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Main Section

COGNITIVE FACTORS IN TRAUMATIC STRESS REACTIONS: PREDICTING PTSD SYMPTOMS FROM ANXIETY SENSITIVITY AND BELIEFS ABOUT HARMFUL EVENTS

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Abstract. The present study evaluated the relative importance of different cognitive factors (anxiety sensitivity and trauma-related beliefs) in predicting PTSD symptom severity and treatment-related changes in these symptoms. Eighty-one victims of motor vehicle accidents (MVAs) completed self-report measures of PTSD symptoms, anxiety sensitivity (AS), MVA-related beliefs and control variables (e.g., medication use, pain severity). A subsample of patients ($n = 28$), who received cognitive-behavioural treatment for PTSD, completed these measures pre- and post-treatment. For the combined sample ($n = 81$), regression analyses indicated that AS and pain severity were significant predictors of PTSD symptoms, whereas MVA-related beliefs were not. For patients completing treatment, regression analyses indicated that reductions in AS and pain severity were significant predictors of reductions in PTSD symptoms. MVA-related beliefs did not significantly predict symptom reduction once AS, pain severity and medication status was controlled for. These findings suggest that AS is a significant cognitive risk factor for exacerbating and maintaining PTSD symptoms. Treatment implications are discussed.

Keywords: Posttraumatic stress disorder, anxiety sensitivity, cognitive therapy, motor vehicle accidents.

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Introduction

Posttraumatic stress disorder (PTSD) is a common and disabilitating disorder, ranging from a current prevalence of 4% to a lifetime prevalence of 8–15% in the general population (Davidson, Hughes, Blazer, & George, 1991; Kessler, Sonnega, Bromet, Hughes, & Nelson, 1995; Stein, Walker, Hazen, & Forde, 1997). PTSD is precipitated by traumatic events, in which the person experiences extreme fear, helplessness, or horror, and believes that serious injury or death could occur. PTSD symptoms include persistent reexperiencing of the traumatic event (e.g., flashbacks, nightmares, intrusive thoughts), avoidance of trauma-related stimuli, numbing of general responsiveness, and persistent hyperarousal (e.g., hypervigilance, exaggerated startle response) (American Psychiatric Association, 1994).

Contemporary models emphasize the role of cognitive factors in the etiology and maintenance of PTSD (Ehlers, Mayou, & Bryant, 1998; Foa & Rothbaum, 1992; Taylor, Rabian, & Fedoroff, 1999). While a broad spectrum of beliefs have been found to be associated with PTSD (i.e., beliefs about guilt, injustice, vulnerability; Foa, Steketee, & Rothbaum, 1989; Ehlers & Steil, 1995; Resick & Schnicke, 1993), the focus of this paper is to compare two distinct types of cognitions. That is, PTSD symptoms are thought to arise from, or be exacerbated by (1) beliefs about the occurrence of harmful events and (2) beliefs about the meaning of one's PTSD symptoms.

The first type of beliefs is based on the cognitive specificity hypothesis (Beck, 1996; Beck, Brown, Steer, Eidelson, & Riskind, 1987). That is, specific types of cognitions are said to be associated with specific emotional problems. Depression, for example, is said to be associated with cognitions of loss, failure, and self-denigration. Anxiety and panic are thought to be associated with cognitions of threat or danger. Similarly, a person who suffers from PTSD as a result of a motor vehicle accident (MVA) may come to have cognitions of danger about driving-related stimuli. The person may believe that they or people in general are dangerous drivers, and most MVAs are lethal. Beliefs such as these can exacerbate or maintain certain PTSD symptoms, such as fear and avoidance of trauma-related stimuli. These beliefs can also contribute to hyperarousal, particularly when the person believes that the threat of harm is ever present.

The second type of beliefs (i.e., beliefs about one's symptoms) can also exacerbate and maintain PTSD symptoms. Many PTSD symptoms are arousal-related sensations (e.g., palpitations, intrusive thoughts, depersonalization, concentration difficulties). People who believe arousal-related sensations are dangerous are said to have elevated anxiety sensitivity (AS). Such people believe that arousal-related sensations have harmful consequences, such as death, insanity, or rejection by others (Reiss & McNally, 1985). Beliefs characteristic of elevated AS appear to play a role in exacerbating a variety of anxiety reactions, including PTSD symptoms (Taylor, Koch, & McNally, 1992; Taylor, Rabian, & Fedoroff, 1999). To illustrate, when a person experiences PTSD symptoms (e.g., intrusive thoughts), he or she misinterprets the symptoms as signs of impending threat (e.g., insanity). This makes the person feel increasingly anxious, thereby exacerbating their PTSD symptoms. Thus, AS is a cognitive factor that appears to play a role in the maintenance of PTSD symptoms.

Little is known about the relative importance of AS compared to other threat-relevant beliefs in exacerbating and maintaining PTSD symptoms. Reiss (Reiss &

McNally, 1985) originally proposed that the tendency to misinterpret sensations catastrophically might arise from learning experiences. In this case, an MVA may act as the conditioning episode that amplifies AS beliefs. Ehlers' cognitive model of PTSD (Ehlers et al., 1998; Ehlers & Steil, 1995), which is consistent with this idea, emphasizes the importance of beliefs about symptoms in maintaining PTSD. Accordingly, Ehlers' model suggests that AS beliefs should play an important role in PTSD. In comparison, other cognitive models (e.g., Foa et al., 1989) emphasize the importance of beliefs about external stimuli and events related to the trauma.

The aims of the present study were (1) to assess the relative importance of two specific types of beliefs (AS beliefs versus MVA-related beliefs) in predicting PTSD symptom severity, and (2) to assess how changes in these beliefs predict changes in PTSD symptoms following psychological treatment for PTSD. Victims of MVAs were assessed for this study because MVAs are one of the most common causes of PTSD (Norris, 1992).

Beliefs about arousal-related sensations were assessed using the Anxiety Sensitivity Index (ASI: Peterson & Reiss, 1992). If AS beliefs play an important role in PTSD, then the ASI should predict PTSD symptom severity, and treatment-related changes in the ASI should predict changes in PTSD symptoms. If beliefs about particular events associated with the traumatic event (e.g., the belief that one is a poor driver and therefore driving is dangerous) are important in MVA-PTSD, then these beliefs should predict PTSD symptoms, and changes in beliefs should predict changes in symptoms. The comparative predictive power of AS versus driving-related events also will be examined to determine which of these plays the most important role in MVA-PTSD.

Contemporary cognitive-behavioural treatments focus on identifying and restructuring beliefs directly related to the traumatic event. However, if beliefs about arousal sensations are more powerful predictors of PTSD symptoms, then treatments may be improved by using methods that reduce AS.

Method

Subjects

The sample consisted of 81 patients; 48 were seeking treatment for pain as a result of an MVA at Wascana Rehabilitation Centre in Regina, Saskatchewan, and 33 were seeking treatment for MVA-induced PTSD at the University of British Columbia. All participants had been in a MVA in which someone was injured. The sample from the Wascana clinic had unremitting pain while the UBC clinic sample had a primary diagnosis of PTSD. Most patients from both sites had some degree of chronic pain and PTSD symptoms. All patients completed self-report measures of PTSD symptoms and the samples were pooled in order to attain a broad range of PTSD symptoms required for the correlational and regression analyses. Given that patients differed in terms of pain severity, the latter was entered into the regressions as a control variable, to control for the possibility that pain might influence the severity of PTSD symptoms.

Patients were recruited from advertisements in the local media, and from physician referrals to our Traumatic Stress Clinic at the University of British Columbia. Inclusion criteria for the UBC site were (1) PTSD (diagnosed according to DSM-IV criteria) as

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the primary presenting problem; (2) over 18 years of age and able to provide written informed consent; (3) fluency in written and spoken English; (4) willingness to participate in a 12-week treatment program and to complete the required assessments. Exclusion criteria were (1) any condition that precluded participation in 12 consecutive weeks of treatment; (2) concurrent psychological therapy; (3) commencement of psychotropic medication (including analgesics) within the past 3 months. Patients currently on psychotropic medication were accepted into the study providing they (and their treating physicians) agreed to keep their doses constant throughout the course of the study. Most of the patients were drivers (54.3%) or passengers (28.3%), and the rest were pedestrians (13%) or motorcyclists (4.3%) at the time of the accident. The average time since the patients' most severe MVA and their assessment was just over 2 years (28.8 months).

Patients at the Wascana site presented with unremitting pain following involvement in a motor vehicle accident. Approximately 17% also met criteria for DSM-IV criteria for PTSD. Most were drivers (80%) or passengers (19%) at the time of the accident. The remainder were pedestrians. Most patients presented at the pain centre within 12 months of the accident. Pain was the primary presenting problem, defined in terms of severity.

The mean age of the combined sample was 39 years ($SD = 10$; range = 18–64) and 67% were female. Most (86%) were Caucasian, 6% Asian, 3% East Indian, and 5% were from other ethnic groups. Over two-thirds were married or cohabiting (67%), 19% were single, 14% were separated or divorced, and 1% were widowed. Many (57%) were taking some form of analgesic medication (prescription medication or over-the-counter medication). A total of 20% were taking psychotropic medications (e.g., tricyclic antidepressants, serotonin selective reuptake inhibitors, benzodiazepines). Mean years driving was 20 years ($SD = 20$; range of 3–46 years). All had a current driver's license at the time of the study.

There were some differences between the two samples. The severity of PTSD symptoms was greater for the UBC sample ($t_{(79)} = 8.77$, $p < .001$; M = 35.7, $SD = 6.78$) than the Wascana sample (M = 16.68, $SD = 11.11$). This difference was expected since the diagnosis of PTSD was an inclusion criteria for the UBC study. The average number of previous MVAs (in which someone was injured) was higher for the UBC sample ($t_{(78)} = 3.22$, $p < .05$; M = 2.2, $SD = 1.2$ than the Wascana sample (M = 1.5, $SD = .85$). The UBC sample was slightly more likely to have completed a 4-year college or university degree (27%) than the Wascana sample (8%) while the Wascana sample was more likely to be working full- or part-time (71%) than the UBC sample (42%). The UBC sample was more likely to be in litigation (67%) than the Wascana sample (23%).

Measures

Symptoms were assessed with the following self-report measures. Severity of PTSD symptoms was assessed by the PTSD Symptom Severity Scale (Foa, Riggs, Dancu, & Rothbaum, 1993). In our combined sample, Cronbach alpha = 0.94. Anxiety Sensitivity was assessed by the Anxiety Sensitivity Index (Peterson & Reiss, 1992). Cronbach alpha = 0.92. Pain severity was assessed by the pain severity score from the Multidimensional Pain Inventory (Kerns, Turk, & Rudy, 1985). Cronbach alpha = 0.84.

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To assess beliefs about MVA-related traumatic events, we developed the Motor Vehicle Accident Scale (Koch, Shercliffe, Fedoroff, Iverson, & Taylor, 1999). The 21-item scale assessed individuals' beliefs about driving-related safety and danger. The scale consisted of three subscales measuring (1) the belief that one is a poor driver (6 items, Cronbach alpha = 0.79). Samples of the items include: "How skilled a driver are you?" "How competent a driver are you in busy urban traffic?" The 5-point scale ranged from "much worse than average" to "much better than average". (2) The belief that others are poor drivers (7 items, Cronbach alpha = 0.73). Samples of the items include: "How many drivers drive more than 20 kilometers faster than the posted speed limit?" "How many drivers 'run' yellow or red lights?" The 5-point scale ranged from "0" to "100 percent". (3) The belief that cars and road travel are dangerous (7 items, Cronbach alpha = 0.60). Samples of the items include: "How effective are modern automobiles in preventing injuries?" The 5-point scale ranged from "not at all" to "extremely". "How serious is the average injury sustained in a car accident?" The 4-point scale ranged from "minor muscle strains" to "death".

Procedure

Patients from Wascana Rehabilitation Centre ($n = 48$) completed the measures during their assessment for treatment of pain. Patients from the University of British Columbia clinic completed the measures before ($n = 33$) and after ($n = 28$) cognitive-behavioural treatment for PTSD (5 patients dropped out).

Treatment consisted of 12 2-hour, weekly group sessions conducted in groups of 4–6 patients. There were two therapists per group who followed a detailed treatment manual. Treatment was comprised of the following components: (1) Education. Patients received information about the nature and the psychological sequelae of MVAs along with a cognitive-behavioural account of PTSD (based on Foa et al., 1989). (2) Applied Relaxation. Patients were trained in applied relaxation using a protocol adapted from Öst (1987). Relaxation exercises were used to reduce muscle tension-related pain, and to help cope with stressful events (e.g., completing exposure assignments, litigation). (3) Cognitive Restructuring. Patients were trained in cognitive restructuring (Beck & Emery, 1985), which focused on identifying and challenging dysfunctional MVA-related thoughts and beliefs. (4) Imaginal Exposure. Patients completed graded imaginal exposure to MVA-related fear stimuli. This included writing out narratives of their accidents. (5) *In vivo* Exposure. Exposure hierarchies were constructed for *in vivo* exposure assignments, which were then completed outside of treatment sessions (see Taylor, Fedoroff, & Koch, 1999 for further details). Note that the focus of this treatment was on changing beliefs about the MVA, not on reducing AS.

Data analysis

Pain severity and medication status (use of psychotropic or analgesic medications) were included as control variables because they might influence the severity of PTSD symptoms. Pearson correlations (Glass & Hopkins, 1984) were computed among the cognitive and control variables for descriptive purposes. To address the aims of the study, simultaneous entry regression analyses were computed (i.e., regressions in which all of

Table 1. Study 1. Pearson correlations: Cognitive variables and control variables versus PTSD symptoms ($N = 81$)

Candidate predictor variables	Total severity of PTSD symptoms (PTSD Symptom Severity Scale)	
Cognitive variables		
Belief that one is a poor driver	0.29**	(0.34**)
Belief that others are poor drivers	0.38**	(0.46**)
Belief that cars and road travel are dangerous	0.11	(0.15)
Anxiety Sensitivity Index	0.65**	(0.70**)
Control variables		
Pain medication (yes/no)	0.13	(0.13)
Psychotropic medication (yes/no)	0.38**	(0.39**)
Pain severity (Multidimensional pain inventory)	0.39**	(0.43**)

Dissattenuated correlations are in parentheses.** $p < .001$.

the cognitive and control variables were simultaneously entered) to assess the extent to which AS and MVA-related beliefs predicted PTSD symptoms for the combined sample ($n = 81$). To identify predictors of treatment response for the 28 treatment completers, we computed residual gain scores (i.e., residualized pre- to post-treatment change in scores) for the PTSD Symptom Scale and for the cognitive variables. The sign of the scores was reflected so that larger scores corresponded to greater reductions in scores.

Results

Part 1: Combined sample

For the combined sample, Pearson correlations were computed among the variables shown in Table 1. The table shows that the belief that one is a poor driver, the belief that others are poor drivers, AS, pain severity, and current use of psychotropic medications were each significantly correlated with PTSD symptom severity. Neither the belief that car and road travel are dangerous nor the use of pain medication was significantly correlated with symptom severity.

To determine whether patterns of results were an artefact of the differing reliabilities (Cronbach alphas) among scales, we also computed disattenuated Pearson correlations (Nunally & Bernstein, 1994). The correction for attenuation was computed by dividing the correlation coefficient of the predictor and criterion variables by the square root of the product of the reliability coefficient of the predictor variable (e.g., AS) and the criterion variable (e.g., PTSD Symptom Severity Scale). This calculation estimates the correlation that would be observed if the variables were measured without any measurement error. Table 1 shows that the pattern of significant correlations did not change when they were disattenuated.

The pattern of correlations in Table 1 suggest that AS compared to the other variables was more strongly correlated with PTSD symptom severity. To test this more formally, we computed differences between correlations and calculated 95% confidence

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Table 2. Study 1. Simultaneous entry regression predicting PTSD symptoms from cognitive variables and control variables ($N = 81$)

Candidate predictors	PTSD symptoms Beta	$t_{(80)}$
Cognitive variables		
Belief that one is a poor driver	−0.02	−0.23
Belief that others are poor drivers	0.06	0.64
Belief that cars and road travel are dangerous	−0.03	−0.29
Anxiety Sensitivity Index	0.57	5.74***
Control variables		
Pain medication	0.11	1.18
Psychotropic medication	0.16	1.68
Pain severity	0.32	3.12**

** $p < .005$, *** $p < .001$ (two-tailed).

intervals (Meng, Rosenthal, & Rubin, 1992) to determine which variables were most strongly correlated with PTSD symptoms. The correlation between the measures of PTSD symptom severity and AS was significantly greater than the correlations between PTSD symptom severity and the following: the belief that one is a poor driver (95% confidence interval = 0.54–0.20), the belief that others are poor drivers (95% confidence interval = 0.11–0.65), pain severity (95% confidence interval = 0.03–0.73), and the use of psychotropic medication (95% confidence interval = 0.10–0.69).

Simultaneous entry regression analyses were computed to assess the extent to which AS and MVA-related beliefs predicted PTSD, after controlling for medication and pain severity (see Table 2). The tolerances ranged from .70 to .90, indicating multicollinearity was not a problem (Norusis, 1988). The regression analysis with all the predictors entered was statistically significant [$F_{(7,63)} = 11.06$, $p < .001$ $R^2 = 0.58$]. Pain severity and scores on the ASI were significant predictors of PTSD Symptom Severity Scale. Thus, the results indicate AS was the strongest predictor of PTSD symptoms. Although MVA-related beliefs were significantly correlated with symptoms of traumatic stress and avoidance, they did not significantly predict these symptoms once AS, pain severity, and medication status were entered into the regression.

Part II: Cognitive correlates of treatment-related symptom change

Another series of analyses were conducted for the 28 patients who completed cognitive-behavioural therapy. Residual gain scores were calculated to determine whether treatment-related changes in PTSD symptoms and MVA-related avoidance were predicted by treatment-related changes in AS and MVA-related beliefs. Pearson correlation coefficients were computed for these variables and the control variables—i.e., residual gain changes in pain severity and pretreatment medication status (yes/no). The positive correlations indicate that reductions in AS, pain severity, and belief in dangerousness

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Table 3. Study 2. Pearson correlations: Residual Gain Scores of cognitive variables and control variables versus PTSD symptoms ($N = 28$)

Candidate predictor variables	Total severity of PTSD symptoms (PTSD Symptom Severity Scale)
Cognitive variables	
Belief that one is a poor driver	−0.02
Belief that others are poor drivers	0.02
Belief that cars and road travel are dangerous	0.47*
Anxiety Sensitivity Index	0.47*
Control variables	
Pain medication (yes/no)	0.14
Psychotropic medication (yes/no)	0.02
Pain severity (Multidimensional pain inventory)	0.45.*

(Dissattenuated correlations could not be calculated because the scores are changed scores).
* $p < .05$.

of MVA travel were associated with reductions in PTSD symptoms (see Table 3). Reductions in AS, pain severity, and the belief that cars and road travel are dangerous were all significantly correlated with reductions in PTSD symptoms. We computed tests of significance between correlations (Meng et al., 1992) to determine if any of the variables were more strongly correlated with PTSD symptoms and with MVA-related avoidance. Tests of significance between correlations were not significant.

Simultaneous entry regression with all the predictors entered was significant [$F_{(7,25)} = 3.87$, $p < .05$ $R^2 = 0.60$] for reduction in PTSD symptoms over treatment (see Table 4). Reductions in AS, and pain severity were significant predictors for reductions in PTSD symptoms. Tolerances ranged from .71 to .94, indicating that multicollinearity was not a problem.

Table 4. Study 2. Simultaneous entry regression predicting residual gain scores of PTSD symptoms from residual gain scores of cognitive variables and control variables ($N = 28$)

	PTSD symptoms	
Candidate predictors	Beta	$t_{(27)}$
Cognitive variables		
Belief that one is a poor driver	0.22	1.26
Belief that others are poor drivers	−0.03	−0.17
Belief that cars and road travel are dangerous	0.25	1.44
Anxiety Sensitivity Index	0.54	3.02**
Control variables		
Pain medication	0.05	0.27
Psychotropic medication	0.07	0.44
Pain severity	0.51	3.17**

** $p < .01$.

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Discussion

The purpose of this study was to assess (1) the role of cognitive factors in predicting the severity of PTSD symptoms, and (2) whether changes in these factors predict changes in PTSD symptoms. While there is evidence that cognitions are important factors, no study has directly compared the importance of arousal-related beliefs (as measured by AS) to specific trauma-related beliefs (i.e., driving-related beliefs) in predicting PTSD symptoms.

AS and pain severity were significant predictors of PTSD symptoms in a sample of MVA victims. Reductions in AS and pain severity also were significant predictors of reductions in PTSD symptoms for patients who completed a 12-week cognitive behavioural treatment program for PTSD. Although MVA-related beliefs were correlated with PTSD symptoms, they did not significantly predict these symptoms when AS, pain severity, and medication status were controlled for. These findings indicate that AS is an important cognitive factor in predicting PTSD symptoms.

The results of the present study are consistent with Ehlers' theory of PTSD that negative interpretations of psychological symptoms play an important role in predicting PTSD symptoms (Ehlers et al., 1998). These authors found that negative interpretations of trauma-related symptoms predicted PTSD symptoms up to one year following the MVA. In the present study AS, which reflects fear of arousal-related sensations and beliefs that these symptoms will have harmful consequences, was the strongest predictor of PTSD symptom severity. AS was also sensitive to treatment-related changes. Based on these findings, AS appears to be useful for assessing individuals at risk for developing chronic PTSD and for measuring response to treatment. Asmundson and colleagues (Asmundson, Norton, & Norton, 1999) have similarly suggested that AS may be useful in assessing those at risk for developing chronic pain.

These findings have important implications for treatment. AS predicted treatment improvement even though the cognitive behavioural treatment in the present study focused primarily on beliefs about driving-related activities (e.g., danger of driving). Treatments for PTSD possibly could be improved by incorporating strategies aimed at reducing AS. Treatment studies for panic disorder indicate that several interventions are effective in reducing AS, including psychoeducation, (e.g., information about the harmlessness of anxiety), cognitive restructuring to correct distorted beliefs about the dangerousness of anxiety symptoms, and specific exposure exercises that target specific dimensions of AS (e.g., Gould, Otto, & Pollack, 1995; Otto & Reilly-Harrington, 1999). Further research is necessary to evaluate the effect of directly addressing AS on reducing PTSD symptoms.

There are limitations to our study. The role of beliefs in the development and maintenance of PTSD is a complex one and all aspects have not been tested. We have focused on only a very specific set of beliefs, driving-related beliefs associated with MVAs. It was beyond the scope of this study to address a broader spectrum of beliefs that are also thought to be involved in the maintenance of PTSD symptoms (see Foa et al., 1989; Ehlers & Steil, 1995; Resick & Schnicke, 1993). Another limitation is the cross-sectional design. Whilst the findings of this study offer valuable information about the relationship between AS and PTSD symptoms, it does not address the course or chronicity of PTSD. For example, do high levels of AS continue to be a maintaining

factor in chronic PTSD symptoms? Prospective studies are needed to evaluate this relationship over the longer term.

In conclusion, it appears that AS is a useful construct for understanding the maintenance and exacerbation of PTSD symptoms. Inclusion of measures of AS as part of a standardized assessment for PTSD may enhance the likelihood of identifying people at risk for developing chronic PTSD symptoms.

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