

PAIN CATASTROPHIZING, RATHER THAN VITAL SIGNS,
ASSOCIATED WITH PAIN INTENSITY IN PATIENTS PRESENTING
TO THE EMERGENCY DEPARTMENT FOR ACUTE PAIN

by

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ABSTRACT

Study Objective: We examined the relationship of self-reported pain intensity with vital signs, pain catastrophizing, and anxiety in patients presenting to the emergency department (ED) for acute pain, exacerbations of chronic pain, and acute pain with concurrent chronic (combined) pain and compared the pattern of relationships among these three groups of pain patients.

Methods: A convenience sample of patients presenting to the ED with a chief complaint of pain were recruited. Vital signs and self-reported pain intensity at triage were obtained from participants' electronic medical records. After triage, participants completed self-report measures of pain catastrophizing, anxiety, and demographic information.

Results: We enrolled 158 adults presenting to the ED with a chief complaint of pain (55 with acute pain, 58 with chronic pain, and 45 with combined pain). No significant associations were found between vital signs and pain intensity at triage in any of the pain patient groups. Pain catastrophizing was significantly associated with self-reported pain intensity in the acute pain group ($r=.34, p<.05$) and combined pain group ($r=.30, p<.05$), and state anxiety was significantly associated with self-reported pain intensity in patients presenting with acute pain group ($r=.27, p<.05$). When pain catastrophizing and state anxiety were used in a stepwise multiple regression analysis to predict self-reported pain intensity pain in the acute pain group, only pain catastrophizing emerged as a unique predictor of pain intensity, $\beta = .405, p<.01$. Neither pain catastrophizing nor anxiety were significantly associated with pain intensity in the chronic pain group.

Conclusion: Consistent with previous research, vital signs are not associated with self-reported pain intensity in patients presenting to the ED for pain, including those presenting to the ED for exacerbations of chronic pain. Given the significant association of pain catastrophizing and pain

intensity among patients presenting to the ED for acute pain (with and without concurrent chronic pain), measurement of pain catastrophizing, a cognitive pain-related variable, may inform pain treatment in the ED.

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INTRODUCTION

Background

Pain is the most common cause for visits to the Emergency Department (ED) ¹⁻². Individuals present to the ED for acute pain, short-term pain caused by tissue damage or disease, or chronic pain, pain lasting three months or longer, and typically beyond the healing of physical injury. At least 20% of individuals presenting to the ED report moderate to severe pain.³ Despite the high prevalence of significant pain in the ED, pain is generally poorly treated in the ED with many patients still experiencing substantial pain at discharge¹⁻². Thus, in order to enhance quality of care in the ED and other healthcare settings, pain, both acute and chronic, needs to be accurately quantified and understood.

While pain is a subjective experience influenced by a multitude of factors, vital signs have been used as an objective measure of pain intensity to validate patients' self-reported pain intensity at triage ⁴⁻⁶. However, previous research with acute pain patients has failed to find clinically significant associations between self-reported pain intensity and vital signs in the ED and prehospital settings ^{5,7-8}. No research has specifically focused on the relationship between vital signs and self-reported pain intensity in individuals experiencing exacerbations of chronic or recurrent pain; specifically, previous research has excluded patients with "nonverifiable pain syndromes" ⁵. Existing literature suggests the association between pain and vital signs differs between those with acute pain and those with chronic pain ⁹. Consequently, the exclusion of individuals with chronic pain from past research is problematic given that half of all patients with pain in the ED present with exacerbations of chronic or recurrent pain ¹⁰.

Furthermore, a large body of evidence supports the importance of psychological factors on pain experience, pain response, and pain treatment ¹¹. Pain catastrophizing, exaggerated

negative thoughts and feelings about actual or anticipated pain, has been identified as particularly important for pain outcomes, e.g. acute and chronic pain severity¹². Higher levels of pain catastrophizing have been associated with higher self-reported pain intensity in a variety of pain diagnoses and in a variety of clinical settings¹³⁻¹⁶. Anxiety has also been found to be a significant predictor of pain treatment outcomes. Patients presenting to the ED for pain with higher levels of anxiety reported higher levels of pain and were more likely to demand pain medication¹⁷. Despite these findings, neither pain catastrophizing nor anxiety are routinely assessed in the ED.

Importance

No studies have examined associations among psychological factors, vital signs, and pain intensity in patients presenting to the ED with exacerbations of chronic pain or compared the relationships among these variables in patients with acute pain, patients with exacerbations of chronic pain, and patients with chronic pain experiencing unrelated acute pain. These factors are particularly important in the ED setting where chief complaints of pain are prevalent.

Goals of This Investigation

We examined the relationships among self-reported pain intensity, vital signs, pain catastrophizing, and anxiety in patients presenting to the ED for acute pain, exacerbations of chronic pain, and acute pain with concurrent, unrelated chronic pain. Both pain catastrophizing and anxiety were hypothesized to be better predictors of pain intensity than vital signs. Finally, exploratory analyses were conducted to examine and identify any differences in the relationship between pain intensity, vital signs, and psychological factors in individuals presenting to the ED with acute pain, exacerbations of chronic pain, or acute pain with concurrent chronic pain.

MATERIALS AND METHODS

Study Design and Setting

This cross-sectional study was performed at an urban ED in the Southeast, which serves approximately 75,000 individuals annually. The institutional review boards of the study sites approved this study. Informed consent was obtained from all participants, and participants were compensated \$10 for their time and effort.

Selection of Participants

A convenience sample was recruited from September 2012 to February 2014. Eligible individuals were aged 19 years and older and presented to the ED with a primary complaint of pain (i.e. acute pain or exacerbation of chronic pain). Individuals with life-threatening conditions, HIV-related pain, or cancer related pain were excluded from the study. During triage, nurses collected vital signs and self-reported current pain intensity using a 0-10 numerical rating scale (NRS). Triage nurses identified potentially eligible participants, informing these individuals of the opportunity to participate in a research study. Eligible individuals interested in study participation were approached by a research assistant after being transferred to an examination room. If study eligibility was confirmed, informed consent was obtained.

A research assistant administered self-report measures of demographic characteristics, pain catastrophizing, anxiety, and pain. Participants were asked to report their age, sex, race/ethnicity, years of education, location of pain complaint, duration of pain complaint, and type of pain complaint (i.e. acute pain or exacerbation of chronic pain). If a participant presenting to the ED for acute pain reported having concurrent, unrelated chronic pain, the location of their chronic pain and duration of their chronic pain were also collected. Pain catastrophizing was measured using the Pain Catastrophizing Scale (PCS). The PCS measures

the degree to which individuals magnify their pain, ruminate about their pain, and feel helpless to manage their pain¹⁸. Total PCS scores range from 0 to 52, with higher scores indicating higher levels of pain catastrophizing. High internal consistency and reliability have been demonstrated, and the internal consistency for the present sample was .92. Participants' anxiety during their ED visit was assessed using the State-Trait Anxiety Inventory-State Subscale (STAI-S)¹⁹. The STAI-S measures state or current anxiety, with scores ranging from 20 to 80. Adequate reliability and validity have been demonstrated for the STAI-S, and it is widely utilized in variety of clinical and research settings to measure anxiety. The internal consistency for STAI-S in the present sample was .90.

After participants were discharged from the ED, participant electronic medical records were examined by a research assistant and the following information was extracted: vital signs at triage (i.e. systolic blood pressure (SBP), diastolic blood pressure (DBP), respiratory rate (RR), and heart rate (HR)), pain intensity rating at triage (0 = no pain to 10 = worst pain imaginable), and final diagnosis for their ED visit. Mean arterial pressure (MAP) was calculated using triage systolic blood pressure and diastolic blood pressure values²⁰.

Outcome Measures

The primary outcome was self-reported pain intensity at triage. This outcome was grouped according to type of presenting pain (i.e. acute pain, exacerbation of chronic pain, or acute pain with concurrent, unrelated chronic pain).

Primary Data Analysis

All data were analyzed using *SPSS* version 22.0²¹. Descriptive analyses were completed for demographic characteristics, pain intensity ratings, vital signs, and psychological variables. For each of the three pain groups, bivariate correlations were conducted to examine the

relationships between pain intensity at triage, vital signs at triage (i.e. MAP, RR, and HR), and psychological variables (i.e. pain catastrophizing and anxiety). Significant correlations were followed up with regression analyses to identify any unique predictors of pain intensity. Stepwise multiple regression analyses were performed when more than one significant correlation was found. Otherwise, simple linear regression analyses were utilized. Follow-up analyses included two multivariate analyses of variance (MANOVA) to identify any differences in (1) vital signs and (2) psychological variables among the acute pain, chronic pain, and combined pain groups.

RESULTS

Characteristics of Study Participants

We enrolled 158 adults presenting to the ED with a primary complaint of pain. These individuals included 55 with acute pain (34.8%), 58 with chronic pain (36.7%), and 45 combined pain (i.e. acute pain with concurrent, unrelated chronic pain) (28.5%). Participant characteristics and demographics are summarized in Table 1. Approximately half of the participants in each pain group were female (58.2% acute, 62.1% chronic, and 55.6% combined) and Caucasian (54.5% acute, 39.7% chronic, and 51.1% combined). All groups averaged over 12 years of education (M 's=12.04 to 12.82). However, the acute pain group ($M=32.33$, $SD=12.34$) was younger than the chronic pain group ($M=42.29$, $SD=14.06$) and combined pain group ($M=40.60$, $SD=13.65$).

The chronic pain group reported the highest pain intensity at triage ($M=8.67$, $SD=1.80$), with all groups averaging pain intensity ratings above 7 (on a 0-10 NRS). All groups averaged clinically significant levels of anxiety (i.e. STAI-S scores above 39)²¹, with mean STAI-S scores ranging from 49.04 ($SD=13.60$) in the acute pain group to 51.11 ($SD=14.24$) in the combined

pain group. The average pain catastrophizing scores of the chronic pain group ($M=37.59$, $SD=10.19$) and combined pain group ($M=33.13$, $SD=14.13$) were also clinically significant (i.e. PCS scores above 30) ¹⁸.

Main Results

Bivariate correlations indicated no significant associations between pain intensity at triage and vital signs at triage in any of the pain groups (r 's=-.03 to .18). See Table 2 for further details.

Self-reported pain intensity was significantly associated with pain catastrophizing (PCS) in the acute pain group ($r=.34$, $p<.05$) and the combined pain group ($r=.30$, $p<.05$). Additionally, there was a significant relationship between state anxiety (STAI-S) and pain intensity in the acute pain group (r 's=.27, $p<.05$). Additional details provided in Table 3.

A follow up simple linear regression of pain intensity on pain catastrophizing in the combined pain group produced significant results, $B=.04$, $SE=.02$, $\beta=.30$, $t(44)=2.06$, $p<.05$. For the combined pain group, pain catastrophizing significantly predicted pain intensity, explaining 9% of the variance in pain intensity ($R^2=.090$). Furthermore, pain catastrophizing emerged as a unique predictor of pain intensity in the acute pain group in a follow up stepwise multiple regression analysis testing pain catastrophizing and state anxiety as predictors of pain intensity, $F(1, 51)=10.04$, $p<.01$. Pain catastrophizing accounted for 16.4% of the variance in self-reported pain intensity in the acute pain group ($R^2=.164$).

The results of the MANOVAs indicated no significant differences among the pain groups on combined vital signs, $F(6,286)=1.75$, $p=.32$, $\Lambda=.95$; partial $\eta^2=.024$, but significant group differences on combined psychological variables, $F(4,302)=10.515$, $p<.01$, $\Lambda=.77$; partial $\eta^2=.122$. When the pain catastrophizing and anxiety were considered separately, only pain

catastrophizing reached significance, $F(2,152) = 15.15$, $p < .01$, partial $\eta^2 = .166$. Post-hoc Tukey HSD test indicated that PCS scores were significantly lower in the acute pain group than in the chronic pain group and the combined pain group.

LIMITATIONS

A major limitation to this study is that we cannot determine whether participants received pain medication between the time of triage and collection of the psychosocial measures (anxiety, catastrophizing). Some participants completed the psychosocial measures within 15 minutes of triage, while others completed the psychosocial measures after being in the ED for an hour or longer. This was due partly to the availability of the research assistants, who may have been interviewing another participant, and partly due to the practical constraints of collecting data in a non-research clinical facility.

Another limitation of this study are the relatively small sizes of the individual pain groups (n 's=45 to 58). While we detected significant and differing relationships between the psychological variables and pain intensity in the three pain groups, it is possible some significant differences and/or associations between groups did not appear due to insufficient power to detect them. However, based on our results it does appear that those presenting with different types of pain experience pain and related cognitive/affective variables differently.

Finally, this study was completed in one ED, which may minimize the generalizability of the findings.

DISCUSSION

Vital signs did not corroborate self-reported pain intensity in patients presenting to the ED with acute pain, exacerbations of chronic pain, or chronic pain with unrelated acute pain (i.e. combined pain). This is consistent with past research with individuals presenting to the ED with

acute pain. However, to our knowledge, it is the first study examining the relationship between self-reported pain intensity at triage with vital signs to include individuals presenting to the ED for exacerbations of chronic pain and acute pain with concurrent chronic pain. This study indicates the lack of association among vital signs and self-reported pain intensity in the ED pertains to individuals with chronic pain as well as those with acute pain.

This study also supports a relationship between psychological variables and self-reported pain intensity in the ED. Pain catastrophizing uniquely predicted self-reported pain intensity in the two acute pain groups (i.e. acute pain group and combined pain group), although the amount of amount of variance explained by pain catastrophizing was relatively small. Thus, there are other unknown variables predicting pain intensity, but, obviously, vital signs are not among the predictors. It is interesting that anxiety was not related to pain intensity for those presenting to the ED for exacerbations of chronic pain or those presenting to the ED for acute pain with concurrent chronic pain (combined pain), despite averaging clinically significant levels of anxiety. At least in the acute pain and combined pain groups, catastrophizing, rather than anxiety, was the clear psychosocial predictor of pain ratings.

Given the significant relationship between pain catastrophizing and self-reported pain intensity among patients presenting to the ED for acute pain (with and without concurrent chronic pain), measurement of pain catastrophizing in the ED could inform treatment. The integration of psychological variables in pain treatment in the ED may enable clinicians to identify patients at risk for a more severe pain experience. Subsequent pain treatment and management could be adapted for “at risk” patients, e.g. patients who tend to catastrophize could be offered brief psychosocial treatments, e.g. an abbreviated cognitive-behavioral intervention to decrease catastrophizing. Ultimately, measuring pain catastrophizing in the ED could enable

clinicians to better identify patients at risk for poor treatment outcomes and adjust treatment accordingly, leading to improved pain outcomes.

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Table 1. Descriptive characteristics and demographics of participants

	Acute Pain N=55	Chronic Pain N=58	Combined Pain N=45
Sex (n, %)			
Female	32 (58.2%)	36 (62.1%)	25 (55.6%)
Male	23 (41.8%)	22 (37.9%)	20 (44.4%)
Race (n, %)			
African American	22 (40%)	33 (56.9%)	21 (46.7%)
Caucasian	30 (54.5%)	23 (39.7%)	23 (51.1%)
Other	3 (5.5%)	2 (3.4%)	1 (2.2%)
Age (<i>M, SD</i>)	32.33 (12.34)	42.29 (14.06)	40.60(13.65)
Years of Education (<i>M, SD</i>)	12.82 (2.30)	12.66 (2.04)	12.04 (2.43)
Triage Pain Intensity (<i>M, SD</i>)	7.20 (2.12)	8.67 (1.80)	7.80 (2.00)
Pain Catastrophizing (<i>M, SD</i>)	24.56 (13.11)	37.59 (10.19)	33.13 (14.13)
State Anxiety (<i>M, SD</i>)	49.04 (13.60)	50.61 (13.80)	51.11 (14.24)
MAP (<i>M, SD</i>)	96.36 (10.74)	100.46 (13.26)	103.39 (14.52)
RR (<i>M, SD</i>)	19.18 (1.56)	19.16 (1.76)	19.12 (2.06)
HR (<i>M, SD</i>)	88.95 (15.80)	88.56 (15.16)	90.41 (13.34)

Note: MAP: mean arterial pressure, RR: respiratory rate, HR: heart rate

Table 2. Correlations between self-reported pain intensity and vital signs at triage

	Acute Pain	Chronic Pain	Combined Pain
	Pain Intensity	Pain Intensity	Pain Intensity
Mean Arterial Pressure	-.03	.05	.09
Heart Rate	.12	.07	.07
Respiratory Rate	.18	.11	.09

Note: *: $p < .05$

Table 3. Correlations between self-reported pain intensity and psychological variables

	Acute Pain	Chronic Pain	Combined Pain
	Pain Intensity	Pain Intensity	Pain Intensity
PCS	.34*	.18	.30*
STAI-S	.27*	.10	.18

Note: *: $p < .05$; PCS: Pain Catastrophizing Scale; STAI-S: State-Trait Anxiety Inventory-State Subscale