Perceived Injustice after Spinal Cord Injury: Evidence for a Distinct Psychological Construct

Kimberley R. Monden, PhD[1,2], **Angela Philippus, BA**[1], **Adriel Boals, PhD**[3], **Christina Draganich, BA**[4], **Leslie Morse, DO**[5], **Jessica M. Ketchum, PhD**[1], **Zina Trost, PhD**[6]

[1]Craig Hospital, 3425 S Clarkson St, Englewood, CO, USA

[2]Department of Physical Medicine and Rehabilitation, University of Colorado School of Medicine, Aurora, CO, USA

[3]Department of Psychology, University of North Texas, Denton, TX, USA

[4]Rocky Vista University, College of Osteopathic Medicine, Parker, CO, USA

[5]Department of Rehabilitation Medicine, University of Minnesota Medical School, Minneapolis, MN, USA

[6]Department of Psychology, University of Alabama at Birmingham, Birmingham, AL, USA

Abstract

Study design—Cross-sectional study.

Objective—To identify unique predictors of perceived injustice compared to depression symptoms within the first year after SCI.

Setting—Inpatient rehabilitation program in a large urban region in the Southwestern United States.

Methods—A sample of 74 participants with median time since injury of 52 days completed measures of perceived injustice, depression symptoms, posttraumatic stress symptoms, expected disability, pain intensity, and anger.

Corresponding Author: Kimberley Monden, PhD, KMonden@craighospital.org.
Author Contributions
KM: Responsible for conceiving and designing the study, data analytic plan, interpretation of results, and manuscript development.
AP: Assisted with writing of introduction, results, and discussion sections.
AB: Provided input on methodology, analysis, and results section.
CD: Assisted with writing of results and major revisions.
LM: Assisted with writing of results and overall editing.
JK: Responsible for data analysis and results.
ZT: Responsible for conceiving and designing the study, writing introduction, and editing.

Results—Three unique predictors of perceived injustice as compared to depression symptoms were found – time since injury, state anger, and sex. These predictors had significantly different relationships with perceived injustice than with depression symptoms.

Conclusions—Results replicate previous findings that perceived injustice is moderately correlated with depression symptoms. However, findings also reveal factors uniquely associated with perceived injustice than with depression symptoms, providing support that these are two separate constructs. Thus, these findings support development of novel interventions targeting perceptions of injustice.

Introduction

Perceived injustice – an appraisal of severity and irreparability of injury or condition-related loss, perceived unfairness, and externalized blame – is a predictor of negative physical and psychological outcomes in acute and chronic pain conditions (1). Appraisal is defined as a cognitive-evaluative process whereby events and conditions are judged with respect to their relevance to physical, environmental, and psychological goals (2). Elevated injustice perception is a critical cognitive-behavioral risk factor for the development and maintenance of persistent pain (3), disability (4), and psychological distress following various injuries (1, 5–7). The impact of perceived injustice after injury is notable in that it predicts poorer physical and psychosocial outcomes over and above demographic and clinical/injury related factors (1, 8). Interest in how this construct applies to individuals with spinal cord injuries (SCI) has recently emerged.

Depression is a significant secondary complication for approximately 20% to 40% of individuals with spinal cord injury (SCI) and is associated with various biopsychosocial factors, including pain, catastrophizing beliefs, perceived stress, decreased social support, and decreased quality of life (9–11). Research reveals a positive association between perceived injustice and depressive mood in various injury populations (5, 12–14).

Given the consistent correlation between depression symptoms and perceived injustice, it is possible that perceived injustice is simply a proxy for depression; this is unlikely, however, as recent findings show as little as 20% shared variance between perceived injustice and depression symptoms (7). In order to develop interventions targeting perceived injustice, further research is necessary to understand the factors associated with perceived injustice that are unique from those associated with depression. Therefore, the present exploratory study aims to build on previous work by determining which particular constructs are *uniquely* associated with perceptions of injustice compared to depression symptoms within the first year after SCI. To explore these relationships, three research questions were investigated: (1) Is the predictor significantly related to the set of outcomes (perceived injustice and depression symptoms)?; (2) Is the predictor significantly related to either outcome?; and (3) Is the relationship between the predictor and perceived injustice significantly different than the relationship between the predictor and depression symptoms? It was hypothesized that the relationship between a set of predictors (selected *a priori*) and

perceived injustice would be significantly different than the relationship between these same predictors and depression symptoms.

Methods

Participants

Data were collected as part of a longitudinal study with four data collection points: inpatient rehabilitation, 3-months, 6-months, and 1-year post-injury. The sample included 89 adults consecutively admitted for inpatient rehabilitation between January 2014 and June 2016. Inclusion criteria consisted of the following: (a) traumatic or non-traumatic SCI; (b) age 18 years; (c) cognitive capacity to participate; (d) medical stability; and (e) absence of serious mental illness or developmental disability. This study is a secondary, cross-sectional analysis of data collected during inpatient rehabilitation focused on acute SCI (within the first year post-injury). Fourteen participants with greater than 365 days post-injury and one individual without neurological deficit were removed from the sample. The cohort consisted of 74 individuals with acute SCI.

Neurological Classification of SCI

Motor level and completeness of injury were confirmed with physical exam by a trained rater according to the American Spinal Injury Association Impairment Scale (AIS). Participants were classified as motor complete (AIS A or B) or motor incomplete (AIS C or D).

Measures

Outcome Variables

Perceived injustice: The Injustice Experience Questionnaire (IEQ) (1) was used to measure the degree to which participants perceived their post-injury life as being characterized by injustice. The 12-item measure ($\alpha = 0.92$) asks respondents to indicate how frequently they experience a sense of unfairness in relation to their injury on a 5-point scale from 0 (*not at all*) to 4 (*all the time*). Higher scores on the IEQ indicate greater perceptions of injustice. The IEQ has strong psychometric properties (1, 15, 16).

Depression symptoms: Depression symptoms were assessed with the Patient Health Questionnaire-8 (PHQ-8) (17), a validated self-report questionnaire that measures how often a person has been bothered by eight depressive symptoms over the past two weeks on a 0 (*not at all*) to 3 (*nearly every day*) scale ($\alpha = 0.78$). Higher scores indicate higher severity of depression symptoms.

Predictor Variables

Demographic and injury characteristics: Information abstracted from the medical record included: time since injury, length of stay (number of days in inpatient rehabilitation), type of injury (traumatic, non-traumatic), level of injury (tetraplegia, paraplegia), and AIS score (A, B, C, D). AIS scores were used to determine completeness of injury (motor complete, motor incomplete). Information collected by self-report at the time of enrollment included:

sex, age, race (white, not white), education (high school diploma or less, more than high school), employment status at the time of the injury (not employed, employed), and income (< $40,000; ≥ $40,000).

Expected disability: A modified version of the Pain Disability Index (PDI) (18, 19) was used as a self-report measure of expected disability. Instructions were altered from asking participants to "*measure the degree to which you think aspects of your life may be disrupted by pain*" to "*measure the degree to which you think aspects of your life may be disrupted by your injury*." Participants rated their expected level of disability in seven areas of daily living using an 11-point scale with the endpoints 0 (*no disability*) to 10 (*total disability*) (α = 0.84). The PDI is internally reliable and is significantly correlated with indices of disability (18).

Posttraumatic stress symptoms: Posttraumatic stress symptoms (PTSS) were evaluated using the 4-item Primary Care PTSD Screen (PC-PTSD) (α = 0.76) (20). Scores range from 0–4; higher scores indicate greater PTSS.

Pain intensity: The Present Pain Intensity index (PPI) of the McGill Pain Questionnaire-Short Form (SF-MPQ) was used to measure pain intensity (21). Participants indicated which of six words, ranging from 0 (*no pain*) to 5 (*excruciating*) best reflected their current pain experiences. The SF-MPQ is sensitive to change and demonstrates high reliability and validity (22–24).

Anger: An abbreviated version of the State-Trait Anger Expression Inventory–II (STAXI–II) (25) was used to assess anger. The measure included seven items from the state subscale (α = 0.95) and five items from the trait subscale (α = 0.86). Participants endorsed each item on a 4-point Likert scale. Higher scores indicate greater state and trait anger. The state subscale reflects the intensity of an individual's feelings of anger at the time of testing; the trait subscale assesses a person's predisposition to become angry.

Statistical Analyses

Statistical analyses were conducted using SAS v.9.4 (26), assuming a 5% level of significance unless otherwise indicated. Sample characteristics are described using frequency counts and percentages for categorical variables, means and standard deviations or medians and interquartile ranges for continuous variables.

Bivariate analyses—Preliminary analyses assessed the bivariate relationship between each predictor and each of the two outcome variables (perceived injustice, depression symptoms), not controlling for other characteristics. Bivariate relationships between each of the two outcomes and each of the 16 predictor variables (listed in Table 2) were assessed using general linear models (GLMs); specifically, linear regression for continuous predictors and *t*-tests for dichotomous predictors. Relationships were quantified using correlation coefficients and slope parameters for continuous predictors and mean differences for dichotomous predictors. During preliminary analyses, necessary assumptions were assessed and satisfied; including sufficient sample sizes for categorical covariates, linearity between continuous covariates and outcomes, and preliminary residual diagnostic analyses.

Multivariate general linear model—Three specific questions were addressed using multivariate GLMs and a mixed-effects model framework (27): (1) Is the predictor significantly related to the joint set of outcomes, (2) Is the predictor significantly related to either outcome, and (3) Does the predictor have a significantly different relationship with each of the outcomes? The first question (*global*) was addressed using a multivariate 2 degree of freedom test to jointly test the significance of the predictor on both perceived injustice and depression symptoms. The second question (*individual*) was addressed using two univariate 1 degree of freedom tests and tested the significance of the relationship between the predictor and each outcome. The third question assessing the uniqueness of the predictors (*interaction*) was addressed by comparing the standardized effect of the predictor on perceived injustice to the standardized effect of the predictor on depressive symptoms. Since the two outcomes were significantly correlated ($r = 0.45$, $p < 0.01$), a multivariate GLM was selected to jointly model the relationship between the two outcomes and the set of predictor variables. Multivariate GLM has the advantage of testing hypotheses comparing the strength of the predictor-outcome relationship between two outcomes. This single model addresses all three questions while accounting for the correlation between the two outcomes. Since the two outcomes are measured on different scales, the strengths of the associations of the predictors with the outcomes were compared using standardized *t*-statistics for the slopes and differences.

Purposeful selection methods (28) were used to identify a parsimonious set of predictor variables most predictive of perceived injustice and depression symptoms (jointly, individually, or "uniquely"). All potential predictors were initially included in the full multivariate GLM and manual backwards selection was utilized to reduce the model to the set of predictors most relevant to perceived injustice and depression symptoms. Global *p*-values were considered primary in this backwards selection process using $\alpha = 0.05$ as a threshold for removal. Once a final adjusted model was identified, the joint, individual, and interaction tests for each predictor were assessed and interpreted. The adjusted relationships between the predictors and the outcomes were quantified using slope parameters for continuous predictors and mean differences for dichotomous predictors.

Results

Participant Sample

Sample characteristics are described in Table 1. Most participants were white males with an average age of 48-years, not college educated, and earned more than $40,000 a year. More than half the sample presented with traumatic, motor incomplete injuries.

Bivariate Relationships between Predictors and Perceived Injustice and Depression Symptoms

Bivariate relationships between the 16 predictor variables and the outcome variables are provided in Table 2. Analyses indicated that time since injury, expected disability, pain intensity, state anger, trait anger, income, and PTSS each increased significantly with perceived injustice (*p*-values < 0.05). Conversely, as depression symptoms increased, expected disability, perceived injustice, trait anger, and PTSS also increased significantly.

There was a significant positive association between perceived injustice and depression symptoms ($r = 0.45$, $p < .01$).

Multivariate Relationship between Predictors and Perceived Injustice and Depression Symptoms

A fully adjusted multivariate GLM was fit containing the predictors summarized in Table 2. Completeness of injury was not considered in the adjusted model due to the high rate of missing data ($> 20\%$). The model was then reduced using manual backwards selection. Predictors not explaining a significant amount of variation in the joint set of outcomes were removed from the model in the following order based on the global tests: trait anger, age, race, length of stay, type of injury, level of education, employment status, income category, and level of injury. The final reduced multivariate GLM was used to answer the research questions and summarized in Table 3.

Global predictors of perceived injustice and depression symptoms

Based on the global test, greater time since injury, higher expected disability, increased pain intensity, higher state anger, increased PTSS, and male sex were significantly associated with higher scores on the joint set of outcomes (Table 3, Global p-values < 0.05).

Individual predictors of perceived injustice and depression symptoms

Multivariate GLM results indicated that greater time since injury, higher expected disability, greater pain intensity, higher state anger, and increased PTSS were significantly associated with greater perceived injustice (Table 3). Greater expected disability and increased PTSS were the only variables associated with greater depression symptoms (Table 3). While the global test for sex was significant, this variable was neither a significant predictor individually of perceived injustice nor depression symptoms.

Unique predictors of perceived injustice and depression symptoms

Interaction tests were used to determine if the relationship between a predictor differed significantly between the two outcomes. Results indicated that time since injury, state anger, and sex each had significantly different (unique) associations with perceived injustice than depression symptoms. Time since injury had a significantly stronger association with injustice (slope = 0.05, $t = 3.45$) than depression symptoms (slope = -0.003, $t = -0.52$). For state anger, there was a significant positive relationship with perceived injustice (slope = 0.51, $t = 2.29$) and a non-significant negative relationship with depression symptoms (slope = -0.05, $t = -0.53$). Sex was not significant for either outcome, however the direction of the relationships differed significantly; males tended to have greater perceived injustice (difference = 3.80, $t = 1.65$) but less depression symptoms than females (difference -1.54, $t = -1.62$). This significant interaction likely explains why the global effect for sex was significant but the individual tests were not.

Discussion

This study examined unique predictors of perceived injustice compared to depression symptoms among individuals admitted for inpatient rehabilitation following SCI. Interaction

tests found three unique predictors of perceived injustice: time since injury, state anger, and sex. These predictors had significantly different relationships with perceived injustice than depression symptoms.

Perceived injustice increased significantly with duration of injury, consistent with previous research (14, 29). Conversely, reports of depressive symptoms remained the same as time since injury increased, consistent with the trajectory of post-injury depressive symptoms, characterized by low-grade symptoms remaining stable over time (9, 30).

Participants with higher state anger reported significantly higher perceptions of injustice, but not increased symptoms of depression, consistent with the findings of Scott and colleagues (31) that state anger partially mediates the relationship between perceived injustice and depression symptoms. A literature search did not reveal research on the association between state anger and depression; however, a relationship between anger expression and depression has been consistently demonstrated (32–34).

Sex had a significantly different relationship with perceived injustice than depression symptoms. While the effect of sex was not significant for either outcome individually, the direction of the relationships did differ significantly. Males reported greater perceived injustice but less depression symptoms than females. This is consistent with the perceived injustice and depression literature, as men tend to report significantly higher perceived injustice than females (1, 12) while females tend to endorse more depressive symptoms than males (35–37). Sex differences in perceived injustice and depressive symptoms were not statistically significant, but may be clinically meaningful.

Expected disability, PTSS, and pain intensity were not unique predictors of perceived injustice or depression symptoms, meaning they had similar relationships with both outcomes. Higher expected disability was significantly associated with both greater perceived injustice and depression symptoms. Indeed, the magnitude of these relationships were nearly identical. Expected disability recovery has been shown to predict actual recovery among individuals with back pain, but not other musculoskeletal conditions (38).

Greater PTSS were significantly associated both with increased perceived injustice and depression symptoms. Previous studies show high perceived injustice is associated with PTSS (5) and contributes to the persistence of PTSS (12). Furthermore, PTSS are shown to be associated with depression symptoms among individuals in both acute and chronic stages of SCI (39, 40).

Pain intensity was positively associated with both perceived injustice and depression symptoms, however these relationships were not statistically different from each other, consistent with the literature on perceived injustice and depression. A substantial amount of literature demonstrates an association between pain intensity and perceived injustice in various pain populations (1, 5, 12, 13, 41–44). In the present study, pain intensity was positively, but not significantly associated with depression symptoms. This is surprising since pain and depression are understood to be comorbid after SCI (45), although this relationship may be weaker than previously indicated (46).

This study contains several limitations. The first is the relatively small sample size and large number of predictor variables. *A priori* power for bivariate analyses suggests that a sample size of 74 has at least 80% power at a 5% level of significance to detect Cohen's *d*-type effect sizes of 0.47 or larger for the dichotomous predictors and Cohen's *f*-type effect sizes of 0.32 or larger for the continuous predictors. Both are considered to be medium to large effect sizes. Although an adjusted model with many predictors reduces power in bivariate analyses, the multivariate GLM increases power by accounting for correlations among the two outcomes.

Second, caution should be taken when interpreting the *p*-values in Table 3. A total of 24 tests were conducted based on the final adjusted model, plus nine additional tests during the model reduction process, inflating the overall Type 1 error rate. A more conservative Bonferroni adjustment of $\alpha = 0.05/24 = 0.0021$ could be applied to each of the 24 tests, however the limited sample size and exploratory nature of this study led us not to rule out meaningful predictors. Additional research should be conducted to assess the replicability and generalizability of these findings using a larger sample in a multi-center study.

Another limitation is the cross-sectional design which precludes any conclusions about directionality or causality. Longitudinal studies are needed to examine the extent to which perceptions of injustice predict the trajectory of psychosocial outcomes in the months and years following injury.

Finally, this sample comprised a majority of participants who were white and earned more than $40,000 annually. Research with more diverse samples is needed to determine the potential influence of race and socioeconomic status on perceived injustice.

Clinical Implications

Appraisals are associated with psychological distress and coping following SCI (47, 48) and may be more amenable to change than dispositional coping strategies (48). Paul Kennedy found that appraisals have a strong association with adjustment, accounting for 12% of the variance in anxiety and 34% of the variance in depression, highlighting the importance of appraisals in the process of psychological adjustment to SCI (49).

Middleton and Craig's (50) Spinal Cord Injury Adjustment Model (SCIAM) emphasizes the importance of appraisals in the adjustment process, while simultaneously recognizing the importance of biological, physiological, and social factors that influence outcomes (51). According to SCIAM, appraisal processes (e.g., perceptions of loss) are the mediators by which biopsychosocial and sociopolitical factors influence adjustment to SCI. The person with SCI will appraise a situation depending upon modifying factors at that particular point in time, relevant to his/her circumstances. The appraisal process then influences adjustment and outcomes. For example, an appraisal of injustice may lead to catastrophic thinking (e.g., my life will never be the same), which may lead to poor coping strategies (e.g., self-neglect) and outcomes (e.g., depression).

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Conclusion

Results replicate findings that perceived injustice is moderately correlated with depression symptoms. Findings also reveal factors uniquely associated with perceived injustice, providing support that perceived injustice and depression symptoms are separate constructs. Time since injury, state anger, and sex were shown to have unique associations with perceived injustice. These findings support development of novel interventions targeting perceptions of injustice as a means to improve psychosocial outcomes after SCI. Further research is needed to develop and test potential interventions. Longitudinal research is also necessary to investigate perceptions of injustice in the chronic-phase of SCI to determine its impact on long-term adjustment to injury.

Acknowledgment

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Table 1

Demographic and Injury Characteristics of Sample

	N	Mean (SD)
Age	74	47.6 (16.4)
Length of Stay	74	52.5 (25.0)
		Median (IQR)
Time Since Injury	74	51.5 (27.0 – 94.0)
	N	Percent
Sex		
Male	50	67.6
Female	24	32.4
Level of Education		
High school or Less	40	54.1
More than High school	34	45.9
Employment Status		
Employed	55	74.3
Not Employed	19	25.7
Income		
< $40,000	24	34.3
$40,000	46	65.7
[Missing]	[4]	
Race		
White	48	65.8
Not White	25	34.2
[Missing]	[1]	
Type of Injury		
Traumatic	55	74.3
Non-Traumatic	19	25.7
Level of Injury		

Tetraplegia	42	60.0
Paraplegia	28	40.0
[Missing]	[4]	
AIS Score		
A	15	25.4
B	9	15.3
C	17	28.8
D	18	30.5
[Missing]	[15]	
Completeness of Injury		
Motor Complete	24	40.7
Motor Incomplete	35	59.3
[Missing]	[15]	
Primary Care Screen		
PTSD (screen ≥ 3)	11	15.1
No PTSD (Screen < 3)	62	84.9
[Missing]	[1]	

SD = Standard Deviation; IQR = Interquartile Range; AIS = American Spinal Injury Association Impairment Scale; PTSD = Posttraumatic Stress Disorder

Table 2

Bivariate Relationships between Outcomes (Perceived Injustice and Depression Symptoms) and Predictor Variables

	Perceived Injustice (IEQ)				Depression Symptoms (PHQ-8)			
	N	r	Slope (SE)	p-value	N	r	Slope (SE)	p-value
Age	73	−0.20	−0.15 (0.09)	0.0914	74	−0.04	−0.01 (0.03)	0.7612
Time Since Injury	73	0.26	0.05 (0.02)	0.0236	74	−0.12	−0.01 (0.01)	0.3243
Length of Stay	73	0.05	0.02 (0.06)	0.6776	74	−0.11	−0.02 (0.02)	0.3662
Depression Symptoms (PHQ-8)	73	0.45	1.19 (0.28)	<0.0001	n/a	n/a	n/a	n/a
Perceived Injustice (IEQ)	n/a	n/a	n/a	n/a	73	0.45	0.17 (0.04)	<0.0001
Expected Disability	68	0.42	0.35 (0.09)	0.0003	68	0.41	0.12 (0.03)	0.0005
Pain Intensity	68	0.27	2.75 (1.22)	0.0271	68	0.19	0.69 (0.43)	0.1131
Anger (State)	68	0.49	1.09 (0.24)	<0.0001	68	0.18	0.14 (0.10)	0.1438
Anger (Trait)	67	0.49	1.66 (0.36)	<0.0001	67	0.25	0.30 (0.14)	0.0387
	N		Difference (SE)	p-value	N		Difference (SE)	p-value
Sex (Male – Female)	73		1.70 (3.03)	0.5768	74		−1.91 (1.11)	0.0908
Level of Education (HS or Less – More than HS)	73		4.74 (2.81)	0.0959	74		1.14 (1.06)	0.2867
Employment Status (Employed – Unemployed)	73		5.10 (3.26)	0.1219	74		0.59 (1.21)	0.6294
Income Category (Less than $40,000 – Greater than $40,000	69		6.44 (2.91)	0.0301	70		−0.31 (1.17)	0.7933
Race (White – Not White)	72		5.10 (2.98)	0.0915	73		0.13 (1.13)	0.9124
Type of Injury (Traumatic – Non-Traumatic)	73		5.09 (3.20)	0.1159	74		−1.01 (1.21)	0.4052
Level of Injury (Tetraplegia – Paraplegia)	70		0.71 (3.00)	0.8124	70		−0.67 (1.05)	0.5285
Completeness (Complete – Incomplete)	59		1.65 (3.22)	0.6097	59		1.47 (1.09)	0.1826
PTSD (Yes – No)	72		11.25 (3.78)	0.0040	73		5.71 (1.34)	<0.0001

IEQ = Injustice Experience Questionnaire; PHQ-8 = Patient Health Questionnaire 8-item; SE = standard error; HS = high school; PTSD = Posttraumatic Stress Disorder

Table 3

Reduced Multivariate GLM Jointly Modeling Perceived Injustice and Depression Symptom

Obs = 132 (out of 148)	Perceived Injustice (IEQ)			Depression Symptoms (PHQ-8)			Global		Interaction
	Slope (SE)	t	p-value	Slope (SE)	t	p-value	F	p-value	p-value
Time Since Injury	0.05 (0.02)	3.45	0.0010	−0.003 (0.006)	−0.52	0.6031	6.83	0.0022	0.0026
Expected Disability	0.27 (0.08)	3.32	0.0015	0.11 (0.03)	3.33	0.0015	9.05	0.0004	0.9301
Pain Intensity	2.55 (0.99)	2.58	0.0124	0.62 (0.41)	1.52	0.1343	3.79	0.0282	0.4259
Anger (State)	0.51 (0.23)	2.29	0.0259	−0.05 (0.09)	−0.53	0.6006	3.18	0.0489	0.0292
	Difference (SE)	t	p-value	Difference (SE)	t	p-value	F	p-value	p-value
Sex (Male − Female)	3.80 (2.30)	1.65	0.1040	−1.54 (0.95)	−1.62	0.1096	3.46	0.0381	0.0109
PTSD (Yes − No)	7.78 (3.16)	2.46	0.0167	4.35 (1.30)	3.34	0.0015	7.13	0.0017	0.4415

GLM = general linear model; Obs = observations; IEQ = Injustice Experience Questionnaire; PHQ-8 = Patient Health Questionnaire 8-item; SE = standard error; t = t-statistic; F = F-Statistic; PTSD = Posttraumatic Stress Disorder