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Hirsch, J.K., Sirois, F.M., Molnar, D.S. et al. (1 more author) (2016) Pain and depressive symptoms in primary care: Moderating role of positive and negative affect. The Clinical Journal of Pain, 32 (7). pp. 562-567. ISSN 0749-8047

https://doi.org/10.1097/AJP.0000000000000292

Pain and Depressive Symptoms in Primary Care: Moderating Role of Positive and Negative Affect

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Disclosure of Funding: No funding to disclose for this study.

Abstract

Objectives: Pain and its disruptive impact on daily life are common reasons that patients seek primary medical care. Pain contributes strongly to psychopathology, and pain and depressive symptoms are often comorbid in primary care patients. Not all those who experience pain develop depression, suggesting the presence of individual-level characteristics, such as positive and negative affect, that may ameliorate or exacerbate this association.

Methods: We assessed the potential moderating role of positive and negative affect on the pain-depression linkage. In a sample of 101 rural, primary care patients, we administered the Brief Pain Inventory, NEO Personality Inventory - Revised positive and negative affect subclusters and the Center for Epidemiology Scale for Depression.

Results: In moderation models, covarying age, sex and ethnicity, we found that positive affect, but not negative affect, was a significant moderator of the relation between pain intensity and severity and depressive symptoms.

Discussion: The association between pain and depressive symptoms is attenuated when greater levels of positive affect are present. Therapeutic bolstering of positive affect in primary care patients experiencing pain may reduce risk for depressive symptoms.

Keywords: Pain; Depression; Positive Affect; Negative Affect; Primary Care

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Introduction

In the United States, depression is the most commonly occurring mental illness, and a serious public health concern [1]. In primary care settings, approximately half of patients report a mental health diagnosis (30% in last year; 45-50% lifetime), the most common of which is depression (5-10%) [2;3].

In addition to traditional psychosocial risk factors for depression, including interpersonal dysfunction or loss, physiological factors, such as pain, are associated with increased depression risk [4]. Chronic pain is one of the most common conditions in medical settings, including primary care [5]. In the United States, it is estimated that one in every three persons will experience chronic pain in their lifetime [6]. Often conceptualized as having two components, pain may be classified according to its intensity, termed pain severity, and its impact on daily function, or pain interference [7]. Sources of pain for primary care patients often includes headaches and migraines, neck and back pain, abdominal, chest and joint pain, and fibromyalgia [8]. Effects of pain on functionality include impact on relationships, vocation, mobility and sleep [9]. Most pain conditions have a chronic-recurrent course and remain some of the most poorly understood conditions in primary care [5].

Chronic pain, and its burden on activities of daily living, is associated with higher reports of poor mental health including anxiety, depression and suicide risk [4;10]. Numerous theoretical perspectives exist that address the coexistence of depression and pain. When comorbid, pain and depression share overlapping symptoms, are more severe, complicate

treatment and promote treatment resistance [11]. Pain and depression also share biological and neurotransmitter pathways, suggesting common etiologies and maintaining mechanisms [12]. From a behavioral perspective, individuals experiencing pain may have reduced opportunities to engage in activities, experiences or relationships that provide positive reinforcement, thereby contributing to feelings of depression. Cognitive models are complementary, suggesting that the experience of pain and its effects on functioning might contribute to feelings of poor self-control and mastery, low self-efficacy, helplessness and hopelessness, and consequent depression [12-14]. One specific model, the Fear Avoidance Model of Musculoskeletal Pain, suggests that when pain occurs, catastrophizing contributes to a fear of pain and pain anxiety, and consequent feelings of avoidance and escape. As pain increases in severity or interference, behavioral disengagement and potential abandonment of goals may contribute to frustration and depression [15]. Little research, however, has examined potential emotional mechanisms of action for this relationship, which may include the impact of pain on trait-level, mood-related thoughts and behaviors, with resultant consequences for the development of depression [16].

Not all patients experiencing pain or its disruptive effects endorse depressive symptoms, suggesting the presence of additional factors, such as positive and negative affect, that might ameliorate or exacerbate this association [17]. Negative affect, characterized as a dispositional characteristic comprised of irritability, anxiety and social dysfunction, is related to poor mental and physical health such as functional impairment, poor perceived health and depression [18;19]. In contrast, positive affect, or the extent to which a person feels engaged, happy and has an adaptive future orientation, is associated with better psychological functioning and quality of life, and improved illness trajectory and recovery [20;21].

Despite the presence of chronic illness and pain, many patients are able to identify positive or meaningful aspects of their physical difficulties, perhaps viewing their circumstances as a "challenge" to be overcome [22;23]. It is important, therefore, to distinguish between positive and negative affect. Some research suggests that positive and negative affect are two independent constructs, not opposite ends of a single continuum [24;25]. Positive affect may actually neutralize some of the consequences of negative affect [26], and previous studies indicate that it is the absence of positive affect, rather than the presence of negative affect, that exerts a greater influence on self-reported general physical and mental health [27;28].

From a theoretical perspective, dispositional models of affect suggest that individuals have an affective set-point that they return to following a negative disturbance, such as the experience of pain [29]. Those with greater levels of positive affect may utilize homeostatic motivational and decision-making processes to regain their typical positive disposition [30;31]. Patients with greater levels of trait positive affect tend to utilize more adaptive coping strategies and exhibit better psychological adjustment to medical difficulties than individuals with less positive affect, in both cross-sectional [18] and prospective studies [32]. A dispositional tendency toward positive affectivity may help a patient to persevere in the face of adversity, may promote engagement in treatment, and may facilitate provision of support from caregivers [33;34].

We examined the association between pain and depressive symptoms in a sample of primary care patients, as well as the potential moderating role of positive and negative affect. At the bivariate level, we hypothesized that greater pain severity and interference would be related to more negative affect, less positive affect and a greater number of depressive symptoms. We also hypothesized that greater positive affect, and less negative affect, would be associated with

fewer depressive symptoms, and that positive and negative affect would be inversely related to one another. In multivariate analyses, we hypothesized that both pain severity and interference would be positively associated with depressive symptoms, and that these associations would be moderated by affect, such that positive affect would weaken, and negative affect would strengthen, the relationship between pain and depressive symptoms.

Method

Participants. Participants in this Institutional Review Board-approved study provided informed consent and were recruited from a rural, primary care clinic serving working and uninsured patients. Importantly, mental health disorders, including depression, are more prevalent among uninsured individuals than insured individuals [35] and, further, presentation of poor mental health is a common occurrence in primary care, accounting for over 50% of patient visits [36].

Participants (n=101) were primarily female (n=71; 71%) and White (n=94; 94%), with a mean age of 42.04 (SD = 12.81) and a range of 18 to 64 years of age; none of the participants qualified for state-level insurance (Tenncare) or federal-level insurance (Medicare). Most participants (n = 46; 47%) reported an annual income less than $20,000, and 27 participants (28%) earned less than $10,000. Further, six percent of our sample (n=6) did not graduate high school, and only 25 persons (25%) had obtained a college degree.

Measures. We assessed pain symptoms using the Brief Pain Inventory – Short Form (BPI) [37;38], a 14-item self-report questionnaire that allows patients to rate the severity of their pain (7 items) and the degree to which pain interferes with daily functioning (7 items). Pain interference questions are scored on a 10-point Likert scale from 0 (does not interfere) to 10

(completely interferes) and assess the interference of pain on daily routines and quality of life, during the past week. Pain severity questions are also scored on a 10-point Likert scale from 0 (no pain) to 10 (pain as bad as you can imagine) and assess severity of pain in the last week. We utilized a composite of 4 items, averaged, to attain a pain severity score, including: worst pain in last week, least pain in last week, average pain and current pain. The BPI is a gold-standard measure of pain, with excellent reliability and validity in medical patients [7;38]. In our sample, internal consistency was good for each subscale, intensity (.94) and interference (.72).

We assessed positive and negative affect using subclusters from the NEO-Five Factor Inventory (NEO-FFI) [39], a 60-item, self-report questionnaire measuring five broad domains of personality. Items comprising the positive (4 items; e.g., "I laugh easily") and negative affect (5 items; e.g., "I am not a worrier") facet scores are derived, respectively, from the extraversion and neuroticism domains [40]; negative affect items are reverse scored. The NEO inventories have been used successfully, with good reliability and validity, in prior clinical and medical research [41;42]. In the current study, given each scale's brevity, coefficient alphas were adequate for both positive (.70) and negative (.73) affect.

We assessed severity of depressive symptoms, in the past week, using the Center for Epidemiologic Studies Depression Scale (CES-D) [43], a 20-item scale on which respondents are asked to rate the extent to which they have experienced specific depressive symptoms (e.g., "I felt depressed"). Items are scored on a 4-point Likert-type scale, ranging from 0 (rarely or none of the time) to 3 (most or all of the time). Evidence for the construct validity of the CES-D has been reported in past studies, including excellent validity and reliability in community and medical samples [43-45]. In the present sample, internal consistency of the CES-D as measured by Cronbach alpha was .93.

Statistical analyses. Bivariate correlation analyses were conducted to assess for associations between, and independence of, study variables; no relationships were multicollinear ($r > .70$) [46]. Multiple, hierarchical regressions, covarying age, race/ethnicity, and sex were conducted, examining positive and negative affect as potential moderators of the association between pain and depressive symptoms; covariates and predictors were entered on the first step of the model, and the interaction term on the second step [47]. Separate models were utilized to assess the independent variables of pain severity and pain interference; as well, separate and combined models were developed to determine the unique and simultaneous effects of both positive and negative affect as moderators. We ran identical models in our full sample as well as in the subset of patients endorsing pain in the past week. Standardized coefficients are presented.

Results

In our sample of primary care patients, of the 52 individuals (52%) reporting at least some pain during the past week, 29% (n=15) described their worst pain of the past week as mild, 37% (n=19) moderate and 34% (n=18) severe [48]. Fifty-nine percent (n=59) of our sample reported having at least some interference from pain in the past week. Forty-one (41%) respondents scored at or above the recommended cut-off score of 16 on the CES-D, suggesting at least significant or "mild" symptoms of depression. See Table 1 for frequencies for all study variables.

At the bivariate level, using the full sample, and in support of hypotheses, positive affect was significantly negatively associated with negative affect, pain interference and pain severity, and depressive symptoms. Negative affect was positively related to pain interference and

depressive symptoms, and pain interference and severity were both positively associated with depressive symptoms (See Table 1).

In full-sample multivariate analyses examining pain severity, and in partial support of hypotheses, pain severity was associated with depressive symptoms, and positive affect, ($t=-2.05$, $p<.05$; $\beta=-1.50$, Cohen's f^2 effect size = .78), but not negative affect, was a significant moderator of this relation. In a model examining the simultaneous influence of both positive and negative affect, only positive affect was a significant moderator, ($t=-2.32$, $p<.05$; $\beta=-1.65$, $f^2=1.51$). The association between severity of pain and depressive symptoms was attenuated at greater levels of positive affect. In sub-sample analyses of patients experiencing pain in the past week, neither positive affect or negative affect were a significant, independent moderator but, in a simultaneous model, positive affect emerged as a significant moderator ($t=-2.65$, $p<.05$; $\beta=-3.27$, $f^2=1.47$).

A similar pattern emerged in full-sample models examining pain interference. Positive, but not negative, affect was a significant moderator in both independent ($t=-2.87$, $p<.01$; $\beta=-1.64$, $f^2=.92$) and combined models ($t=-3.11$, $p<.01$; $\beta=-1.86$, $f^2=1.68$). The link between self-reported interference of pain on daily activities and depressive symptoms was weakened with greater levels of positive affect. Although negative affect failed to reach significance as a moderator, it did exert a main effect in all models ($p<.001$). In analyses utilizing a subset of patients experiencing pain in the past week, neither positive nor negative affect were significant as independent moderators; however, in a simultaneous model, positive affect emerged as significant ($t=-2.55$, $p<.05$; $\beta=-2.47$, $f^2=1.60$).

Discussion

We examined the association between pain intensity and severity and depressive symptoms, in a sample of rural, uninsured and underinsured primary care patients. In support of bivariate hypotheses, we found that pain, negative affect and depressive symptoms were all positively related, and all were negatively related to positive affect. In moderation models, using our full sample, although negative affect was directly associated with depressive symptoms, only positive affect was a significant moderator of the relationship between pain and depressive symptoms. In a subset of patients experiencing pain in the past week, positive affect alone emerged as a moderator in models also including negative affect. The association between pain and depressive symptoms was attenuated at higher levels of positive affect, partially supporting our hypotheses.

Positive affect may facilitate redefinition or reframing of discomfort from pain or pain-induced interference, thereby enhancing perceived ability to cope with pain-related stressors. Positive affect is also associated with creative problem solving which may foster novel problem resolution and consequent ability to overcome health-related barriers associated with pain [49]. Positive affect may also contribute to improved mood in the context of the experience of pain. For instance, previous research suggests that positive affect may aid in recovery from pain via improvements in emotional functioning and sense of resilience [17].

Although negative affect was significantly directly associated with depression, as in previous studies [50], it did not emerge as a significant moderator of the association between pain and depression, indicating the relative salience of positive affect over negative affect as an influence on the association between pain and depressive symptoms. Lack of significance as moderator may be due to the already-strong association of negative affect and depressive symptoms. Previous research suggests that individuals experience high levels of anxiety and

sadness as a result of negative affect [51]. Our findings also suggest that it is the presence or absence of positive affect, rather than negative affect, which attenuates the pain-depression relationship. Such patterns have been found in previous medical samples [21].

Our novel findings must be interpreted in the context of limitations. Our cross-sectional design precludes the ability to assess causality, and bidirectionality is a possibility. It may be that depressed individuals experience more intense and impairing experiences of pain, as in previous research [11]. Our use of self-report questionnaires, although necessary, may be subject to demand characteristics such as social desirability, and underreporting of symptoms may be a possibility. Given the quite high rates of depressive mood endorsed by our sample, which neared the clinical cut-off score for the CES-D (Mean Score = 15.74; SD=11.74) [43], it does not appear that underreporting occurred. Prospective, longitudinal research using objective assessments is needed to substantiate our conclusions. Although our assessment of an underserved, under-researched sample of patients is a strength of our study, our primarily White, female sample, which had relatively low mean scores on the Brief Pain Inventory, may limit generalizability. Lack of information on physician diagnosis, or on acuity or chronicity and location of pain, is also less than ideal, and limits translational applicability to specific pain populations. Additional research is needed that focuses on diverse community and clinical samples, including patients with a formal diagnosis of chronic pain and with more detailed classification of type of pain experienced.

It is also important to note the potential complexities that could be involved in the translational application of our findings. The trait-based or "set point" positive affect assessed by our measure of personality may be less amenable to alteration, both in the short and long-term, than state affect [52] and may be dependent, to some extent, on the effect of genetic

makeup on personality [53]. Yet, some research indicates that dispositional affect may vacillate under some contextual life circumstances, such as health crises and chronic pain [54]. On the other hand, extremely positive events may shift, upwards, the set-point of positive affect. Even less extreme occurrences, such as greater social interaction [55], contribute to long-term increases in positive affect [56].

Although mixed findings exist, the robustness of interventions to increase positive affect may be moderate, with diminishing results over time [57;58]. Poor consensus may also be due to a lack of prospective investigation, although preliminary research suggests that affective changes can be maintained with implementation of behavioral, cognitive and volitional therapeutic strategies [59;60]. In the context of poor health-related quality of life, increases in coping resources, including self-mastery, self-efficacy and self-esteem, contribute to greater positive affect over time [61]. Such results suggest that therapeutic interventions to bolster these types of characteristics may have a more persistent effect than previously considered. Rigorous, longitudinal research is necessary to determine the effect of intervention on extended manifestation and influence of positive affect.

Implications. Our results may have clinical implications for improving mental health in primary care patients experiencing pain. Our results suggest that for patients experiencing pain, healthcare providers should assess the quality of their mood to determine the absence and presence of both positive and negative affect, as these characteristics may contribute to more serious episodes of depression. Given the ubiquitous nature of pain and mood dysfunction in primary care samples, screening for the presence of pain and depressive symptoms should be routine [62;63].

Co-existing pain and depressive symptoms, given their common physiological and neural pathways, often respond to singular treatment, including anti-depressant medications and deep brain stimulation [64;65]. Primary-care based treatments for comorbid pain and depression, including collaborative and stepped care models, which often involve patient and provider education, patient self-management training and supervised case management, are also effective [66;67].

Cognitive-behavioral and mindfulness-based interventions, including use of self-affirming statements, cognitive reappraisal and behavioral activation, may increase positive affect and reduce negative affect, by allowing patients to reframe negative and catastrophizing thoughts often associated with pain and by promoting acceptance of chronic pain, thereby reducing the deleterious association between pain and depression [68-70]. Interpersonal Therapy (IPT), focused on resolution of the interpersonal consequences of pain (e.g., loss of interaction, burden and changing social roles), may also be an effective clinical intervention for patients experiencing comorbid pain and depressive symptoms, and can be delivered within the primary care setting [71].

In conclusion, it appears to be the absence or presence of positive mood that qualifies the relation between pain and depression. Although reduction of negative affect remains an important therapeutic goal, bolstering adaptive strengths and positive affectivity may result in greater improvements to mental health functioning. Physicians and clinicians may be unable to reduce the amount of pain a patient experiences, however therapeutic interventions that reduce negative affect and improve positive affect may reduce risk of psychopathology associated with pain.

Role of Funding Source: no funding declared

Conflict of Interest: No conflict of interest declared.

Acknowledgements: No acknowledgements are included with this manuscript.

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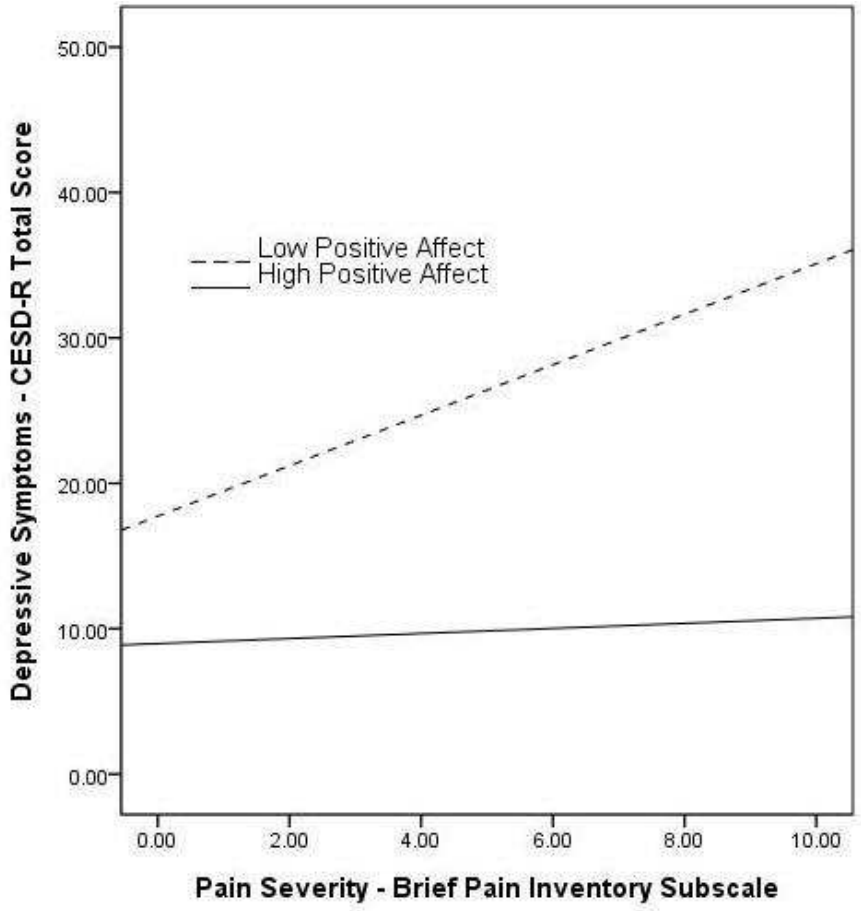
TABLE 1: Means, standard deviations and correlations for study variables

		Mean (SD) N (%)		Age	Sex	Pain Severity	Pain Interference	Positive Affect	Negative Affect	Depressive Symptoms
Age		42.04 (12.81)		-	.04	.15	.21*	-.02	-.19	-.11
Sex (Female)		71 (71%)		.03	-	.06	.03	-.05	.27**	.24*
Pain Severity		2.54 (2.35)		.16	.06	-	.85**	-.25*	.19	.25*
Pain Interference		2.39 (2.66)		.21*	.03	.85**	-	-.27**	.22*	.31**
Positive Affect		3.47 (.77)		-.02	-.05	-.25*	-.27**	-	-.52**	-.58**
Negative Affect		3.19 (.88)		-.19	.27**	.18	.22*	-.52**	-	.68**
Depressive Symptoms		15.71 (11.74)		-.11	.24**	.25*	.31**	-.58**	.68**	-

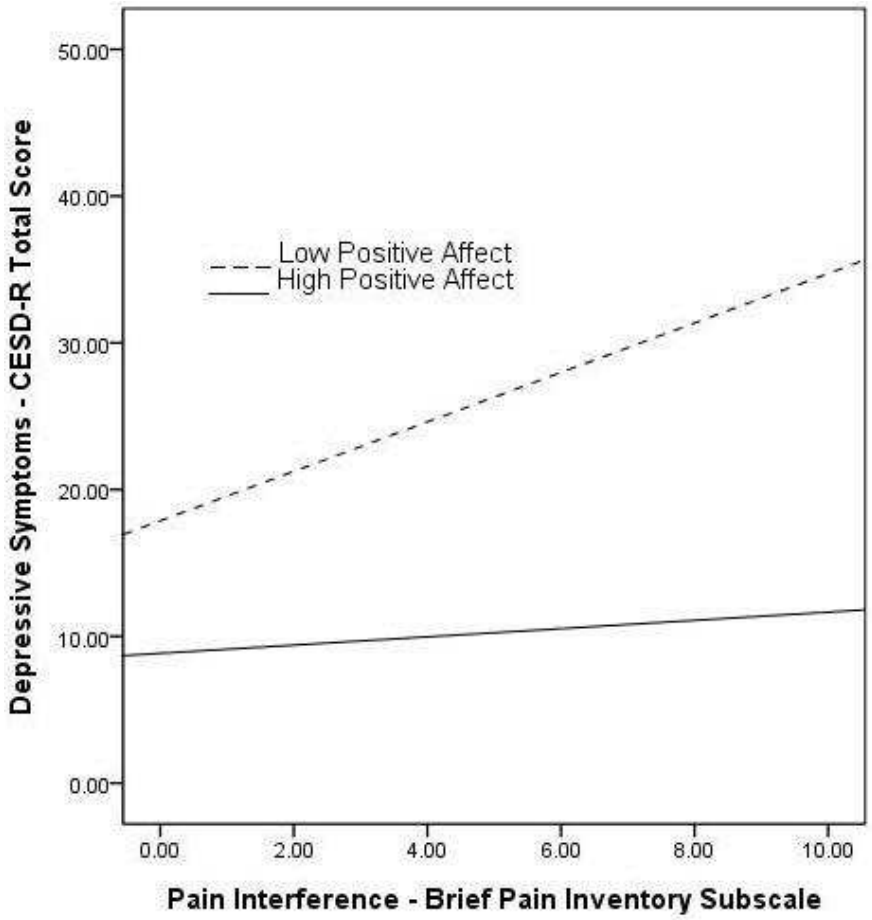
Note: Pain severity and interference = Brief Pain Inventory subscales; positive and negative affect = NEO Personality Inventory subscales; depressive symptoms = Center for Epidemiological Studies Depression Scale. *p<.05, **p<.00

FIGURE 1: Positive affect moderates the relation between pain severity and depressive symptoms.



Note: Pain severity = Brief Pain Inventory subscale; positive affect = NEO Personality Inventory subscale; depressive symptoms = Center for Epidemiological Studies Depression Scale.

FIGURE 2: Positive affect moderates the relation between pain interference and depressive symptoms.



Note: Pain interference = Brief Pain Inventory subscale; positive affect = NEO Personality Inventory subscale; depressive symptoms = Center for Epidemiological Studies Depression Scale.