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The Role of Anger in Psychosocial Subgrouping for Patients with Low Back Pain

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Abstract

Low back pain (LBP) is a common and costly condition that often becomes chronic if not properly addressed. Recent research has shown that psychosocial symptoms can complicate LBP, necessitating more comprehensive screening measures. The present study investigated the role of psychosocial factors, including anger regulation, in pain and disability using a screening measure designed for LBP treated with physical therapy.

One-hundred and three LBP patients initiating physical therapy completed an established screening measure to assess risk for developing chronic pain, as well as psychosocial measures assessing anger, depression, anxiety, fear-avoidance, and pain-catastrophizing before and after four weeks of treatment. Dependent variables were pain intensity, physical impairment, and patient-reported disability. Risk subgrouping based on anger and other psychosocial measures was examined using established screening methods and through employing an empirical statistical approach.

Analyses revealed that risk subgroups differed according to corresponding levels of negative affect, as opposed to anger alone. General psychosocial distress also predicted disability post-treatment, but, interestingly, did not have a strong relationship to pain. Subsequent hierarchical agglomerative clustering procedures divided patients into overall High and Low Distress groups, with follow-up analyses revealing that the High Distress group had higher baseline measures of pain, disability, and impairment.

Findings suggest that anger may be part of generalized negative affect rather than a unique predictor when assessing risk for pain and disability in LBP treatment. Continued research in the area of screening for psychosocial prognostic indicators in LBP may ultimately guide treatment protocols in physical therapy for more comprehensive patient care.

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INTRODUCTION

Often present with no known underlying pathology, back pain is difficult to treat and has been found to lead to continued pain problems in as much as 80% of cases consulting primary care (1,2). Thus, efforts aimed at identifying prognostic indicators prior to the development of chronic pain syndromes are crucial in helping control these consequences. Current research on contributing factors to chronic pain development and maintenance points towards the presence of comorbid negative affect, namely depression, anxiety, and, more recently, fear-avoidance beliefs (3,4). However, there is a growing body of literature on the role of anger in pain, and how both the experience and regulation of anger can impact one's pain presentation and chronicity. Despite the interconnectivity of negative emotions frequently found in chronic pain (5–7), there is sufficient evidence to suggest that anger uniquely impacts pain (8), and seems to be particularly relevant to low back pain (LBP). It has been demonstrated that chronic LBP patients reported greater pain intensity, greater blood pressure reactivity, and slower recovery time during an anger induction than a sadness induction as compared to healthy participants, even when controlling for the effects of other negative emotions, such as sadness and anxiety (9).

There are several theories as to why there is such a high prevalence of anger in pain, which describe neurobiological, cognitive, and psychosocial mechanisms behind their association. The common thread of these theories deals more with the way anger is regulated than with the intensity or frequency of one's anger. One theory that has been supported in both the pain and cardiac literature (10,11) is the state-trait matching hypothesis, which states that those who appropriately manage their anger can experience a reduction in anger arousal and resulting negative physiological effects through behavioral expression of the emotion (12). Furthermore, this theory posits that when anger is behaviorally mismanaged, such as suppression of anger in individuals who tend to aggressively express anger (i.e., high anger-out), or, conversely, forced anger expression in those who tend to suppress anger (i.e, anger-in), it can lead to increased pain sensitivity in both acute and chronic cases. Anger control refers to an active anger regulation strategy in which anger is experienced and appropriately addressed through nonaggressive behaviors, and is thus often inversely related to anger-out in pain studies (13). Studies have shown that those with effective and appropriate anger regulation abilities have been shown to have better pain outcomes (14). As for those with maladaptive or situationally-inappropriate anger management techniques, implementing appropriate interventions may be helpful in maximizing healthy pain coping styles.

Although only 3–10% of acute LBP patients go on to develop a chronic pain condition, these individuals represent approximately 75–80% of the financial burden, further highlighting the importance of early screening measures that take into account various identified physical and psychological risk factors (15). In physical therapy settings, multivariate clinical prediction rules (CPR's) offer potentially important criteria to help identify and guide treatment for LBP patients (16–18). Previous studies have indicated that CPR's are useful for identifying subgroups of LBP patients and matching those patients with treatment approaches, ultimately resulting in more favorable treatment outcome (19,20). A major limitation to most published CPR's involving interventions for LBP patients is that they do not incorporate a thorough psychosocial assessment during the developmental

phase, and are not conclusive in terms of the potential treatment approaches available for these patients (21). There are few comprehensive, yet brief screening tools in non-specific LBP patients that include both physical and psychosocial scales, one such being The Subgroups for Targeted Treatment Back Screening Tool (STarT) (22). The STarT tool has shown promise in identifying LBP patients at risk for developing and maintaining chronic pain in primary care settings (22,23), indicating that screening measures including psychosocial indicators such as depression, anxiety, and fear-avoidance beliefs may serve as powerful instruments for deciding appropriate treatment protocols. Among psychosocial variables, there have been a few studies to suggest that anger has clinical and theoretical importance in the development of functional impairment, and therefore, may be informative in treatment-matching classification systems (24–26). Presently, there has been very limited investigation into the role of anger regulation in physical therapy settings, despite plentiful recent research examining other aspects of negative affect impacting therapy outcomes (27,28) . In particular, fear avoidance beliefs has made a huge impact on the physical therapy literature within the past 10 years, and has opened up the doors for more research on unique facets of negative affect in physical therapy settings (29–31). To this end, our study aimed to (*1*) investigate the role of anger among other psychosocial variables in distinguishing risk subgroups using the STarT screening tool, (*2*) investigate the unique contribution of anger to pain and disability post-treatment, and (*3*) use empirically-based methodology to define patient risk subgroups including anger as an additional psychosocial variable. Based on the research, we hypothesized that those demonstrating poorer anger regulation would be more likely to fall in the high risk group and report worse pain and disability after 4 weeks of treatment. We also predicted that empirical subgrouping procedures would divide LBP patients based on psychosocial measures with those indicating more symptomatology falling into higher risk groups.

PATIENT AND METHODS

Patients with a current diagnosis of LBP who were referred for treatment primarily for their low back pain to one of six physical therapy clinics were consecutively approached to participate in the present study. Inclusion criteria were: (*1*) adults aged 18 years or older, (*2*) a referral to outpatient physical therapy for LBP, with or without radiating symptoms of any duration, and (*3*) the ability to read and speak English fluently. Exclusion criteria for the study were: (*1*) physical or psychological disorders related to metastatic disease, visceral disease, or fracture, and (*2*) osteoporosis. Participants were not excluded for having additional pain sites; however, only patients seeking treatment specifically for LBP were invited to participate. All participants were required to provide signed informed consent prior to enrollment. All procedures were approved by the University of Florida Institutional Review Board.

Licensed physical therapists involved in the study were requested to invite potential participants at the time of their initial physical therapy evaluation after providing a brief explanation of the study as well as a study brochure detailing primary investigator contact information. Informed consent was initially obtained by physical therapists, and was thoroughly reviewed by study investigators at the time of follow-up, or as needed by participant request. Following informed consent procedures, participants completed a packet

of intake questionnaires and underwent a routine physical examination. Patients were then provided with a 4-week treatment plan by their physical therapist based on their individual symptoms. Importantly, treatments were not standardized in this study, and there were no experimental controls or randomization procedures included. The physical therapist involved in the treatment of an individual study participant determined the appropriate interventions to be administered based on his or her professional opinion. These procedures were employed in order to avoid compromising the standard of care for patients, following ethical practice guidelines. Physical therapists did not score, interpret, or review responses from the standardized measures employed in the study, other than those that were standard and necessary for treatment, namely the Physical Impairment Index. Furthermore, physical therapists were assigned LBP patients according to their availability prior to study recruitment. Thus, potential biases for treatment implementation were limited only to information that was part of the normal treatment protocol, as opposed to study-specific influences. After four weeks, patients were asked to return to their clinic to complete outcome measures. A selection of psychosocial measures, namely those assessing fear-avoidance, anger, depression, and catastrophizing, were also collected at follow-up, but were not employed in the context of this study. Adherence to treatment plans was not necessary for re-evaluation in this study. All study materials were scored and interpreted by trained study investigators only.

Measures

A questionnaire was administered eliciting information pertaining to the participants' age, gender, race, years of education, marital status, and employment status. Additionally, clinical characteristics of the patients' pain condition were obtained, including duration and history of pain symptoms and any LBP surgical procedures.

Subgroups for Targeted Treatment (STarT) Back Screening Tool—The STarT is a 9-item measure used to screen for prognostic indicators associated with poor LBP outcomes in primary care settings. The STarT was validated for both acute and chronic pain cases, with episode duration lasting from less than one month to over three years. An overall score and a psychosocial subscale are used to subdivide LBP patients into low, moderate, and high risk groups, based on their likelihood for an unfavorable treatment outcome. Psychosocial symptoms assessed by the STarT include bothersomeness, depression, fear avoidance, anxiety, and catastrophizing. The four STarT items that are not included in the psychosocial scale involve pain location, radiating symptoms, and functional limitations (e.g., impaired gait and dressing time). Responses on the STarT are dichotomized, such that patients choose "agree" or disagree" for each item, with the exception of bothersomeness (e.g., perceived interference with quality of life), which uses a 5-point Likert scale. The STarT demonstrated adequate test-retest reliability for both the overall tool score (kappa= 0.73) and the psychosocial subscale (kappa= 0.69). Cronbach's alpha ranged from 0.74 for the overall tool score to 0.79 for the psychosocial items, indicating adequate internal consistency for the measure, and that the psychosocial subscale formed a single dimension. The measure also demonstrated adequate predictive validity, with 78.4% of patients identified as being high risk for having poor disability outcome at 6-month follow-up (22).

The following three measures were used to assess the dependent variables of pain, physical impairment, and patient-rated impairment, respectively.

Pain Intensity Numerical Rating Scale (NRS): Patients were asked to rate their pain intensity using a numerical rating scale (NRS), anchored from 0 ("No pain sensation") to 10 ("Worst pain sensation imaginable"), and to provide lowest, highest, and average pain ratings over the past 2 weeks. For the purposes of this study, only average pain intensity ratings were included in the analyses. NRS's have been shown to have high convergent validity and to be sensitive to treatment (32).

Physical Impairment Index (PII): The PII consists of 7 physical examination tests routinely implemented in a physical therapy examination for patients with low back pain. Each test is scored as being either "positive" or "negative" for impairment based on published cut-off values (33). The overall PII score ranges from 0–7, with higher scores indicating greater levels of physical impairment. Adequate reliability has been reported for individual items of the PII and convergent validity has been supported via correlations with disability in patients with chronic low back pain (33) and acute low back pain (34).

Roland-Morris Disability Questionnaire (RMDQ): The RMDQ is a 24-item measure used to assess functional status of patients with LBP (35). The RMDQ has been shown to have good criterion-based construct and discriminant validity (36) and well-established internal consistency (Cronbach's alpha = 0.84 to 0.93) (37). The RDMQ was chosen over other disability measures because it has been shown to be more sensitive in populations with lower levels of disability, and, therefore, may be more appropriate for an outpatient setting (37).

The following five measures were used to assess mood factors commonly associated with chronic pain conditions:

State-Trait Anger Expression Inventory (STAXI) (38): The STAXI is a 44-item questionnaire designed to measure several dimensions of anger experience and regulation. Six separate dimensions may be derived from the STAXI: State Anger (STAXI-S) (i.e., intensity of anger at the time of testing); Trait Anger (STAXI-T) (i.e., dispositional anger); Anger-in (AX/IN) (i.e., tendency to suppress angry feelings); Anger-out (AX/OUT) (i.e., tendency to aggressively express angry feelings); Anger Control (AX/CON) (i.e., appropriate or non-hostile regulation of anger); and Anger Expression (AN/EX) (i.e., general index of anger expression). For the purposes of this study, we examined the Trait Anger, Anger Control, and Anger-in and Anger-out scales, as previous research indicates that these dimensions have a significant and independent association with pain intensity and chronicity (8,39). The STAXI boasts high internal consistency, with Cronbach alpha scores ranging from $\alpha = 0.70$ to 0.93 for State-Trait Anger scales, and from $\alpha = 0.73$ to 0.80 for Anger Regulation scales. Additionally, construct validity studies indicate a strong relationship between STAXI-Trait and measures of hostility, such as the MMPI Hostility subscale ($r = 0.59$) (38).

Fear –Avoidance Beliefs Questionnaire (FABQ) (40): The FABQ is a 16-item questionnaire designed to assess fear-avoidance beliefs in pain patients, particularly those with low back pain conditions. Items on the FABQ are divided into Work and Physical Activity subscales to assess fear-avoidance beliefs in these two domains separately. For the current study, the FABQ Work subscale was chosen for analyses due to its demonstrated association with current and future disability in patients with LBP (40,41). The FABQ has demonstrated high levels of internal consistency (Cronbach's alpha= 0.88) and test-retest reliability (r = 0.95) (40).

Spielberger State-Trait Anxiety Inventory (STAI) (42): The STAI is a 40-item measure assessing both transient and long-standing anxiety in adults. It is composed of two 20-item scales, one examining state anxiety, or how anxious the respondent is in the given moment, and one for trait anxiety, or one's dispositional anxiety levels. For the purposes of this study, only trait anxiety was measured, as it is more closely related to disability following pain (43). The STAI-Trait has demonstrated high internal consistency (Cronbach's alpha= 0.90) and has been used extensively in research and clinical practice.

Patient Health Questionnaire- 9 (PHQ-9) (44): The PHQ-9 is a 9-item measure used to measure depression in medical settings. Participants were asked to rate the frequency with which they experience each of the 9 DSM-IV criteria for clinical depression on a 4-point Likert scale, ranging from 0 (Not at all) to 3 (Nearly every day). The PHQ-9 has demonstrated strong test-retest reliability (r = 0.84) and internal consistency (Cronbach's alpha = 0.89) when used in primary care settings, and is considered a valid measure for depression in clinical samples.

Pain Catastrophizing Scale (PCS) (45): The PCS is a 13-item measure used to assess catastrophic cognitions related to LBP, with higher scores (ranging from 0 to 52) indicating increased pain catastrophizing. The PCS has been found to have good test-retest reliability as well as internal consistency.

Statistical Analyses

Power analyses were conducted to determine the number of participants needed to detect a sizable effect when examining the impact of anger regulation styles on obtained STarT risk groups, based on the most conservative value achieved in order to maximally power the study. Analyses suggest that a sample of size of N=54 was needed to achieve a moderate effect (r= 0.30 – 0.40) with power set to 0.80 and α=0.05, according to published studies examining the impact of STAXI anger variables on pain interference in chronic pain (24,46). However, it was decided that a sample size of N= 80–100 was necessary to conduct cluster analyses in the third aim of this study in order to achieve an adequate participant to variable ratio. Means and standard deviations were calculated for continuous demographic and clinical variables and frequency tables were established for categorical demographic and clinical variables.

To examine whether LBP patients differed on measures of anger according to risk profile, we used responses from the STarT to divide our sample into 3 groups: Low risk, Moderate

risk, and High Risk. One-way analyses of covariance (ANCOVAs) using planned contrasts were employed to compare groups on their anger experience and regulation styles, with other mood measures added as covariates to distinguish the relationship of anger to risk grouping from overall emotional distress. To examine whether anger regulation styles strengthened the predictive power of existing screening measures, hierarchical multiple regression analyses were conducted with baseline mood measures employed in established screening measures entered in the first stage, and the anger subscale scores entered in the second stage as the independent variables. Four week measures of pain intensity, PII, and RMDQ served as the dependent variables. To investigate whether the addition of anger affects psychosocial subgrouping of patients, a hierarchical agglomerative cluster analysis (Ward's method, squared Euclidian distance) was employed. Psychosocial items present in the STarT tool were represented by the STarT Bothersomeness item, total PCS score, total FABQ-Work Scale score, STAI-Trait score, and PHQ-9 Total Score, all taken at the baseline evaluation. Additionally, the 4 anger subscales of the STAXI were entered into the cluster analysis, totaling 9 variables. Following cluster analyses, classification accuracy was evaluated using a discriminant function analysis. We also performed a chi-square test to compare the categorical composition of the patient subgroups achieved by Hill et al. (22) with that derived from our cluster analysis.

RESULTS

Study logs kept of participant recruitment indicate that 6.9% of eligible participants chose not to participate in the study and 8.7% did not fully complete informed consent procedures, thereby excluding them from the study. A total of 106 LBP patients were successfully recruited for the study, with 103 LBP patients fully completing the baseline protocol, and 87 participants (84.5%) fully completing the 4-week follow-up protocol. Independent samples t-tests conducted to compare demographic, clinical, and psychosocial characteristics of those who completed the follow-up protocol versus those who did not indicate that completers were generally older [$t(95)= 2.58$, $p<.05$] by a mean of 11.4 years (SE= 4.4) and reported higher depression scores on the PHQ-9 [$t(93)= 2.96$, $p<. 05$] by a mean of 3.0 points (SE= 1.3). Demographic variables as well as clinical information are presented in Table 1. Fifty percent of participants reported having pain for 90 days or less, 11.8% of participants reported having pain for 91–180 days, and 38.2% indicated being in pain for 181 days or more. Fifty-six participants (54.4%) reported having a prior history of LBP, and 17 (16.5%) participants reported having a history of surgery for LBP. The mean number of physical therapy sessions completed by the follow-up evaluation was $M = 6.82$, $SD = 2.73$, and ranged from 1–12 sessions. Normality assumptions were tested and met for all data; therefore, parametric procedures were used in all subsequent analyses.

Comparison of STarT Risk Groups on Anger Variables

One-way ANOVAs and chi-square tests did not reveal significant differences in demographic variables or in duration of pain symptoms among the STarT risk groups identified in this study. However, there was a significant relationship between the presence of low back pain history and STarT risk grouping, such that those who fell in the High Risk group were more likely to report having prior episodes of LBP, χ^2 (2)= 8.36, $p<.05$.

Additional correlational analyses examining the relationship between the STarT overall score and the psychosocial measures revealed a significant relationship between measures of depression (r= 0.59), anxiety (r= 0.31), and fear-avoidance (r= 0.23); however, in terms of anger measures, only anger control (r= −0.29) was significantly related to the STarT overall score (p<.05). .

Psychosocial characteristics of each pain risk group are presented in Table 2. One-way ANOVAs using planned contrasts revealed a difference in trait anger among groups [F(1,102)= 10.55, p<.01], such that the Low Risk group reported less anger than the Medium Risk group [t(99)= 2.53, p<.05], which, in turn, indicated less anger than those identified as High Risk [t(99)= 2.23, p<.05]. However, when controlling for other mood variables by examining them as covariates to the analyses, trait anger was no longer significantly different among risk groups [F(2,95)= 2.03, p>.05]. Trait anxiety held the only unique significant relationship in the model [F(1,95)= 4.33, p<.05], indicating an influence of anxiety on trait anger within risk groups.

In terms of anger expression styles (Anger-in versus Anger-out), planned comparisons did not reveal a significant difference among risk groups at p<.05. There was a nearly significant relationship among risk groups and anger-in when only anger measures were examined, [F(1,101)= 3.88, p=.05], such that the Medium and High Risk groups combined showed a greater tendency towards an internalized anger expression style than the Low Risk group [t(99)= 1.60, p=.11]. However, similar to trait anger, when controlling for trait anxiety, the effect of anger-in for STarT risk subgrouping was no longer close to significance.

Anger Control was the only anger variable that significantly differed among groups [F(1,101)= 6.86, p<.01], and then remained significant when controlling for other psychosocial variables [F(2,94)= 3.26, p<.05, η_p^2= .07]. Sidak-adjusted pairwise comparisons revealed that individuals in the Low Risk group indicated greater anger control abilities (M = 26.13, SD = 4.49) than those identified as being high risk for poor treatment outcome (M = 22.93, SD = 5.15).

The Contribution of Anger Variables to Pain and Disability

For all regression models, assumptions of homoscedasticity and linearity of standardized residuals were met, and independence of residuals was confirmed through the Durbin-Watson statistic. Furthermore, the averages of variance inflating factors (VIF) were not substantially greater than one and were all under 10, and tolerance was well above 0.2, suggesting the absence of excessive multicollinearity according to published guidelines (47). Correlations between the psychosocial predictors as well as the bothersomeness item on the STarT, and dependent variables are presented in Table 3. Correlations among the psychosocial variables ranged from r= 0.01 to 0.60, with the strongest relationship existing between anger-out and trait anger, similar to values reported by Spielberger (38). Between psychosocial and dependent variables, bothersomeness held the strongest relationship to reported pain intensity (r=0.65). Analyses did not reveal a significant relationship between age and dependent variables. There was, however, a significant relationship between sex and pain intensity [t(101)= 2.7, p<.01] and the RMDQ scores [t(101)= 2.1, p<.01], such that

women reported higher scores on both measures. Results of multiple regression analyses indicate that psychosocial symptoms did not predict pain intensity ratings at follow-up, with or without the inclusion of anger variables, $F(7,75)=1.33$, $p>.05$, $R^2=0.11$. Psychosocial symptomatology did predict performance-based impairments as measured by the PII [$F(7,63)= 2.30$, $p<.05$], shown in Table 4. Specifically, work-related fear-avoidance beliefs held the greatest weight in the model, $t(63)= 3.46$, $p<.01$. However, anger variables did not significantly contribute to the model above and beyond other mood variables (R^2 change= 0.01, $p>.05$). Similarly, the inclusion of anger variables did not add significantly to the predictive power of the model when examining patient-rated disability (R^2 change= 0.83, $p>.05$), although the model was significant when examining all psychosocial variables together [$F(7,73)= 3.27$, $p<.01$], shown in Table 5. The work items on the FABQ also held the greatest influence in this model, $t(73)= 3.08$, $p<.01$. Sex was added as a predictor for patient-rated disability in a separate stage, given the significant relationship between sex and RMDQ scores, but was not found to significantly contribute to the model [$t(79)= 1.0$, $p>.05$]. Given the high correlation between anger variables ($r= 0.12$ to 0.60), parallel analyses using centered interaction terms between anger variables were employed, but did not reveal significantly different results.

Aim 3: Empirical Grouping of Low Back Pain Patients

Hierarchical agglomerative cluster analyses used to examine subgrouping of patients based on psychosocial risk factors most closely resulted in a two-group division. Independent-samples t-tests and Pearson's chi-square tests revealed that the two clusters did not differ significantly on clinical variables or on demographic variables. The groups divided across all psychosocial variables, creating higher (N=17) and lower (N=81) psychosocial symptom endorsement groups (See Table 6). Discriminant function analysis revealed that 96.9% of cross-validated grouped cases were correctly classified. An examination of the discriminant function coefficients for each variable reveal that scores on the FABQ-W (0.58), PHQ-9 (0.56), and PCS (0.55) were the most relevant in differentiating the clusters, whereas STAI-T (0.28), AX/IN (0.26), STAXI-T (0.19), bothersomeness (0.18), AX/OUT (0.10), and AX/CON (−0.05) held substantially less influence. Independent samples t-tests employed to examine the relationship between the empirically-derived subgroups and pain and disability revealed significant differences in all three measures. The groups differed on the RMDQ [$t(96)= 4.36$, $p<.01$], such that the group with fewer psychosocial symptoms indicated lower disability scores. Similarly, the lower psychosocial symptom group had lower baseline scores on the PII, $t(95)= 2.34$, $p<.05$. Finally, those with lower psychosocial symptoms reported lower pain intensity, $t(96)= 2.98$, $p<.01$.

Chi-square tests were performed to compare the two-group cluster grouping of our sample to scores on the 3-group STarT measure. Results indicated a highly significant relationship [$\chi^2(2)= 12.69$, $p < .01$] suggesting related categorical composition of patient subgroups, despite the addition of anger.

DISCUSSION

The current study aimed to provide an in-depth examination of the presentation and impact of anger in low back pain, particularly in a physical therapy setting. As physical therapy treatment has been moving towards the use of more targeted approaches based on patient classification systems, creating a well-specified measure to identify risk factors is becoming more important to clinical practice. To this end, screening measures, such as the STarT, were developed to help clinicians identify LBP patients who may need a more multidisciplinary approach to address both psychological and physical factors maintaining the pain condition. The present study attempted to contribute to this line of literature by using an empirical approach to examine anger, in addition to other psychosocial symptoms, as a possible prognostic indicator in identifying patient subgroups.

As initially predicted, LBP patients did differ on trait anger, such that those with worse outcome risk profiles endorsed more anger than those in lower risk groups. However, other psychosocial variables, especially anxiety, held stronger relationships to risk grouping. Additionally, anger regulation style, specifically anger-in, was only marginally related to risk grouping when measured alone. These results suggest that anger may have contributed to the overall construct of psychosocial distress, as opposed to uniquely impacting risk classification. This finding supports the substantial body of literature suggesting that general negative affect is related to somatic symptomatology, and subsequently, increased pain and disability (5,48). Essentially, our results suggest that the experience of “suffering” in LBP is multifactorial and cannot be decomposed easily.

The current study did find a significant relationship between anger control and patient risk grouping. This finding is not unexpected given the context of the study question. Patients in our sample scored in the 35th percentile, on average, in trait anger, indicating anger levels comparable to the general population. Because anger scores in our sample were rather low and limited in range, there may have been a floor effect limiting exploration of trait anger in pain. The dimension of anger control as measured by the STAXI, on the other hand, focuses more on the appropriate management of situational anger when it is present. Those with poor anger control abilities are more likely to have mismanaged anger behaviors and, as previous studies have shown, greater susceptibility to pain (13). This finding also is somewhat in line with the state-trait matching hypothesis of anger in pain, which suggests that those who unsuccessfully try to manage their anger tend to experience more pain and health consequences. However, as noted below, more focused testing methods would be needed to fully examine this hypothesis than was conducted in this study.

It may be worthwhile to re-examine the methodology used to access anger in LBP patients, as several studies have advised against the use of self-report measures of anger alone due to strong covariation with general negative affect (49,50). Studies including an anger or mood induction component in addition to self-report measures, have reported more consistent relationships between anger expression and pain (51–53). Thus, including an anger induction procedure in the present study may have yielded a clearer picture on the relationship between anger management and risk profiles in LBP patients, or if one even exists outside of generalized negative affect.

Our study indicated that the psychosocial constructs already used in established screening measures, especially work-related fear avoidance, were the main factors predicting disability at the 4-week follow-up evaluation, and that anger regulation was not a primary factor in this relationship. An issue to consider is that half of our sample reported having acute low back pain and two-thirds of our sample reported having subacute pain, indicating a relatively short duration of symptoms. While results did not indicate a relationship between pain duration and psychosocial factors, LBP episode duration has been significantly associated with poor treatment outcome in other studies (54,55). This study did show a significant positive association between low back pain history and outcome risk, indicating that general pain course and history may be influencing results.

In terms of risk profiles based on psychosocial prognostic indicators, our results more closely followed a two group division, separating patients into higher and lower psychosocial symptom endorsement. This finding makes sense, as the present study was conducted in a physical therapy setting, thereby likely establishing a higher impairment threshold than the lowest of the three risk groups found in primary care settings according to the STarT measure. The group sizes found in the two cluster solution were notably mismatched, as the group with lower psychosocial scores had more than four times the number of patients than those who endorsed greater symptomatology. This finding further supports the conclusion that the study sample was generally low on psychosocial distress, thereby restricting possible statistical effects. Importantly, however, by identifying those with significant distress, the two-cluster solution may help single out patients who would truly benefit from multidisciplinary treatment. Our data are also aligned with studies indicating that while only a small percentage of acute LBP patients go on to develop more chronic conditions, these patients consume the vast majority of financial burden, and would likely benefit from a thorough screening and appropriate treatment as early as possible (15).

Given the pattern of results preceding the cluster analysis, it is not surprising that the anger variables did not carry as much weight in dividing the groups as some of the other psychosocial variables. While it is very possible that anger regulation simply does not play a role in patient subgrouping for patients with acute to chronic LBP, it may be that anger was one of the components within the general construct of emotional distress. In clinical pain, lines between negative affect constructs tend to get blurred and may have state-dependent qualities that influence patient ratings (50,56). Thus, understanding how anger uniquely contributes to risk for poor outcome in LBP may require a different experimental model, such as mood or pain induction. Another possible explanation takes our patient sample into account, which was largely comprised of patients with acute LBP lasting less than 6 months. Often these patients have not had many of the exasperating experiences encountered by those with chronic pain, such as multiple failed treatments, diminished social support, and disagreements with third-party payers. Thus, it may be interesting to reexamine the relationship between anger management and risk grouping in patients with longer LBP duration.

This study benefited from including multiple measures of treatment outcome, as focusing on one modality may inflate or minimize potential effects. Furthermore, results indicated that performance-based impairment generally had a weaker association to risk grouping than

patient-rated disability. This finding has also been supported in the literature, as a study comparing the two forms of impairment found a stronger relationship between psychological variables and self-report disability measures (57). Another strength of this study was the inclusion of acute and subacute LBP cases, thereby contributing to generalizability of results. As not all LBP patients presenting to physical therapy will eventually transition to chronic symptoms, our results reflect a relatively broad perspective of the relationship between low back pain and emotional distress, and how they can serve to develop and maintain each other in the course of a chronic back pain condition.

Many of the general limitations of the current study have been noted above. Additionally, patients were not evaluated for psychological treatment history or psychiatric diagnoses, thereby precluding analyses on the impact of preexisting psychological conditions. Although the scores on psychosocial measures were notably low across all patients, there is no apparent reason to suspect that our sample of LBP patients were clinically or demographically different from other physical therapy clinics. Also, our sample showed similar disability scores to other studies investigating disability and pain in LBP in physical rehabilitation centers (58,59). Another limitation was that physical therapy treatment type, duration, or compliance were not standardized in this study. While this aspect of the study ensured that treatment was based on the individual needs of the patient, it most likely increased variability in our results. Finally, although a recruitment log was kept to track LBP patients who chose not to participate in the study upon initial recruitment, there is no way to guarantee that the log was complete; thus, there may be a potential sampling bias in the data.

In sum, while it is evident that anger is part of the negative affect construct, the unique contribution of anger experience and management to risk grouping in terms of chronic pain and disability is less clear and may require additional study. Overall, this study supported that low back pain is multifactorial, and is, therefore, difficult to predict. However, implementing screening measures based on psychosocial factors may help guide practice in physical therapy treatment. These efforts may then be further extended to improve treatment of low back pain in different patient populations at risk for developing chronic pain with concomitant psychosocial factors, such as those in military settings (14,60).

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Table 1

Descriptive Data

Demographic/ Clinical Variable	***N***	
Age, in years *M(SD)*	103	40.48 (13.84)
Education		
7–12 years	22	21.4%
12–16 years	67	65.0%
16+ years	14	13.6%
Sex		
Male	40	38.8%
Female	63	61.2%
Race		
White	76	73.8%
Black/ African-American	18	17.5%
Asian	4	3.9%
Pacific Islander	3	2.9%
More than one race	2	1.9%
Marital Status		
Single	34	33.0%
Partnered/Married	59	57.3%
Divorced	9	8.7%
Widowed	1	1.0%
Employment Status		
Employed	66	64.1%
Unemployed	31	30.1%
Retired	6	5.8%
Average Pain Intensity Rating *M (SD)*	103	5.41 (1.96)
Duration of Pain Symptoms, in days *M (SD)*	102	508.05 (1101.68)

Table 2

Psychosocial Characteristics of Risk Groups According to StarT

	STarT Group *M (SD)*		
Psychosocial Symptom	**Low Risk Group (N=39)**	**Moderate Risk Group (N=34)**	**High Risk Group (N=30)**
FABQ-W	10.64 (10.38)	12.50 (10.53)	15.60 (12.04)
PHQ-9	3.92 (4.26)	6.79 (5.10)	12.23 (6.43)
STAI-Trait	33.49 (7.71)	35.76 (10.26)	38.67 (10.06)
STAXI-Trait	13.90 (3.80)	14.74 (3.60)	17.37 (5.51)
AX/IN	13.87 (4.24)	14.62 (4.29)	16.03 (4.88)
AX/OUT	12.82 (3.17)	12.74 (2.51)	13.67 (3.38)
AX/CON	26.13 (4.49)	25.03 (5.25)	22.93 (5.15)

FABQ-W: Fear Avoidance Beliefs Questionnaire- Work Scale, PHQ-9: Patient Health Questionnaire, STAI-T: Spielberger State-Trait Anxiety Inventory- Trait Scale, STAXI-Trait: State-Trait Anger Expression Inventory- Trait Subscale, AX/IN: Anger-in Subscale, AX/OUT: Anger-out Subscale, AX/CON: Anger Control Subscale

Table 3

Correlations between Psychosocial Predictors and Outcome Variables

	Pain	PII	RMDQ	Bother	FABQ-W	PHQ-9	STAI-Trait	STAXI-Trait	AX/IN	AX/OUT	AX/CON
Pain	1.0										
PII	.23[a]	1.0									
RMDQ	.60[b]	.41[b]	1.0								
Bother	.65[b]	.16	.59[b]	1.0							
FABQ-W	.32[b]	.19	.42[b]	.09	1.0						
PHQ-9	.39[b]	.26[b]	.50[b]	.39[b]	.32[b]	1.0					
STAI-T	.15[b]	.12	.25[a]	.09	.20[a]	.46[b]	1.0				
STAXI-T	.06	.01	.10	.20[a]	.04	.32[b]	.31[b]	1.0			
AX/IN	.01	.06	.13	.12	.07	.35[b]	.47[b]	.52[b]	1.0		
AX/OUT	.02	.07	.11	.17	.01	.14	.34[b]	.60[b]	.31[b]	1.0	
AX/CON	−.26[b]	−.12	−.29[b]	−.26[a]	−.01	−.17	−.48[b]	−.28[b]	−.12	−.45[b]	1.0

PII: Physical Impairment Index, RMDQ: Roland-Morris Disability Questionnaire, Bother: Bothersomeness item from STarT measure

[a] $p<.05$

[b] $p<.01$

Table 4

The Effect of Established Psychosocial Variables and Anger on PII

Model: PII Score	B	SE B	β
Step 1: Established Psychosocial Variables[a]			
FABQ- Work Scale	.07	.02	.44*
STAI-T	.02	.02	.11
PHQ-9	−.01	.04	−.06
Step 2: Anger variables plus mood variables[b]			
STAXI-Trait	−.04	.06	−.09
AX/IN	.02	.06	.06
AX/OUT	.02	.09	−.03
AX/CON	−.03	.05	−.09
FABQ- Work Scale	.07	.02	.44*
STAI-T	.01	.03	.05
PHQ-9	−.01	.04	−.04

Hierarchical regression analysis examining the effect of established psychosocial measures (entered in Step 1) and added anger variables (entered in Step 2) on physical impairment as measured by the Physical Impairment Index.

[a] Model accounted for 19.5% of the variance in PII, $F(3,67)= 5.40$, $p<.01$.

[b] Model accounted for 20.4% of the variance in PII, $F(7,63)= 2.30$, $p<.05$.

* $p<.05$

Table 5

The Effect of Established Psychosocial Variables and Anger on RMDQ

Model: RMDQ Score	B	SE B	β
Step 1: Established Psychosocial Variables[a]			
FABQ- Work Scale	.18	.06	.35*
STAI-T	−.02	.07	−.03
PHQ-9	.17	.11	.20
Step 2: Anger variables plus mood variables[b]			
STAXI-Trait	−.04	.18	−.03
AX/IN	.28	.18	.22
AX/OUT	−.18	.26	−.10
AX/CON	−.19	.16	−.17
FABQ- Work Scale	.18	.06	.34*
STAI-T	−.11	.09	−.18
PHQ-9	.15	.11	.17

Hierarchical regression analysis examining the effect of anger variables (entered in Step 1) and other psychosocial variables (entered in Step 2) on patient-rated disability as measured by the Roland Morris Disability Questionnaire.

[a] Model accounted for 20.4% of the variance in RMDQ, $F(3,77)= 6.58$, $p<.01$.

[b] Model accounted for 23.9% of the variance in RMDQ, $F(7,73)= 3.27$, $p<.01$.

* $p<.05$

Table 6

Psychosocial Characteristics of Cluster Division of LBP Patients

	Cluster Solution *M (SD)*	
Psychosocial Symptom	**Low Psychosocial Symptoms Cluster (*N*=81)**	**High Psychosocial Symptoms Cluster (*N*=17)**
Bothersomeness	2.55 (0.88)	3.21 (0.66)
PCS	12.43 (8.65)	32.00 (10.24)
FABQ-W	13.54 (5.55)	17.46 (4.82)
PHQ-9	5.69 (5.27)	12.46 (5.74)
STAI-Trait	33.18 (6.43)	45.58 (10.98)
STAXI-Trait	14.31 (3.68)	18.13 (5.46)
AX/IN	13.55 (3.61)	18.50 (4.80)
AX/OUT	12.65 (2.93)	14.42 (3.11)
AX/CON	25.39 (4.75)	22.54 (5.64)

Average psychosocial measure scores per LBP patient subgroup obtained following hierarchical agglomerative cluster analyses.