HHS Public Access

Author manuscript

Int J Psychiatry Med. Author manuscript; available in PMC 2015 May 26.

Published in final edited form as:

Int J Psychiatry Med. 2014 ; 47(1): 1–16.

EMOTIONAL REACTIONS TO PAIN PREDICT PSYCHOLOGICAL DISTRESS IN ADULT PATIENTS WITH SICKLE CELL DISEASE (SCD)

CHRISTOPHER L. EDWARDS, PhD,
Duke University, North Carolina

ALVIN KILLOUGH, PhD,
University of Minnesota, Crookston

MARY WOOD, MA,
Duke University, North Carolina

TODD DOYLE, PhD,
Duke University, North Carolina

MIRIAM FELIU, PsyD,
Duke University, North Carolina

CAMELA S. BARKER, MA,
B & D Behavioral Health, Inc

PRIYANKA UPPAL, MD,
Duke University, North Carolina

LAURA DeCASTRO, MD,
Duke University, North Carolina

CHANTÉ WELLINGTON, PhD,
Shaw University

KEITH E. WHITFIELD, PhD,
Duke University, North Carolina

JAY TRAMBADIA, PsyD,
Duke University, North Carolina

DARIENE GUINYARD, MA,
North Carolina A&T State University

MALIK MUHAMMAD, PhD,
Elite Biobehavioral Health, Inc

KEISHA-GAYE N. O'GARO, PsyD,

Direct reprint requests to: Christopher L. Edwards, PhD, BCB, IABMCP, Associate Professor, Medical Director, Biofeedback Laboratory and Pediatric Neuropsychology Service, Director, Chronic Pain Management Program, Duke University Medical Center, 932 Morreene Rd., Rm 170, Durham, NC 27705, christopher.edwards@duke.edu.

Womack Army Medical Center

KAI MORGAN, PsyD,
University of the West Indies

LEKISHA Y. EDWARDS ALESII, PhD,
University of North Carolina at Chapel Hill

GOLDIE S. BYRD, PhD,
North Carolina A&T State University

MELANIE McCABE, MA,
University of North Carolina at Chapel Hill

VEERAINDAR GOLI, MD,
Duke University, North Carolina

ABIGAIL KEYS, PsyD,
Duke University, North Carolina

LABARRON HILL, PhD,
Duke University, North Carolina

JANICE COLLINS-McNEIL, RN, PhD,
Winston-Salem State University

PATRICIA McDONALD, BA,
North Carolina Central University

DONALD E. SCHMECHEL, MD, and
Southeastern Neurology and Memory Clinic

ELWOOD ROBINSON, PhD
North Carolina Central University and Cambridge College

Abstract

Differentiating somatic from emotional influences on the experience of chronic pain has been of interest to clinicians and researchers for many years. Although prior research has not well specified these pathways at the anatomical level, some evidence, both theoretical and empirical, suggest that emotional reactions influence the experience of disease and non-disease-related pains. Other studies suggest that treatments directed at negative emotional responses reduce suffering associated with pain. The current study was conducted to explore the influence of emotional reactions to pain as a predictor of psychological distress in a sample of adult Blacks with Sickle Cell Disease (SCD). Using cross-sectional survey data, we evaluated whether negative emotional reactions to the experience of pain were predictive of psychological distress after controlling for the somatic dimension of pain and age in $n = 67$ Black patients with Sickle Cell Disease (SCD). Results showed that greater negative emotion associated with pain predicted Somatization ($p < .01$), Anxiety ($p < .05$), Phobic Anxiety ($p < .05$), and Psychoticism ($p < .05$). Increased negative emotion associated with pain was also predictive of the General Symptoms Index ($p < .05$) and the Positive Symptoms Total from the SCL-90-R ($p < .01$). We believe the current study demonstrates that negative emotional reactions to the experience of pain in adults with SCD are predictive of

psychological distress above and beyond the influences of age and the direct nociceptive experience. We also believe these data to be valuable in conceptualizing the allocation of treatment resources toward a proactive approach with early identification of patients who are responding poorly for the purpose of potentially reducing later psychopathology. A deeper understanding of the ways that subpopulations cope with chronic disease-related pain may produce models that can be ultimately generalized to the consumers of the majority of healthcare resources.

Keywords

depression; pain; negative emotional reactions; sickle cell disease

INTRODUCTION

Chronic pain remains one of the more poorly understood phenomena in medical and social science research. Although pain is the single most common reason to visit a physician [1, 2] and one of the most common reasons patients seek medical care [3], there remains controversy over the biological, psychological, and social basis of chronic pain. Many clinicians and scientists continue to debate the existence, for example, of fibromyalgia, chronic fatigue syndrome, and myofascial pains as manifestations of mental illnesses rather than physical disorders or biological syndromes [4]. Patients with these conditions often present with debilitating primary effects under conditions of unclear etiology and powerful secondary effects that can alter emotional states and facilitate misdiagnosis [5].

When present in patients with chronic pain, psychological symptoms such as depressed mood or elevated anxiety can be even more perplexing and difficult to identify due to their comorbidity and shared symptomatology [6–9]. Commonly shared symptoms of pain and depression, for example, include but are not limited to sleep and appetite disturbances, fatigue, reduced behavioral activity with anhedonia, social withdrawal, changes in weight, and decreased libido [10–12]. These depressive symptoms are less likely to be recognized by clinical providers when primary complaints are pain-related [13]. Many patients with chronic pain experience an increased prevalence of psychosocial crises that include job loss, the loss of roles in the family system, decreases in social functioning, and increased healthcare costs [14]. This shift in functioning and resource utilization can also be associated with depressive symptomatology [15]. Conversely, patients with depression may present with emotional symptoms [15] and painful somatic symptoms including, headaches [16], muscle aches, and backaches [17].

Negative mood states and stress predict physical symptoms of pain-related illnesses and vice versa (e.g., arthritis, irritable bowel syndrome, and recurrent abdominal pain in children) [17]. Studies have shown that fluctuations in negative mood and stress predict not only pain, but also psychosocial and functional outcomes [2, 5]. Clinicians and researchers alike have speculated that psychological disorders, such as depression or anxiety, can be associated with the onset of painful episodes in diseases like sickle cell disease (SCD), a class of inherited blood disorders (e.g., sickle cell anemia, sickle hemoglobin C, sickle beta

thalassemia) characterized by a decreased quantity of red-blood cells capable of effectively carrying oxygen as a result of their shortened lifespan and sickled shape. Previously, this speculation was supported by predominately anecdotal evidence and retrospective studies [2]. However, in recent years, several investigations have provided evidence for a relationship between mood, stress, and pain in patients with SCD [6–8, 18]. To our knowledge, none of these previous studies have examined the impact of negative emotional responses to the experiences of chronic pain as the basis of the prediction of clinically relevant psychiatric dispositions in adult patients with SCD.

There is evidence of substantial variability in the presentation of negative mood symptoms, among ethnic groups and across cultures, but few if any of these models have been used as the basis of a study in a sample of Blacks [19–21]. The majority of patients with SCD in the United States are Black, have chronic pains, generally present with a high incidence and prevalence of psychopathology [7, 22–30], and are an ideal sample for such a study.

In the context of a general literature that documents the impact of pain on mood (2, 5, 17), and in the absence of findings in samples of Blacks with SCD, we asked: Can emotional reactions to pain in patients with SCD be used to predict differences in the magnitude of psychological distress? The primary aim of this study was to investigate the predictive value of the negative emotional dimension of pain on the magnitude of psychological distress in patients with SCD. We hypothesized that negative emotional reactions to pain would be significantly predictive of psychological distress in this population.

METHODS

Study Design

The current study represents a cross-sectional evaluation of data collected as part of a longitudinal investigation of the relationship of medical and psychosocial factors to pain in patients with SCD.

Participants

Participants were 67 adult patients diagnosed with SCD from the Duke University Comprehensive Sickle Cell Center. Inclusion criteria included a diagnosis of SCD provided by the study hematologist. Participants were excluded from the study if they were actively in an acute episode of pain or other urgent medical crisis at the time of clinic visit or if they were unable to read and comprehend the written instructions for testing. Patients were also excluded from analysis if they had a significant diagnosis other than SCD (e.g., history of psychotic episode in the past 6 months). The consent form and all study procedures were approved by the institutional review board at Duke University Medical Center.

Materials

Pain—The Short Form McGill Pain Questionnaire (SF-MPQ) [31] and a visual analogue scale were used to measure pain severity. The SF-MPQ is structured to assess qualitative and quantitative aspects of pain including location, intensity, quality, and temporal dimensions. Participants were asked to rate the current intensity of each pain-related

adjective by circling “none, mild, moderate, or severe.” The measure has demonstrated validity and reliability with multiple pain populations. Intra-class correlations, as estimates of reliability, for the sensory, affective, and average pain scores, are 0.96, 0.95, 0.88, and 0.89, respectively [32]. There is a very high correlation between scales of the long and short-forms of the McGill Pain Questionnaire.

Psychopathology—The Symptoms Checklist 90-items, Revised (SCL-90-R) [33] was used to evaluate the magnitude of common psychopathologies including Somatization (SOM; distress arising from perceptions of bodily dysfunctions), Obsessive-compulsion (O-C; irresistible thoughts, behaviors, or impulses), Interpersonal Sensitivity (I-S; feelings of personal inadequacy or uneasiness), Depression (DEP; dysphoric mood and other symptoms associated with depression), Anxiety (ANX; a tendency toward anxiety as manifest by nervousness, tension, and trembling), Phobic Anxiety (PHOB; a persistent fear response to a specific person, place, object, or situation), Hostility (HOS; thoughts, feelings, or actions that are associated with a state of anger), Paranoia (PAR; suspiciousness or the fear of loss of autonomy), and Psychosis (PSY; the perception of unusual experiences or interpersonal isolation). The SCL-90-R also has 3 global indices including General Severity Index (GSI; the current level and depth of negative emotional distress), Positive Symptom Distress Index (PSDI; intensity of symptoms as a function of the number of endorsed symptoms), and the Positive Symptom Total (PST; number of symptoms that patients endorse). Response options range from 0 (not at all) to 4 (extremely). Internal consistency for the subscales ranged from .77 to .90. Cronbach alphas for the global severity index (GSI) are high, ranging between .96 and .97 [33].

Social Desirability—The Marlow-Crowne Social Desirability Scale (MCSD) is often incorporated in studies to account for a study subject’s tendency to respond to questions in a culturally desirable manner within the context of a current ethnic-cultural population under study. The original instrument was developed by Marlow and Crowne in 1960 [34]. The scale presents culturally approved behaviors with a low probability of occurrence. Higher scores represent an increased tendency to answer questions according to what the participant believes would likely please the proctor. Kuder-Richardson coefficient of internal consistency is .88 with a one-month test-retest correlation of .89.

Procedures

Study procedures have been described previously [6, 7, 22, 35]. Briefly, all patients were consented and enrolled individually in the current study during routine visits to the Duke University Comprehensive Sickle Cell Center. Patients were identified by the study hematologist as suitable for participation based upon the patient’s ability to read, and their characteristics matched against inclusion and exclusion criteria. They were then approached by study personnel about participation. All patients were given a brief verbal overview of the study, which included conducting a review of their historical patterns of healthcare utilization from their medical records, and then allowed to read the consent forms.

Participants were then provided a copy of the survey, moved to a relatively quiet or isolated portion of the waiting room when possible, and given instructions for completion of the

survey by a member of the study team. Once complete, the survey was collected and an informal debriefing was provided.

Statistical Analyses—Statistical analyses were conducted using SAS [36]. Data were examined for normality, homoscedasticity, skewedness, kurtosis, and multicollinearity prior to analysis. The primary data analysis strategy was to conduct separate regression analysis models on the nine symptom scales and three global indices of the SCL-90-R. Following adjustment for age, the Sensory and Affective scales of the McGill Pain Questionnaire–Short Form were entered into the models to predict outcomes on the SCL-R-90.

RESULTS

Participants

Sixty-seven participants (n = 30 male and n = 37 female), mean age 36.82 ± 11.47 (range 18–70), mean years of education 13.28 ± 1.84 completed the assessment during the first year of evaluation. Thirty-two percent of patients were married, 48% were single, 17% were divorced/separated, and 3% were living with a significant other. Sixty-four percent of patients were employed at the time of assessment. Twenty-nine percent of patients reported that they had experienced "Anxiety," and 36% indicated that they had experienced "Depression" in the 30 days prior to assessment. Patients who endorsed these psychological symptoms did not differ in their age, education, tendency to report in a socially desirable manner, or reports of pain from patients who did not endorse the presence of these symptoms.

Zero-Order Correlations between Predictor and Outcome Variables

Generally, there were high intercorrelations among scales of the SCL-90-R ($p < .001$; Table 1). Further, the negative emotional dimension of pain was significantly positively correlated ($p < .05$) with all scales of the SCL-90-R except for Hostility ($p > .05$). The SCL-90-R scales were less strongly correlated with age and the sensory dimension of pain. Age was significantly positively correlated with Interpersonal Sensitivity ($p < .05$) and Hostility ($p < .05$), while the Sensory experience of pain was significantly positively correlated with SOM, O-C, I-S, DEP, ANX, and PSY symptom scales, well as the GSI, PSDI, and PST ($p < .05$). Social desirability was unrelated to any of the study variables.

Association between Negative Emotional Responses and Psychopathology

After covarying for age and the sensory dimension of pain, the negative emotional dimension of pain was found to be significantly associated with SOM ($F[3, 62] = 7.75$, $p < .01$, $R^2 = 0.27$) and ANX ($F[3, 62] = 5.39$, $p < .01$, $R^2 = 0.21$). In addition, the negative emotional dimension of pain was also found to be significantly associated with PHOB ($F[3, 62] = 2.86$, $p < .05$, $R^2 = 0.12$), and PSY ($F[3, 62] = 4.88$, $p < .01$, $R^2 = 0.19$). Lastly, the negative emotional dimension of pain was predictive of the GSI ($F[3, 62] = 6.72$, $p < .001$, $R^2 = 0.25$) and the PST ($F[3, 62] = 6.81$, $p < .001$, $R^2 = 0.25$). Regression coefficients are presented in Table 2. The negative emotional dimension of pain was not predictive of the O-C, I-S, DEP, HOS, or PAR symptom scales as well as the PSDI.

DISCUSSION

To our knowledge, this is one of only two studies to evaluate the relationship between negative emotional reactions to pain and subsequent psychological outcomes in adult patients with SCD. Previous studies have identified the somatic experience of pain as significant in predicting negative emotional states, healthcare utilization, and quality of life [37]. We extended these previous findings to include that the negative emotional reaction to the somatic experience of pain, controlling for the magnitude of nociceptive experience, was predictive of psychological distress which included anxiety about health and other issues, elevated levels of distrust, and the increased belief that one is isolated by experiences that are disparate from the general population. Negative emotional reactions to pain were also predictive of the number of symptoms endorsed by patients who have SCD, and the level and depth of negative emotional distress.

These results are consistent with past studies in other populations that have found a relationship between psychological symptoms and the experience of chronic pain in patients with SCD [7, 22, 32, 35, 38]. Pain perception and psychological disposition are intricately intertwined, with one affecting the other. More broadly, the experience of pain influences and is influenced by biological, cognitive, and emotional processes all experienced in a social context [25, 35, 39, 40]. Our study suggests that beyond previous findings, negative affective reactions to pain, independent of the magnitude of the somatic experience, are predictive of a range of anxieties and fears, and even the magnitude of symptoms reported by patients.

Beyond previous studies, however, the current results highlight the need to better resource patients with SCD to manage and control their responses to pain as a way of possibly reducing later psychological distress. For example, it is possible that patients who have access to care providers and well-defined plans for responses when painful crises arise may respond differently and with greater anxiety and fear than patients without such resources. In the current model, such reaction may be associated with later and more complicated negative psychological consequences. In essence, the nature, unpredictability, and intensity of pains in adult patients with SCD may produce a more intense and debilitating overall experience, and potentially more affective morbidities among patients who view and then respond to their disease state as negative. Previous studies, in non-SCD samples, have demonstrated that individuals who experience intense physical pain are more likely to endorse and experience high levels of psychological distress and vice versa [41, 42]. These models should increasingly be applied to understanding reactions to SCD pain and related psychopathology.

We also found that the tendency to ruminate and obsess, to be overly sensitive to the opinions of others, and the tendency to be sad or hostile were not predicted by negative reactions to experience of pain. Unfortunately, the current state of the pain literature does not provide substantial guidance to interpret these findings. For example, some studies indicate that emotionally disturbed individuals report higher pain intensities then their healthier counterparts; whereas other studies have shown that individuals with negative emotional disturbance have high thresholds and tolerances for pain [43, 44]. We do,

however, believe that further research will begin to elucidate the complicated relationship between negative emotional reactions to pain and subsequent psychopathology in patients with SCD.

We recognize that many scientists conceptualize behavioral manifestations of negative emotional states like hostility as the product of cognitive processes like rumination among patients with pain [45, 46]. These manifestations are subsequently the products of multidimensional social, interpersonal, psychological, and biological factors (e.g., anger, negative perception, cynicism, appraisals concerning others, etc.) that are differentially experienced and coped with [2, 6, 22, 47–54] across racial, ethnic, age, gender, and other demographic characterizations [21, 35, 39] as well as genetic predispositions [9]. Better understanding the interaction of such factors with reports of acute and chronic pain is a growing mission for many clinical and academic researchers. Additional prospective investigations are needed, if the desire is to better understand what is unique about these relationships among patients with SCD and why they are not predicted by emotional reactions as are other related variables.

Limitations

The primary limitation to the current study is the modest sample size within a limited sample of adult patients with SCD. This limitation precluded a substantial increase in N for potentially more power, and limited extensive exploration of the influence of additional demographic factors on outcome variables of interests. We did not present power analyses in the current article, particularly because we were adequately powered to see significance in a majority of analyses that we conducted and presented in the Results section.

Secondarily, the authors acknowledge that reactions to acute episodes of pain may substantially differ from reactions to a more non-crisis chronic pain. For example, the degree to which patients are likely to catastrophize in response to a sudden and acute episode of acute pain may differ substantially as compared to their reactions to a more chronic familiar pain. The primary role of factors that have historically been associated with explaining such differences in reactions to acute and chronic pain in the general population are largely unexplored in patients with SCD. We also note that there may be little difference between multiple and repeated acute episodes of pain across a lifespan and a single chronic enduring (chronic) pain. Hence, we view the study of chronic pain in patients with SCD as a stable and reliable indicator of nociceptive experience, and likely the best estimate of disability. We note that future studies must begin to better understand the difference between a repeat acute pain over time and a chronic pain, and the impact of the difference, if it exists, on disability and functionality.

We view better understanding these factors as legitimate and necessary for future studies. Although negative emotion and other cognitive behavioral factors have been shown to independently predict increased reports of pain and psychosocial dysfunction among patients with SCD [55–58], a substantial amount of the variance is still left unexplained suggesting that further exploration is warranted.

We view our study as the impetus for additional rigorous prospective exploration. No previous studies have explored the impact of negative reactions to pain in the manifestation of clinically relevant psychiatric dispositions in adult patients with SCD. We view this study as a very important first step toward characterizing reactions to SCD-related pain on risk for psychopathology in adults.

Lastly, the current study demonstrates that, in a sample of Black adults with SCD, the initial emotional reactions to pain predict longer-term psychological distress independent of age. We believe that the model established by this study should be replicated and has the potential to elucidate the important role that psychological distress has on opiate utilization patterns, dyspnea, sleep dysfunction, and other clinical outcomes among patients with SCD in the United States and around the world [59–67].

Acknowledgments

The authors would like to thank Linda Weaver, Markece Mathis, and Aurrielle Cobb for their support and contributions to this publication. The views expressed herein are those of the author(s) and do not reflect the official policy of the Department of the Army, Department of Defense, or the U.S. Government.

References

1. Reed W, Jagust W, Al-Mateen M, Vichinsky E. Role of positron emission tomography in determining the extent of CNS ischemia in patients with sickle cell disease. American Journal of Hematology. 1999; 60(4):268–272. [PubMed: 10203099]
2. Edwards CL, Scales M, Loughlin C, Bennett G, Harris-Peterson S, DeCastro LM, Whitworth E, Abrams M, Feliu M, Johnson S, Wood M, Harrison MO, Killough A. A brief review of the pathophysiology, associated pain, and psychosocial issues associated with sickle cell disease (SCD). International Journal of Behavioral Medicine. 2005; 12(3):171–179. [PubMed: 16083320]
3. Institute of Medicine Report from the Committee on Advancing Pain Research, Care, and Education. Relieving pain in America: A blueprint for transforming prevention, care, education and research. The National Academies Press; 2011. Retrieved September 14, 2011 from http://books.nap.edu/openbook.php?record_id=13172&page=17
4. Natelson BH, Lange G. A status report on chronic fatigue syndrome. Environmental Health Perspectives. 2002; 110(4):673–677. [PubMed: 12194905]
5. Schmechel D, Edwards CL. Fibromyalgia, mood disorders, and intense creative energy: A1AT polymorphisms are not always silent. Neurotoxicology. 2012; 33(6):1454–1472. [PubMed: 22414631]
6. Edwards CL, Whitfield K, Sudhakar S, Pearce M, Byrd G, Wood M, Feliu M, Leach-Beale B, DeCastro L, Whitworth E, Abrams M, Jonassaint J, Harrison MO, Mathis M, Scott L, Johnson S, Durant L, Holmes A, Presnell K, Bennett GG, Shelby R, Robinson E. Parental substance abuse, reports of chronic pain, and coping in adult patients with sickle cell disease (SCD). Journal of the National Medical Association. 2006; 98(3):420–428. [PubMed: 16573309]
7. Harrison MO, Edwards CL, Koenig HG, Bosworth HB, DeCastro L, Wood M. Religiosity/spirituality and pain in patients with sickle cell disease. Journal of Nervous and Mental Disease. 2005; 193(4):250–257. [PubMed: 15805821]
8. Pells J, Presnell K, Edwards CL, Wood M, Harrison MO, DeCastro L, Johnson S, Feliu M, Canada S, Jonassaint JC, Barker C, Leach-Beale B, Mathis M, Applegate K, Holmes A, Byrd G, Robinson E. Moderate chronic pain, weight, and dietary intake in African American adult patients with sickle cell disease (SCD). Journal of the National Medical Association. 2005; 97(12):1622–1629. [PubMed: 16396054]
9. Whitfield KE, Brandon DT, Robinson E, Bennett G, Merritt M, Edwards CL. Sources of variability in John Henryism. Journal of the National Medical Association. 2006; 98(4):641–647. [PubMed: 16623079]

10. Parham-Vetter PC. Depression and chronic pain: A review. Primary Psychiatry. 1996:65–70.
11. Perkins DO, Leserman J, Stern RA, Baum SF, Liano D, Golden RN, Evans DL. Somatic symptoms and HIV infection: Relationship to depressive symptoms and indicators of HIV disease. American Journal of Psychiatry. 1995; 152:1776–1781. [PubMed: 8526245]
12. American Psychiatric Association. Diagnostic and statistical manual of mental disorders. 4. American Psychiatric Association; Washington, DC: 2004.
13. Dantz B, Ashton AK, D'Mello DA, Hefner J, Leon FG, Matson GA, Montano CB, Pradko JF, Sussman N, Winsberg B. The scope of the problem: Physical symptoms of depression. Journal of Family Practice. 2003; (Suppl):S6–S8. [PubMed: 14693073]
14. Kemier MA, Furnée CA. The impact of chronic pain on life in the household. Journal of Pain and Symptom Management. 2002; 23(5):433–441. [PubMed: 12007761]
15. Lerner D, Adler DA, Chang H, Lapitsky L, Hood MY, Perissinotto C, Reed J, McLaughlin TJ, Berndt ER, Rogers WH. Unemployment, job retention, and productivity loss among employees with depression. Psychiatric Services. 2004; 55:1371–1378. [PubMed: 15572564]
16. Simon GE, VonKorff M, Piccinelli M, Fullerton F, Ormel J. An international study of the relation between somatic symptoms and depression. The New England Journal of Medicine. 1999; 341:1329–1335. [PubMed: 10536124]
17. Trivedi MH. The link between depression and physical symptoms. Primary Care Companion Journal of Clinical Psychiatry. 2004; 6(Suppl 1):12–16.
18. Porter LS, Gil KM, Carson JW, Anthony KK, Ready J. The role of stress and mood on sickle cell disease pain: An analysis of daily diary data. Journal of Health Psychology. 2000; 5(1):53–63. [PubMed: 22048823]
19. Simon GE. Treating depression in patients with chronic disease: Recognition and treatment are crucial; depression worsens the course of a chronic illness. Western Journal of Medicine. 2001; 175(5):292–293. [PubMed: 11694462]
20. Simon GE. Long-term prognosis of depression in primary care. Bulletin of the World Health Organization. 2000; 78(4):439–445. [PubMed: 10885162]
21. Edwards CL, Fillingim RB, Keefe F. Race, ethnicity, and pain. Pain. 2001; 94(2):133–137. [PubMed: 11690726]
22. Pells J, Edwards CL, McDougald C, Wood M, Barksdale C, Jonassaint J, Leach-Beale B, Byrd G, Mathis M, Harrison MO, Feliu M, Edwards LY, Whitfield K, Rogers L. Gender differences in fear of movement (kinesiophobia) and pain-related outcomes in patients with sickle cell disease (SCD). Clinical Journal of Pain. 2007; 23(8):707–713. [PubMed: 17885350]
23. Edwards CL, Johnson S, Goli V, Byrd G. Extending the science beyond medication: In response to "Treatment of chronic pain in persons with dementia: An overview" by Robert N. Rubey, MD, MA. American Journal of Alzheimer's Disease and Other Dementias. 2005; 20(3):139–140.
24. Phan A, Edwards CL, Robinson E. The assessment of pain and discomfort in individuals with mental retardation. Research in Developmental Disabilities. 2005; 26(5):433–438. [PubMed: 16039095]
25. Edwards CL, Feliu M, Johnson S, Webster W, Bennett GG, Bishop D, Samios V, Ellison-Manuel T, Martinez S. The application of cognitive-behavioral techniques for the management of complicated and persistent gout pain. Ciencias de la Conducta. 2005; 20:89–116.
26. Winterowd, C.; Beck, AT.; Gruener, D. Cognitive therapy for chronic pain patients. Springer; New York: 2003.
27. Lou X, Edwards CL, Richardson W, Hey L. Relationship of clinical, psychological, and individual factors with the functional status of neck pain patients. Values in Health. 2003; 7(1):61–69.
28. Lou X, George ML, Kakouras I, Edwards CL, Pietrobon R, Richardson W, Hey L. Validity and responsiveness of short form 12-item survey (SF-12) in patients with back pain. Spine. 2003; 28(15):1739–1745. [PubMed: 12897502]
29. Dersh J, Polatin PB, Gatchel RJ. Chronic pain and psychopathology: Research findings and theoretical considerations. Psychosomatic Medicine. 2002; 64:773–786. [PubMed: 12271108]
30. Henningsen P, Zimmermann T, Sattel H. Medically unexplained physical symptoms, anxiety, and depression: A meta-analytic review. Psychosomatic Medicine. 2003; 65:528–533. [PubMed: 12883101]

31. Melzack R. The Short-Form McGill Pain Questionnaire. Pain. 1987; 30(2):191–197. [PubMed: 3670870]
32. Grafton KV, Foster NE, Wright CC. Test-retest reliability of the Short-Form McGill Pain Questionnaire: Assessment of intraclass correlation coefficients and limits of agreement in patients with osteoarthritis. Clinical Journal of Pain Special Topic Series: Cognitive-Behavioral Treatment for Chronic Pain. 2005; 21(1):73–82.
33. Derogatis LR, Rickels K, Rock AF. The SCL-90 and the MMPI: A step in the validation of a new self-report scale. British Journal of Psychiatry. 1976; 128:280–289. [PubMed: 1252693]
34. Marlow D, Crowne DP. A new scale of social desirability independent of psychopathology. Consulting Psychology. 1960; 24:349–354.
35. Edwards CL, Raynor R, Feliu M, McDougald C, Johnson S, Saurona P, Bonner M, Wellington C, Schmechel D, Bennett GG, Wood M, DeCastro LM, Whitworth E, Abrams M, Logue P, Edwards L, Martinez S, Whitfield K. Early cerebral damage and adult neuropsychological functioning: Neuropsychological assessment, neuroimaging, and early neurocognitive evaluation in patients with sickle cell disease (SCD). Neuropsychiatric Disease and Treatment. 2007; 3(6):705–709. [PubMed: 19300604]
36. SAS Software, Version 9.2 of the SAS System for Windows Copyright © 2009. SAS Institute Inc. SAS and all other SAS Institute Inc. product or service names are registered trademarks or trademarks of SAS Institute Inc., Cary, NC.
37. Sogutlu A, Levenson JL, McClish DK, Rosef SD, Smith WR. Somatic symptom burden in adults with sickle cell disease predicts pain, depression, anxiety, health care utilization, and quality of life: The PiSCES project. Psychosomatics. 2011; 52(3):272–279. [PubMed: 21565599]
38. Gil KM, Williams DA, Thompson RJJ, Kinney TR. Sickle cell disease in children and adolescents: The relation of child and parent pain coping strategies to adjustment. Journal of Pediatric Psychology. 1991; 16:643–663. [PubMed: 1744811]
39. Edwards CL, Keefe F. New directions in research on pain and ethnicity: A comment on Riley, Wade, Myers, Sheffield, Pappas, and Price. Pain. 2002; 100:211–212. [PubMed: 12467991]
40. Feliu M, Wellington C, Crawford R, Wood M, Edwards L, Byrd G, Edwards CL. Opioid management and dependency among adult patients with sickle cell disease. Hemoglobin. 2011; 35(5–6):485–494. [PubMed: 21910605]
41. Montoya P, Pauli P, Batra A, Wiedemann G. Altered processing of pain-related information in patients with fibromyalgia. European Journal of Pain. 2005; 9(3):293–303. [PubMed: 15862479]
42. Montoya P, Sitges C, Garcia-Herrera M, Izquierdo R, Truylos M, Blay N, Collado D. Abnormal affective modulation of somatosensory brain processing among patients with fibromyalgia. Psychosomatic Medicine. 2005; 67:957–963. [PubMed: 16314601]
43. Lautenbacher S, Roscher S, Kohl G, Vedder H, Krieg J. Corticotropin-releasing-hormone lacks analgesic properties: An experimental study in humans, using non-inflammatory pain. Pain. 1999; 83(1):1–7. [PubMed: 10506666]
44. Lautenbacher S, Spernal J, Schreiber W, Krieg JC. Relationship between clinical pain complaints and pain sensitivity in patients with depression and panic disorder. Psychosomatic Medicine. 1999; 61(6):822–827. [PubMed: 10593634]
45. Turner JA, Holtzman S, Mancl L. Mediators, moderators, and predictors of therapeutic change in cognitive-behavioral therapy for chronic pain. Pain. 2007; 127(3):276–286. [PubMed: 17071000]
46. Moulds ML, Kandris E, Starr S, Wong AC. The relationship between rumination, avoidance and depression in a non-clinical sample. Behaviour Research & Therapy. 2007; 45(2):251–261. [PubMed: 16631110]
47. Brummett BH, Maynard KE, Babyak MA, Haney TL, Siegler IC, Helms MJ, et al. Measures of hostility as predictors of facial affect during social interaction: Evidence for construct validity. Annals of Behavioral Medicine. 1998; 20(3):168–173. [PubMed: 9989323]
48. Rosenberg EL, Ekman P, Blumenthal JA. Facial expression and the affective component of cynical hostility in male coronary heart disease patients. Health Psychology. 1998; 17:376–380. [PubMed: 9697948]

49. Pope MK, Smith TW, Rhodewalt F. Cognitive, behavioral, and affective correlates of the Cook and Medley Hostility Scale. Journal of Personality Assessment. 1990; 54:501–514. [PubMed: 2348338]
50. Smith TW, Sanders JD, Alexander JF. What does the cook and medley hostility scale measure? Affect, behavior, and attributions in the marital context. Journal of Personality & Social Psychology. 1990; 58:699–708. [PubMed: 2348365]
51. Brissette I, Cohen S. The contribution of individual differences in hostility to the associations between daily interpersonal conflict, affect, and sleep. Personality & Social Psychology Bulletin. 2002; 28:1265–1274.
52. Heponiemi T, Ravaja N, Elovainio M, Keltikangas-Jarvinen L. Relationships between hostility, affective ratings of pictures, and state affects during task-induced stress. The Journal of Psychology. 2007; 141(2):183–201. [PubMed: 17479587]
53. Guyll M, Contrada RJ. Trait hostility and ambulatory cardiovascular activity: Responses to social interaction. Health Psychology. 1998; 17(1):30–39. [PubMed: 9459067]
54. Linden W, Chambers L, Maurice J, Lenz JW. Sex differences in social support, self-deception, hostility, and ambulatory cardiovascular activity. Health Psychology. 1993; 12:376–380. [PubMed: 8223361]
55. Fisher BJ, Haythornthwaite JA, Heinberg LJ, Clark M, Reed J. Suicidal intent in patients with chronic pain. Pain. 2001; 89:199–206. [PubMed: 11166476]
56. Hassett AL, Cone JD, Patella SJ, Sigal LH. The role of catastrophizing in the pain and depression of women with fibromyalgia syndrome. Arthritis & Rheumatism. 2000; 43:2493–2500. [PubMed: 11083273]
57. Martin PR, Teoh HJ. Effects of visual stimuli and a stressor on head pain. Headache. 1999; 39:705–715. [PubMed: 11279946]
58. Schaeffer JJ, Gil KM, Burchinal M, Kramer KD, Nash KB, Orringer E, et al. Depression, disease severity, and sickle cell disease. Journal of Behavioral Medicine. 1999; 22:115–126. [PubMed: 10374138]
59. Stanton MV, Jonassaint CR, Bartholomew FB, Edwards C, Richman L, DeCastro L, Williams R. The association of optimism and perceived discrimination with health care utilization in adults with sickle cell disease. Journal of the National Medical Association. 2010; 102:1056–1063. [PubMed: 21141295]
60. Feliu M, Wellington C, Crawford R, Wood M, Edwards L, Byrd G, Edwards CL. Opioid management and dependency among adult patients with sickle cell disease. Hemoglobin. 2011; 35(5–6):485–494. [PubMed: 21910605]
61. Mechlin B, Heymen S, Edwards CL, Girdler SS. Ethnic differences in cardiovascular-somatosensory interactions and in the central processing of noxious stimuli. Psychophysiology. 2011; 48(6):762–773. [PubMed: 21039586]
62. Ohayon MM, Schatzberg AF. Using chronic pain to predict depressive morbidity in the general population. Archive of General Psychiatry. 2003; 60(1):39–47.
63. Bediako S, Haywood C. Sickle cell disease in a “postracial” America. Journal of the National Medical Association. 2009; 101:1065–1066. [PubMed: 19860308]
64. Killough AL. Enhancing the role of understanding community, ethnicity and gender in advancing the sickle cell disease agenda: In response to individually oriented research policy level models. Journal of Best Practices in Health Professions Diversity: Education, Research & Policy. 2010; 3(1):75–95.
65. Gibson RC, Morgan K, Abel W, Sewell C, Martin J, Lowe GA, De La Haye W, Edwards CL, O’Garo K, Reid M, Asnani MR. Locus of control, depression, and quality of life among persons with sickle cell disease in Jamaica. Psychology, Health & Medicine. 201310.1080/13548506.2012.749353
66. Barker CS, Edwards CL, Bryson WJ, Swinkels C, Wellington C, Wood M, Alessi LYE, Whitfield KE, McNeil J, Byrd GS, Feliu M, Guinyard D, Green M, McCabe M, Blackmon M, Hill L, Robinson E, DeCastro L. Sleep and chronic pain in an ethnically congruent sample of adult patients with sickle cell disease (SCD). Journal CIENCIAS DE LA CONDUCTA. 2012; 27:35–50.

67. Johnson H, Wellington C, Alessi LYE, McNeil J, Wood M, Hobkirk A, Hill L, Feliu M, Byrd GS, Barker CS, Whitfield KE, Patrice J, Guinyard D, Muhammad M, McCabe M, Wood V, Martinez S, Scott D, Jonassaint J, Edwards CL. The influence of dyspnea on chronic pain and psychological distress among adult patients with sickle cell disease (SCD). Journal CIENCIAS DE LA CONDUCTA. 2012; 27:65–80.

Table 1

Zero-Order Correlations between Predictor and Outcome Variables

	MCSDS	SOM	O-C	I-S	DEP	ANX	HOS	PHOB	PAR	PSY	GSI	PSDI	PST	Age	Sensory	Emotional
MCSDS	1	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
SOM	−.060	1	—	—	—	—	—	—	—	—	—	—	—	—	—	—
O-C	−.010	.456**	1	—	—	—	—	—	—	—	—	—	—	—	—	—
I-S	−.200	.471**	.833**	1	—	—	—	—	—	—	—	—	—	—	—	—
DEP	−.091	.582**	.807**	.762**	1	—	—	—	—	—	—	—	—	—	—	—
ANX	−.107	.593**	.767**	.753**	.821**	1	—	—	—	—	—	—	—	—	—	—
HOS	−.144	.394**	.518**	.547**	.512**	.618**	1	—	—	—	—	—	—	—	—	—
PHOB	−.036	.351*	.731**	.617**	.652**	.735**	.588**	1	—	—	—	—	—	—	—	—
PAR	−.059	.405*	.750**	.746**	.689**	.684**	.395**	.589**	1	—	—	—	—	—	—	—
PSY	−.190	.501**	.736**	.748**	.791**	.767**	.564**	.693**	.713**	1	—	—	—	—	—	—
GSI	−.089	.680**	.890**	.851**	.926**	.899**	.614**	.740**	.791**	.849**	1	—	—	—	—	—
PSDI	−.024	.592**	.712**	.576**	.740**	.637**	.408*	.535**	.554**	.612**	.786**	1	—	—	—	—
PST	−.130	.662**	.840**	.842**	.883**	.883**	.634**	.744**	.791**	.854**	.962**	.620**	1	—	—	—
Age	.152	−.236	−.102	−.275*	−.188	−.120	−.242*	−.118	−.084	−.207	−.228	−.194	−.229	1	—	—
Sensory	.088	.353*	.303*	.275*	.289*	.317*	.167	.200	.159	.287*	.346*	.296*	.314*	.033	1	—
Emotional	−.034	.459**	.352*	.318*	.320*	.402*	.213	.107*	.282*	.378*	.431*	.345*	.437*	.025	.723**	1

Note: MCSDS = Marlowe-Crown Social Desirability Scale; SOM = Somatization; O-C = Obsessive-Compulsive; I-S = Interpersonal Sensitivity; DEP = Depression; ANX = Anxiety; HOS = Hostility; PHOB = Phobic Anxiety; PAR = Paranoid Ideation; PSY = Psychoticism; GSI = Global Severity Index; PSDI = Positive Symptom Distress Index; PST = Positive Symptom Total; Sensory = Sensory Subscale of the SF-MPQ; Emotional = Affective Subscale of the SF-MPQ.

* $p < .05$;

** $p < .001$.

Table 2

Association between Negative Emotional Responses to Pain and Psychiatric Outcomes

SCL-90-R Outcomes	Predictors	B	S.E.
Somatization (SOM)	Age	−7.06*	3.08
	Sensory	.073	0.22
	Affective	1.29**	0.47
Anxiety (ANX)	Age	−7.79	4.19
	Sensory	.11	0.29
	Affective	1.43*	0.65
Phobic Anxiety (PHOB)	Age	−3.63	3.37
	Sensory	−.09	0.24
	Affective	1.11*	0.52
Paranoid Ideation (PAR)	Age	−2.69	3.49
	Sensory	−.13	0.24
	Affective	1.08†	0.54
Psychoticism (PSY)	Age	−7.70	4.03
	Sensory	.06	0.28
	Affective	1.34	0.62
Depression (DEP)	Age	−6.95	4.11
	Sensory	.21	0.29
	Affective	.87	0.63
Hostility (HOS)	Age	−8.14*	3.83
	Sensory	.06	0.27
	Affective	.66	0.59
Obsessive-Compulsive (O-C)	Age	−3.48	3.64
	Sensory	.15	0.25
	Affective	.92	0.56
Interpersonal Sensitivity (I-S)	Age	−9.53	3.87
	Sensory	.17	0.27
	Affective	.90	0.60
General Severity Index (GSI)	Age	−8.25*	3.80
	Sensory	.13	0.27
	Affective	1.40*	0.59
Positive Symptom Distress Index (PSDI)	Age	−6.13	3.44
	Sensory	.15	0.24
	Affective	.86	0.53
Positive Symptom Total (PST)	Age	−8.14*	3.76
	Sensory	.01	0.26
	Affective	1.60**	0.58

* $p < .05$;

** $p < .01$;

† $p = .05$.