.06		
Opioid	.07		
Step 2			
PCS	.47	.21	29.4**
Regression 1b: The mediating role of anxiety			
Step 1		.01	.41
Sex	.03		
Age	−.06		
Opioid	.07		
Step 2			
PASS	.44	.19	26.1**
Step 3			
PCS	.31	.05	7.0*

Note. Opioid, Opioid status; PASS. Pain Anxiety Symptoms Scale; PCS, Pain Catastrophizing Scale; SOAPP-R, Screener and Opioid Assessment for Patients with Pain-Revised

* $p < .05$

** $p < .01$

Table 4

Hierarchical multiple regression analyses examining the role of depression as mediator of the association between catastrophizing and risk for opioid misuse

	B	R^2 change	F change
Regression 1a: Catastrophizing predicting risk for opioid misuse (SOAPP-R)			
Step 1		.01	.41
Sex	.03		
Age	−.06		
Opioid	.07		
Step 2			
PCS	.47	.21	29.4**
Regression 1b: The mediating role of depressive symptoms			
Step 1		.01	.41
Sex	.03		
Age	−.06		
Opioid	.07		
Step 2			
BDI	.34	.11	14.2**
Step 3			
PCS	.39	.10	15.6**

Note. Opioid, Opioid status; BDI, Beck Depression Inventory; PCS, Pain Catastrophizing Scale; SOAPP-R; Screener and Opioid Assessment for Patients with Pain-Revised

* $p < .05$

** $p < .01$

Table 5

Hierarchical multiple regression analysis examining the unique influence of catastrophizing on risk for opioid misuse (SOAPP-R)

	B	R^2	R^2 change	F change
Step 1		.01	.01	.41
Sex	.03			
Age	−.06			
Opioid	.07			
Step 2		.09	.08	4.5*
BPI	.20*			
TPTH	−.21*			
Step 3		.24	.16	11.0**
PASS	.36*			
BOI	.16			
Step 4		.28	.04	5.4*
PCS	.30*			

Note. Opioid, Opioid status; BPI, Brief Pain Inventory; TPThs, Thermal Pain thresholds; PASS, Pain Anxiety Symptoms Scale; BOI, Beck Depression Inventory; PCS, Pain Catastrophizing Scale; SOAPP-R, Screener and Opioid Assessment for Pain Patients-Revised

* $p < 05$

** $p < 01$