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An examination of the synergy of pain and PTSD on quality of life: Additive or multiplicative effects?

Joshua D. Clapp, J. Gayle Beck, Sarah A. Palyo, and DeMond M. Grant

Department of Psychology, University at Buffalo – SUNY

Abstract

Although models have been proposed to explain common factors that maintain comorbid pain and PTSD [41], the exact nature of the relationship between these two conditions and their impact on quality of life (QOL) is unknown. The aim of the present investigation was to examine the unique and interactive effects of PTSD and pain on role functioning and life satisfaction - two important domains of QOL. The study utilized a help-seeking sample of motor vehicle accident (MVA) survivors whose accidents resulted in symptoms of comorbid PTSD and pain ($N = 192$). Hierarchical regression models were used to examine the relationship between four PTSD symptom clusters, pain, and the interaction of each cluster and pain on role functioning and life satisfaction separately. Results of these analyses revealed a significant interaction of pain and emotional numbing on role functioning, suggesting a multiplicative effect on this domain of QOL. Decomposition of this interaction revealed a negative association between numbing and functioning at low levels of pain but no relationship at higher levels. A marginal interaction of pain and hyperarousal also was noted for life satisfaction. Decomposition of the interaction effect revealed a marginal association between hyperarousal and decreased satisfaction only at high levels of pain. A main effect of emotional numbing on decreased life satisfaction also was observed in this model, suggesting a unique influence of numbing. The results of the current research indicate that the synergistic relationship of pain and PTSD may vary across domains of QOL.

Posttraumatic Stress Disorder (PTSD) is defined as a syndrome of characteristic symptoms involving intrusive memories, avoidance, emotional numbing, and physiological hyperarousal [4]. Given that the event initiating post-trauma symptoms may involve severe physical injury, chronic pain often is found to co-occur along with PTSD [12]. Decrements in quality of life (QOL) have been associated both with chronic pain [34] and with PTSD [40], but these two literatures have remained largely separate. To date, no study has examined the unique and interactive effects of comorbid pain and PTSD on QOL.

QOL is conceptualized as a multidimensional construct encompassing a number of life domains [29] and has been recognized as an important component of health care. In a cogent review, Gladis et al. [23] noted that the majority of available QOL assessments can be categorized by two separate frameworks. Health-related measures of QOL are concerned primarily with criteria such as role functioning and impairment (e.g., number of days absent from work). Measures of generic QOL, in contrast, emphasize life satisfaction and perceptions of well-

Correspondence concerning this article should be sent to Joshua D. Clapp or J. Gayle Beck at: Department of Psychology, University at Buffalo – SUNY, Park Hall, Buffalo, NY, 14260, Phone: (716) 645-3650 ext.476, Fax: (716) 645-3801, e-mail: joshclapp@yahoo.com, jgbeck@buffalo.edu.

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being. Both role functioning and life satisfaction are argued to be important, but potentially independent, components of global QOL [23].

Escalation of chronic pain and PTSD should impact both role functioning and life satisfaction, and researchers have proposed a number of processes by which characteristics of pain and trauma may contribute synergistically to this outcome [3,41]. These models do not, however, explicate the exact nature of the synergy between pain and PTSD. Specifically, symptoms of both conditions may combine additively to compound distress and impairment. This interplay would suggest cumulative but independent contributions of PTSD symptoms and pain on reductions in functioning and satisfaction. In contrast, pain and PTSD may hold an interactive influence on QOL. Evidence of an interactive relationship would suggest that the impact of one differs depending on the severity of the other. Moreover, the relationships between pain and individual PTSD clusters may vary depending on which domain of QOL one considers. Clarification regarding the exact nature of these relationships has both theoretical and practical implications. Theoretical models of mutual maintenance may be elaborated through a greater understanding of the dynamic between pain and PTSD. Clarification of the nature of this synergy also should help clinicians and health-care providers to guide treatment and to develop more effective interventions for individuals with comorbid pain and PTSD.

The aim of the current study was to examine the unique and interactive effects of PTSD symptom clusters and pain across dimensions of role functioning and life satisfaction. Multiple regression models were used to examine the nature of these associations with each dimension of QOL. Evidence of independent effects of pain and PTSD would suggest an additive impact of these factors on QOL. Observation of significant cluster by pain interactions, in contrast, would be consistent with an interactive synergy.

1. Method

1.1 Procedure

Data for the present investigation were collected as part of a research clinic specializing in the assessment and treatment of PTSD [6,7,37]. All procedures received approval from an institutional review board. Patients were referred to the project from a variety of professional contacts including physicians, chiropractors, physical therapists, psychologists, social workers, and other healthcare providers. Public service announcements, flyers, and local advertisements also were used for recruitment. Written informed consent was obtained from all individuals prior to data collection. Exclusion criteria for the research clinic included MVAs which failed to meet standards for Criterion-A (i.e., the MVA did not pose a serious threat and/or the individual did not respond with fear, helplessness, or horror) [3], evidence of significant cognitive impairment (i.e., indicated by a score of 23 or less on the Mini-Mental State Examination) [20], current substance abuse or dependence, psychosis (e.g., delusions, hallucinations, etc.), and/or acute suicidality. Patients were asked to complete a number of measures pertaining to symptoms of PTSD, chronic pain, emotional distress, and functional impairment as part of their participation.

1.2 Participants

Given the aims of the study, the present sample was restricted to patients reporting ongoing pain as a result of MVA-related injuries. Ongoing pain status was defined as reports of significant lifestyle limitations or continued medical care (i.e., use of prescription pain medication at least 3 days/week, physical therapy, massage therapy, chiropractic care, etc.) due to injuries sustained during the MVA. Two hundred eighty-eight patients with ongoing, MVA related pain were screened for symptoms of PTSD. A total of 39 individuals failed to meet inclusion criteria for the present study: 15 due to significant cognitive impairment, 9

because their MVA failed to meet *DSM-IV* Criterion-A, 8 owing to psychotic symptoms, 4 because of a diagnosis of current Substance Abuse, 2 due to suicidal ideation requiring immediate care, and one because of insufficient English to complete assessment measures. Fifty-seven additional patients withdrew from participation or failed to complete assessment measures. The final sample contained 192 individuals with ongoing pain as a result of an MVA.

The majority of the current sample was Caucasian (80.2%) and female (77.6%). Mean age of participants was 43.30 ($SD = 11.01$). The majority of the sample (84.9%) reported some level of college education. Fifty-nine patients (30.7%) reported receiving disability payments subsequent to injuries sustained in the MVA. Full demographic information is provided in Table 1.

The average period from MVA to assessment was 25.22 months ($SD = 43.71$). Seventy-two percent of patients reported injuries both to the neck and back. Approximately three quarters ($n = 145$) of the sample reported pain in the extremities. Thirty-five percent reported jaw pain, and 76.3% endorsed experiencing headaches since the accident. Nearly two thirds of the sample ($n = 125$) reported using prescription medication to control their pain. Forty-eight percent of patients reported using opiod analgesics, and 30.4% were prescribed muscle relaxants. Thirty-six percent endorsed regular use of over the counter pain medications (e.g., ibuprofen). A large proportion of individuals reported taking psychopharmacological agents with 37.6% patients taking medication for depression (e.g., SSRIs), and 18% using anti-anxiety medication (barbiturates, benzodiazepines, anxiolytics, and sedatives/hypnotics).

1.3. Measures

1.3.1. Pain Severity—Subjective pain was assessed using the pain severity subscale of the West Haven – Yale Multidimensional Pain Inventory (WHYMPI) [30]. The WHYMPI is an empirically validated measure designed to assess the subjective experience of pain. The pain severity subscale of the WHYMPI contains three items rated on a 6-point Likert scale (0 = *not at all* to 5 = *extremely*). Raw pain severity is calculated as the mean of these three items. The pain severity subscale has demonstrated significant associations with other measures of physical pain as well as adequate internal consistency and test-retest reliability. Kerns et al. [30] report an average score of 4.52 ($SD = 1.04$) for the pain severity scale of the WHYMPI based upon normative data obtained from patients with heterogeneous, chronic pain ($N = 300$).

1.3.2. PTSD symptoms—The PTSD Symptom Scale – Self Report (PSS-SR) [17] is a 17-item self report measure of PTSD based on *DSM-IV* criteria. Symptom severity over the previous two weeks is rated on 4 point Likert scale with total scores ranging from 0 to 51. Foa et al. [17] have shown the PSS-SR to demonstrate good internal consistency ($\alpha = .91$), and the measure has been found to adequately converge with interviewer-based diagnoses of PTSD. Wohlfarth et al. [49] report both diagnostic sensitivity and specificity of 0.90 using a cut-off score of 15 in a sample of 126 victims of violent crime (e.g., burglary, robbery, physical assault).

Scores corresponding to four PTSD symptom clusters were created for the present analyses. Although the *DSM-IV* specifies three clusters of symptoms, a number of studies have suggested that the avoidance and numbing cluster of PTSD may be better conceptualized as two distinct groups of symptoms [5,32]. Intrusion and hyperarousal scores were calculated as the item sum of the corresponding cluster as outlined by *DSM-IV*. Scores for avoidance were derived by summing effortful avoidance items (i.e., avoidance of thoughts and feelings, avoidance of people, places, and situations). Numbing was calculated as the sum of items corresponding to loss of interest, detachment, restricted affect, and sense of foreshortened future. Posttraumatic amnesia sometimes is included as a symptom of emotional numbing [32]; however, this

symptom was excluded from the present analysis given that many participants reported losing consciousness during their MVA.

1.3.3. Role Functioning—Three subscales of the Medical Outcomes Study (MOS) 36-Item Short-Form Health Survey (SF-36) [47] were summed to form an index of self-reported functioning in day-to-day roles. Previous investigations of the relationship between QOL and anxiety [38] have noted that the Role Limitations due to Physical Problems (role-physical), Role Limitations due to Emotional Problems (role-emotional), and Social Functioning scales of the SF-36 are minimally confounded with specific symptoms of psychopathology. As such, these scales were chosen as a composite index of role functioning. McHorney et al. [35] have shown all three SF-36 subscales to evidence factorial validity in data collected from the MOS. This research also demonstrated the discriminative validity of the scales, with role-physical scores identifying patients with serious medical illness and role-emotional scores characterizing psychiatric patients. Social functioning was found to hold moderate to strong associations with both samples. Wittuik, Turk, Sukiennik, and Rogers [48] have published norms for role-physical ($M = 14.46$, $SD = 28.94$), role-emotional ($M = 42.97$, $SD = 43.76$), and social functioning ($M = 40.89$, $SD = 27.50$) subscales of the SF-36 in a sample of patients with chronic pain ($N = 424$).

1.3.4. Life Satisfaction—Frisch, Cornell, Villanueva, and Retzlaff's [21] Quality of Life Inventory (QOLI) was used as an index of subjective life satisfaction. The QOLI includes ratings of importance (0 = *not at all important* to 2 = *extremely important*) and satisfaction (−3 = *very dissatisfied* to *very satisfied*) in 17 different life areas. The products of importance and satisfaction ratings for each area are calculated, and total QOLI scores are computed as the average score across all areas with nonzero importance ratings. The QOLI has been found to show adequate stability over time with test-retest reliability coefficients ranging between 0.80 and 0.91. QOLI scores also have been shown to correlate strongly with self-report, interview, and peer-rated measures of life satisfaction. QOLI scores of 2.00 and 3.75 have been suggested to correspond with the 25th and 75th percentile of “typical” adult populations based on norms published by Frisch et al. [21].

1.4. Data Analysis

Hierarchical regression modeling was used to address the aims of the current study using a step-up approach proposed by Cohen [13]. Epidemiological research [31,36] indicates that both age and sex are associated with the development and severity of PTSD. Additional research reviewed by Kahn and Juster [28] suggest that age also may be an important factor with regard to various domains of QOL. As such, age and sex were entered as covariates in the first step of the hierarchical model. Pain severity and PTSD symptom clusters were entered in the second step of the regression while the interactions of pain severity and each symptom cluster were entered in the final step. All variables at each step were entered into the model simultaneously. As recommended by Cohen [13], interaction terms were interpreted if their inclusion contributed appreciable variance to the overall model (i.e., change in R^2)¹. Two separate models were examined. The first examined the relationships between age, gender (Step 1), pain severity, PTSD symptom clusters (Step 2), and the interaction of pain and each symptom cluster (Step 3) on role functioning. The second model used the same structure to examine associations with life satisfaction.

Prior to analysis, scores for raw pain severity, PTSD symptom clusters, life satisfaction, and role functioning were transformed into Z-scores ($M = 0$, $SD = 1$). Interactions terms were

¹The present data also were analyzed using a multiple regression model whereby all covariates, predictor variables, and interaction terms were entered into the analysis simultaneously. Results of this analysis were functionally identical to the presented hierarchical models.

calculated as the product of standardized pain severity and PTSD cluster scores as recommended by Aiken and West [1]. This procedure reduces collinearity between first-order and higher-order variables and facilitates direct comparison of regression coefficients. Significant interaction effects were examined through analysis of simple-slopes [1]. Effect sizes for all regression coefficients are reported as squared partial correlations (pr^2) which reflects the percentage of variance in the outcome variable attributable to the independent variable controlling for other predictors in the model. Squared partial correlations of 0.02, 0.13, and 0.26 can be used as guidelines for interpretations of small, medium, and large effect sizes based on recommendations provided by Cohen [14].

Prior to standardization, variables were examined to determine concordance with the assumptions of multiple regression analysis. No univariate or multivariate outliers were detected, and all variables met the normality assumptions of multiple regression [44].

2. Results

2.1. Sample Characteristics

One hundred fifty-three individuals (79.7%) in the sample met criteria for probable PTSD using a cut-off score of 15 on the PSS-SR [49]. The majority of the sample (85.6%) experienced pain of a chronic nature (i.e., at least 3 months in duration) as a consequence of the MVA. Scores on the WHYMPI pain severity scale ($M = 4.07$; $SD = 1.30$) were largely consistent with normative scores for heterogeneous, chronic pain provided by Kerns et al. [30]. Means, standard deviations, and coefficient alpha reliabilities for all variables are shown in Table 2.

2.2. Role Functioning

Results of the hierarchical regression for role functioning are provided in Table 3. Neither age nor sex were found to be associated with functioning ($R^2=0.02$; $F(2, 184)=1.96$; $p=0.14$). Pain severity and individual PTSD symptom clusters in the second step accounted for approximately 46% of the variance in role functioning ($F(5, 184)=24.33$; $p<.001$). Entry of the individual interactions of pain and each PTSD symptom cluster contributed an additional 3% of the variance in role functioning ($F(4, 180)=17.35$; $p=.02$) and revealed a significant interaction between pain and emotional numbing ($\beta = 0.19$, $pr^2 = 0.03$, $p=.02$). Simple slopes analysis of this interaction suggested a strong relationship between emotional numbing and functioning at *low* levels of pain ($\beta = -0.57$, $pr^2 = 0.13$, $p<.001$) such that increased severity of numbing was related to significant decreases in role functioning. In contrast, numbing and functioning were found to be unrelated at *high* levels of pain ($\beta = -0.18$, $pr^2 = 0.01$, $p=.11$). The results of the simple slopes analysis are presented graphically in Figure 1. No other variables were observed to hold a unique relationship with role functioning.

In an effort to further clarify the nature of this interaction, 95% confidence intervals were calculated for values of role functioning at high pain/high numbing, high pain/low numbing, low pain/high numbing, and low pain/low numbing as estimated by the regression model (See Fig.1). High and low values for pain and numbing correspond to 1 *SD* above and below their respective means. Examination of the confidence intervals at low levels of emotional numbing suggest a cumulative influence of pain on role functioning such that increases in pain severity were associated with decreased functioning (CI: low numbing/high pain = $-0.34, 0.60$; CI: low numbing/low pain = $0.66, 1.62$). Confidence intervals for estimates of functioning at high levels of numbing, however, evidenced comparable levels of impairment regardless of pain severity (CI: high numbing/high pain = -0.76 to 0.30 ; CI: high numbing/low pain = -0.50 to 0.50). Guidelines for interpretation of confidence intervals provided by Cumming and Finch [15] suggest that increases in pain severity did not contribute decreased functioning at high levels of emotional numbing.

2.3. Life Satisfaction

Results from the satisfaction model are presented in Table 3. Age and gender again were found to be unrelated to overall life satisfaction ($R^2=0.01$; $F(2, 189)=0.59$; $p=.56$). Pain severity and individual PTSD symptom clusters accounted for 40% of the variance in life satisfaction ($F(5, 184)=24.63$; $p<.001$). Inclusion of the interactions of pain and each PTSD symptom cluster score resulted in a marginal increase in overall variance after controlling for the unique effects of pain and PTSD symptom clusters ($R^2=0.03$; $F(4, 180)=2.17$; $p=.07$). In the full model, a main effect of emotional numbing was observed such that increases in numbing were related to decreases in life satisfaction ($\beta = -0.54$, $pr^2 = 0.21$, $p<.001$). A trend for the interaction of pain and hyperarousal also was observed in the full model ($\beta = -0.21$, $pr^2 = 0.02$, $p=.06$; see Table 3). Simple slopes analysis indicated that severity of hyperarousal was unrelated to subjective satisfaction at low levels of pain ($\beta = 0.16$, $pr^2 = 0.01$, $p=.12$). In the presence of more severe pain, however, hyperarousal was found to be marginally associated with decreased life satisfaction ($\beta = -0.26$, $pr^2 = 0.02$, $p=.06$). The results of the simple slopes analysis are presented graphically in Figure 2.

Confidence intervals again were calculated for estimated values of life satisfaction at high pain/high hyperarousal, high pain/low hyperarousal, low pain/high hyperarousal, and low pain/low hyperarousal (See Fig. 2). These estimates correspond to 1 *SD* above and below the means of pain and hyperarousal. The 95% confidence intervals around estimates of satisfaction at low levels of hyperarousal suggest no cumulative effect of pain on life satisfaction (CI: low hyperarousal/high pain = $-0.86, 0.36$; CI: low hyperarousal/low pain = $-0.87, 0.25$). Confidence intervals for estimates of satisfaction at high levels of hyperarousal (CI: high hyperarousal/high pain = $-1.30, -0.25$; CI: high hyperarousal/low pain = $-0.55, 0.56$) suggest a marginal contribution of increased pain to decreases in life satisfaction [15].

3. Discussion

Results of the current study suggest that the relationship between pain and individual PTSD symptom clusters varies across QOL domains. Specifically, pain and symptoms of emotional numbing evidenced a multiplicative association with self-reported role functioning. No other PTSD symptom clusters demonstrated a relationship with role functioning either alone or in interaction with pain severity. Pain severity evidenced a marginally significant interaction with hyperarousal in its association with subjective life satisfaction. Symptoms of emotional numbing also were found to hold an association with life satisfaction independent of the synergy of pain and hyperarousal.

The relationship of chronic pain and PTSD with increased impairment and distress is well documented in the literature [8,22], but few studies have examined the contributions of individual PTSD symptom clusters in these outcomes. The design of the present study builds upon the existing literature through an examination of the association of pain and individual PTSD clusters in relation both to functioning and life satisfaction. With regard to self-reported role functioning, pain and emotional numbing evidenced a multiplicative relationship with their impact on performance of day-to-day activities. Specifically, numbing was negatively related to role functioning at low levels of physical pain whereas no association was observed at severe levels of pain. Confidence intervals imply that high levels of numbing and/or high levels of physical pain may both be associated with considerable impairment in role functioning. Independent investigations have demonstrated that both pain severity [9,43] and emotional numbing [33,39] are associated with reduced functioning. The present study suggests that these two factors may interact to contribute to self-reported impairment in patients with comorbid pain and PTSD.

Severity of pain and emotional numbing also were related to reductions in life satisfaction, but the nature of these associations differed from those observed with respect to functioning. First, the interaction of pain and hyperarousal was found to hold a marginal association with life satisfaction whereby symptoms of hyperarousal were related to reduced satisfaction only in the presence of severe pain. This relationship implies that severe levels of comorbid pain may magnify the cumulative impact of insomnia, impaired concentration, irritability, hypervigilance, and exaggerated startle (e.g., symptoms of hyperarousal) on subjective satisfaction. This notion is consistent with existing conceptualizations of the dynamic relationship of pain and PTSD [3,41]. These models posit that symptoms of hyperarousal subsequent to trauma exposure may interact with physical pain to exacerbate distress. Severity of emotional numbing, in contrast, demonstrated an association with overall life satisfaction independent of physical pain. These data replicate previous research demonstrating that symptoms of flattened affect and emotional detachment hold unique associations with indices of satisfaction and subjective distress [10,46]. Existing conceptualizations of the etiology and maintenance of emotional numbing typically emphasize either psychological [18] or biological [26] factors. An integration of these perspectives may facilitate a greater understanding of numbing and its potential impact on QOL.

The interactive relationships observed in the current study support models proposing a dynamic association between symptoms of trauma and physical pain. Although the magnitude of the observed interaction effects is considered to be small based on Cohen's [14] guidelines, effects of this size are typical of research examining the interactive relationships. Continued examination of these influences may be used to further refine models of comorbid pain and PTSD.

In addition to the theoretical implications of this research, the results of the present study contain a number of important clinical implications. These data suggest that interventions targeting physical pain and emotional numbing may be central to improving QOL in many patients with comorbid pain and PTSD. As such, consideration of the severity of posttraumatic numbing and physical pain may assist in determining the primary focus of potential interventions (e.g., specifying an emphasis on pain management, alleviating emotional numbing, or a combination of both). Pain and emotional numbing also seem relevant to decreases in life satisfaction. Physical pain appears to contribute most strongly to decreased satisfaction in the interactive effect of pain and hyperarousal. Numbing, in contrast, held a strong, independent association with reduced life satisfaction. Although a number of pharmacological agents and psychosocial interventions have been developed to improve QOL in patients with chronic pain, techniques directly targeting symptoms of posttraumatic numbing are largely unavailable at present. The relationships between numbing and QOL observed in the present study suggest that continued research is needed to inform the development of interventions targeting symptoms of posttraumatic numbing.

Although the current investigation has several interesting implications for understanding comorbid pain and PTSD, a number of limitations should be considered in the interpretation of these data. The present study is unable to account for pre-morbid deficits in QOL associated with factors such as income and health status prior to the MVA. For example, of the 62 participants in the sample who reported income consistent with poverty (i.e., < \$20,000) 25 (40%) were collecting disability payments as a consequence of injuries sustained during the accident. Considering the sample as a whole, 30.7% ($n = 59$) were receiving disability payments owing to injuries from the MVA. These data suggest that a substantial proportion of patients experienced a significant decline in economic and health status as a *consequence* of the MVA. Regardless, the present study is unable to directly account for the influence of pre-morbid QOL including income, and further research is needed to account for the potential influence of these pre-existing factors.

The relationship between medication use and QOL also was not examined in this research. It is possible that medication use may impact QOL by alleviating physical pain and/or psychological distress. The heterogeneous compilation of medications reported by the present sample (e.g., variability in medication type, dosage, and frequency of use) precluded an effective examination of this factor, but the impact of medication usage on QOL in patients with comorbid pain and PTSD warrants further investigation.

The demographic homogeneity of the present sample may be viewed as an additional limitation. Individuals included in these analyses were predominantly Caucasian and female, all of whom experienced a similar type of trauma. As such, the observed relationships may have limited generalizability to more diverse patient samples. Despite the relative homogeneity of the sample, these data may have considerable relevance with respect to patients likely to be encountered in community settings. MVAs have been shown to be the single leading cause of PTSD in the general population [36], and epidemiological research suggests that females are at greater risk of developing both PTSD and chronic pain [24,31]. In addition, several lines of research indicate that women may exhibit more overall help-seeking behavior than men [11]. As such, the demographic characteristics of the current sample may be fairly representative of helpseeking individuals with comorbid pain and PTSD.

Evidence from the current study demonstrated that similar factors were related to reductions in role functioning and life satisfaction, but the nature of these synergistic relationships varied across domains of QOL. As this study is the first to examine the unique and interactive relationships of pain and PTSD symptom clusters on functioning and satisfaction, replication of these findings in additional trauma samples is recommended. Longitudinal investigations as well as research examining potential mechanisms by which pain and PTSD symptom clusters may synergistically influence QOL are needed to begin to establish causal relationships between these factors. Finally, interventions intended to enhance QOL in patients with comorbid pain and PTSD may be improved through a greater emphasis on addressing symptoms of posttraumatic numbing. Research regarding the etiology and biological substrates of this cluster of symptoms is inconclusive, but robust associations between numbing and poor psychosocial outcomes indicate that development of specific interventions targeting numbing may be warranted.

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Figure 1.

Interaction of pain severity and emotional numbing on Role Functioning with 95% confidence intervals around estimated values

—— Low Pain (-1 SD)
 - - - - High Pain (1 SD)

Note: Bars represent 95% confidence intervals around estimated values of high & low pain/numbing; Role functioning = sum of SF-36 Role-physical, Role-emotional, & Social functioning subscales; Low & High Pain = WHYMPI pain severity scores; Low & High Numbing = PSS-SR numbing cluster scores.

Figure 2.
Interaction of pain severity and hyperarousal on Life Satisfaction with 95% confidence intervals around estimated values

— Low Pain (-1 SD)
 - - - - - High Pain (1 SD)

Note: Bars represent 95% confidence intervals around estimated values of high & low pain/hyperarousal; Life Satisfaction = QOLI total score; Low & High Pain = WHYMPI pain severity scores; Low & High Hyperarousal = PSS-SR hyperarousal cluster scores.

Table 1

Demographic characteristics (N=192)*

	n	%
Gender		
Female	149	77.6
Male	43	22.4
Race		
Caucasian	154	80.2
African American	31	16.1
Hispanic	4	2.1
Other	3	1.5
Education		
High school or less	29	15.1
Some undergraduate	104	54.2
BA/BS	35	18.2
Post-graduate	25	12.5
Employment		
Full-time	43	22.4
Part-time	29	15.1
Disability	59	30.7
Unemployed	45	23.4
Homemaker	13	6.8
Income		
Below 10,000	28	14.6
10 – 20,000	34	17.7
20 – 30,000	31	16.1
30 – 40,000	18	9.4
40 – 50,000	25	13.0
50 – 60,000	20	10.4
Over 60,000	25	13.0

*
Note: Some categories do not sum to 192 given incomplete data

Table 2

Means, standard deviations, and coefficient alpha reliabilities of model variables

Variable	<i>M</i>	<i>SD</i>	Coefficient alpha
Pain Severity	4.07	1.30	0.87
PTSD Intrusions	6.52	4.00	0.86
PTSD Avoidance	3.08	1.91	0.67
PTSD Numbing	6.38	3.63	0.84
PTSD Hyperarousal	8.60	3.91	0.76
Role function	81.92	73.54	0.74
Role-physical	11.20	25.03	0.82
Role-emotional	28.99	39.02	0.84
Social functioning	41.73	24.98	0.80
QOLI	-0.03	1.72	0.86

Note: Pain severity = WHYMPI pain severity subscales; PTSD Intrusion, Avoidance, Numbing, & Hyperarousal = PSS-SR cluster scores; Role functioning = sum of SF-36 Role-physical, Role-emotional, & Social functioning subscales; QOLI: Quality of Life Inventory total score

Table 3
Standardized regression coefficients and effect sizes for hierarchical Role Functioning and Satisfaction models

Step	Variables	β	Role Functioning p^2	ΔR^2	R^2	F	β	Satisfaction p^2	ΔR^2	R^2	F
1	Age Sex	-.08 -.11	.01 .01	-	.02	1.96	.06 -.06	.00 .00	-	.01	.59
2	Age Sex Reex Avd Num Hyp Pain	-.07 -.04 -.08 .05 -.37** -.12** -.33**	.01 .00 .01 .00 .12 .01 .16	.46**	.48	24.33**	.10 .00 .03 -.04 -.54** -.04 -.17**	.02 .00 .00 .00 .20 .00 .04	.40**	.40	17.87**
3	Age Sex Reex Avd Num Hyp Pain Pain $\times$ Reex Pain $\times$ Avd Pain $\times$ Num Pain $\times$ Hyp	-.07 -.03 -.06 .06** -.38** -.13** -.31** -.11 -.02 .19* .05	.01 .00 .00 .00 .13 .01 .14 .01 .00 .03 .00	.03*	.72	17.35**	.10 -.01 .03 -.05 -.54** -.05 -.18** -.02 .03 .08 -.21+	.01 .00 .00 .00 .21 .00 .04 .00 .00 .00 .02	.03 ⁺	.43	12.45**

** p<.01

* p<.05

+ p<.10

p^2 = squared partial correlation; ΔR^2 = change in R^2 ; Role functioning = sum of SF-36 Role-physical, Role-emotional, & Social functioning subscales; Satisfaction = QOLI total score; Reex, Avd, Num, & Hyp = PSS-SR cluster scores; Pain severity = WHYMPI pain severity subscale