Anger differentially mediates the relationship between perceived injustice and chronic pain outcomes

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Sponsorships or competing interests that may be relevant to content are disclosed at the end of this article.

ABSTRACT

Emerging evidence suggests that perceived injustice is a risk factor for adverse outcomes associated with chronic pain. To date, however, the processes by which perceived injustice impacts on pain outcomes remain speculative. Evidence from several lines of research suggests that anger may mediate the relationship between injustice and pain outcomes. However, this relationship has not been empirically tested in patients with chronic pain. Thus, the purpose of this study was to examine whether anger mediates the relationships between perceived injustice and pain intensity, depressive symptoms, and self-reported disability. One hundred and seventy-three individuals with chronic musculoskeletal pain completed self-report measures of perceived injustice, anger, pain intensity, depressive symptoms, and disability. Consistent with previous research, high scores on a measure of perceived injustice were associated with greater pain, more severe depressive symptoms, and more pronounced disability. Hierarchical regression analyses indicated that anger variables completely mediated the relationship between perceived injustice and pain intensity, and partially mediated the relationship between perceived injustice and depressive symptoms. Anger did not mediate the relationship between perceived injustice and self-reported disability. The Discussion addresses the theoretical and clinical implications of the findings.
Social psychological research indicates that anger is the predominant emotional response to perceiving injustice [42,43]. Furthermore, numerous investigations have shown that elevated levels of anger are associated with adverse pain outcomes [4,12]. Research suggests that both anger intensity (state/trait) and regulation style (inhibition-expression) negatively impact pain outcomes [4,12,32,47]. It has recently been proposed that perceived injustice might be a cognitive antecedent to anger in chronic pain patients [63]. To date, however, the inter-relations among perceived injustice, anger, and adverse pain outcomes have not been empirically investigated. It is also not presently known which facets of the anger experience (ie, intensity vs regulation style) may account for the negative impact of perceived injustice.

This study examined whether anger intensity and regulation style mediated the relationship between perceived injustice and pain outcomes. Consistent with previous research, it was hypothesized that perceived injustice would be associated with greater pain intensity, depressive symptoms, and disability. It was hypothesized that anger intensity and regulation style would be associated with more negative pain outcomes and that these variables would mediate the relationship between perceived injustice and pain outcomes.

2. Methods

2.1. Participants

One hundred and seventy-three individuals (113 women, 60 men) with chronic musculoskeletal pain participated in this study. Chronic low back pain was the most prevalent diagnosis in this sample (approximately 42% of participants), followed by fibromyalgia/diffuse myofacial pain (approximately 26%), and chronic pain in the cervical spine (approximately 15%). Participants had a mean age of 49.67 years with a range of 21–65 years. The mean duration of pain was 9.98 years with a range from 1 to 50 years. The majority of participants (68%) had completed at least 12 years of education. Approximately half the sample (54%) was married or living with a common-law partner. At the time of assessment, the majority of participants (65%) were not working. Approximately 94% of participants were taking at least one class of analgesic medication, and approximately 58% of the sample were receiving at least one non-pharmacological intervention (including psychological intervention). At the time of assessment, approximately 24% of the sample indicated they were receiving psychological treatment.

2.2. Procedure

The Quebec Pain Registry (QPR) was used to identify patients with diagnoses of chronic musculoskeletal pain. The QPR is a database of over 3000 patients with chronic pain conditions who have received treatment at 1 of 3 university-affiliated tertiary pain management clinics in the province of Québec. Patients with musculoskeletal pain represent the majority of patients in the QPR.

Recruitment letters describing the procedures of the present study were mailed to patients with a diagnosis of chronic musculoskeletal pain, who were entered in the QPR at the time the present study began. The desired sample size was calculated to be between 150 and 200 patients, assuming power = 0.80, α < 0.05, and medium effects sizes for the associations among study variables [27]. Approximately 900 letters were mailed to patients registered in the QPR. In total, 183 individuals contacted the laboratory following receipt of the recruitment letter, representing a response rate of approximately 20%.

Interested participants contacted a research coordinator at McGill University. Individuals were considered eligible for the study if they had a current diagnosis of a musculoskeletal pain condition that had been present for at least 3 months. Individuals were included if they were capable of completing study measures in English or French. Of the 183 individuals who contacted the laboratory, 4 individuals were ineligible or declined to participate. Of the 179 eligible participants, 6 were excluded due to incomplete data. Participants with and without complete data did not differ significantly for any demographic or study variables. Data were collected over a period of approximately 3 months.

Participants provided demographic information and completed self-report measures of perceived injustice, anger, pain intensity, depressive symptoms, and disability. Participants were given the option to complete questionnaires online or to mail their questionnaire responses to the laboratory. Volunteers were invited to sign a consent form as a condition of participating in the study. The research was approved by the Comité d’Ethique de la Recherche du Centre Hospitalier de L’Université de Montréal.

2.3. Measures

2.3.1. Perceived injustice

The Injustice Experiences Questionnaire (IEQ) was used to measure pain-related perceptions of injustice [56]. Participants rated the frequency with which they experienced each of 12 pain-related thoughts on a 5-point scale, ranging from 0 (never) to 4 (all the time). Previous findings suggest that the IEQ yields two correlated factors, labeled “severity/irreparability of loss” and “blame/unfairness.” Examples of items loading onto the former factor include, “Most people don’t understand how severe my condition is,” and “My life will never be the same.” Examples of items loading onto the latter factor include, “I am suffering because of someone else’s negligence,” and “It all seems so unfair.” The IEQ has been shown to have high internal and test–retest reliability, and to be valid for use among individuals with persistent musculoskeletal pain [52,56].

2.3.2. Anger

The State-Trait Anger Expression Inventory—II (STAEI) [3,55] was used to assess anger. Participants were asked to rate 57 statements on a 4-point Likert scale. The following subscales of the STAEI were examined in the present study: state anger (15 items); trait anger (10 items); anger inhibition (8 items); and anger expression (8 items). Anger inhibition items assess the frequency with which participants attempt to suppress feelings of anger. Anger expression items assessed the frequency with which anger is outwardly expressed. Previous research suggests the distinctiveness of the anger intensity and anger regulation subscales (ie, inhibition and expression) of the STAEI [12]. Research supports the reliability and validity of these subscales for use with chronic pain patients [6,15].

2.3.3. Pain intensity

Participants were asked to rate their present pain intensity on a numerical rating scale ranging from 0 (no pain) to 10 (excruciating pain). Previous research indicates that this is a reliable measure of pain intensity [19]. Participants also indicated the location of their pain on a body schematic.

2.3.4. Depressive symptoms

The Patient Health Questionnaire 9 (PHQ-9) [33] was used to measure depressive symptom severity. The PHQ-9 is a 10-item questionnaire that asks respondents to indicate the frequency with which they experience each of the 9 symptoms considered in the diagnostic criteria for Major Depression, and 1 item assessing the difficulty with which they experience these symptoms. The PHQ-9 has been shown to be a valid and reliable measure of depressive symptoms in patients with a variety of medical conditions [14,33].
2.3.5. Self-reported disability

The Pain Disability Index (PDI) [28, 61] was used to assess the degree to which patients perceive themselves to be disabled by pain in 7 different areas of daily living: home, social, recreational, occupational, sexual, self-care, and life support. For each life domain, respondents were asked to provide perceived disability ratings on 11-point scales with the endpoints (0) no disability and (10) total disability. The PDI has been shown to be internally reliable and significantly correlated with objective indices of disability [28].

2.3.6. Demographic and treatment variables

Participants responded to questions concerning their age, sex, marital status, education, employment status, and pain onset. Participants indicated current medications taken for pain. The sum of different medication classes was taken as an index of medication use. Participants also indicated the types of non-pharmacological treatments (eg, physical therapy, occupational therapy, psychological treatment, etc.) they were currently receiving. Participants' pain diagnosis was ascertained from the QPR following their participation in the present study.

2.4. Data analytic approach

The following subscale scores were computed for the anger measure: state anger, trait anger, anger inhibition, and anger expression [15, 55]. Total scores were computed for all other measures. Total and subscale scores were computed on the measure of perceived injustice [56]. Means and standard deviations were computed for total and subscale scores. t Tests for independent samples were used to compare men and women on study variables. Independent samples t tests were also computed to compare scores on study variables for patients whose pain was and was not precipitated by an injury. Where reported degrees of freedom do not correspond to the total sample size (n = 173), it is due to missing data on variables included in those analyses.

Pearson product–moment correlations were computed to examine zero-order associations among perceived injustice, anger intensity and expression style, pain severity, depressive symptoms, and self-reported disability. Multiple regression analyses were used to test for mediation. According to Baron and Kenny [2], the following conditions are necessary to test for mediation: the independent variable (IV; ie, perceived injustice) must be significantly correlated with the dependent variable (DV; ie, pain, depressive symptoms, and disability); the IV must be significantly correlated with the mediator (ie, anger variables); the mediator must be significantly correlated with the DV; and, the presence of the mediator reduces the effect of the IV on the DV to zero (complete mediation) or partially reduces the effect of the IV (partial mediation). Therefore, each of the anger intensity and expression variables was only entered into the mediation analysis if it showed a significant zero-order correlation with both perceived injustice and the dependent variable of interest. A separate hierarchical multiple regression analysis was conducted for each of the dependent variables to test for mediation of perceived injustice by the candidate anger variables identified in zero-order correlations. Mediation analyses were repeated for the blame/unfairness and irreparability of loss subscales of the IEQ. In all regression analyses, the tolerance and variance inflation factors of the IVs fell within acceptable ranges [46]. Sobel tests were conducted to examine the significance of the mediation effects.

3. Results

3.1. Sample characteristics

Demographic information of the sample appears in Table 1. Mean scores on the IEQ are comparable to mean scores on this measure in previous samples of patients with chronic musculoskeletal pain [56]. Mean scores on other study variables are also comparable to previous studies of patients with chronic pain [15, 58]. Mean scores for perceived injustice, pain intensity, depressive symptoms, and self-reported disability are above the established clinical cut-offs for these measures [25, 33, 54, 57]. Thus, on average, participants in the present sample appeared to have clinically meaningful levels of perceived injustice, pain, depressive symptoms, and self-reported disability.

Men (M = 6.35, SD = 1.89) rated their pain as significantly more intense than women (M = 5.54, SD = 2.15), t (171) = 2.46, P < 0.05. Men and women did not differ significantly on any other study variable. Participants whose pain was precipitated by an injury had significantly higher IEQ total scores (M = 30.61, SD = 11.08) and ‘blame/unfairness’ scores (M = 13.15, SD = 6.87) than participants whose pain was not precipitated by an injury (M = 26.36, SD = 10.71; M = 10.21, SD = 6.43), t (170) = 2.52, P < 0.05 and t (170) = 2.84, P < 0.01, respectively. The self-reported disability scores of participants whose pain was precipitated by an injury (M = 41.58, SD = 13.27) were significantly higher than the disability scores of participants whose pain was not precipitated by an injury (M = 37.13, SD = 14.84), t (170) = 2.07, P < 0.05. Participants with and without precipitating injuries did not differ significantly on any other study variable.

3.2. Zero-order correlations among study variables

Table 2 displays the zero-order correlations among study variables. IEQ total and subscale scores were each significantly correlated with state anger, trait anger, and anger inhibition. IEQ total and subscale scores were each significantly correlated with all of the pain outcome variables. State anger and anger inhibition were significantly correlated with pain intensity, depressive symptoms, and self-reported disability. Trait anger and anger expression were significantly correlated with depressive symptoms. All of the anger subscales were significantly intercorrelated. Pain intensity,

### Table 1

<table>
<thead>
<tr>
<th>Variable</th>
<th>M (SD) or N (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age</td>
<td>49.67 (9.66)</td>
</tr>
<tr>
<td>Duration (years)</td>
<td>9.98 (2.20)</td>
</tr>
<tr>
<td>Pain site (categories not mutually exclusive)</td>
<td></td>
</tr>
<tr>
<td>Neck</td>
<td>99 (57.23%)</td>
</tr>
<tr>
<td>Back</td>
<td>147 (84.97%)</td>
</tr>
<tr>
<td>Upper extremity</td>
<td>81 (46.82%)</td>
</tr>
<tr>
<td>Lower extremity</td>
<td>122 (70.52%)</td>
</tr>
<tr>
<td>Precipitating injury</td>
<td></td>
</tr>
<tr>
<td>No</td>
<td>72 (41.86%)</td>
</tr>
<tr>
<td>Yes</td>
<td>100 (58.14%)</td>
</tr>
<tr>
<td>Work accident</td>
<td>39 (39.00%)</td>
</tr>
<tr>
<td>Motor vehicle accident</td>
<td>30 (30.00%)</td>
</tr>
<tr>
<td>Post-surgical</td>
<td>21 (21.00%)</td>
</tr>
<tr>
<td>Other/injury type not indicated</td>
<td>10 (10.00%)</td>
</tr>
<tr>
<td>Number of pain medications</td>
<td>2.72 (1.53)</td>
</tr>
<tr>
<td>Number non-pharmacological treatments</td>
<td>1.85 (2.54)</td>
</tr>
<tr>
<td>IEQ</td>
<td>28.91 (11.11)</td>
</tr>
<tr>
<td>STAEI-State</td>
<td>22.88 (8.49)</td>
</tr>
<tr>
<td>STAEI-Trait</td>
<td>19.86 (6.62)</td>
</tr>
<tr>
<td>STAEI-Expression</td>
<td>14.76 (3.97)</td>
</tr>
<tr>
<td>STAEI-Inhibition</td>
<td>18.21 (5.58)</td>
</tr>
<tr>
<td>PPI</td>
<td>5.82 (2.09)</td>
</tr>
<tr>
<td>PHQ-9</td>
<td>15.65 (7.06)</td>
</tr>
<tr>
<td>PDI</td>
<td>39.82 (14.10)</td>
</tr>
</tbody>
</table>

Abbreviations: IEQ, Injustice Experiences Questionnaire; STAEI, State Trait Anger Expression Inventory—II; PPI, Present Pain Intensity; PHQ-9, Patient Health Questionnaire—9; PDI, Pain Disability Index.
that state anger (Sobel test = 3.44, \(P < 0.001\)) mediated between the blame/unfairness component of perceived injustice and pain intensity. Examination of the beta weights in the final regression equation indicated that only state anger contributed significant unique variance to the prediction of pain intensity, \(\beta = 0.33, t(171) = 3.94, P < 0.001\).

### 3.4. Anger as a mediator of the relationship between perceived injustice and depressive symptoms

State anger, trait anger, and anger inhibition were each significantly correlated with perceived injustice and depressive symptoms, and were thus candidate mediators. Table 4 displays the results of regression analyses examining the mediating role of state anger, trait anger, and anger inhibition in the relationship between perceived injustice and depressive symptoms. In the first regression analysis, perceived injustice accounted for a significant proportion of the variance in depressive symptoms \((\beta = 0.49)\), above and beyond that accounted for by pain intensity. In the second analysis, state anger, trait anger, and anger inhibition together contributed significant unique variance to the prediction of depressive symptoms, controlling for the influence of pain intensity. Perceived injustice was entered in the third step of this analysis, and contributed significant unique variance to the prediction of depressive symptoms, above and beyond the contributions of state anger, trait anger, and anger inhibition.

### Table 4

<table>
<thead>
<tr>
<th>Dependent Variable</th>
<th>(R^2) change</th>
<th>(F) change</th>
<th>(P)</th>
<th>(\beta)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Regression 1: Dependent = PHQ-9</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Step 1: PPI</td>
<td>0.14</td>
<td>27.83</td>
<td>&lt;0.001</td>
<td>0.25**</td>
</tr>
<tr>
<td>Step 2: IEQ Total</td>
<td>0.23</td>
<td>61.14</td>
<td>&lt;0.001</td>
<td>0.49**</td>
</tr>
<tr>
<td>Regression 2: Dependent = PHQ-9</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Step 1: PPI</td>
<td>0.14</td>
<td>27.83</td>
<td>&lt;0.001</td>
<td>0.16</td>
</tr>
<tr>
<td>Step 2: STAEI-State</td>
<td>0.32</td>
<td>33.11</td>
<td>&lt;0.001</td>
<td>0.25**</td>
</tr>
<tr>
<td>STAEI-Trait</td>
<td>0.12</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>STAEI-Inhibition</td>
<td>0.22</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Step 3: IEQ Total</td>
<td>0.07</td>
<td>26.08</td>
<td>&lt;0.001</td>
<td>0.31**</td>
</tr>
</tbody>
</table>

**Abbreviations:** IEQ, Injustice Experiences Questionnaire; STAEI, State Trait Anger Expression Inventory—II; PPI, Present Pain Intensity; PHQ-9, Patient Health Questionnaire-9; PDI, Pain Disability Index.

**Notes:** *P < 0.05.* **P < 0.001.

### Table 3

Mediating role of state anger and anger inhibition in the relationship between perceived injustice and pain intensity.

<table>
<thead>
<tr>
<th>Regression 1: Dependent = PPI</th>
<th>(R^2) change</th>
<th>(F) change</th>
<th>(P)</th>
<th>(\beta)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Step 1: IEQ Total</td>
<td>0.07</td>
<td>12.37</td>
<td>&lt;0.001</td>
<td>0.26**</td>
</tr>
<tr>
<td><em>Step 2: IEQ Total</em></td>
<td></td>
<td></td>
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<td></td>
</tr>
</tbody>
</table>

**Abbreviations:** IEQ, Injustice Experiences Questionnaire; STAEI, State Trait Anger Expression Inventory—II; PPI, Present Pain Intensity; PHQ-9, Patient Health Questionnaire-9; PDI, Pain Disability Index.

**Notes:** *P < 0.001.

### Table 2

Zero-order correlations among study variables.

<table>
<thead>
<tr>
<th></th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
<th>9</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. IEQ Total</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2. IEQ-Loss</td>
<td>0.91**</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3. IEQ-Blame</td>
<td>0.95**</td>
<td>0.75**</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4. STAEI-State</td>
<td>0.42**</td>
<td>0.37**</td>
<td>0.42**</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5. STAEI-Trait</td>
<td>0.27**</td>
<td>0.24**</td>
<td>0.26**</td>
<td>0.43**</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6. STAEI-Expression</td>
<td>0.10</td>
<td>0.09</td>
<td>0.10</td>
<td>0.35**</td>
<td>0.67**</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>7. STAEI-Inhibition</td>
<td>0.33**</td>
<td>0.29**</td>
<td>0.33**</td>
<td>0.43**</td>
<td>0.39**</td>
<td>0.18**</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>8. PPI</td>
<td>0.26**</td>
<td>0.22**</td>
<td>0.26**</td>
<td>0.38**</td>
<td>0.08</td>
<td>0.07</td>
<td>0.17**</td>
<td></td>
<td></td>
</tr>
<tr>
<td>9. PHQ-9</td>
<td>0.56**</td>
<td>0.51**</td>
<td>0.53**</td>
<td>0.58**</td>
<td>0.41**</td>
<td>0.19**</td>
<td>0.50**</td>
<td>0.37**</td>
<td></td>
</tr>
<tr>
<td>10. PDI</td>
<td>0.51**</td>
<td>0.47**</td>
<td>0.49**</td>
<td>0.31**</td>
<td>0.05</td>
<td>0.07</td>
<td>0.16**</td>
<td>0.44**</td>
<td>0.49**</td>
</tr>
</tbody>
</table>

**Abbreviations:** IEQ, Injustice Experiences Questionnaire; STAEI, State Trait Anger Expression Inventory—II; PPI, Present Pain Intensity; PHQ-9, Patient Health Questionnaire-9; PDI, Pain Disability Index.

**Notes:** *P < 0.05.* **P < 0.01.
symptoms, beyond that accounted for by pain intensity and anger variables. State anger (Sobel test = 3.81, \(P < 0.001\)), trait anger (Sobel test = 2.76, \(P < 0.01\)), and anger inhibition (Sobel test = 3.37, \(P < 0.001\)) partially mediated between perceived injustice and depressive symptoms. Examination of the beta weights in the final regression equation indicated that pain intensity (\(\beta = 0.16, t (171) = 2.68, P < 0.01\)), state anger (\(\beta = 0.25, t (171) = 3.62, P < 0.001\)), trait anger (\(\beta = 0.12, t (171) = 1.94, P = 0.05\)), anger inhibition (\(\beta = 0.22, t (171) = 3.65, P < 0.001\)), and perceived injustice (\(\beta = 0.31, t (171) = 5.12, P < 0.001\)) each contributed significant unique variance to the prediction of depressive symptoms.

A subsequent regression analysis was conducted to examine the independent contributions of the IEQ subscales to the prediction of depressive symptoms. The severity/irreparability of loss and blame/unfairness subscales each contributed significant unique variance to the prediction of depressive symptoms, \(\beta = 0.24, t (171) = 2.64, P < 0.05\) and \(\beta = 0.29, t (171) = 3.07, P < 0.05\), respectively. An additional hierarchical regression analysis indicated that state anger (Sobel test = 3.80, \(P < 0.001\)), trait anger, (Sobel test = 2.74, \(P < 0.01\)), and anger inhibition (Sobel test = 3.35, \(P < 0.001\)) mediated between the blame/unfairness subscale and depressive symptoms. State anger (Sobel test = 3.57, \(P < 0.001\)), trait anger (Sobel test = 2.56, \(P = 0.01\)), and anger inhibition (Sobel test = 3.01, \(P < 0.01\)) partially mediated between the severity/irreparability of loss subscale and depressive symptoms. Examination of the beta weights in the final regression equation indicated that pain intensity (\(\beta = 0.16, t (171) = 2.69, P < 0.01\)), state anger (\(\beta = 0.25, t (171) = 3.63, P < 0.001\)), anger inhibition (\(\beta = 0.23, t (171) = 3.66, P < 0.001\)), and the severity/irreparability of loss subscale (\(\beta = 0.19, t (171) = 2.32, P < 0.05\)) each contributed significant unique variance to the prediction of depressive symptoms.

### 3.5. Anger as a mediator of the relationship between perceived injustice and self-reported disability

State anger and anger inhibition were significantly correlated with perceived injustice and self-reported disability in zero-order analyses, and were thus candidate mediators. Table 5 displays the results of regression analyses examining the mediating role of state anger and anger inhibition in the relationship between perceived injustice and self-reported disability. In the first regression analysis, perceived injustice accounted for a significant proportion of the variance in disability (\(\beta = 0.43\), above and beyond that accounted for by pain intensity. In the second analysis, state anger and anger inhibition did not contribute significant unique variance to the prediction of disability, above and beyond that accounted for by pain intensity. Perceived injustice was entered in the third step of this analysis, and contributed significant unique variance to the prediction of disability, beyond that accounted for by pain intensity and anger variables. State anger (Sobel test = 0.04, \(P > 0.05\)) and anger inhibition (Sobel test = -0.61, \(P > 0.05\)) did not mediate between perceived injustice and disability. Examination of the beta weights from the final regression equation revealed that pain intensity (\(\beta = 0.28, t (171) = 4.38, P < 0.001\)), depressive symptoms (\(\beta = 0.20, t (171) = 2.65, P < 0.01\)), and perceived injustice (\(\beta = 0.33, t (171) = 4.53, P < 0.001\)) were all significant unique predictors of disability.

### 4. Discussion

The present study adds to a growing body of research examining the contribution of perceived injustice to chronic pain-related adjustment. Consistent with previous research, perceived injustice was significantly correlated with pain intensity, depressive symptoms, and self-reported disability [53,56,58]. This study provides an important extension of previous research by showing that anger intensity and inhibition differentially mediate the association between perceived injustice and pain, depressive symptoms, and disability. To the authors’ knowledge, this is the first study to provide support for perceived injustice as a cognitive correlate of anger intensity and anger inhibition in chronic pain.

The present study replicated previous findings showing that perceived injustice, state anger, and anger inhibition are significantly correlated with pain intensity [5,15,56,58]. Research has not previously investigated the processes by which perceived injustice and self-reported disability in zero-order analyses, and were thus candidate mediators. Table 5 displays the results of regression analyses examining the mediating role of state anger and anger inhibition in the relationship between perceived injustice and self-reported disability. In the first regression analysis, perceived injustice accounted for a significant proportion of the variance in disability (\(\beta = 0.43\), above and beyond that accounted for by pain intensity. In the second analysis, state anger and anger inhibition did not contribute significant unique variance to the prediction of disability, above and beyond that accounted for by pain intensity. Perceived injustice was entered in the third step of this analysis, and contributed significant unique variance to the prediction of disability, beyond that accounted for by pain intensity and anger variables. State anger (Sobel test = 0.04, \(P > 0.05\)) and anger inhibition (Sobel test = -0.61, \(P > 0.05\)) did not mediate between perceived injustice and disability. Examination of the beta weights from the final regression equation revealed that pain intensity (\(\beta = 0.28, t (171) = 4.38, P < 0.001\)), depressive symptoms (\(\beta = 0.20, t (171) = 2.65, P < 0.01\)), and perceived injustice (\(\beta = 0.33, t (171) = 4.53, P < 0.001\)) were all significant unique predictors of disability.

### Table 5

<table>
<thead>
<tr>
<th>Regression 1: Dependent = PDI</th>
<th>(R^2) change</th>
<th>F change</th>
<th>(P)</th>
<th>(\beta)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Step 1 PPI</td>
<td>0.20</td>
<td>41.91</td>
<td>&lt;0.001</td>
<td>0.33**</td>
</tr>
<tr>
<td>Step 2 IEQ Total</td>
<td>0.17</td>
<td>45.60</td>
<td>&lt;0.001</td>
<td>0.43**</td>
</tr>
</tbody>
</table>

### Abbreviations:
- IEQ, Injustice Experiences Questionnaire;
- STAEI, State Trait Anger Expression Inventory–II;
- PPI, Present Pain Intensity;
- PHQ-9, Patient Health Questionnaire–9;
- PDI, Pain Disability Index.

** \(P < 0.001\)**

P < 0.05 and anger inhibition (Sobel test = -0.16, \(P > 0.05\)) also did not mediate between the severity/irreparability of loss subscale and disability. Examination of the beta weights from the final regression equation indicated that pain intensity (\(\beta = 0.33, t (171) = 4.98, P < 0.001\)), the blame/unfairness subscale (\(\beta = 0.23, t (171) = 2.42, P < 0.05\)), and the severity/irreparability of loss subscale (\(\beta = 0.23, t (171) = 2.50, P < 0.05\)) each contributed significant unique variance to the prediction of self-reported disability. In light of the finding that anger did not mediate the injustice–disability relationship, an additional regression analysis was conducted to determine whether depressive symptoms mediated the relationship between perceived injustice and disability. After controlling for pain intensity, depressive symptoms entered in the second step of the analysis contributed an additional 12% of the variance to the prediction of disability (\(F (1,170) = 30.29, P < 0.001\)). Perceived injustice was entered in the third step, and contributed an additional 7% of the variance to the prediction of disability, above and beyond that accounted for by pain intensity and depressive symptoms (\(F(1,169) = 20.50, P < 0.001\)). Depressive symptoms (Sobel test = 2.51, \(P = 0.01\)) partially mediated between perceived injustice and disability. Examination of the beta weights from the final regression equation revealed that pain intensity (\(\beta = 0.28, t (171) = 4.38, P < 0.001\)), depressive symptoms (\(\beta = 0.20, t (171) = 2.65, P < 0.01\)), and perceived injustice (\(\beta = 0.33, t (171) = 4.53, P < 0.001\)) were all significant unique predictors of disability.
injustice contributes to increased pain intensity. The present results indicated that perceived injustice was significantly correlated with state anger and anger inhibition. Regression analyses suggested that state anger and anger inhibition completely mediated the relationship between perceived injustice and pain intensity. Thus, anger appears to be the vehicle through which perceived injustice impacts pain intensity.

Subscale analyses indicated that only the ‘blame/unfairness’ subscale of the IEQ contributed significant unique variance to the prediction of pain intensity. This association was completely mediated by state anger. Conceptual models highlight the attribution of blame as an antecedent of injustice perceptions and anger reactions [1,41,51]. Experimental and clinical research likewise suggests that the identification of external sources of blame contributes to greater levels of anger [35,42,47]. It is possible that chronic pain patients’ attributions of blame might give rise to anger reactions that, in turn, trigger a cascade of physiological responses that ultimately result in more intense pain experience.

Increasing evidence points to the mechanisms by which anger may exacerbate pain. In both patients and healthy controls, acute induction of anger is associated with endogenous opioid dysfunction in response to painful stimuli [5,7]. Increased muscle tension and systolic blood pressure have been shown to follow acute induction of anger, which may also increase pain sensitivity [9,10]. Although not yet empirically examined, it has been suggested that activation in the anterior cingulate cortex and dorsal lateral prefrontal cortex may subserve the relationship between anger and pain [12].

The present results indicated that perceived injustice and anger variables were each significantly correlated with depressive symptoms, which is in line with previous research [11,20,47,53,56]. Previous work has not examined mechanisms linking perceived injustice to depressive symptoms. In the present study, regression analyses revealed that state and trait anger and anger inhibition partially explained the association between perceived injustice and depressive symptoms. This suggests that anger may be one mechanism through which perceived injustice influences depressive symptoms.

Analyses of the IEQ subscales indicated that anger variables completely mediated the relationship between blame/unfairness and depressive symptoms, and partially mediated between severity/irreparability of loss and depressive symptoms. The severity/irreparability of loss subscale remained a significant unique predictor of depressive symptoms in the final equation. The direct effect of this subscale is unsurprising in light of numerous reports highlighting the central role of loss experiences in the precipitation of depressive symptoms [26,31,49].

Several processes may account for the strong association between anger and depressive symptoms. It has been suggested that serotonergic and dopaminergic dysfunction may be common physiological substrates for both anger and depression [44,48,64]. Reduced activation in the orbitofrontal cortex also appears common in states of both anger and depression [34]. Behaviorally, characteristic suppression of anger may contribute to withdrawal from anger-provoking social environments [13,17,22]. Consequently, social isolation and the associated loss of positive reinforcement from interpersonal interactions may exacerbate depressive symptoms [30,67].

Perceived injustice, state anger, and anger inhibition were each significantly correlated with self-reported disability, which replicates previous findings [20,47,58]. Despite significant zero-order associations between perceived injustice, anger intensity and inhibition, and disability, the current results did not support anger as a mediator between perceived injustice and disability. Subscale analyses also did not support depressive symptoms as a mediator between perceived injustice and disability. Subscale analyses revealed that both the blame/unfairness and severity/irreparability of loss subscales of the IEQ each uniquely predicted disability. These results highlight the complexity of the injustice construct, and suggest that different processes may underlie its impact on various pain outcomes.

Previous research suggests that heightened displays of pain behavior partially account for the impact of perceived injustice on disability [58]. However, reasons for the link between perceived injustice, pain behavior, and disability remain speculative. One explanation may be that pain behaviors represent a public display of pain and suffering and, by association, the injustice experienced. Consequently, pain behavior may be a means to receive validation for the injustice. It has also been suggested that injustice perceptions contribute to retribution motives, which might compromise engagement in or response to rehabilitation interventions [43,62]. In the rehabilitation context, failure to functionally improve may be a powerful means to punish the perceived unjust behavior of the insurer or the treating clinician. Future research is needed to determine the motivational factors that underlie increased pain behavior and disability among individuals with heightened injustice perceptions, and the degree to which these factors are consciously represented [58].

The present results suggest that interventions targeting anger may reduce the impact of perceived injustice on pain intensity and depressive symptoms. At present, limited research has examined the effectiveness of interventions designed to manage anger reactions in individuals with chronic pain [63]. One study examined the effects of written anger expression in patients with pain [29]. During 2 sessions (20 minutes each, over 2.5 weeks) participants wrote letters describing their anger, what made them angry, and a resolution that would reduce their anger. Nine weeks later, participants who received the anger expression intervention experienced greater improvements on depression and pain compared to control participants [29]. Future research is needed to replicate this finding and to examine the long-term effectiveness of written anger expression.

Several additional intervention strategies may be useful. Forgiveness interventions attempt to reduce anger by increasing empathy and compassion towards perceived offenders, and have been shown to benefit crime and accident victims [38,66]. However, ongoing pain may serve as an ongoing reminder of the offence, which may impede the forgiveness process [23,24]. Acceptance-based interventions have also been advocated for problematic anger [21]. Acceptance interventions use metaphor and experiential exercises to demonstrate how the struggle to control anger may exacerbate suffering. Acceptance-based interventions direct behavior towards achieving valued life goals, rather than control and avoidance of difficult experiences, such as pain and anger [37]. Interventions may also need to address the social context within which perceptions of injustice and anger arise. Recent research suggests that validation techniques might be effective for reducing anger in patients with pain [65]. Future research is needed to investigate the utility of these interventions to reduce the impact of perceived injustice and anger among patients with pain.

Several limitations warrant consideration. First, the cross-sectional, correlational design of this study limits the nature of conclusions that can be drawn about the causal and sequential relations among perceived injustice, anger, and pain outcomes. Future research using paradigms to experimentally induce blame attributions (eg, [8,10,50]) will be necessary to clarify the antecedent status of perceptions of injustice in contributing to problematic health and mental health outcomes in individuals with chronic pain. The reliance on self-report measures is also a limitation, as shared method variance may partially account for the observed relationships.
The sample consisted of patients with musculoskeletal pain of longstanding duration that were attending or had previously attended a tertiary care outpatient pain management clinic. Furthermore, the response rate of individuals who were contacted and agreed to participate was low (20%). This may give rise to concerns over selection bias and the generalizability of the present results. However, mean scores on the IEQ in the present study are comparable (ie, within one standard deviation) to mean scores reported in a sample of patients with persistent pain following whiplash injury attending a secondary care rehabilitation program [54]. Mean IEQ scores in the present study are likewise comparable to those reported in a sample of fibromyalgia patients recruited consecutively from primary care [52]. Taken together, these findings increase confidence that the present results are not simply due to selection bias. The generalizability of the present results to patients with varying pain diagnoses and with pain of less chronic duration remains an important question for future research.

Conflict of interest statement

The authors have no conflicts of interest.

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