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The Communal Coping Model of Catastrophizing: Patient–Health Provider Interactions

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Abstract

Objective. The study sought to elucidate and refine the interpersonal, communicative dimension of the communal coping model (CCM) of catastrophizing. The primary aim was twofold. First, we examined the relations among pain intensity, catastrophizing, and pain behaviors as they function within the patient–health provider relationship. Second, we investigated the role of catastrophizing and pain behaviors in potentially influencing patient satisfaction with the provider, provider attitudes, and provider behavior. Mediation models were examined.

Design. The study was cross-sectional design with repeated measures.

Setting. This study was conducted at a university-based family medicine clinic and a private practice rheumatology clinic. Nineteen health providers and 49 chronic pain patients receiving treatment in a medical setting completed the study.

Outcome Measures. Patient outcome measures included pain intensity, catastrophizing, pain behaviors, and patient satisfaction with the provider. Health provider outcome measures were an assessment of provider attitudes and length of medical exam.

Results. The patient's level of catastrophizing entering the medical exam significantly predicted the interactive dynamics between the patient and the health provider during the exam and patient satisfaction after the exam. The patient's perceptions of pain and catastrophic thought processes may be interpersonally expressed to health providers via exaggerated pain behaviors.

Conclusions. Current findings indicate suggestions for refining the CCM. Results suggest that alleviation of catastrophic cognitions may facilitate more effective interpersonal communication within the patient–health provider relationship. Identification of those factors that improve patient–provider dynamics has important implications for the advancement of treatment for chronic pain and reducing the costs associated with persistent pain.

Key Words. Communal Coping Model (CCM); Catastrophizing; Patient–Provider Interactions; Chronic Pain

Introduction

Cognitive factors, such as catastrophizing, are important contributors in the behavioral expression of pain. Broadly defined, pain-related catastrophizing is an "exaggerated negative 'mental set' brought to bear during painful experiences" [1]. Conceptually, catastrophizing represents a maladaptive way of coping with stress in the face of real or anticipated pain. Although initially conceptualized as a dispositional variable, several studies have shown that catastrophizing can be situational and state dependent and can be assessed as such. Furthermore, compared with measures of dispositional catastrophizing, situational catastrophizing has been found to more

accurately predict current pain intensity [2–4]. Furthermore, although catastrophizing is traditionally viewed as an internal, personal experience, the social context in which catastrophizing occurs has received growing research interest.

The communal coping model (CCM) of catastrophizing is a framework that theorizes how catastrophizing represents a social-goal-oriented process and may be part of a broader interpersonal orientation to coping with distress [1,5,6]. The CCM posits that catastrophic thoughts predicate exaggerated displays of pain behaviors (i.e., grimacing, sighs, and moans), and that these pain behaviors serve a communicative function (i.e., express needs, garner attention, etc.) within the social context. Research on the interpersonal domain of the CCM is currently limited; however, there are some promising findings in the literature.

Experimental research by Sullivan and colleagues has found that high catastrophizing individuals show more sustained communicative pain behaviors and fewer pain management behaviors (e.g., rubbing arm) when an observer is present (compared with that when they are alone) [5,7]. These findings suggest that individuals with a propensity to catastrophize express more pain behaviors in the social context, and that rather than serving a palliative function, these overt behaviors are mobilized to communicate information about perceived pain to others. This supports the CCM premise that catastrophizing and coping behaviors may be more associated with interpersonal goals rather than pain reduction per se. Survey research has examined similar relations within clinical settings and results indicated that among individuals with chronic pain, catastrophizing is associated with self- and other-reported pain behaviors, caregiver/partner responses (i.e., perceived support, solicitousness, and punishing behaviors), and relationship quality [8–11]. In patients with chronic pain of relatively short duration, catastrophizing is significantly and positively related to patient-perceived solicitous spousal responses. However, in patients with pain of longer duration, no such relation is observed; among these patients, catastrophizing is significantly and positively related to patient-perceived punishing spouse responses [12].

Limited research on the patient–provider relationship indicates that contextual variables such as situation (e.g., lack of medical evidence, clinic setting), patient (e.g., severity levels, behavior), and provider (e.g., training specialization, attitude) variables are important factors and form the basis for provider clinical decision making [13]. To the best of our knowledge, no previous research has directly examined the relation between catastrophizing, pain behaviors, and the support-seeking contextual components of the CCM within the patient–health provider relationship. It is plausible that catastrophic cognitions translate into exaggerated pain behaviors in the medical setting, and that these behaviors represent a means by which patients communicate needs to their health provider. Thus, catastrophic behaviors are potentially a cue to which health providers respond when forming perceptions of their patients; catastrophic behaviors may thereby influence health provider attitudes and behavior.

The Current Study

The purpose of this study was to elucidate and refine the interpersonal, communicative dimension of the CCM within a clinical sample of chronic pain patients receiving treatment in a medical setting. The primary specific aim was twofold. Aim one was to examine the relations between pain intensity, pain catastrophizing, and pain behaviors as they function within the patient–health provider relationship. According to the CCM, individuals catastrophize in response to pain to serve interpersonal goals and pain behaviors may be one way that catastrophizing is manifested behaviorally. Thus, based on the hypothesized relations within the CCM framework, we expected that higher levels of reported pain intensity and catastrophizing would be associated with increased pain behaviors, and that catastrophizing would mediate the relation between pain intensity and pain behaviors. Furthermore, given that contextual factors have been shown to influence patient–provider relationships, the effect of provider experience and pain duration on the hypothesized aim one relations was examined.

Our second aim was to investigate the role of catastrophizing and pain behaviors in potentially influencing patient satisfaction with the provider, provider attitudes, and provider behavior (length of medical exam served as a proxy for this outcome). Given that high pain catastrophizers typically use more health care resources, it is likely that providers generally have repeated, high exposure to such patients [14]. Therefore, it is possible that providers respond to patient pain behaviors reflective of catastrophizing in a manner similar to spouses of chronic pain patients, i.e., in a punishing manner [12]. Within the patient–provider context, this “punishing manner” may manifest as the provider having a more negative attitude toward the patient and a desire to spend less time with the patient (i.e., shorter medical exam time). Concurrently, it is logical that the complex interplay of these dynamics leave the patient feeling less satisfied with their health care provider. Hence, we hypothesized that increased catastrophizing and pain behaviors would be associated with decreased patient satisfaction with the provider (i.e., the extent to which the patient perceived the health provider to meet their needs), more negative provider attitudes toward patients, and decreased length of exam. The contextual factors controlled for in examination of aim one were also included in aim two.

The CCM posits that patient-perceived solicitousness may mediate the relation between catastrophizing and pain behaviors. Thus, given this proposition, an exploratory aim was to examine the mediating role of patient satisfaction with the provider on the hypothesized association between pain catastrophizing and provider attitudes, and/or provider behavior.

Method

Design

The study was cross-sectional design with two repeated measures; measurements of pain intensity and catastrophizing were obtained before and after provider interaction with the patient. Pre-exam scores reflected baseline levels of pain intensity and catastrophizing before seeing the provider. Post-exam scores were collected after the medical exam and participants were asked to reflect upon pain intensity and catastrophizing thoughts experienced during the medical exam. Based on previous research suggesting that situational catastrophizing is distinct from dispositional catastrophizing, we conceptualized catastrophizing as a situation-dependent variable in this study [2–4]. During the medical exam, the provider asked the patient to perform a set of physical tasks (i.e., walking, sitting, standing, and lying down) while under the observation of a neutral third party who coded for total observed pain behaviors. Details about presentation of additional assessments will be described in the subsequent procedure section.

Setting

This study was conducted at two clinics, a university-based family medicine training clinic (clinic A) and a private practice rheumatology clinic (clinic B). At clinic A, patients were often being seen for acute care issues not related to their chronic pain (e.g., infections, skin conditions, pelvic exams, etc.). At clinic B, patients were being seen specifically for pain-related rheumatic issues. Prior to data collection, Institutional Review Board permission was obtained for both sites.

Participants

Patients

Participants were adult chronic pain patients who reported having pain for longer than 3 months or were referred by their health provider based on their diagnosis of a chronic pain condition. Inclusion criteria were the following: 1) history of chronic pain as indicated by patient self-report or provider report; 2) at least 19 years of age; 3) were under regular care of a health care provider at clinic A or clinic B (at least two visits with a health care provider at the facility for pain or other complaints); and 4) demonstrated the ability to comprehend and complete questionnaires. Primary pain diagnoses were obtained from patient report and medical records.

Among the 206 patients approached for study participation, 77 (37.4%) met the inclusion criteria. At clinic A, a large convenience sample was approached and it was not known whether or not they had chronic pain, until patients were asked. At clinic B, only physician referred patients were approached. Of the eligible patients, 74 consented to participate in the study, and 49 (27 from clinic A and 22 from clinic B) actually completed the study protocol. Even though participants were encouraged to participate on the same day, most patients completed the study on a subsequent visit to the medical clinic. Subsequent visits with the 25 other participants that initially consented to participate could not be coordinated. Reasons for nonparticipation included: not having available funds for additional medical visits, wishing to speak with significant other before agreeing and not having enough time to participate. Not all participants completed all the measures, mostly due to personal time constraints, other scheduled appointments, or follow-up tests, for example. Some participants did not complete the pain behavior task as administration of this assessment is contingent upon provider involvement, and not all providers of patient participants consented to be in the study.

Providers

Providers were eligible to participate if one of their patients completed the study. Thus, even if a provider agreed to participate, he or she may not have had participation opportunity. In total, 30 health care providers consented to participate in this study. Out of the 30 providers who consented, 19 actually participated in the study. Fifteen provider participants were located at clinic A, and four providers were located at clinic B. Of the clinic A provider participants, 12 were medical residents in their second or third year of residency (specializing in family medicine), one was a resident at the end of his first year of residency, and the remaining two were attending physicians who supervised residents. At clinic B, two physicians, one nurse practitioner, and one occupational therapist (all of whom had specialized training in rheumatic diseases and working with people who have chronic pain) participated in the study. The mean number of patient participants seen by each provider was 2.2 (with a range of 1–8 patient participants seen by a provider).

Patient Recruitment

Two methods for recruitment were used: 1) health care provider referral and 2) research assistant (RA) recruitment (i.e., approaching patients in the clinic waiting room). For the first method, providers simply referred patients to the study who met the inclusion criteria. Thereafter, the RA approached the patient, typically in the exam room, described the study, and obtained written informed consent for study participation. In the second method, RAs approached patients in the waiting room area, introduced themselves as research assistants working with investigators at the clinic, described the study, and attempted to obtain consent for study participation.

Physician/Health Care Provider Recruitment

RAs typically approached providers during their scheduled shifts and at group meetings. Two group emails were sent to residents and attending physicians informing them about the study and recruitment efforts. RAs made efforts

to not reveal the specific variables under investigation to the providers to minimize reactivity during the pain behavior task. Providers were told that their behaviors during the pain behavior observation task were not being analyzed. Providers were not told that the length of exam was being recorded. Providers were also informed that patients recruited for this study would be referred to resources, such as free cognitive behavioral pain group treatment and mental health services as necessary.

Procedure for Patient and Provider

See Figure 1 for a flowchart of the procedure. After obtaining written informed consent, participants completed the self-administered questionnaires. RAs accompanied the patient to the exam room and assisted with completing initial assessments. Pre-exam catastrophizing and pain intensity scores were a reflection of pain experienced at the present time of measurement. Subsequently, the RA left the room during the medical exam and recorded the length of time the provider remained in the exam room. When the provider completed the exam, he or she informed the RA that the patient was ready for behavior observation. The provider read a script of commands for the patient to perform (adapted from procedure used in Feuerstein et al.) [15].

After the exam, the participants completed the remaining assessments. For post-exam reports, participants were asked to reflect upon their experience during the exam while the provider was in the room. Thus, catastrophizing and pain intensity scores taken after the exam were retrospective reports on catastrophizing and pain intensity during the medical exam. At the end of the study, participants were reimbursed $10 for their time and effort. Providers were asked to complete a brief questionnaire assessing their attitudes toward their respective patients within 24 hours.

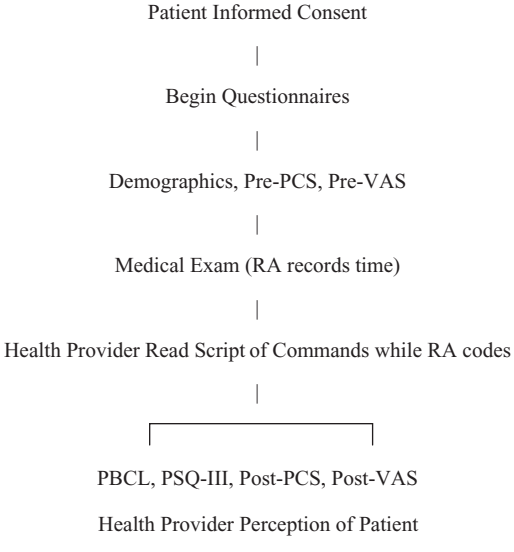

Figure 1 Flowchart of procedures for patient and provider. PBCL = pain behavior checklist; Pre-PCS = pre-exam pain catastrophizing scale; Post-PCS = post-exam pain catastrophizing scale; PSQ-III = Patient Satisfaction Questionnaire III; RA = research assistant; Pre-VAS = pre-exam visual analog scale; Post-VAS = post-exam visual analog scale.

Measures

Demographics

Brief demographic questionnaires were developed for use in the current study. The following descriptive information was obtained from patients: age, gender, race/ethnicity, income, marital status, pain diagnosis or description of pain, length of time with pain, and frequency of pain episodes. Demographic variables for providers included: age, gender, race/ethnicity, resident status (year in program), length of time in practice, and specialty.

Pain Intensity

A visual analog scale (VAS) was used to assess pain intensity. The VAS consists of a 10 cm line with two anchors ("No pain" and "Worst possible pain"). Respondents were asked to place a mark on the line that reflects current pain intensity (pre-exam) and pain intensity experienced during the medical exam (post-exam). VAS scores were measured in centimeters. Evidence supporting the validity of the VAS has been demonstrated. VAS responses have been positively correlated with other measures of self-reported pain intensity [16–18] and with observed pain behavior [19,20]. The VAS was chosen for its ease of administration and high number of response categories. The VAS is potentially more sensitive to changes in pain intensity than measures with limited numbers of response categories [21].

Pain Catastrophizing

The pain-catastrophizing scale (PCS) was used to assess the level of catastrophizing [22]. The 13-item measure asks participants to rate, on a 5-point Likert scale ranging from zero ("not at all") to four ("all the time"), the degree to which they have certain thoughts and feelings when experiencing pain. Example items from the PCS included: "I worry all the time about whether the pain will end;" "I feel I can't go on;" "It's terrible and I think it's never going to get any better." An overall PCS score is obtained by summing the values of the 13 items with higher scores indicating a greater degree of catastrophizing. The PCS has exhibited strong internal consistency ($\alpha = 0.93$), concurrent and discriminant validity, and high test–retest reliability over a 6-week period ($r = 0.78$) [22–24]. For the current study, instructions were modified to measure catastrophizing during two time points: pre-exam for pain experienced at the present time and post-exam for pain experienced during the exam. The full 13-item PCS was

used. Only the instructions were modified. For the pre-exam catastrophizing assessment, the last sentence of the instructions was modified as follows: ". . . Using the following scale, please indicate the degree to which you have these thoughts and feelings for your CURRENT PAIN." The question stem to the items was modified to read: "When thinking about my pain now . . ." In the current study adequate reliability was shown for the pre-exam PCS measure ($\alpha = 0.95$).

For the post-exam catastrophizing measure, the last sentence of the instructions was modified as follows: ". . . Using the following scale, please indicate the degree to which you had these thoughts and feelings for your pain DURING THE MEDICAL EXAM." The question stem to the items was modified to read: "When thinking about my pain during the exam when my doctor was present . . ." Adequate reliability of the post-exam PCS measure used in the current study was shown ($\alpha = 0.95$).

Observed Pain Behavior

The University of Alabama (UAB) Pain Behavior Scale was used to quantify observed pain behaviors [25]. Patients were observed while performing a set of physical activities (e.g., walk, stand, and transition from sitting to standing) and 10 target pain behaviors are scored on a 3-point scale, where 0 = "None;" 0.5 = "Occasional (Less than 3×);" and 1 = "Frequent (3× or more)." Coders rated how frequent the participant displayed the following pain behaviors: verbal complaints, nonverbal complaints (e.g., moans, gasps, and groans), facial grimaces, standing posture, mobility, body language (clutching or rubbing body part), the use of visible support equipment (e.g., braces, crutches, cane, and leaning on furniture), and stationary movement (e.g., sitting still or how often there was shifting positions) on a scale from none, occasional, or frequent. The total process typically takes 5 minutes. Self-report items of Down-time and Medication were removed for this study; reliability and validity for the scale without these items have been established in previous research [15]. In the current study, a team of raters was trained to administer the UAB Pain Behavior Scale. Initially, two coders were in the room and practiced together until reliability was consistently above 80%. After this was achieved, only one coder could be present in the room. Percentage agreement of over 80% among a team of trained raters for the assessment of observed pain behaviors is usually considered acceptable reliability [26]; in the current study, percentage agreement was 85%.

Self-Reported Pain Behaviors

The pain behavior checklist (PBCL) [27] is a self-report assessment of pain behaviors and is based on Fordyce's categorization of pain behaviors [28]. The standard instructions were given, which asked respondents to reference their experiences of chronic pain in general. Participants rated how often they engaged in 25 behaviors on a scale from 0 ("never") to 6 ("very often"). Example items include: "Walk with a limp or distorted gait;" "Move extremely slowly;" "Walk in a protective fashion." There is evidence of criterion-related and discriminant validity for patients with predominantly back and musculoskeletal pain [27]. Reliability estimates for the subscales range from 0.63 to 0.83 and the coefficient alpha for the total PBCL is 0.85 [27]. The stability coefficient for the total PBCL was 0.80, which indicates that the PBCL is stable over time [27]. In the current study, adequate reliability of the PBCL was shown ($\alpha = 0.90$).

Patient Satisfaction with Provider

The Patient Satisfaction Questionnaire (PSQ-III) was used to assess patient perception of treatment [29]. For the purposes of this research, items related to financial aspects of care, accessibility, availability, and convenience of care were omitted as they were not directly measuring perception of provider care. Items related to satisfaction with provider were kept and statements were changed to reflect attitudes pertaining to the most recent medical visit, resulting in 22 items. Participants rated 22 items designed to measure satisfaction with pain treatment on a 5-point Likert scale ranging from strongly agree to strongly disagree. Participants were instructed to make their rating on the basis of the consultation with the health care professional included in this study. Sample items included: "The doctor needs to be more thorough in treating and examining me;" "The doctor was good about explaining the reason for medical tests;" "The doctor should have given me more respect." A total score was obtained by summing scores. Several items were reverse coded so that a higher total score would indicate greater patient satisfaction with the provider. The PSQ has evidence of predictive, content, convergent, and discriminant validity, and reliability estimates ranged from 0.77 to 0.89 [30]. Adequate reliability of the 22-item version used in the current study was shown ($\alpha = 0.85$).

Provider Attitudes

Provider attitudes toward the patient were measured using a scale used in previous research [31]. The original scale was composed of 10 items and assessed provider attitudes about patients with pain and confidence with management of pain on a 5-point Likert scale ranging from strongly agree to strongly disagree. Scale scores were calculated by adding the numeric values of each response and dividing by the number of items. Exploratory and confirmatory factor analyses revealed two dimensions, which were labeled confidence and attitude [31]. For this study, only the four items comprising the attitude factor were included. Providers were asked to answer questions about the degree of agreement with the following statements: "The patient had unrealistic expectations about what doctors can do for them;" "This patient will be dissatisfied if I do not order additional lab tests;" "I often have negative feelings about dealing with this patient;" "This patient was probably very satisfied with my care." The overall response rate in this study was 75%.

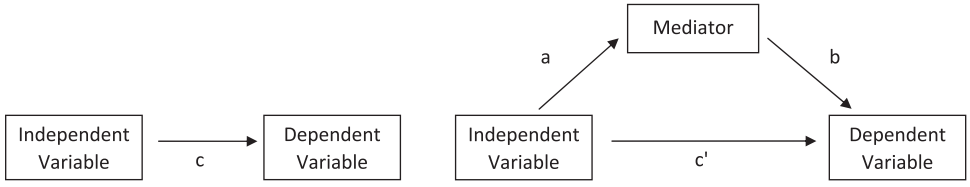

Figure 2 Paths tested to examine the mediating role of pain catastrophizing and depression.

Statistical Analyses

All analyses were conducted using SPSS version 16.0 (SPSS Inc., Chicago, IL, USA). For any missing item data, the mean of the completed items within the questionnaire was substituted provided that the number of missing items did not exceed 10% for any individual's responses to a questionnaire. Questionnaire data were considered missing if the individual completed less than 10% of the items. Any case with missing questionnaire data was not included in the analysis for that questionnaire. Pearson product-moment correlations were used to determine bivariate relations. Frequency statistics were obtained, and reliability and validity of pain behavior coding were examined. Exploratory independent samples *t*-test analyses were conducted to examine potential clinic differences in terms of the following patient population characteristics: 1) duration of pain; 2) pain intensity; 3) pain catastrophizing; 4) pain behaviors (both observed and self-reported); and 5) length of medical exam. Mean changes in pain intensity and catastrophizing from pre- to post-exam were analyzed using paired-samples *t*-tests.

Separate hierarchical regression analyses were conducted in accordance with the aims of the study. The hierarchical models conducted for aim one examined the associations between the independent variables of pre- and post-exam pain intensity and pre- and post-exam pain catastrophizing on the dependent variables: observed pain behaviors and self-reported pain behaviors. For aim two, the hierarchical models examined the relations between the independent variables of pre- and post-exam pain catastrophizing, observed pain behaviors and self-reported pain behaviors on the dependent variables: patient satisfaction, provider attitudes, and length of exam time. Duration of pain and clinic site were included as covariates in all hierarchical models. Nonsignificant covariates were removed from the final models.

For each regression analysis, parametric assumptions of normality, equality of variances and independence were examined to ensure appropriateness of selected statistics. Omnibus tests for the regression models predicting each of the criterion variables were measured using the *F* statistic.

To examine the hypothesized and exploratory mediation models, the bootstrapping technique (with N = 5,000 bootstrap re-samples) was implemented [32]. Bootstrapping is a nonparametric re-sampling procedure that makes no assumptions about the shape of the distributions of the variables or the sampling distribution of the statistic. The bootstrapping sampling distributions are empirically generated and the indirect effects are calculated in the re-samples. This way, point estimates and confidence intervals are estimated for the indirect effects. As a stringent test of the hypotheses, point estimates of indirect effects are significant in the case zero is not contained within the confidence interval. If zero is contained within the confidence interval, then it cannot be determined that the result is significantly different from zero. The 99% confidence interval was used to determine significance of the bootstrap mediation analyses.

Referencing the paths depicted in Figure 2, it was determined that: 1) the independent variable was significantly related to the dependent variable (direct path c_1); 2) the independent variable was significantly related to the proposed mediator (path a_1); and 3) the proposed mediator was significantly related to the dependent variable (path b_1) while controlling for the effects of the independent variable. The indirect effect is represented by the product of the coefficients (e.g., a_1 b_1 in Figure 2).

Results

Preliminary Analyses

Summary data from the 49 patient participants and 19 health provider participants are presented in Tables 1 and 2. Table 3 presents means and standard deviations for the two independent variables and five dependent variables analyzed in this research. Table 4 shows Pearson product-moment correlations among these measures.

Pre- and Post-Exam Scores

Participants at clinic B ($M = 13.84$, standard deviation [SD] = 9.53) reported experiencing pain for a significantly longer duration of time (in years) than participants at clinic A ($M = 8.45$, SD = 8.19; $t[45] = –2.09$, $P = 0.04$). Effect size was medium ($d = 0.61$) [33]. There were no significant mean differences between the clinics in the following variables: pre-exam pain intensity ($t[42] = –1.18$, $P = 0.25$), post-exam pain intensity ($t[43] = –1.55$, $P = 0.13$), pre-exam catastrophizing ($t[42] = 0.53$, $P = 0.60$), post-exam catastrophizing ($t[43] = 1.24$, $P = 0.22$), self-reported pain behaviors ($t[44] = –0.06$, $P = 0.95$), observed pain behaviors ($t[40] = –0.54$, $P = 0.59$), and length of medical exam

Table 1 Patient demographic data for the total sample and broken down for clinic A (university-based family medicine training clinic) and clinic B (private practice rheumatology clinic)

	Total sample (N = 49)	Clinic A (N = 27)	Clinic B (N = 22)
Age			
Mean (SD)	54.122 (13.092)	54.667 (14.027)	53.455 (12.137)
Sex (%)			
Male	12.2	22.2	0.0
Female	87.8	77.8	100.0
Marital status (%)			
Married	53.2	53.8	52.4
Not married	46.8	46.2	47.6
Race or ethnicity (%)			
Non-Hispanic white	57.1	63.0	50.0
African American	20.4	22.2	18.2
Hispanic/Latino	6.1	0.0	13.6
Native Americans	10.2	11.1	9.1
Asian	2.0	0.0	4.5
Other	4.1	3.7	4.5
Yearly income (%)			
0–24,999	52.2	62.5	40.9
25,000–49,999	28.3	16.7	40.9
50,000–74,999	8.7	12.5	4.5
75,000–99,999	6.5	4.2	9.1
100,000+	4.3	4.2	4.5
Pain diagnosis (%)			
Arthritis	18.4	22.2	13.6
Back pain	6.1	11.1	0
Fibromyalgia	8.2	7.4	9.1
Neuropathic pain	2.0	3.7	0
Abdominal	2.0	3.7	0
Multiple pain sites	42.9	33.3	54.5
Other	20.4	18.5	22.7
Pain duration (years)			
Mean (SD)	10.86 (9.12)	8.45 (8.19)	13.84 (9.53)

SD = standard deviation.

($t[38] = -1.00$, $P = 0.32$). Therefore, pre- to post-exam changes in pain intensity and catastrophizing were analyzed for the total sample only. It was found that pain intensity scores did not change significantly from pre- to post-exam ($t[42] = -0.56$, $P = 0.58$). Pain catastrophizing scores were significantly lower on post-exam than pre-exam ($t[39] = 2.71$, $P = 0.01$). Effect size was small ($d = 0.16$) [33].

Hierarchical Regression Models

Parametric assumptions were met for all hierarchical regression models. The order of entry of all predictor variables was determined on the basis of relative causal priority and relevant past research. See Table 5 for results of the hierarchical regression models examining the relations among pain intensity, pain catastrophizing, and pain behaviors as they function within the patient–health provider relationship (aim one). In all aim one models, both duration of pain and clinic site were nonsignificant covariates, thus they were removed from the models for final analyses. In the final aim one models, pain intensity was entered in step one and pain catastrophizing in step two. The observed pain behaviors regression models indicated that only post-exam pain intensity contributed significantly. Tests of the parameter estimates determined that as post-exam pain intensity increased, so did the observed pain behaviors ($\beta = 0.349$, $t[1] = 2.235$, $P = 0.032$, $R^2\Delta = 12.2\%$). In the self-reported pain behavior models, pre- and post-exam pain intensity and pre- and post-exam pain catastrophizing accounted for a significant proportion of the variance. Parameter estimates indicated that self-reported pain behaviors increased as pre- and post-exam pain intensity increased ($\beta = 0.615$, $t[1] = 4.805$, $P < 0.001$, $R^2\Delta = 37.8\%$, and $\beta = 0.603$, $t[1] = 4.719$, $P < 0.001$, $R^2\Delta = 36.3\%$, respectively). Increased pre- and post-exam pain catastrophizing was also uniquely associated with increased self-reported pain behaviors while controlling for pain intensity ($\beta = 0.425$,

Table 2 Provider demographic data

	Total sample (N = 19)
Medical clinic (%)	
Clinic A	60.9
Clinic B	39.1
Sex (%)	
Male	62.5
Female	37.5
Race or ethnicity (%)	
Non-Hispanic white	70.8
African American	0.0
Hispanic/Latino	0.0
Native Americans	12.5
Asian	16.7
Other	4.1
Year of residency (%)	
1	12.5
2	31.2
3	56.2
Specialty (%)	
Family medicine	79.2
Rheumatology	8.3

$t[2] = 2.772$, $P = 0.009$, $R^2\Delta = 10.7\%$, and $\beta = 0.345$, $t[2] = 2.157$, $P = 0.037$, $R^2\Delta = 6.9\%$, respectively).

See Table 6 for the results of the hierarchical regression models conducted to examine the role of catastrophizing and pain behaviors in potentially influencing patient satisfaction with the provider, provider attitudes, and provider behavior (aim two). For the outcomes of patient satisfaction and provider attitudes, both duration of pain and clinic site were nonsignificant covariates, thus they were removed from these models for final analyses. In the patient satisfaction and provider attitudes models, pain catastrophizing was entered in step one, and pain behaviors were entered in step two. In the model examining variance in provider behavior (length of medical exam), pain duration was a significant covariate and was therefore entered in step one and was statistically controlled. Clinic site was a nonsignificant covariate, thus was removed from the model for final analyses. Thus, in the provider behavior model, pain catastrophizing was entered in step two, and pain behaviors were entered in step three. The patient satisfaction regression models indicated that pre- and post-exam pain catastrophizing accounted for a significant proportion of the variance. When observed and self-reported pain behaviors were

Table 3 Summary of means and standard deviations

	Total sample mean (SD)	Clinic A mean (SD)	Clinic B mean (SD)
Pre-exam pain intensity	5.682 (2.417)	5.255 (2.088)	6.109 (2.688)
Post-exam pain intensity	5.727 (2.748)	5.112 (2.384)	6.364 (3.006)
Pre-exam catastrophizing	24.909 (14.837)	26.044 (13.660)	23.667 (16.277)
Post-exam catastrophizing	22.533 (14.075)	24.958 (13.547)	19.762 (14.481)
Total self-reported pain behavior	52.370 (21.848)	52.192 (22.466)	52.600 (21.595)
Total observed pain behavior	3.226 (1.665)	3.104 (1.622)	3.389 (1.754)
Patient satisfaction	95.341 (12.706)	93.167 (13.249)	97.950 (11.821)
Provider attitudes	15.541 (3.540)	15.842 (4.537)	15.222 (2.130)
Length of medical exam (minutes)	19.48 (12.96)	17.524 (9.136)	21.632 (16.184)

SD = standard deviation.

Table 4 Pearson product-moment correlation matrix (N = 49)

Measure	1	2	3	4	5	6	7	8	9
1. Observed pain behavior	—	0.489**	0.227	0.179	0.322*	0.374*	0.083	–0.209	–0.060
2. PBCL		—	0.654**	0.585**	0.609**	0.617**	–0.247	–0.026	0.009
3. Pre-exam PCS			—	0.895**	0.658**	0.719**	–0.376*	–0.054	–0.133
4. Post-exam PCS				—	0.555**	0.658**	–0.406*	–0.162	–0.046
5. Pre-exam VAS					—	0.853**	–0.108	–0.159	–0.119
6. Post-exam VAS						—	–0.112	–0.231	–0.046
7. PSQ-III							—	0.141	0.067
8. Provider attitudes								—	0.147
9. Length of medical exam									—

* $P < 0.05$; ** $P < 0.01$.

PBCL = pain behavior checklist; PCS = pain catastrophizing scale; PSQ-III = Patient Satisfaction Questionnaire III; VAS = visual analog scale.

Table 5 Examination of the relations between pain intensity and pain catastrophizing on both observed and self-reported pain behaviors

Model	IV	*F*	*B* (SE)	R^2
1†	Pre-VAS	3.911	0.218 (0.110)	0.103
	Pre-PCS	1.899	–0.001 (0.025)	0.000
2†	Post-VAS	4.997	0.225 (0.101)	0.122*
	Post-PCS	2.512	–0.010 (0.025)	0.004
1‡	Pre-VAS	23.092	5.829 (1.213)	0.378***
	Pre-PCS	17.418	0.659 (0.238)	0.485**
2‡	Post-VAS	22.270	5.061 (1.072)	0.347***
	Post-PCS	14.505	0.552 (0.256)	0.403*

* Significant at the $P < 0.05$ level.
** Significant at the $P < 0.01$ level.
*** Significant at the $P < 0.001$ level.
† Dependent variable: Observed pain behaviors.
‡ Dependent variable: Pain behavior checklist (self-reported pain behaviors).
IV = independent variable; PCS = pain catastrophizing scale; SE = standard error; VAS = visual analog scale.

included in the regression models, higher pre-exam pain catastrophizing was uniquely associated with less patient satisfaction with the provider ($\beta = –0.387$, $t[1] = –2.408$, $P = 0.022$, $R^2\Delta = 14.9\%$, and $\beta = –0.344$, $t[1] = –2.261$, $P = 0.030$, $R^2\Delta = 11.9\%$, respectively). Higher post-exam pain catastrophizing was associated with less satisfaction with the provider in models including both observed and self-reported pain behaviors ($\beta = –0.407$, $t[1] = –2.562$, $P = 0.015$, $R^2\Delta = 16.6\%$, and $\beta = –0.385$, $t[1] = –2.575$, $P = 0.014$, $R^2\Delta = 14.9\%$, respectively). In the models examining variance in provider attitudes, no independent variables accounted for a significant proportion of the variance. The provider behavior regression models indicated that the only significant variable accounting for variance was the covariate, pain duration, such that higher duration was associated with longer exam time (see Table 6).

Mediation Models

Mediation was tested to explore the hypothesis that pain catastrophizing would mediate the relationship between pain intensity and pain behaviors (included as part of aim one; see Table 7). Baron and Kenny's assumptions were met for examination of mediation in reference to self-reported pain behaviors, but not observed pain behaviors [34]. In the first model (see Table 7), pre-exam catastrophizing was examined as a mediator of the relation between pre-exam pain intensity and self-reported pain behaviors. After controlling for pre-exam catastrophizing, the effect of pain intensity on pain behaviors was reduced but remained significant. Examination of the 99% confidence interval generated by the bootstrapping procedure indicated that pre-exam pain catastrophizing partially mediated the relation between pre-exam pain intensity and pain behaviors.

In the second mediation model (see Table 7), post-exam catastrophizing was examined as a mediator of the post-exam intensity to self-reported pain behaviors relation. After controlling for post-exam catastrophizing score, the effect of intensity on pain behaviors was reduced but remained significant. Examination of the 99% confidence interval indicated that post-exam catastrophizing did not mediate the post-exam pain intensity to pain behaviors relation.

Mediation was tested to examine the exploratory models investigating the mediating role of patient satisfaction with the provider on the hypothesized association between pain catastrophizing and provider attitudes, and/or provider behavior. Given that catastrophizing did not predict provider attitudes or behavior in the regression models, the mediating role of these variables was not further examined. The ability of patient satisfaction to mediate the pain catastrophizing to pain behaviors relation was explored (see Table 7); however, patient satisfaction did not significantly predict variance in self-reported pain behaviors (path *b*). Thus, Baron and Kenny's criteria for mediation were not met, indicating further investigation of this proposed exploratory model is not warranted in the present data [34].

Discussion

This is the first study to examine the CCM of catastrophizing within the patient–physician relationship. Results indicated that within a clinical sample of chronic pain patients, internal perceptions of pain and catastrophic thought processes related to pain may externally manifest and be expressed to health providers via exaggerated pain behaviors. Furthermore, the contextual social determinants within the patient–health provider relationship have the potential to elicit and reinforce catastrophic thought processes and their potential behavioral concomitants. The current findings indicate suggestions for refining the interpersonal, communicative dimension of the CCM.

Consistent with previous research [1,22,35], and the CCM's premise that people with higher pain intensities may catastrophize more to achieve interpersonal goals, pain intensity was significantly associated with pain catastrophizing in the current study. Furthermore, pain intensity accounted for a significant proportion of the variance in both observed and self-reported pain behaviors. Catastrophic thoughts were found to translate into communicative pain behaviors; however, the nature of this relation varied as a function of assessment methodology (i.e., observed vs self-reported). Within the current sample, pre- and post-exam catastrophizing were significantly related to self-reported pain behaviors, but not observed pain behaviors. Although inter-rater reliability of observed pain behaviors could not be calculated in the current study, it should be noted that the UAB Pain Behavior Scale was designed for clinical application, and thus the standard method of administration is with one single coder. While an alternative explanation for the finding that catastrophizing was unrelated to observed pain behaviors

Table 6 Examination of the relations between pain catastrophizing, observed pain behaviors, and self-reported pain behaviors on patient satisfaction, provider attitudes, and provider behavior

Model	IV	*F*	*B* (SE)	R^2
1†	Pre-PCS	5.798	–0.342 (0.142)	0.149*
	Obs. PB	4.262	2.216 (1.411)	0.210
2†	Post-PCS	6.564	–0.350 (0.137)	0.166*
	Obs. PB	4.341	1.877 (1.351)	0.213
3†	Pre-PCS	5.111	–0.308 (0.136)	0.119*
	PBCL	2.488	0.000 (0.118)	0.119
4†	Post-PCS	6.630	–0.335 (0.130)	0.149*
	PBCL	3.237	–0.013 (0.104)	0.149
1‡	Pre-PCS	0.062	–0.012 (0.047)	0.002
	Obs. PB	0.408	–0.360 (0.414)	0.028
2‡	Post-PCS	0.576	–0.035 (0.045)	0.019
	Obs. PB	0.632	–0.344 (0.412)	0.042
3‡	Pre-PCS	0.046	–0.011 (0.049)	0.002
	PBCL	0.095	0.015 (0.038)	0.007
4‡	Post-PCS	0.741	–0.040 (0.046)	0.023
	PBCL	0.519	0.020 (0.036)	0.033
1§	Pain duration	7.720	0.620 (0.223)	0.210**
	Pre-PCS	3.886	–0.078 (0.155)	0.217
	Obs. PB	2.535	–0.382 (1.303)	0.220
2§	Pain duration	5.426	0.489 (0.214)	0.153*
	Post-PCS	2.718	–0.063 (0.157)	0.158
	Obs. PB	1.768	–0.280 (1.315)	0.159
3§	Pain duration	4.580	0.530 (0.248)	0.125*
	Pre-PCS	3.470	–0.245 (0.165)	0.183
	PBCL	2.494	–0.113 (0.143)	0.200
4§	Pain duration	3.275	0.430 (0.238)	0.090
	Post-PCS	2.885	–0.250 (0.163)	0.153
	PBCL	2.088	–0.100 (0.133)	0.168

* Significant at the $P < 0.05$ level.
** Significant at the $P < 0.01$ level.
† Dependent variable: Patient Satisfaction Questionnaire III.
‡ Dependent variable: Provider attitudes.
§ Dependent variable: Provider behavior (length of medical exam, minutes).
IV = independent variable; Obs. PB = observed pain behaviors; PBCL = pain behavior checklist; PCS = pain catastrophizing scale; SE = standard error.

might be low potential reliability of coded pain behaviors, we think this is unlikely based on the initial reliability values that we obtained (i.e., initial percentage agreement among raters of 85%).

Based on the above noted findings, both time-point measures of catastrophizing were examined as potential mediators of the pain intensity to self-reported pain behaviors relation. Results showed that pre-exam catastrophizing was a significant partial mediator of this relation, supporting the idea that one's cognitive appraisal of pain influences perceptions of pain intensity and expression of pain behaviors. Thus, given that perceptions of pain intensity were found to be significantly and uniquely associated with pain behaviors, a possible refinement to the CCM is the inclusion of a direct path from perceived pain intensity to greater pain behaviors.

Thorn and colleagues hypothesized that there is a distinction between catastrophic thinking and exaggerated, catastrophic behaviors in chronic pain patients [6]. The aforementioned mediation findings suggest that the nature of the relation is such that catastrophizing is possibly an antecedent to subsequent pain behaviors rather than a co-occurring phenomenon. Preliminary support for this hypothesized time sequential relation was demonstrated in the present results; while pre-exam catastrophizing was a significant partial mediator of the pain intensity to pain behaviors relation, catastrophizing during the medical exam was not.

Results also indicated that the mean pain catastrophizing score was significantly lower during the medical exam than before the exam; however, pain intensity was not significantly different at these time points. This is

Table 7 Summary of mediation results for pre- and post-exam pain catastrophizing and patient satisfaction (5,000 bootstrap samples)

Independent Variable (IV)	Mediating Variable (M)	Dependent Variable (DV)	Effect of IV on M (a)	Effect of M on DV (b)	Total Effects (c)	Direct Effects (c′)	Indirect Effect (a × b)	Confidence Interval‡
1. Pre-VAS	Pre-PCS	PBCL	3.89	0.65	5.82	3.31	2.51†	0.15–6.65
2. Post-VAS	Post-PCS	PBCL	3.38	0.55	5.06	3.20	1.87†	–0.22–5.96
3. Pre-PCS	PSQ-III	PBCL	–0.32	–0.01	0.98	0.98	0.004	–0.29–0.25

† Significant point estimate ($P < 0.01$).
‡ Bias-corrected and accelerated confidence interval.
PBCL = pain behavior checklist; PCS = pain catastrophizing scale; PSQ-III = Patient Satisfaction Questionnaire III; VAS = visual analog scale.

consistent with research demonstrating that catastrophizing may be conceptualized as a fluid, situational/state-dependent construct, rather than a stable, trait-like variable [2–4]. These findings suggest that even though pain per se was not reduced after seeing the provider in the current study, the presence of the health provider and the subsequent patient–health provider interaction functioned to alleviate distress associated with pain. More importantly, previous research has found that reducing anxiety and catastrophic thoughts during the medical exam decreases future health care usage [14].

The finding that catastrophizing (both pre- and post-exam) was not significantly associated with observed pain behaviors, yet accounted for a significant proportion of the variance in self-reported pain behaviors was contrary to what has been found in previous studies [5,36–38]. The nature of this conditional relationship found in the present results suggests there may be important differences between how patients perceive their own behavioral expressions of pain, and how these behaviors are quantified by trained observers. High catastrophizing patients may believe they are outwardly expressing more pain behaviors than what is actually observable, and subsequently responded to by others, including health providers. Unless the health provider routinely addresses catastrophic thoughts during the exam, the lack of health provider response to the patients' perceived behavior may subsequently influence patient satisfaction with their health provider. This may then lead to further catastrophic thinking and heightened, exaggerated displays of pain behaviors in future medical visits.

In partial support for this conjecture was the finding that higher levels of catastrophizing (both pre- and post-exam) were associated with decreased patient satisfaction. These concurrent findings indicate an interconnection between internal thought processes, communicative behaviors, and social perceptions, as proposed within the CCM framework. The present data precluded the ability to fully elucidate the causal connections between catastrophizing, patient satisfaction, and pain behaviors due to Baron and Kenny's criteria not being met in the third mediation model [34]. However, the results provide preliminary evidence to suggest that catastrophizing may lead to increased displays of exaggerated, observable pain behaviors, and this may predominantly occur within the context in which the patient both expects and then perceives the health provider to not meet their needs (and vice versa).

Results indicated that outcome variables, specifically measuring health provider attitudes and behaviors, were not significantly related to *any* of the patient outcome variables. This finding is somewhat inconsistent with previous research, comparing solicitous partner responses in the context of short vs long duration pain [12]. Given it is probable that health providers frequently interact with high catastrophizing patients (due to their increased usage of health care resources) [14], we had initially expected that health providers would respond to such patients in a

similar manner as spouses do in response to long duration pain (i.e., with more frequent punishing behaviors in the form of poorer provider attitudes and reduced exam time length). It may be that the lack of support we found for this hypothesis is a function of the different contextual factors within the medical setting in comparison to other social environments. It is also possible that our assessment of health provider behaviors was not sensitive enough to detect such relational nuances. Future studies should include more objective assessments of solicitous vs punishing health provider responses, such as direct, third-person observation and/or coding of digitally recorded health providers' behaviors during the medical exam. Additionally, it would be interesting to investigate how such an objective assessment of health provider behavior during the exam corresponded with indicators of treatment (e.g., diagnosis, referral pattern, and prescribed treatment).

Limitations

A potential limitation of the current research is the lack of an assessment of depression and the affective concomitants of pain, which are included as peripheral components within the CCM. While the purpose of this study was to specifically examine and refine the interpersonal, communicative dimension of the CCM, future studies should include assessment of these components to facilitate comprehensive examination of the model as a whole. Another potential limitation in this study was that the type of chronic pain reported by patients in this sample was quite diverse. It is possible that patient–provider interactions vary as a function of pain type; future studies should investigate this possibility. Furthermore, it is also likely the entire visit was not spent discussing issues directly related to chronic pain, particularly at the family medicine clinics. Objective recordings (as suggested above) would help determine if discussion of numerous issues other than chronic pain influences patient–provider interactions and overall treatment outcome. An additional consideration was that provider experience in the current study was also diverse, and, in some cases, paramedical professionals were included, which may influence patient–provider interactive dynamics. A further limitation was that the sample size was relatively small, which was further compounded by participants failing to complete each measure included within the study design. While this is an inherent concern when working with a clinical population, the effects of missing data become less influential when sample size is large. However, this is the first study to examine the tenets of the CCM within a medical setting and despite the restricted statistical power stemming from the aforementioned issues, significant findings were obtained that add incrementally to the literature on this topic.

Conclusions

Individuals with chronic pain often seek help from specialized pain providers to decrease pain and increase the number of pain-free periods [39]. Health care maintenance organizations have put provider time at a premium; however, chronic pain still annually costs upward of $100 billion due to lost work days, medical expenses, and other benefit costs [40]. While past clinical literature investigating the CCM has examined only the applicability of this model within spousal relationships, this study extends the application of the CCM to other important interpersonal contexts within the realm of chronic pain. Results indicate that the CCM of catastrophizing provides a heuristic framework for understanding patient behaviors within the health care context. The current study found that the internal, cognitive framework of the patient entering the medical exam is strongly determinative of the interactive dynamics between the patient and the health provider during the exam and patient satisfaction after the exam. More importantly, health providers have the capacity to positively influence patient cognitions and subsequent behaviors, which may help prevent excessive health care usage. Identifying the specific factors within the patient–health provider relationship, which facilitate or enhance adaptive ways of thinking about pain, acceptance of pain, and self-management behaviors, has the potential to inform interventions to improve treatment for chronic pain and reduce the astronomical expenses associated with persistent painful conditions.

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