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PTSD, appraisal, and coping among firefighters during a disaster scenario

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PTSD, APPRAISAL, AND COPING AMONG FIREFIGHTERS

DURING A DISASTER SCENARIO

by

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PTSD, APPRAISAL, AND COPING AMONG FIREFIGHTERS DURING A DISASTER SCENARIO

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ABSTRACT

The transactional model of stress and coping (Lazarus and Folkman, 1984) and the cognitive model of Posttraumatic Stress Disorder (PTSD; Ehlers and Clark, 2000) both emphasize the importance of appraisal in understanding the person by environment interaction. However, very few studies have examined Lazarus and Folkman's (1984) challenge and threat appraisals as they relate to PTSD. The current research studied the relationships between PTSD, situation-specific appraisal, and state coping among 124 firefighters presented with a chemical spill disaster scenario. Challenge appraisal was related to problem-focused coping whereas threat appraisal was strongly related to avoidant coping. As part of an exploratory aim, challenge appraisal was found to demonstrate a stronger relationship with pre-reflective coping whereas threat appraisal was related to reflective coping. Hypothesized relationships between PTSD symptom severity level and appraisal and coping were not found. However, threat appraisal did mediate the relationship between functional impairment from PTSD symptoms and avoidant coping in a post hoc mediation model. Discussion focuses on the potential role of enactive appraisal in stress and coping research and the implications of appraisal for understanding PTSD symptomatology.

Keywords: PTSD, appraisal, coping, firefighters

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INTRODUCTION

PTSD in the DSM-IV

Posttraumatic Stress Disorder (PTSD) is classified by the *Diagnostic and Statistical Manual for Mental Disorders* (*DSM-IV-TR;* APA, 2000) as an anxiety disorder. Its hallmarks include re-experiencing of the trauma (Criterion B), avoidance and emotional numbing (Criterion C), and hyperarousal (Criterion D). To meet criteria for PTSD, individuals have to meet an objective (Criterion A1) and subjective (Criterion A2) measure. That is, individuals have to have been exposed to an event or events that involved "actual or threatened death or serious injury, or a threat to the physical integrity of others" (Criterion A1) and responded with "intense fear, helplessness, or horror" (Criterion A2) (*DSM-IV-TR;* APA, 2000).

Despite being an established diagnosis in the DSM-IV-TR, differences in presentation of PTSD symptoms have prompted debate on appropriate criterion for PTSD diagnosis and furthered efforts to map symptom clusters onto underlying factors characterizing PTSD (e.g. King, Leskin, King & Weathers, 1998;Simms, Watson, & Doebbeling, 2002). Regardless of differing opinions on appropriate diagnostic criterion or factor structure, individuals with PTSD exhibit appraisal and coping tendencies. Given the limited prospective research on the development of PTSD and its effects on subsequent appraisal/coping patterns, and in lieu of experimental design, most studies of appraisal and coping patterns and PTSD are cross-sectional. Useful explanatory models of understanding PTSD have emerged; however there remains a paucity of research studying subsequent situational appraisal and coping among individuals with PTSD diagnosis or PTSD symptoms. The goal of the current research, therefore, was to

understand how PTSD screen for diagnosis and symptom level may be related to appraisal and coping during a stressful situation. By exploring prominent models of PTSD, highlighting appraisal and coping tendencies consistent with PTSD, and arguing for an enactive view of appraisal, the implications of threat and challenge appraisal constructs for PTSD development and persistence will be discussed.

Emphasis on the Objective and Subjective

Criterion A1 and A2 are informed by models emphasizing dose-response (A1) and subjective experience (A2). From a dose-response perspective (Dohrenwend & Dohrenwend, 1974; Wyler, Masuda, & Holmes, 1971), direct exposure to a traumatic event, longer duration of the event, and proximity of events should predict higher rates of PTSD. This relationship has been supported (Hoge, Castro, Messer, McGurk, Cotting & Koffman, 2004; Goenjian, Walling, Steinberg, Karayan, Najarian & Pynoos, 2005); however, there is also a considerable body of research finding stronger predictability of PTSD levels from subjective experience (Brewin, Andrews, & Valentine, 2000; Kaysen, Rosen, Bowman & Resick, 2010). Creamer, McFarlane, and Burgess (2005) argue that A1, although necessary, is not a sufficient predictor of PTSD and that A2 is critical for forming traumatic memories. Hathaway, Boals, and Banks (2010) did not find Criterion A1 to significantly predict PTSD when Criterion A2 was included in a statistical model. Bedard-Gilligan and Zoellner (2008) found an *absence* of A2 predicted *absence* of PTSD symptoms, duration, and functional impairment. Among sexual assault victims, Kaysen et al. (2010) found support for dose-response to predict response to the immediate aftermath of a trauma, but found longer term adjustment to be better predicted by subjective

appraisal. Regardless of whether or not A2 predicts PTSD, the subjective experience clearly cannot be discounted.

Although use of Criterion A2 for diagnostic purposes has been debated (Karam, et al., 2010), a burgeoning body of literature suggests that emotional reactions to trauma vary. Hathaway et al., (2010) found anger, disgust, and sadness (emotions beyond the three specified by A2 of fear, helplessness, or horror) to be associated with high levels of PTSD. Anger has been shown to be a common response to a traumatic event (e.g. Brewin et al., 2000; Ehlers, Mayou, & Bryant, 1998; Grey, Holmes, & Brown, 2001) along with guilt and shame (Andrews, Brewin, Rose & Kirk, 2000; Grey et al., 2001) and sadness (Bernsten & Rubin, 2007).

Symptoms associated with PTSD have also been conceptualized in terms of emotion. PTSD symptom severity has been associated with emotion regulation difficulties (Ehring & Quack, 2010). Furthermore, a dissociative subtype of PTSD has been proposed based on emotion regulation difficulties (Lanius, Vermetten, Loewenstein, Brand, Schmahl, Bremner & Spiegel, 2010). Lanius et al. (2010) claim that dissociation and numbing are characterized by emotional overmodulation; that is, access to somatosensory and emotional information related to the trauma is inhibited. Conversely, reexperiencing and hyperarousal are described as undermodulation; that is, a failure to inhibit somatosensory and emotional information related to the trauma (Lanius et al., 2010). This research combined with results of a meta-analysis finding peritraumatic emotionality to be a significant predictor of PTSD (Ozer, Best, Lipsey & Weis, 2008), suggest that emotion provides critical information as to the subjective experience of individuals during and following traumatic events.

Models for Understanding Development of PTSD

Models for understanding the development of PTSD and its trajectories rely heavily on the subjective experience. Emotional processing theory (Foa & Kozak, 1986; Foa & Riggs, 1993; Foa & Rothbaum, 1998) posits that a rigid pretrauma belief system about the self and the world contributes to vulnerability to PTSD. This model suggests that compared to those holding a flexible belief system, those with a rigid belief system are more likely to face distressing disruption to held beliefs and to experience confirmation of negative beliefs. Park and colleagues (Park, 2008; Park, Edmondson, Fenster, & Blank, 2008; Park &Folkman, 1997) built on emotional processing theory to include goals as components of an individual's meaning system. This meaning-making model suggests that events which violate one's goals can be distressing. Park, Mills, and Edmondson (2010) found support for both components of these overlapping models; PTSD was independently predicted by both belief violation and personal goal violation. Both emotional processing theory and the meaning-making model use appraisal as a central component to understanding the effect of the traumatic event on the individual. The levels of meaning (global and situational) described originally by Park and Folkman (1997) are captured through appraisal in the cognitive model of PTSD proposed by Ehlers and Clark (2000).

Because cognitive models hold that anxiety results from appraisals of impending threat, a cognitive approach to PTSD suggests that individuals with persistent PTSD do not see trauma as a time-limited event. Rather, these individuals appraise the event in a way that creates a sense of serious current threat (Ehlers & Clark, 2000). Whether internal (e.g. threat to view of one's self) or external (e.g. the world is dangerous),

individuals with persistent PTSD take global implications from a traumatic event and its sequelae (Ehlers & Clark, 2000). Appraisal of the traumatic event may result in catastrophizing (e.g. "bad things always happen to me") and cognitions about how one reacted or behaved during the event may produce negative expectations about the future or about the self (e.g. "I cannot cope"). Ehlers and Clark (2000) also propose that individuals with persistent PTSD are likely to interpret their PTSD symptoms as indicative of a permanent negative change. Poor elaboration and integration of a trauma memory into context of time, place, and information likely contributes to the perception of current threat (Ehlers & Clark, 2000). Ehlers and Clark (2000) assert that a serious threat to someone's view of self (e.g. capability) may result in an inability to maintain a stable view of themselves and their environmental context.

According to this model, to control sense of threat and symptoms, individuals may employ a variety of strategies to manage each appraisal. To manage appraisals related to what might happen if an individual thinks about the trauma (e.g. … "I will fall apart"), one may try not to think about it, keep his/her mind occupied, or use drugs. To control appraisals related to what might happen if s/he did not control emotions (e.g. … "I would not be able to work"), one may engage in emotional numbing. These are thought of as dysfunctional coping strategies that will only perpetuate PTSD. Therefore, the cognitive model posits that appraisal and coping contribute both to the development of PTSD and its persistence.

Appraisal and Coping Tendencies Associated with PTSD

These models have been supported by the PTSD literature on appraisal and coping. Appraisal has been consistently associated with PTSD (Dougall, Ursano,

Posluszny, Fullerton, Baum, 2001; Norris, Friedman, Watson, Byrne, Diaz & Kaniasty, 2002; Ozer, Best, Lipsey & Weiss, 2003). Although most research in this domain is retrospective, some studies have been able to use appraisal to predict PTSD beyond statistical prediction. Pre-trauma appraisal was found to be a significant predictor of PTSD levels in a longitudinal study by Bryant and Guthrie (2005). Bryant and Guthrie (2005) studied 82 recruit firefighters (i.e firefighters still in training at the fire academy) before they began active duty and six months following active duty status. PTSD was assessed using the Clinician Administered PTSD Scale (CAPS; Blake, Weathers, Nagy, Kaloupek, Charney, & Keane, 1998) and appraisal was assessed with the Posttraumatic Cognitions Inventory (PTCI; Foa, Ehlers, Clark, Tolin & Orsillo, 1999). Bryant and Guthrie (2005) found that in a regression model including pretrauma maladaptive appraisals, preexisting stress symptoms, extent of prior traumatic experiences, and perceived severity of worst traumatic event experienced, the only significant predictor of posttraumatic stress symptoms at six months was PTCI-Self score. This negative self-appraisal (e.g. "I am a weak person") found before firefighters entered active duty accounted for 24% of the variance in PTSD symptoms.

Posttraumatic appraisals have also been associated with elevated PTSD symptoms over time. A longitudinal study by O'Donnell, Elliot, Wolfgang, and Creamer (2007) assessed 253 trauma survivors (74.3% motor vehicle crash survivors) approximately eight days post-injury, three months post-injury, and 12 months post-injury using the PTCI (Foa et al., 1999) and the CAPS (Blake et al., 1998). Of posttraumatic appraisals, negative self-appraisal was most the influential in determining later posttraumatic stress symptoms; an increase in negative self-appraisal was associated with elevated PTSD

symptoms over time. The authors suggest that this may indicate a feedback loop in which negative self-appraisal increases an individual's sense of current threat and subsequently his/her anxiety level. This is consistent with Ehlers and Clark's (2000) cognitive model of PTSD.

Coping tendencies found among those with PTSD (North, Tivis, McMillen, Pfefferbaum, Cox, Spitznagel, Bunch, Schorr, & Smith, 2002; Sharkansky et al., 2000) parallel Ehlers and Clark's (2000) claim about the efforts individuals make to manage appraisal and symptoms. Avoidant coping has been consistently associated with worse overall mental health outcomes (Coyne & Racioppo, 2000) and with PTSD (Marmar, Weiss, Metzler & Delucchi, 1996; Schnider, Elhai, & Gray, 2007). Schnider et al. (2007) found that among college students, problem-focused (e.g. planning or behaviors aimed at overcoming the problem causing distress), active emotional coping (e.g. venting emotional distress/cognitive reframing), and avoidant coping (e.g. denial or self-distraction) were positively correlated with PTSD severity. Only avoidant coping remained a significant predictor of PTSD severity when controlling for time since the trauma and trauma frequency. In a study of firefighters (Brown, Mulhern, & Joseph, 2002), a differential association between coping style and distress was found depending on level of trauma exposure. Among those with higher trauma exposure, task-focused coping (similar to problem-focused coping) was associated with less distress, whereas for those with less trauma exposure, emotion-focused coping (e.g. "think of good things in the future" or "try to distract yourself with some fun or pleasurable activity") was associated with less distress. Avoidant coping accounted for the most variance in psychological distress (Brown, Mulhern, & Joseph, 2002). Among police recruits,

LeBlanc et al. (2008) found that those with emotion-oriented and avoidant-oriented coping styles were more likely to have trauma symptoms and have trauma symptoms consistent with a diagnosis of PTSD than recruits who did not use these coping styles. Task-oriented coping style was not related to trauma symptoms (LeBlanc et al., 2008).

Although associations between avoidant coping and PTSD have been established, less research has focused on coping subsequent to PTSD. However, a study by Fairbank, Hansen, and Fitterling (1991) suggests that there may be consistencies in coping both with situational stressors and with traumatic memories that differ for those with PTSD and without PTSD. Fairbank, Hansen, and Fitterling (1991) compared coping among World War II noncombat veterans, repatriated prisoners of war with PTSD, and repatriated prisoners of war without PTSD. Although not statistically significant, repatriated prisoners of war (RPWs) with PTSD used more self-isolation and wishful thinking to cope with recent stressors than noncombat veterans and RPWs without PTSD. RPWs without PTSD used problem-focused coping and emphasizing the positive. Noncombat veterans reported using problem-focused coping and seeking social support. To cope with both WWII memories and recent stressors, repatriated prisoners of war with PTSD used self-isolation most often, whereas RPWs without PTSD used emphasizing the positive. Noncombat veterans did not show a similarity in the type of coping used with WWII memories and recent stressors. The authors assert that the similarity found among the combat veterans in coping both with WWII memories and with recent stressors suggests that although coping is often thought of as context specific, it may be more stable among those who have been exposed to potentially traumatic events.

Maladaptive coping has also been suggested as a result of cumulative adversity

and PTSD among those with chronic illness. Cumulative adversity refers to lifetime exposure to potentially traumatic events (Kahana & Kahana, 1998). Alonzo (2000) argues that an individual's response to a symptomatic event associated with a chronic disease is affected by the burden of cumulative adversity. In this model, perceptions of signs and symptoms of chronic disease are distorted or constricted as a result of extensions of maladaptive and impaired coping triggered by trauma responses. Effective coping strategies are prevented. Similar to Fairbank, Hansen, and Fitterling (1991), Alonzo (2000) suggests that maladaptive coping resulting from trauma exposure may generalize to situation-specific coping. Alonzo (2000) also implies that appraisal is distorted which impairs effective coping.

Relationship between Appraisal and Coping

Appraisal determines both the stressfulness of the situation and the coping mechanism used to alter the environment in a transactional model of stress and coping (Lazarus & Folkman, 1984). Appraisal is defined as the "process of categorizing an encounter, and its various facets, with respect to its significance for well-being" (Lazarus & Folkman, 1984, p. 31). Lazarus and Folkman (1984) identify two main appraisals, primary and secondary. Primary appraisals can be thought of as what is at stake for the person in the environment. Depending on how the environment may impact goals or values, it is appraised as irrelevant, benign-positive, or stressful. Stress appraisals, a form of primary appraisal, can be classified as harm/loss, threat, and challenge. Whereas harm/loss refers to damage already sustained, threat and challenge both refer to potential events. Threat and challenge appraisals are not always mutually exclusive; it is likely that they often co-occur. Their cognitive and affective cores differentiate them: challenge

appraisals infer the possibility of gain or growth and positive emotions whereas threat appraisals are characterized by potential harm or loss and negative emotions.

Secondary appraisals can be thought of as what can be done to alter or manage the environment (Lazarus & Folkman, 1984). They determine which action a person will take to cope with the environment by considering all possible coping options available and evaluating the likelihood of obtaining a desired outcome if each coping option were utilized. Coping is defined as a "constantly changing cognitive and behavioral effort to manage specific external and/or internal demands that are appraised as taxing or exceeding the resources of a person" (Lazarus & Folkman, 1984, pp. 178). This process-oriented view of coping states that coping allows the person to deal with a troubled person-environment through problem-focused and emotion-focused coping. Problem-focused coping refers to efforts one makes to manage or alter the problem with the environment whereas emotion-focused coping refers to efforts one makes to regulate emotional response to the problem.

Research on threat and challenge appraisals has extended to a variety of settings. Studies on test taking and speech preparation have found challenge and threat appraisals to be related to coping (Skinner & Brewer, 2000). Others have used the concept of threat and challenge appraisals and affect to predict performance in areas such as sports (Zaichowsky & Baltzell, 2001). Performance is expected to increase when a situation is appraised as a challenge, and decrease when the situation is appraised as a threat. Drach-Zahay and Erez (2002) explored the interaction between goal setting and appraisal and found that under an appraisal of threat, goal difficulty impaired performance and adaptation to change. This same level of goal difficulty improved adaptation to change

when the situation was appraised as a challenge. A higher level of performance was reached in the challenge condition regardless of goal setting. These studies suggest that a challenge appraisal is adaptive and associated with effective coping and increased performance.

A recent study of emergency responders found a strong relationship between the stressfulness of a situation and threat and challenge appraisals. Harvey, Nathens, Bandiera, and LeBlanc (2010) subjected thirteen emergency medicine and general surgery residents to a high and low stress trauma resuscitation simulation. By comparing group means for cognitive appraisals, Harvey et al. (2010) found that in the low-stress condition, post-scenario appraisals indicated challenge appraisals whereas post-scenario appraisals in the high-stress condition suggested a threat appraisal. Previously outlined research on performance and appraisal suggests that it may be beneficial for emergency responders if they are able to enter into a highly stressful situation and appraise it as a challenge and not a threat (i.e. performance may improve).

Emergency response is a promising area for the application of threat and challenge appraisals given the inherent potential for traumatic events. It is important to consider threat and challenge appraisals in the context of PTSD. As Olff, Langeland, and Gersons (2005) point out, the DSM-IV-TR definition of a traumatic event is framed as a threat appraisal followed by a response involving emotional, behavioral, and biological components. Salutary neuroendocrine response is associated with a challenge appraisal whereas a potentially detrimental neuroendocrine response is associated with a threat appraisal (Olff et al., 2005). Olff et al. (2005) describe a failure in regulating biological stress as a risk factor leading to symptom clusters of PTSD such as hyperarousal.

Appraisal as threat or challenge is therefore given a critical role in contributing to whether someone experiences posttraumatic stress or develops posttraumatic stress disorder.

Despite accumulating research on threat and challenge appraisals, there is great variability in indexing threat and challenge appraisals. Given the potential that threat and challenge appraisal have for understanding stress response in emergency responders and for contributing to models of PTSD, it is crucial to revisit the original conceptualization of these constructs as it relates to their operationalization.

Threat and Challenge Appraisals

As Lazarus and Folkman (1984) describe, challenge and threat appraisals can co-occur which means that they are not one dimensional or polar opposites. A large number of studies (e.g. Harvey, Nathens, Bandiera, & LeBlanc, 2010; Tomaka, Blascovich, Kelsey &Leitten, 1993; Tomaka, Blascovich, Kibler& Ernst, 1997) have operationalized challenge and threat as a ratio of demand to resources. Wright and Kirby (2003) offer an extensive critique of the biopsychosocial analysis of threat and challenge proposed by Blascovich and colleagues and argue that by indexing threat and challenge as a ratio of demand to resources, anticipated effort is really what is being assessed.

Some studies have used the Appraisal of Life Events Scale (Ferguson, Matthews, & Cox, 1999) which states that it was designed specifically to capture Lazarus and Folkman's dimensions of challenge, threat, and harm-loss. This measure asks participants to rate their perception of their current circumstances on a scale from "not at all" to "very much". A sum of ratings for the following constitutes a challenge: "enjoyable", "challenging", "stimulating", "exhilarating", "informative", and "exciting". A threat is comprised of: "threatening", "fearful", "worrying", "hostile", "frightening", and

"terrifying". Lazarus and Folkman (1985) describe challenge emotions as confident, hopeful, and eager and threat emotions as worried, fearful, and anxious.

Challenge itself has been described as an emotion. To differentiate emotional states, Smith and Ellsworth (1985) identified six orthogonal dimensions: pleasantness, anticipated effort, certainty, attentional activity, self-other responsibility/control, and situational control. The emotion of challenge was distinguished from pride and hope by a high level of anticipated effort and by being less pleasant. It was associated with a desire to attend to a situation, feeling fairly certain about a situation, and having moderately strong attributions of human agency and self-responsibility/control. Participants describing a challenge emotion gave examples of situations in which they felt somewhat confident that a desired goal could be achieved, but only if great effort was expended. Examples include athletic events, skiing on an advanced slope, or attempting to succeed at a difficult job. Although Smith and Ellsworth classify this as an emotion, challenge in this case shares commonalities with Lazarus and Folkman's conceptualization of a challenge appraisal. Related to Lazarus and Folkman's definition of primary appraisal, identifying a goal implies that there is something at stake for the person; that is, there is something to be gained. A need to expend effort is consistent with the situation being appraised as stressful and not benign/positive or irrelevant.

Although Smith and Ellsworth (1985) do not describe a threat emotion, their description of fear similarly parallels threat appraisal. Fear is described as unpleasant and demanding of extreme effort. Maximum uncertainty about the future, strong attributions of situational control, and an association with appraisals of other-responsibility/control are all aspects of fear. It is further characterized by uncertainty about being able to escape

or avoid an unpleasant outcome. Examples of situations involving fear included being lost in the mountains, losing control while driving in a blizzard, and losing control while riding a bicycle down a very steep hill. The primary appraisal of something being at stake for the person (i.e. something could be lost) is implied by the need to escape or avoid an unpleasant outcome. The need for expending effort, as in the case of challenge, also implies that the situation is stressful.

Appraisal as Meaning: An Enactive Approach

The indices of threat and challenge appraisal outlined above suggest that threat and challenge are indicators of the meaning of a situation. Appraisal theory posits that people are constantly interacting with the environment and deriving meaning from it as a function of its relevance for personal well-being (Lazarus & Folkman, 1984). Although an appraisal theory of emotion suggests that emotion is a function of appraising, appraisal is the evaluative product of that process. Lazarus states that it is relational meaning (personal significance of information) that is constructed by the person that gives appraisal its emotional quality (Lazarus, 1991). The crux of appraisal is meaning (Lazarus, 2001), which is consistent with the original concept of appraisal introduced by Arnold (1960) that it is a process allowing an individual to determine the meaning and personal significance of a situation.

Perhaps partly in response to the continued primacy debate on emotion and appraisal, Lewis (2005) argues for an appraisal-emotion amalgam. Lewis (2005) describes reaction to the environment in terms of "what" and "what to do" components. The "what" includes perception, evaluation, memory, attention, and planning, whereas the "what to do" includes bodily arousal, feeling, action, and attentional orientation. The "what" (appraisal) and the "what to do" (emotion) are intimately connected as functions

of the same system. Colombetti (2007) takes this discussion further by arguing that the experience of appraisal is thoroughly embodied and therefore enactive. Bodily sensations are not merely responses to cognitions, but rather provide a sense of knowing that is inherently connected with the individual's thoughts and feelings. Appraisal is therefore distributed across mind and body with neither a primacy of cognition nor emotion. This view of appraisal allows for immediately knowing one's place in the environment. Northoff (2008) underscores the inherent "embeddedness" of embodied appraisal; that is, that the environment is directly involved in determining meaning and personal significance in appraisal.

Enactive appraisal in a transactional model of stress and coping allows for a more complete, more immediate person by environment interaction. By allowing emotion and appraisal to be a function of the same system, an arrival at a threat or challenge appraisal or particular coping mechanism can arise without the need for an artificial deconstruction of the information available to the person. Enactive appraisal allows a threat or challenge appraisal to be immediate and not mediated by a higher-order cognitive processing. Many of the terms used to derive a challenge appraisal according to the Appraisal of Life Events (Ferguson, Matthews, & Cox, 1999), a measure designed specifically to assess threat and challenge appraisals, are inherently emotive and corporeal (e.g. "exhilarating"). Enactive appraisal can help resolve some of the discrepancy present in the literature on indexing threat and challenge appraisals by calling for both indices of emotion and cognition to inform threat/challenge.

This view of appraisal is perhaps even more useful when considering the person by environment interaction during a potentially traumatic event. Models of PTSD

development suggest that meaning is changed or violated during a traumatic event. Enactive appraisal, by allowing individuals to derive meaning from both cognitions and emotion without one preceding the other, perhaps more closely aligns with the experience of an individual during an event.

Roediger (1990) states that conceptual (i.e. processing the meaning of situation and putting it into context) and data-drive processing (i.e. processing sensory impressions) are critical for encoding memories. In this way, conceptual and data-driven processing seems to parallel cognitive and emotional indices of meaning in a situation. Similarly, enactive appraisal may help capture experiences in which individuals do not report specific A2 emotions (fear, helplessness, or horror), but still exhibit signs and symptoms of PTSD or endorse assessment items aimed at bodily experience during a traumatic event. Specifically in terms of dissociation, items from the Posttraumatic Dissociative Experiences Questionnaire (PDEQ; Marshall, Orland, Jaycox, Foy & Belzberg, 2002) such as "You felt separate or disconnected from your body or like your body was unusually large or small" or "You felt confused or couldn't make sense of what was happening", emphasize both a corporeal and cognitive awareness of the environment. Questions from the Posttraumatic Check List (PCL; Weathers, Litz, Herman, Huska& Keane, 1993) also reflect a corporeal sense of knowing: "Having physical reactions such as heart pounding, trouble breathing, or sweating when something reminded you of a stressful experience from the past?" Given that peritraumatic dissociation (e.g. memory disturbances, altered time sense during the trauma, depersonalization and derealization) and emotional response have been significant predictors of PTSD (Ozer et al., 2008) and that well-validated measures of PTSD and

indicators of PTSD do not constrict appraisal to its cognitive components, threat and challenge appraisals can be most informative if they are not limited to either their cognitive or affective cores.

In summary, adopting an enactive view of threat and challenge appraisal helps capture the richness of these constructs by allowing appraisal to indicate both the cognitive and emotional aspects of responding to a traumatic event. The cognitive model of PTSD and the transactional model of stress and coping suggest that appraisal may account for the variance found in stress responses. Instead of an ability to see events as changeable, those with PTSD may experience a feeling of permanent negative change. Instead of a sense that stimuli are structured, predictable, and explicable, those with PTSD may have an unstable view of self and the context they live in. As level of prior trauma exposure has been found to differentiate stress responses during stressful scenarios (Regehr, LeBlanc, Jelley, Barath & Daciuk, 2007) and high-stress situations have been associated with threat appraisals (Harvey, Nathens, Bandiera & LeBlanc, 2010), studying the relationship between PTSD or PTSD symptoms, appraisal, and coping during stressful scenarios is a natural next step. Such research will contribute to models of PTSD and symptom conceptualization. Furthermore, it may yield a better understanding of how challenge and threat appraisals relate to the persistence of or resistance to PTSD.

Studying PTSD, Appraisal, and Coping among Firefighters

Exploring the relationships between appraisal, coping, and PTSD is perhaps most critical for those likely to repeatedly face potentially traumatic events. PTSD among U.S. firefighters has been reported at 17% (Corneil, Beaton, Murphy, Johnson & Pike, 1999), which is approximately 1.5 to 2 times higher than normative comparison. Wagner,

McFee, and Martin (2010) studied the mental health of firefighters and suggest that previous findings on mental health symptoms among firefighters are indicative of posttraumatic symptomatology (e.g. hostility and intrusive thoughts). Firefighters also present with a high proportion of substance use issues, which is perhaps partly reflective of efforts to cope with stressors (North et al., 2002). Problem drinking among firefighters has been estimated at 30% (Murphy, Beaton, Pike, & Johnson, 1999), although more recent studies among firefighters have found higher prevalence rates. North et al., (2002) reported that 50% of firefighters sampled met for lifetime diagnosis of alcohol use disorder and 25% met for current alcohol use disorder.

In addition to reports of stress-related disorders, there is a body of literature suggesting that firefighters endorse coping tendencies which, according to the models outlined previously, would exacerbate PTSD symptoms and be consistent with threat appraisals. In a study of 25 active volunteer firefighters, Werner, Bates, Bell, Murdoch, and Robinson (1992) found that 72% of respondents endorsed "*keep active"* (i.e. behavioral effort to focus on the task in order to avoid experiencing any signs and symptoms) and 56% endorsed "*switch off*" (i.e. cognitive effort to prevent or avoid conscious registering of signs and symptoms of stress; not reflecting on what one is doing during the critical incident) as means of coping during a call. Authors suggest that these are effective coping mechanisms on the basis of 15 subjects who used "*keep active"* and *"switch off"* and reported that their coping could not have been more effective. Stress responses did emerge after the incident, however, which suggests that although firefighters may view these strategies as allowing them to function during a call, they may not be helpful for the long-term. The cognitive model for PTSD posited by Ehlers

and Clark (2000) implies that using these coping mechanisms during a trauma would be more likely to yield persistent PTSD because of the impact it would have on encoding.

A trauma memory is dependent upon the quality of processing during encoding (Siegel, 1995). Whether one engages in conceptual (i.e. processing the meaning of situation, organizing it and putting it into context) or data-driven processing (i.e. processing sensory impressions) during encoding determines how well a memory can be intentionally retrieved or how strongly it will be primed (Roediger, 1990). These have implications for the persistence of PTSD as it is often characterized by unorganized memories. By trying to shut out what is happening during a call, firefighters may be able to complete their duties, but may end up placing themselves at increased risk for developing PTSD by limiting their conceptual and data-driven processing. Individuals experiencing peritraumatic dissociation have been shown to be more than four times more likely to develop PTSD than those who do not (Ursano, Fullerton, Epstein, Crowley, Vance, Kao & Baum, 1999).

In a study of 53 emergency room responders, 44% reported clinically meaningful levels of dissociation and at least half endorsed degrees of blanking out or going on automatic pilot (Laposa & Alden 2003). PTSD severity was significantly correlated with negative cognitions about the self, the world, self blame for the trauma, and total Posttraumatic Cognitions Inventory scores (PTCI; Foa et al., 1999; Laposa & Alden, 2003). Seventeen percent reported intrusive recollections of a traumatic event once a month, 4% several times a month, 6% once a week, and 4% everyday. Moreover, 27% reported impaired work functioning in the past month due to symptoms of posttraumatic stress (Laposa & Alden, 2003). This study implies that the findings from Werner et al.

(1992) regarding coping during a critical incident (i.e. “switch off”) should be viewed as problematic and suggests that PTSD may affect ability to optimally perform during a call, possibly because of its association with negative appraisals.

Need for Situation-specific Appraisal and Coping Research among Responders

A study of 84 police recruits explored the effect of previous traumatic exposure on subjective stress before, during, and after an emergency scenario (Regehr et al., 2007). Although those reporting more previous traumatic exposures did not differ from their peers during the highest stress periods of the scenario, they did differ afterward (Regehr et al., 2007). Anxiety levels did not diminish among those with more exposure to traumatic events prior to the scenario. Appraisal was not directly assessed in the study, yet the authors concluded that individuals with previous traumatic exposure and preexisting symptoms of stress are more vulnerable to stress responses during a critical incident.

The same simulation and group of 84 police recruits were also used to address whether coping style was related to stress response and performance (LeBlanc, Regehr, Jelley & Barath, 2008). Unfortunately coping was not assessed during the simulation, but rather was reflective of a general approach to stressful situations or a trait. Performance was assessed through behavior ratings made by raters at the police college. Coping style was associated with ratings of anxiety and physiological responses. Task-oriented coping style (similar to problem-focused coping) was associated with lower anxiety levels immediately before the scenario and 10 and 20 minutes after the scenario. Avoidant coping style (defined as both avoiding confronting the problem or engaging in behaviors to avoid emotional tension) was associated with lower levels of anxiety immediately

following the scenario, and emotion-oriented coping (defined as attempts to manage emotional reactions/maintain emotional equilibrium) was not associated with anxiety at any time point (LeBlanc et al., 2008). However, emotion-oriented coping style was associated with a larger heart rate response to the scenario and a larger cortisol response. Avoidant-oriented coping was also related to larger cortisol response during the scenario. Coping style was not associated with performance.

To determine whether PTSD symptoms or exposure to traumatic events impaired performance, LeBlanc, Regehr, Jelley, & Barath (2008) broke the sample down by critical incident exposure and trauma symptom level. Of the 84 police recruits subjected to a policing simulation, 79.3% had been exposed to at least one critical incident, 51% scored in the no to low trauma symptom range, 16% scored in the moderate symptom range, 14% in the high range, and 19% in the severe range (LeBlanc et al. 2008). Neither scores on the Impact of Events-Scale Revised (Weiss & Marmar, 1997) nor scores on the Critical Incident History Questionnaire correlated with behavior ratings or relative rankings of performance. Police recruits at different trauma symptom severity levels also did not differ on behavior ratings or performance ratings.

These findings contrast Laposa and Alden (2003) who found that 27% of emergency responders sampled indicated that work functioning was impaired by PTSD symptoms. It is possible that had the recruits rated their individual performance themselves, those with greater symptom severity may have indicated impaired performance. It is also possible that even though this sample had trauma exposure, it was different from Laposa and Alden (2003) because recruits were still at the training academy and not on active duty. PTSD symptoms may be more apparent when on active

duty because of trauma cues. Finally, it is possible that PTSD symptoms related to trauma exposure prior to occupation-specific stressors differentially affect someone. That is, PTSD symptoms associated with a work-related incident might affect an emergency responder during a call differently than symptoms associated with a non-work related trauma.

Given findings such as Laposa and Alden (2003), it is crucial to understand how PTSD symptoms associated with trauma may affect what occurs during a call among emergency responders. The extent to which situational appraisals form a negative feedback loop wherein PTSD symptoms are worsened (e.g. catastrophizing) is unclear; however, cognitive models of PTSD suggest that threat appraisals and avoidant coping may perpetuate PTSD symptoms. If as proposed by the transactional model of stress and coping, coping results from appraisal, then helping firefighters to reappraise a situation could provide a route toward adaptive coping for the situation and prevent worsening of PTSD symptoms.

The vast majority of firefighters will continue in their career until retirement (U.S. Department of Labor Statistics, 2010). Given the accumulation of exposure to potentially traumatic events and the high-demand, low-control nature of this occupation, exploring threat and challenge appraisals may also yield information on resilience among firefighters. Even with a higher percentage of PTSD compared to the general population, firefighters have a low prevalence rate of PTSD relative to what might be expected based on the number of traumatic events they encounter during the course of their career (i.e. Criterion A1). For those who do develop PTSD symptoms and yet are able to continue through retirement, as well as for those who do not develop or maintain PTSD symptoms,

identifying the role of challenge versus threat appraisal may help explain their resilience or recovery. It may also inform conceptualization of posttraumatic pathology. Studying appraisal, coping, and PTSD among this population is therefore critical both for treatment and resilience interventions.

Current Study

The current study examined the relationships between PTSD (screen/symptoms), threat/challenge appraisals, and three forms of coping important to threat, challenge, and PTSD (problem-focused, active emotion-focused, and avoidant coping) during a disaster scenario. These relationships were studied among firefighters, a population known to have both a high percentage of PTSD and PTSD symptoms relative to the general population and to consistently face potentially traumatic events for the duration of their career.

Research Aims and Hypotheses

Research Aim 1. The first aim of this study was to explore the relationship between (a) PTSD screen and state coping and (b) the relationship between PTSD symptoms and state coping. Hypothesis 1a) Individuals screening positive for PTSD will demonstrate higher levels of avoidant coping and lower levels of problem-focused and active emotion-focused coping compared to those who do not screen positive for PTSD. Hypothesis 1b) PTSD symptom severity level will be positively related to avoidant coping and negatively related to problem-focused and active emotion-focused coping, with greater symptom levels being related to more or less of each form of coping, respectively.

Research Aim 2. The second aim of this study was to explore (a) the relationship between PTSD screen and threat/challenge appraisals and (b) the relationship between PTSD symptoms and threat/challenge appraisals. Hypothesis 2a) Individuals screening positive for PTSD will demonstrate higher levels of threat appraisal compared to those who do not screen positive for PTSD. Individuals who do not screen positive for PTSD will demonstrate higher levels of challenge appraisal compared to those who did screen positive for PTSD. Hypothesis 2b) PTSD symptom level will be positively related to threat appraisal and negatively related to challenge appraisal.

Research Aim 3.The third aim of this study was to determine whether challenge and threat appraisals mediate the relationship between PTSD and state coping. Hypothesis 3a) The relationship between PTSD screen/PTSD symptom level and avoidant coping will be mediated by threat appraisal. Hypothesis 3b) The relationship between PTSD screen/PTSD symptom level and problem-focused and active-emotion focused coping will be mediated by challenge.

METHOD

Participants

The sample consisted of 124 career (i.e. not volunteer) firefighters in the Albuquerque, New Mexico metropolitan area who were recruited through email announcements sent to all firefighters and by flyers distributed at fire stations. Participants were excluded if they were unable to read or write English or did not have normal or corrected normal vision.

Materials and Procedures

The current study stemmed from a larger study that involved a series of questionnaires and computer tasks aimed at understanding the effect of personality, emotion, and coping on responses among firefighters to disaster scenarios. The general design of the larger study involved an initial questionnaire (assessing demographic, personality, and social factors, religion and spirituality, and current levels of stress, emotion, and health), a disaster scenario, and a follow-up questionnaire to assess what participants anticipated feeling, thinking, and doing to cope during the disaster event. Following study completion, participants were debriefed. Participants were compensated $80 for completing the entire study, which totaled approximately 3 hours. The University of Albuquerque Main Campus Institutional Review Board approved the study.

Chemical Spill Scenario. The disaster scenario was designed by Virginia Kay, B.A., who was provided with consultation by the Albuquerque Fire Department on the design of the scenario to ensure that it reflected a real emergency. The disaster scenario used for the current study involved a massive chemical spill. A computer presentation on chlorine gas provided approximately 15 minutes worth of audio. Participants were oriented to the format: a video clip depicting a chlorine spill, background information on

chlorine gas, and a scenario depicting a chlorine spill in Albuquerque. The 2- minute video clip showed firefighters responding to a tanker accident resulting in a chemical spill (for a description of the video clip, see Appendix A). The presentation continued with educational slides on chlorine gas including its properties, its uses, how it is transported, and safety issues regarding its transport. Recent examples of chlorine gas accidents followed. The toxicity and impact of chlorine gas was elaborated on before participants were presented with a New Mexico scenario. The New Mexico scenario described a 60,000 gallon chlorine gas spill resulting from a collision on the interstate between a tanker carrying liquefied chlorine gas and a tanker carrying ammonia (for a detailed description of the scenario, see Appendix A).

The scenario had important components for situation factors influencing appraisal. Although firefighters receive training in hazardous materials, the magnitude of the chemical spill described made it unlikely firefighters would have experienced this situation before (novelty of situation). The detail provided on expected panic lends a sense that firefighters can expect a chaotic situation (predictability). Given the training that occurs in fire academy, firefighters probably had some knowledge that their responding to the event could result in physical harm to self (event uncertainty). The scenario also had temporal implications. Firefighters knew they would be responding as they were told to stand by for their orders (imminence) and were told to expect continued response throughout a four-day period (duration). Although they were given information as to how long they might be responding, they were also told that it would be a chaotic unfolding given the public's expected response. Therefore, firefighter did not know when

they would be responding to specific components of this disaster such as traffic accidents or injuries resulting from exposure (temporal uncertainty).

Measures

The current study used PTSD screening and PTSD symptom severity level as independent variables, appraisal as a mediator variable, and state coping as the dependent variable. Control variables included: gender, age, income, education, years worked as a firefighter, and firefighter stress.

Individual Differences

Demographics. Basic demographic information was collected through a series of questions assessing gender, age, ethnic background education, marital status, employment status, and income (see Appendix B).

Firefighter-related Questions. Questions were administered from Corneil, Beaton, Murphy, Johnson, and Pike (1999) on firefighter background information such as "How long have you worked as a firefighter?" and "How many years do you think you will continue to work as a firefighter?" (see Appendix B).

Firefighter Stress. Firefighter stress was assessed through a list of 33 stressful events that firefighters and paramedics often experience (e.g. "CPR/full arrest-family present"). This measure, developed by Beaton, Murphy, Johnson, Pike, & Corneil (1998), asks participants to indicate whether or not they have experienced each event and to rate how stressful it was (0 = *not stressful at all* to 10 = *extremely stressful*). Instances in which the participant has experienced it more than once, participants are asked to indicate the range of ages that they experienced it. Although this measure lacks extensive reports of psychometrics, it has high face validity and is one of the only measures available for capturing a breadth of firefighter experiences. (see Appendix C).

PTSD. The Posttraumatic Diagnostic Scale (PDS; Foa et al., 1997) assessed symptoms of posttraumatic stress disorder over the past month. Four sections comprise the PDS: a trauma checklist, a section which asks participants to describe their most upsetting traumatic event, a 17-item section to assess symptoms of PTSD, and a section to assess interference from symptoms (functional impairment). A total severity score of 0-51 results; this is reflective of the frequency summaries of the 17 symptoms of PTSD. These 17 items assess reexperiencing, avoidance, and arousal and are responded to on a four point scale from 0 = *not at all or only one time* to 3 = 5 or *more times a week/almost always*. Symptom severity cut offs have been broken down as 0 = *no rating,* 1-10 = *mild,* 11-20 = *moderate,* 21-35 = *moderate to severe*, and > 36 = *severe* (Foa et al., 1997). A total score of 15 or higher along with Criterion A met and presence of 1 reexperiencing symptom, 3 avoidance symptoms, and 2 arousal symptoms as well as clinically significant distress is considered a positive screen for PTSD (Sheeran & Zimmerman, 2002). For identifying PTSD cases, cut-off scores of 27 have been used among psychiatric outpatient samples to agree with the SCID diagnosis of PTSD (Sheeran & Zimmerman, 2002) and cut off scores of 17 have been used among female victims of domestic violence to agree with a CAPS diagnosis of PTSD (Griffin, Uhlmansiek, Resick, & Mechanic, 2004).

The PDS was validated in a diverse sample of 248 men and women and retested in 110 of those in this sample (Foa, Cashman, Jaycox & Perry, 1997). Internal consistency was high for symptom clusters B-D (alphas = .78-.84) and for the total scale (alpha = .92). Test-retest reliability was high for each cluster (*r*'s = .77-.85) as well as for the total scale (*r* = .83). The PDS and Structured Clinical Interview for DSM-IV yielded

the same diagnosis 82% of the time (kappa = .65), with sensitivity of the PDS of .89 and specificity of .75 (Foa et al., 1997).

For the current study, firefighters were asked to respond to items in reference to an experience on the job that bothered or disturbed them most in the past month. PTSD screening was considered a dichotomous variable. A positive screen for PTSD followed the method outlined by Sheeran and Zimmerman, 2002, (i.e. a total symptom score of 15 or higher, plus meeting for Criterion A and presence of 1 reexperiencing symptom, 3 avoidance symptoms, and 2 arousal symptoms). Participants were grouped on PTSD symptomatology based on the method described by Foa et al., 1997 (i.e. 0 = *no rating,* 1-10 = *mild,* 11-20 = *moderate,* 21-35 = *moderate to severe*, and > 36 = *severe*) (Appendix D).

Responses to the Chemical Spill Scenario

Appraisal. Appraisal was assessed by a modified version of the Appraisal Tendency Scale (Smith & Ellsworth, 1985) and the Positive and Negative Affect Schedule-Expanded (PANAS-X; Watson & Clark, 1994). The PANAS-X consists of 60 items to assess higher order scales, Positive Affect and Negative Affect, and 11 specific affects: Fear, Sadness, Guilt, Hostility, Shyness, Fatigue, Surprise, Joviality, Self-assurance, Attentiveness, and Serenity. When oriented to emotions during the past week, internal consistencies for the higher order scales have been reported at .86-.90 (Watson & Clark, 1994). The original 10 items for both the Positive Affect and Negative Affect scales were included along with a selection of items from the Basic Negative Emotions Scales (items related to Fear, Hostility, Guilt, and Sadness) and from the Basic Positive Emotions Scales (items related to Joviality, Self-Assurance, and Attentiveness). Each

item (e.g., "excited") was responded to on a Likert scale from 1 = *very slightly or not at all* to 5 = *extremely*. Participants were anchored to thinking about the scenario and indicating how much they would feel each item.

The Appraisal Tendency Scale assessed the unpleasantness/pleasantness of the situation, the effort they anticipated expending, the certainty of an outcome, and their perception of control. Each question (e.g., "how unpleasant or pleasant would it be to be in this situation?") was responded to on an 11-point Likert scale. Depending on the item, the available scale ranges from -5 = *unpleasant* to 5 = *pleasant,* 1 = *not at all* to 11 = *extremely*, -5 = *unenjoyable* to 5 = *enjoyable*, and -5 = *divert attention* to 5 = *devote attention*.

Challenge and threat appraisals were assessed by items from the Appraisal Tendency Scale and the PANAS-X. The items selected were based on threat and challenge conceptualization outlined previously. Items from the Appraisal Tendency Scale are reflective of challenge and fear as described by Smith and Ellsworth (1985). Items selected from the PANAS-X (Watson & Clark, 2004) reflect items describing threat and challenge on the Appraisal of Life Events (Ferguson et al., 1999) and Lazarus and Folkman's description of threat and challenge emotions.

ATS Assessment of Threat and Challenge. Items 1 (pleasantness of being in the situation), 3 (expected exertion), 4 (ability to influence the situation), 11 (anticipated effort), and 13 (devote or divert attention to situation) from the Appraisal Tendency Scale were initially proposed for assessing challenge appraisal. Items 1 (reverse scored), 3 (reverse scored), 6 (try to shut the event out - reverse scored), 12 (circumstances beyond anyone's control controlling the situation), and 14 (uncertainty about what would be

happening) were proposed for assessing threat appraisal. Exploratory Factor Analysis (EFA) was conducted with selected items using Principal Axis Factoring (PAF). Oblique (direct oblim) rotation was conducted in which only one factor was extracted. This resulted in dropping item 1 (unpleasantness/"pleasantness"). Since pleasantness and unpleasantness is also assessed by items from the PANAS-X, item 1 was dropped from the ATS measure of challenge and threat leaving 4 items for each. Internal consistency for the 4-item appraisal tendency measure of challenge was acceptable (α = .69). The ATS threat scale, however, demonstrated very poor internal consistency (α = .18). Nunnally (1967) claims that for early stage research of a hypothesized measure of a construct, modest reliability (alpha coefficients of .60 or .50) and a correlation of .2 suffices. As the ATS threat index demonstrated very poor internal consistency, the ATS measure of threat and challenge was not used independently for analysis.

PANAS-X Assessment of Challenge and Threat. The following items from the PANAS-X (Watson & Clark, 1994) were used to assess challenge: "inspired", "strong", "alert", "active", "enthusiastic", "determined", "interested", and "attentive". Internal consistency for this scale was good (α = .83). The following items from the PANAS-X were used to describe threat: "afraid", "angry", "nervous", "shaky", "scared", "alone", "dissatisfied with self", and "frightened". (Appendix E). Internal consistency was good (α = .85). As both threat and challenge as measured by the PANAS-X demonstrated adequate internal consistency, these measures were used for primary aims analysis.

Composite Measure of Challenge and Threat. Correlation analyses were used to explore the relationship between the two indices of threat and challenge. The PANAS-X and ATS threat indices were significantly related ($r = .28$, $p = .005$). The PANAS-X

and ATS challenge indices were significantly related ($r = .43$, $p < .001$). ATS threat and ATS challenge were significantly negatively correlated ($r = -.51$, $p = .001$). PANAS-X threat and challenge were not related. PANAS-X challenge was negatively related to ATS threat ($r = -.26$, $p = .008$). PANAS-X threat was not related to ATS challenge. Because indices of threat and challenge were significantly correlated above .2 (the cutoff recommended by Nunnally for exploratory scale construction), indices were combined to yield a composite threat scale and a composite challenge scale. Prior to constructing challenge and threat scales, items from the PANAS-X and ATS were z-scored to standardize the scales. The composite challenge scale (n = 12) yielded an alpha of .84, whereas the composite threat scale (n = 12) yielded an alpha of .76.

State Coping. State coping was assessed with items from the Brief COPE (Carver, 1997) and the Emotional Approach Coping Scale (Stanton, Kirk, Cameron, Danoff-Burg, 2000). The Brief COPE presents 14 scales assessing different coping dimensions: 1) acceptance, 2) denial, 3) humor, 4) planning, 5) religion, 6) self-blame, 7) self-distraction, 8) venting, 9) active coping, 10) behavioral disengagement, 11) positive reframing, 12) substance use, 13) using emotional support, and 14) using instrumental support. The COPE was developed based on theoretical models, including Lazarus and Folkman's transactional model of stress, 1984. Alpha reliabilities of the subscales all meet or exceed .50 (Carver, 1997). The Brief COPE, like the COPE, is intended to be used either in its entirety or by selecting scales of interest. It can also be used as a retrospective, situational measure, a concurrent, situational measure, or a dispositional measure (Carver, 1997).

To assess state coping, each statement (e.g., "I take action to try to make the situation better") was responded to on a four-point scale from 0 = *I don't do this at all* to 3 = *I do this a lot.* The Emotional Approach Coping Scale (Stanton et al., 2000) consists of 4-items related to emotional processing (e.g. "I take time to figure out what I'm really feeling") and 4-items related to emotional expression (e.g. "I allow myself to express my emotions"). Two items from each scale were responded to on the same 4-point scale as the Brief COPE items. The EAC has demonstrated good internal consistency and predictive validity (Stanton et al., 2000). Similar to the Brief COPE, participants can be oriented different time frames or situations on the EAC.

Participants were instructed to "indicate the extent to which you would do each of the following when trying to cope with the effects of the scenario." State coping categories were informed by prior research (Schnider et al., 2007). Problem-focused coping was comprised of the Brief COPE subscales of "Planning" "Active Coping" and "Instrumental Support". Internal inconsistency for this scale was acceptable ($\alpha = .69$). Active emotion-focused coping was comprised of the subscales "Acceptance", "Humor", "Emotional expression", "Emotional Processing", "Emotional Support", and "Positive Reframing". Internal consistency for this scale was good ($\alpha = .81$).Avoidant coping was defined by subscales of "Denial", "Self-blame", "Self-distraction", "Behavioral disengagement", and "Substance use". Internal consistency for this scale was acceptable ($\alpha = .67$) (see Appendix F for individual scale items).

As an exploratory aim, coping items were also coded as pre-reflective and reflective coping (see Appendix F). Pre-reflective coping stemmed from the idea of pre-reflective self-awareness in which the self is experienced or lived through as the subject

of awareness (Zahavi, 2005). Reflective-coping stemmed from the idea of reflective self-awareness in which the self is reflected upon and objectified (Zahavi, 2005). More specifically, pre-reflective coping was distinguished from reflective coping by viewing coping as doing or acting in the reality of a situation (pre-reflective; e.g. "I look for something good in what's happening") vs. coping as planning or altering perspective (reflective; e.g. "I try to see it in a different light, to make it seem more positive."). In the example of "I look for something good in what's happening", this is distinguished from coping as planning or altering perspective in that looking for something good that is happening can be an automatic reaction rather than a cognitive effort to stop and evaluate what might be happening in the situation to see something good in it. "I try to see it in a different light, to make it seem more positive", however, implies that the situation has been evaluated and a conscious effort is being made to change the experience with the situation. Pre-reflective and reflective coping scales demonstrated reliability alphas of .77 and .63, respectively. It was hypothesized that challenge would be more strongly related to pre-reflective coping whereas threat would be more strongly related to reflective coping.

Statistical Analysis

All of the analyses were conducted using SPSS version 17 .0 (SPSS Inc., 2008). Descriptive statistics were calculated for demographic variables and self-report measures. Pearson's correlations for continuous data were done to identify significant relationships between study variables (e.g. PTSD symptom severity, appraisal, and coping). Multiple regression was used to test the relationships outlined in research aims 1 – 3. Bonferroni adjustments were used to control Type I Error for the analysis of pre-reflective/reflective

coping and appraisal (i.e. .05/8 comparisons or $p < .006$). Mediation was tested using Baron and Kenny's (1986) steps for mediation. That is, (1) independent variable (IV; for example, PTSD symptoms) needed to be related to: the dependent variable (DV; for example, state coping), (2) the Mediator variable (MED; for example, appraisal), and the MED and DV needed to be related (MED—DV; for example, appraisal and state coping).

RESULTS

Descriptive statistics for the sample are shown in Table 1. The sample was predominantly male (93% male; n = 114). Participants' age ranged from 19 to 69 with a mean of 33.6 years (*SD* =8.12*)*. Half of the participants identified themselves as Hispanic. Thirty-seven percent identified as non-Hispanic Caucasian, 4% African American, 3% Asian American, 2% Native American, and 4% other or mixed ethnicity. Most of the participants had a technical or vocational certificate for education. Participants had been in Fire Service an average of 8.4 years (*SD* = 6.92*)*. Based on the symptom severity categories outlined by Foa et al. (1997) for the PDS, 31.7% (n = 39) had no PTSD symptoms, 51.2% (n = 63) had mild symptoms, 11.4% (n = 14) had moderate symptoms, 4.9% (n = 6) had moderate to severe symptoms, and .8% (n = 1) had severe symptoms. Two participants screened positive for PTSD. The relationships between demographic variables and outcome variables are displayed in Table 2.

Relationship between Appraisal and State Coping

Challenge (composite) was significantly related to problem-focused coping (r = .40, $p < .001$) and active emotion-focused coping (r = .21, p = .034). It was not related to avoidant coping. Threat (composite) was positively related to avoidant coping (r = .35, $p < .001$). It was not related to problem-focused coping, but a trend was found between threat (composite) and active emotion-focused coping (r = .17, p = .094). Challenge (PANAS-X) was positively related to problem-focused coping (r = .31, p = .002). It was not related to avoidant coping, although a trend was found between challenge (PANAS-X) and active emotion-focused coping (r = .18, p = .073). Threat (PANAS-X) was positively related to avoidant coping (r = .35, $p < .001$). It was not related to problem-

focused coping, although a trend was found for active emotion-focused coping (r = .18, p = .071).

Regression Analysis Using Composite Threat and Challenge.

When using the composite measures, challenge (β = .39, p < .001) was related to problem-focused coping (R^2 = .16, F(4, 94) = 4.02, p = .005). Challenge (β = .21, p = .034), threat (β = .21, p =.034), and age (β = -.24, p =.016) were related to active emotion-focused coping (R^2 = .18 F(4,94) = 4.81, p = .001). Threat (β = .40, p < .001) and age (β = -.27, p =.004) were related to avoidant coping (R^2 = .27, F(4, 94) = 8.36, p < .001). A trend was found for challenge (β = .17, p = .067).

Regression Analysis Using PANAS-X Threat and Challenge

When using the PANAS-X measures, challenge (β = .31, p = .003) was related to problem-focused coping (R^2 = .10, F(4,94) = 2.49, p = .049). Threat (β = .20, p =.044) and age (β = -.25, p =.013) were related to active emotion-focused coping (R^2 = .17, F(4,94) = 4.65, p = .002). Trends were found for challenge (β = .18, p = .072) and gender (β = .-.16, p = .099). Threat (β = .38, p <.001) and age (β = -.27, p = .005) was related to avoidant coping (R^2 = .26, F(4,94) = 7.86, p < .001).

In summary, both the composite and PANAS-X measure of challenge were positively related to problem-focused coping and both the composite and PANAS-X measure of threat were positively related to avoidant coping. The composite measures of threat and challenge were both positively related to active emotion-focused coping. The PANAS-X measure of threat was significantly related to active emotion-focused coping, although a trend was found for challenge.

Exploratory Aim 1 Results

Consistent with the hypothesis, pre-reflective coping was significantly related to both the composite measure of challenge (r = .33, p = .001) and the PANAS-X measure of challenge (r = .27, p = .006). A trend was found between pre-reflective coping and the PANAS-X threat measure (r = .17, p = .086). Reflective coping was not related to either measure of challenge. It was, however, related to both the composite measure of threat (r = .29, p = .002) and the PANAS-X measure of threat (r = .30, p = .002).

Regression Analysis Using Composite Threat and Challenge.

Challenge (β = .34, p < .001), threat (β = .20, p = .038), and age (β = -.20, p = .035) were related to pre-reflective coping (R^2 = .21, F(4,94) = 7.972, p = .001). However, using the Bonferroni corrected p-value of .006, only challenge remained significantly related. Threat (β = .33, p = .001) and age (β = -.23, p = .020) were related to reflective coping (R^2 = .19, F(4, 94) = 5.20, p =.001). Again, using the Bonferroni corrected p-value of .006, only threat remained significantly related.

Regression Analysis Using PANAS-X Threat and Challenge

Challenge (β = .29, p = .003), threat (β = .19, p = .050), and age (β = -.22, p = .024) were related to pre-reflective coping (R^2 = .19, F(4, 94) = 5.35, p = .001). Threat (β = .33, p = .001) and age (β = -.22, p = .024) were related to reflective coping (R^2 = .19, F(4, 94) = 5.16, p= .001). However, again using the Bonferroni corrected p of .006, only challenge remained significantly related to pre-reflective coping and only threat remained significantly related to reflective coping.

Research Aim 1 Results

The first primary aim of this proposal was to explore the relationship between (a) PTSD screen and state coping and (b) the relationship between PTSD symptoms and state

coping. It was hypothesized that individuals screening positive for PTSD would demonstrate higher levels of avoidant coping and lower levels of problem-focused and active emotion-focused coping compared to those who do not meet for PTSD. As only 2 people in the current sample met all DSM-IV criteria for PTSD using the PDS, independent samples t-tests based on PTSD screen were not conducted. It was also hypothesized that PTSD symptom severity level would be positively related to avoidant coping and negatively related to problem-focused and active emotion-focused coping, with greater symptom levels being related to more or less of each form of coping, respectively. PTSD symptom severity was not significantly related to state coping (see Table 3) or the proposed control variables related to fire service (see Table 2).

Research Aim 2 Results

The second aim of this proposal was to explore (a) the relationship between PTSD screen and appraisal and (b) the relationship between PTSD symptoms and appraisal. It was hypothesized that individuals screening positive for PTSD would demonstrate higher levels of threat appraisal compared to those who did not meet for PTSD. Individuals who did not screen positive for PTSD were expected to demonstrate higher levels of challenge appraisal compared to those who did screen positive for PTSD. Independent means t-tests were not used to test this hypothesis, however, because only 2 participants in the sample screened positive for PTSD. PTSD symptom severity level was also not significantly related to challenge or threat appraisal.

Given the limited PTSD in the sample, post hoc analysis for primary aim 2 included examining the potential relationship between subscales of PTSD symptoms and functional impairment with appraisal and coping. Functional impairment from PTSD reflects the extent to which symptoms of PTSD are interfering with life domains such as

work, family, and personal relationships. Reexperiencing, avoidance, and arousal subscales were not significantly related to appraisal or state coping scales (see Table 3). Functional impairment, however, was significantly related to the composite measure of threat appraisal ($r = .39$, $p < .001$), the PANAS-X threat appraisal measure ($r = .33$, $p = .001$), and state avoidant coping ($r = .30$, $p = .004$).

Research Aim 3 Results

The third aim of this proposal was to determine whether challenge and threat appraisals mediate the relationship between PTSD screen/PTSD symptoms and state coping. It was hypothesized that the relationship between PTSD symptom severity level and avoidant coping would be mediated by threat appraisal whereas the relationship between PTSD symptom severity level and problem-focused and active emotion-focused coping would be mediated by challenge. To test mediation using the Baron and Kenny (1986) method, PTSD symptoms needed to be related to both (1) state coping (DV) and (2) appraisal (MED), and appraisal and state coping needed to be related (MED – DV). The Baron and Kenny (1986) steps for testing mediation were not carried out beyond the first step because PTSD symptoms were not related to appraisal or state coping.

Post hoc Mediation Model. Because functional impairment was significantly related to the composite measure of threat appraisal ($r = .39$, $p < .001$), the PANAS-X measure of threat appraisal ($r = .33$, $p = .002$), and state avoidant coping ($r = .30$, $p = .004$), mediation was tested. Mediation was first examined using the composite measure of threat. The indirect effect was .14, yielding 47% mediation between functional impairment and avoidant coping through threat appraisal (Sobel's $z = 2.62$, $p = .009$). This mediation model was also examined through the PANAS-X index of threat, which yielded an indirect effect of .12 and 40% mediation (Sobel's $z = 2.54$, $p = .011$).

DISCUSSION

The purpose of this study was to explore the relationships between PTSD (screen and symptoms), appraisal (threat and challenge), and three forms of coping important to threat, challenge, and PTSD (problem-focused, active emotion-focused, and avoidant coping). This was achieved through a sample of firefighters presented with a disaster scenario.

Challenge and Threat Appraisal

Although not a primary aim, the scale construction for threat and challenge appraisal merits some discussion. Appraisal is central to the widely used transactional model of stress and coping introduced by Lazarus and Folkman (1984). Much of the literature on challenge and threat appraisals has been limited by assessment of threat and challenge. Therefore, one goal of this study was to explore two different indices of threat and challenge by drawing from the PANAS-X (Watson & Clark, 1994) and the Appraisal Tendency Scale (ATS; Smith & Ellsworth, 1985).

This study found support for assessing threat and challenge through the PANAS-X (Watson & Clark, 1994) and by combining PANAS-X items with items from the Appraisal Tendency Scale (Smith & Ellsworth, 1985). Although work needs to be done to establish a reliable threat measure using the ATS, this study was able to incorporate ATS items into a composite measure. Challenge appraisal, assessed both by the composite measure and by the PANAS-X, was positively related to problem-focused coping. The trend between the composite measure of challenge and avoidant coping was unexpected. However, when running the regression analysis using a pared down version of avoidant coping (i.e. eliminating items related to drug or alcohol use), challenge was not related to avoidant coping (results not shown). Threat appraisal, assessed both by the

composite measure and by the PANAS-X, was positively related to avoidant coping. The findings between active emotion-focused coping and appraisal were unexpected. Challenge and threat appraisal exhibited seemingly equal relationships. It is possible that the active emotion-focused coping scale was not defined well enough to differentially relate to appraisal. It is also possible that there is not a clear relationship between threat and challenge appraisals and active emotion-focused coping. Lazarus and Folkman's (1984) transactional model of stress and coping does not provide information on these relationships. The finding of age being negatively related to coping was also not anticipated. This could be an artifact of the scenario presented in this study. Perhaps older firefighters in this sample had less training in chemical spill response than younger firefighters; unfortunately, the data do not allow a clear explanation.

When comparing the composite measures of threat and challenge to the PANAS-X measures, there were not significant differences in the relationship between appraisal and coping. This might imply that one could simply use the PANAS-X measures of threat and challenge and drop the ATS component. However, the composite measure of threat and challenge could offer some advantage in future studies wishing to differentiate between challenge and threat appraisal as it was the only measure with adequate internal consistency to display a possible negative relationship between threat and challenge appraisal. The literature on threat and challenge appraisal is mixed on the relationship between threat and challenge appraisal. Skinner and Brewer (2002) found a significant negative relationship between challenge and threat appraisals. Gaab, Rohleder, Nater, and Ehlert (2005) found a significant positive relationship between threat and challenge appraisal. Although this study did not find a significant difference in predictive utility

between the PANAS-X and the composite measure of appraisal, it seems important to continue to refine a composite measure to better operationalize the constructs of threat and challenge appraisals as defined by Lazarus and Folkman's (1984) transactional model of stress and coping.

A composite measure drawing from both a cognitive and affective perspective promotes the transactional model of stress and coping by reverting back to the essential definition of appraisal (i.e. that it marks the personal significance and meaning of a situation). If as Lazarus and Folkman (1984) assert, people are constantly interacting with the environment and deriving meaning from it, then limiting our assessment of challenge and threat appraisal to either their cognitive or affective component seems inadequate. Consequently, one goal of this study was to incorporate the idea of enactive appraisal (i.e. the view that emotion and cognition are functions of the same system working to provide a sense of knowing in the environment; see Colombetti, 2007; Northoff, 2008) into the assessment of threat and challenge appraisal. It is under this theoretical framework that the exploratory aim of looking at the relationship between appraisal and reflective/pre-reflective coping emerged.

Although preliminary, this study found support for a stronger positive relationship between challenge and pre-reflective coping than threat. A positive relationship between threat appraisal and reflective coping was also found. The relationship between pre-reflective coping and challenge appraisal can be understood by revisiting the distinction between pre-reflective and reflective processes. Pre-reflective processes have been described as "knowing how", whereas reflective processes have been described as "knowing that" (Krueger, 2009). Pre-reflective processes create fluid, continually

evolving adjustments between person and environment (Krueger, 2009). This expert interaction with the environment can be thought of as almost an instinctual awareness, which means that it transcends cognitive awareness (Krueger, 2009). This conceptualization of pre-reflective consciousness is consistent with the notion of first order consciousness in which the subject is immediately engaged in the flow of experience (see Petitmengin & Bitbol, 2009, for discussion) Within the transactional model of stress and coping, pre-reflective coping allows the person to interact with the environment without having to engage in substantial cognitive effort. This "at homeness" with the situation corresponds with challenge appraisals involving a degree of certainty in the situation, a confidence in responding, and the positive emotions which might facilitate a broader understanding of an environment and the body's place in it.

Reflective coping, however, may correspond more to threat appraisals because a threat appraisal implies the need to distance oneself from or escape a situation instead of just being able to act in it. Reality must be renegotiated in a sense. The lack of "knowing how" and just "knowing that" implies some uncertainty and insecurity in one's ability to respond immediately and effectively in the situation. Krueger (2009) describes that unlike pre-reflective coping in which a body is at home in an environment and has no need to stop, think, and observe, reflective coping implies the need to analyze an environment. This is similar to the idea of second-order consciousness in which the self is distanced from the immediate experience through the act of observation and reflection (Petitmengin & Bitbol, 2009). Petitmengin and Bitbol (2009) however, caution against equating reflective consciousness with self-objectification and claim that reflection and introspection can actually bring one closer to the experience with the environment.

Perhaps in the case of threat appraisal, reflective coping may actually be adaptive to the extent that it helps someone manage an internal state (e.g. negative affect). These relationships warrant further exploration in research.

Relationship between PTSD, Appraisal, and Coping

Although statistically significant relationships between PTSD and appraisal and PTSD and coping were not found in this study, the significant mediation found between functional impairment from PTSD symptoms and avoidant coping through threat appraisal is worth consideration. While post hoc, this result is consistent with the study hypothesis regarding the relationship between PTSD, threat appraisal, and avoidant coping. This suggests that the greater interference or distress a person is experiencing from PTSD symptoms, the more likely that person might be to experience threat appraisals and exhibit avoidant coping (e.g. behavioral disengagement).

This may in part be due to negative affect. Threat appraisal was comprised largely of indicators of negative affect in this study. The trend between threat appraisal and the PTSD symptom subscale of arousal was not unexpected given the arousal items on the PDS (e.g.,"Feeling emotionally upset when you were reminded of the traumatic event (for example, feeling scared, angry, sad, guilty, etc."). Similarly, threat appraisal may be related to functional impairment because of negative affect, but it may also be related because someone experiencing functional impairment in domains such as life or work may be more prone to negative self-appraisals and feel less capable of handling situations. Research by Skinner and Brewer (2002) found threat appraisal to be negatively related to coping expectancy (i.e. anticipated coping ability and expected level of performance). Perhaps this is similar to the negative feedback loop proposed by Ehlers and Clark (2000); that is, functional impairment from PTSD symptoms may increase the

likelihood of threat appraisals and decrease coping expectancy (and thereby maintain functional impairment). However, because this finding was post hoc, more research must be conducted between these relationships.

Clinical Research Implications

This study highlights the importance of appraisal. Appraisal was significantly related to state coping. It also mediated the relationship between functional impairment and avoidant coping. Helping those experiencing functional impairment from PTSD to reappraise a situation as a challenge may decrease the likelihood of engaging in avoidant coping. Functional impairment is clearly important for emergency responders whose performance during a call could have life or death implications for themselves or others. Laposa and Alden (2003) corroborate the importance of functional impairment at work among emergency responders. Many emergency responders may not meet DSM-IV criteria for PTSD yet still experience functional impairment from PTSD symptoms.

One of the proposed changes to the DSM-V captures the experience of emergency responders. A Criterion A1 event may be expanded to include repeated exposure to aversive details of events such as picking up body parts (APA, 2010). However, another proposed change to PTSD diagnosis in the DSM-V is to eliminate Criterion A2 (reaction of fear, helplessness, or horror). A2 may be dropped in an effort to not blur the distinction between stressful events and traumatic events. Appraisal will be covered in symptom cluster D under changes in cognition or mood including "persistent and exaggerated negative expectations about one's self, others, or the world" and "a pervasive negative emotional state (fear, horror, anger, guilt, or shame)" (D4; APA, 2010). The addition to Criterion D seems to address much of the concern in the literature regarding emotions previously listed under A2 and fits with some aspects of the cognitive model of PTSD

(Clark & Ehlers, 2000). However, given the predictive utility of A2 demonstrated in other studies (Brewin, Andrews, & Valentine, 2000; Kaysen, Rosen, Bowman & Resick, 2010) and the inherent subjectivity in defining what constitutes trauma, it seems likely that many will present with multiple symptoms of PTSD and functional impairment from PTSD symptoms, yet not qualify for a diagnosis of PTSD only because of a new Criterion A. Perhaps the potential DSM-V diagnosis of Other Trauma or Stress-Related Disorder will capture the experience of those who cannot tie their symptoms to one specific DSM-V defined traumatic event, yet still exhibit PTSD symptoms and functional impairment from them.

Regardless of changes that occur in diagnostic criteria for PTSD in the DSM-V, the importance of appraisal in PTSD research remains and will likely continue to be incorporated into understanding PTSD symptomatology. The neuroendrocrine response associated with stress, for example, can aid in understanding hyperarousal. Sapolsky (2007) suggests that extended exposure to glucocorticoids makes synapses more excitable in the amygdala and this may help explain how someone can experience hyperarousal without immediately being able to link it to a specific cognition. Neuroendocrine response is one area of overlap between studies of PTSD symptoms and studies of threat and challenge appraisal. Understanding stress response and characterizing patterns of stress response occurring in those with PTSD symptoms may enhance our diagnostic efforts concerning PTSD.

Implications for Fire Service

Clinicians serving emergency responders and fire service administrators know the importance of stress research. The structure of fire service provides good opportunities for stress management education. Firefighters are accustomed to refresher trainings. Fire

service currently does not have a nation-wide policy on stress training during fire service academy (Ron Tapscott, personal communication, July 2011). Drills and vignettes designed to increase skill in responding to emergencies could easily include a component to assess appraisal by asking firefighters questions from the PANAS-X and the Appraisal Tendency Scale as well as taking physiological readings. By helping firefighters to see how the skills they have acquired apply to new situations, firefighters may feel better equipped to handle emergencies and more likely to experience challenge appraisals. The hierarchical structure of fire service also provides an opportunity for leadership in stress management. Captains play an important role in both assuring that the crew responds effectively to an emergency and in recognizing signs of distress among the crew. Training captains on the importance of appraisal and stress response may be a natural place to start in the absence of department-wide training.

Limitations

This study has several shortcomings. First, although participants entered the study with a pre-existing level of PTSD symptoms, the design was cross-sectional. Ideally, a longitudinal design would assess appraisal tendencies for various firefighter-related stressful situations before firefighters leave training academy and then assess them throughout their first few years of fire service along with PTSD symptoms and functional impairment. Second, the study was underpowered for looking at the relationship between PTSD symptoms, appraisal, and coping because of the limited PTSD in the sample. PTSD symptom levels may have been misrepresented in the study because the PDS was anchored to a work-specific event and not lifetime. Future research should consider using the PDS for work-specific and lifetime events. Using the Clinician Administered PTSD Scale (Blake et al., 1998) would also be important for diagnosing PTSD instead of just

screening for it. Third, the finding of mediation using functional impairment from PTSD symptoms, threat appraisal, and avoidant coping, while consistent with hypotheses for PTSD symptom severity, threat appraisal, and avoidant coping, was post hoc. This proposed mediation model must be tested in future studies. Fourth, although the composite measures of threat and challenge demonstrated good internal consistency, the ATS measure of threat needs considerable work before it could be used as an index of threat by itself. The composite measure of threat and challenge needs to be compared with other assessments of threat and challenge appraisals (e.g. Appraisal of Life Events, Ferguson, Matthews, & Cox, 1999; Stress Appraisal Measure, Peacock & Wong, 1990**)** for predictive utility and psychometrics and then validated in other samples.

Finally, the relationship between challenge appraisal and pre-reflective coping and between threat appraisal and reflective coping should be considered exploratory. Some may argue that coping is inherently reflective given that coping is viewed as an attempt to alter or manage the situation. The Brief COPE was not designed to assess pre-reflective and reflective coping and it is therefore possible that there are pre-reflective and reflective coping efforts occurring within both threat and challenge appraisals that are not reflected by items in the Brief COPE. For example, a pre-reflective coping item for threat could be "I turn away from the situation" or "I focus on the potential harm of the situation". Also, some may argue that in light of the introduction of enactive appraisal into the study of threat and challenge and pre-reflective and reflective coping, it would have been better to combine appraisal and coping into one composite measure. This was not done because pre-reflective and reflective coping conceptualization was preliminary.

Conclusion

Despite these limitations, this study contributes to the literature on stress and coping by attempting to provide a synthesis of existing assessments of threat and challenge appraisal and finding support for a composite measure that uses both a cognitive and affective perspective. Clinical psychology may benefit from incorporating literature on enactive appraisal into stress research. Concerning the role that appraisal plays in PTSD, studying appraisal from an enactive perspective may yield valuable information as the field continues to refine diagnostic assessment of PTSD and understand its trajectories. Although these relationships and processes are not easily studied, longitudinal research such as daily diary methods may improve our conceptualization of PTSD symptoms, appraisal, and coping. Particularly for emergency responders or others likely to face repeated exposure to potentially traumatic events, interventions aimed at addressing appraisal may yield powerful benefits in both situation-specific coping and long-term adjustment.

REFERENCES

Alonzo, A.A. (2000). The experience of chronic illness and post-traumatic stress disorder: the consequences of cumulative adversity. *Social Science & Medicine, 50*, 1475-1484. doi: 10.1016/S0277-9536(99)00399-8.

American Psychiatric Association. (2000). *Diagnostic and statistical manual of mental disorders (4th ed., Text Revision)*. Washington, DC.

American Psychiatric Association Official DSM-5 Development Website (2010). Retrieved on September 4, 2011 from: http://www.dsm5.org/Pages/Default.aspx.

Andrews, B., Brewin, C.R., Rose, S., & Kirk, M. (2000). Predicting PTSD symptoms in victims of violent crime: The role of shame, anger, and childhood abuse. *Journal of Abnormal Psychology, 109,* 69-73. doi: 10.1037//0021-843X.1M.I.69.

Arnold, M. (1960). *Emotion and Personality.* New York: Columbia University Press.

Baron, R.M., & Kenny, D.A. (1986). The moderator-mediator variable distinction in social psychological research: Conceptual, strategic, and statistical considerations. *Journal of Personality and Social Psychology, 51,* (6), 1173-1182. doi: 10.1037/0022-3514.51.6.1173.

Beaton, R. D., & Murphy, S. A. (1993). Sources of occupational stress among firefighter/EMTs and firefighter/paramedics and correlations with job-related outcomes. *Prehospital and Disaster Medicine, 8,* 140 – 150.

Beaton, R. D., Murphy, S. A., Johnson, C., Pike, K., &Corneil, W. (1998). Exposure to duty-related incident stressors in urban firefighters and paramedics. *Journal of Traumatic Stress, 11,* 821 – 828. doi: 10.1023/A:1024461920456.

Bedard-Gilligan & L.A. Zoellner, L.A. (2008). The utility of the A1 and A2 criteria in the diagnosis of PTSD. *Behaviour Research and Therapy,46*, (9), 1062–1069. doi:

10.1016/j.brat.2008.06.009.

Berntsen, D., & Rubin, D.C. (2007). When a trauma becomes a key to identity: Enhanced integration of trauma memories predicts posttraumatic stress disorder symptoms. *Applied Cognitive Psychology, 21,* 417-431. doi: 10.1002/acp.1290.

Blake, D. D., Weathers, F. W., Nagy, L. M., Kaloupek, D. G., Charney, D. S., & Keane, T. M. (1998). Clinician-Administered PTSD Scale for DSM-IV. Boston: National Center for Posttraumatic Stress Disorder.

Brewin, C.R., Andrews, B., & Rose, S. (2000). Fear, helplessness, and horror in posttraumatic stress disorder: Investigating the DSM-IV criterion A-2 in victims of violent crime. *Journal of Traumatic Stress, 13,* 499-509. doi: 10.1023/A:1007741526169.

Brewin, C.R., Andrews, B., & Valentine, J.D. (2000). Meta-analysis of risk factors for posttraumatic stress disorder in trauma-exposed adults. *Journal of Consulting and Clinical Psychology, 65* (8), 748-766. doi: 10.1037//0022-006X.68.5.748.

Brown, J., Mulhern, G., &Joseph, S.(2002). Incident-related stressors, locus of control, coping and psychological distress among firefighters in Northern Ireland. *Journal of Traumatic Stress*, *15*,161-168. doi:10.1023/A:1014816309959.

Bryant, R.A., & Guthrie, R.M. (2005). Maladaptive appraisals as a risk factor for posttraumatic stress: a study of trainee firefighters. *Psychological Science, 16,* 749-752. doi:10.1111/j.1467-9280.2005.01608.x

Carver, C. S. (1997). You want to measure coping but your protocol's too long: Consider the Brief COPE. *International Journal of Behavioral Medicine, 4,* 92–100. doi: 10.1207/s15327558ijbm0401_6.

Colombetti, G. (2007). 'Enactive appraisal'. *Phenomenology and the Cognitive Sciences, 6* (4).527–546. doi: 10.1007/s11097-007-9077-8.

Corneil, W., Beaton R.D., Murphy, S.A., Johnson, L.C., & Pike, K. (1999). Exposure to traumatic incidents and prevalence of posttraumatic stress symptomology in urban fire fighters in two countries. *Journal of Occupational Health Psychology, 4,* 131-141. doi: 10.1037/1076-8998.4.2.131.

Coyne, J.C., & Racioppo, M.W. (2000). Never the twain shall meet? Closing the gap between coping research and clinical intervention research. *American Psychologist, 55,* 655-664. doi: 10.1037/0003-066X.55.6.655.

Creamer, M., McFarlane, A. C., & Burgess, P. (2005). Psychopathology following trauma: The role of subjective experience. *Journal of Affective Disorders*, *86*, 175-182. doi: 10.1016/j.jad.2005.01.015.

Dohrenwend, B. S., &Dohrenwend, B. P. (Eds.). (1974).*Stress life events: Their nature and*

effects. New York: John Wiley & Sons.

Dougall, A.L., Ursano, R.J. ,Posluszny, D.M., Fullerton, C.S., & Baum, A. (2001). Predictors of posttraumatic stress among victims of motor vehicle accidents. *Psychosomatic Medicine, 63,* 402-411.

Drach-Zahavy, A. &Erez, M. (2002). Challenge versus threat effects on the goal-performance relationship. *Organizational Behavior and Human Decision Processes, 88* (2), 667-682. doi: 10.1016/S0749-5978(02)00004-3

Dunmore, E., Clark, D.M., & Ehlers, A. (1999). Cognitive factors involved in the onset and maintenance of posttraumatic stress disorder (PTSD) after physical or sexual

assault. *Behaviour Research and Therapy, 37,* 809–829. doi: 10.1016/S0005-7967(98)00181-8.

Ehlers, A., & Clark, D. M. (2000). A cognitive model of posttraumatic stress disorder. *Behaviour Research and Therapy, 38,* 319–345. doi: 10.1016/S0005-7967(99)00123-0.

Ehlers, A., Mayou, R.A., & Bryant, B. (1998). Psychological predictors of chronic PTSD after motor vehicle accidents. *Journal of Abnormal Psychology, 107,* 508–519. doi: 10.1037/0021-843X.107.3.508.

Ehring, T., & Quack, D. (2010). Emotion regulation difficulties in trauma survivors: The role of trauma type and PTSD symptom severity. *Behavior Therapy, 41*, 587-598. doi: 10.1016/j.beth.2010.04.004.

Fairbank, J.A., Hansen, D.J., & Fitterling, J.M. (1991). Patterns of appraisal and coping across different stressor conditions among prisoners of war with and without Posttraumatic Stress Disorder. *Journal of Consulting and Clinical Psychology, 59, 2*, 274-281. doi: 10.1037/0022-006X.59.2.274.

Ferguson, E., Matthews, G., & Cox, T. (1999). The appraisal of life events (ALE) scale: Reliability and validity. *British Journal of Health Psychology, 4*, 97-116. doi: 10.1348/135910799168506.

Foa, E. B., Cashman, L., Jaycox, L. H., & Perry, K. (1997). The validation of a self-report measure of PTSD: The Posttraumatic Diagnostic Scale (PDS). *Psychological Assessment, 9,* 445–451. doi: 10.1093/occmed/kqn062.

Foa, E. B., Ehlers, A., Clark, D. M., Tolin, D. F., &Orsillo, S.M. (1999). The Posttraumatic Cognitions Inventory (PTCI): Development and validation.

Psychological Assessment, 11, 303–314.

Foa, E.B. & Kozak, M.J. (1986). Emotional processing of fear: exposure to corrective information. *Psychological Bulletin, 99,* 20-35.

Foa, E. B., & Riggs, D. S. (1993). Post-traumatic stress disorder in rape victims. In J. Oldham, M. B. Riba, & A. Tasman (Eds.), *American psychiatric press review of psychiatry* (Vol. 12, pp. 273–303). Washington, DC: American Psychiatric Press.

Foa, E. B., &Rothbaum, B. O. (1998).*Treating the trauma of rape: Cognitive behavioral therapy for PTSD.* New York, NY: Guilford Press.

Gaab, J., Rohleder, N., Nater, U.M., & Ehlert, U. (2005). Psychological determinants of the cortisol stress response: the role of anticipatory cognitive appraisal. *Psychoneuroendocrinology, 30*, 599-610. doi: 10.1016/j.psyneuen.2005.02.001.

Goenjian, A. K., Walling, D., Steinberg, A. M., Karayan, I., Najarian, L. M., Pynoos, R. (2005).A prospective study of posttraumatic stress and depressive reactions among treated and untreated adolescents 5 years after a catastrophic disaster. *American Journal of Psychiatry,162*(12), 2302-2308. doi: 10.1176/appi.ajp.162.12.2302.

Grey, N., Holmes, E., & Brown, C.R. (2001). Peritraumatic emotional ‘‘hot spots’’ in memory. *Behavioural and Cognitive Psychology, 29*, 367-372. doi: 10.1017/S1352465801003095.

Griffin, M.G., Uhlmansiek, M.H., Resick, P.A., & Mechanic, M.B. (2004). Comparison of the Posttraumatic Stress Disorder Scale versus the Clinician-Administered Posttraumatic Stress Disorder Scale in domestic violence survivors. *Journal of Traumatic Stress, 17 (6)* 497-503.doi: 10.1007/sl0960-004-5798-4.

Hathaway, L.M., Boals, A., & Banks, J.B. (2010). PTSD symptoms and dominant

emotional response to a traumatic event: an examination of DSM-IV Criterion A2. *Anxiety, Stress, & Coping, 23* (1), 119-126. doi: 10.1080/10615800902818771

Hoge, C. W., Castro, C. A., Messer, S. C., McGurk, D., Cotting, D. I., & Koffman, R. L. (2004). Combat duty in Iraq and Afghanistan, mental health problems, and barriers to care. *New England Journal of Medicine, 351*, 13-22. doi: 10.1056/NEJMoa040603.

Kahana, B.*,* & Kahana, E.(1998)*.* Toward a temporal–spatial model of cumulative life stress: Placing late-life stress effects in a life-course perspective*. In* J.Lomranz *(Ed.),* Handbook of aging and mental health: An integrative approach *(pp.* 153–178*).* New York*: Plenum.*

Karam, E. G., Andrews, G., Bromet, E., Kessler, R. C., …(2010).The role of criterion A2 in the DSM-IV diagnosis of posttraumatic stress disorder. *Biological Psychiatry, 68*, 465–473. doi: 10.1016/j.biopsych.2010.04.032.

Kaysen, D., Rosen, G., Bowman, M., & Resick, P. (2010) Duration of exposure and the dose-response model of PTSD. *Journal of Interpersonal Violence, 25,* 63-74.doi: 10.1177/0886260508329131

King, D., Leskin, G., King, L., & Weathers, F. (1998). Confirmatory factor analysis of the clinician-administered PTSD scale: evidence for the dimensionality of posttraumatic stress disorder. *Psychological Assessment*, *10,* 90-96.

Krueger, J.W. (2009). Knowing through the body: the Daodejing and Dewey. *Journal of Chinese Philosophy, 36 (1),* 31-52. doi: 10.1111/j.1540-6253.2008.01503.x.

Lanius, R.A., Vermetten, E., Loewenstein, R.J., Brand, B., Schmahl,, C., Bremner, J.D.,

& Spiegel, D. (2010). Emotion modulation in PTSD: Clinical and neurobiological evidence for a dissociative subtype. *American Journal of Psychiatry, 167,* 640-647. doi: 10.1176/appi.ajp.2009.09081168.

Laposa, J.M., & Alden, L.E. (2003). Posttraumatic stress disorder in the emergency room: Exploration of a cognitive model. *Behaviour Research and Therapy, 41,* 49-65. doi: 10.1016/S0005-7967(01)00123-1.

Lazarus, R.S. (1991). *Emotion and Adaptation.* New York: Oxford University Press.

Lazarus, R. S. (2001). Relational meaning and discrete emotions. In K. R. Scherer, A. Schorr, & T. Johnstone, (Eds.) Appraisal processes in emotion. Oxford: Oxford University Press.

Lazarus, R. S., & Folkman, S. (1984). Stress, appraisal, and coping. New York: Springer.

LeBlanc, V.R., Regehr, C., Jelley, R.B., & Barath, I. (2008) The relationship between coping styles, performance, and responses to stressful scenarios in police recruits. *International Journal of Stress Management, 15* (1) 76-93.doi: 10.1037/1072-5245.15.1.76

Lewis, M. D. (2005). Bridging emotion theory and neurobiology through dynamic systems modelling. *Behavioral and Brain Sciences, 28*(2), 169–194.

Marmar, C.R., Weiss, D.S., Metzler, T.J., & Delucchi, K. (1996). Characteristics of emergency services personnel related to peritraumatic dissociation during critical incident exposure. *American Journal of Psychiatry, 153,* 94-102.

Marshall, G.N., Orland, M., Jaycox, L.H., Foy, D.W., & Belzberg, H. (2002). Development and validation of a modified version of the Peritraumatic Dissociative Experiences Questionnaire. *Psychological Assessment, 14,* 123-134.

doi: 10.1037/1040-3590.14.2.123.

McCarthy, S. (2008). Post-Traumatic Stress Diagnostic Scale (PDS).*Occupational Medicine, 58 (5)*. doi: 10.1093/occmed/kqn062.

Murphy, S. A., Beaton, R. D., Pike, K. C., & Johnson, L. C. (1999). Occupational stressors, stress responses, and alcohol consumption among professional firefighters: A prospective, longitudinal analysis. *International Journal of Stress Management, 6,* 179 – 196. doi: 10.1023/A:1021934725246.

Norris, F.H., Friedman, M.J., Watson, P.J., Byrne, C.M., Diaz, E. & Kaniasty, K. (2002). 60,000 disaster victims speak: Part I. An empirical review of empirical literature, 1981-2001. *Psychiatry, 65*, 207–239.

North, C.S. Tivis, L., McMillen, J.C., Pfefferbaum, B., Cox, J., Spitznagel, E.L., Bunch, K., Schorr, J., & Smith, E.M. (2002). Coping, functioning, and adjustment of rescue workers after the Oklahoma City Bombing. *Journal of Traumatic Stress, 15,* 171-175.

Northoff, G. (2008). Is appraisal 'embodied' and 'embedded?' A neurophysiological investigation of emotions. *Journal of Consciousness Studies, 15,* 68-99.

Nunnally, J.C. (1967). *Psychometric Theory.* New York: McGraw-Hill Book Company.

O'Donnell, M.L., Elliott, P., Wolfgang, B.J., & Creamer, M. (2007). Posttraumatic appraisals in the development and persistence of posttraumatic stress symptoms. *Journal of Traumatic Stress, 20 (2)*, 173-182. doi: 10.1002/jts.20198.

Olff, M., Langeland, W. & Gersons, B. P. (2005). Effects of appraisal and coping on the neuroendocrine response to extreme stress. *Neuroscience and Biobehavioral Reviews*, *29,* 457 –467. doi: :10.1016/j.neubiorev.2004.12.006.

Ozer, E. J., Best, S. R., Lipsey, T. L., & Weiss, D. S. (2003). Predictors of posttraumatic stress disorder and symptoms in adults: A meta-analysis. *Psychological Bulletin, 129,* 52–73. doi: 10.1037/0033-2909.129.1.52.

Ozer, E.J. Best, S.R., Lipsey, T.L., & Weis, D. S. (2008). Predictors of Posttraumatic Stress Disorder and Symptoms in Adults: A Meta-Analysis. *Psychological Trauma: Theory, Research, Practice, and Policy, 1* (1), 3-36. doi: 10.1037/1942-9681.S.1.3

Park, C. L. (2008). Testing the meaning making model of coping with loss. *Journal of Social and Clinical Psychology, 27,* 970–994. doi: 10.1521/jscp.2008.27.9.970.

Park, C. L., Edmondson, D., Fenster, J. R., & Blank, T. O. (2008). Meaning making and psychological adjustment following cancer: The mediating roles of growth, life meaning, and restored just world beliefs. *Journal of Consulting and Clinical Psychology, 76,* 863–875. doi: 10.1037/a0013348.

Park, C. L., & Folkman, S. (1997). The role of meaning in the context of stress and coping. *General Review of Psychology, 1,* 115–144.

Park, C.L., Mills, M.A., & Edmondson, D. (2010). PTSD as Meaning Violation: Testing a Cognitive Worldview Perspective. *Psychological Trauma: Theory, Research, Practice, and Policy*. doi: 10.1037/a0018792.

Peacock, E. J., Wong, P. T. P. (1990). The Stress Appraisal Measure (SAM): A Multidimensional Approach to Cognitive Appraisal, *Stress Medicine, Volume 6*, 227-236.

Petitmengin, C., & Bitbol, M. (2009). The validity of first-person descriptions as authenticity and coherence. *Journal of Consciousness Studies, 16 (10-12)*, 363-

404.

Regehr, C., LeBlanc, V., Jelley, R., Barath, I., & Daciuk, J. (2007). Previous Trauma Exposure and PTSD Symptoms as Predictors of Subjective and Biological Response to Stress. *Canadian Journal of Psychiatry*, *52*(10), 675-683.

Roediger, H. L. (1990). Implicit memory: retention without remembering. *American Psychologist, 45,* 1043-1056.

SPSS Inc. (2008). SPSS for Windows (Version 17.0.1). Chicago: SPSS Inc.

Sapolsky, R. M. (2007). *Why Zebras Don't Get Ulcers.* Henry Holt and Company, LLC: New York, New York.

Schnider, K.R., Elhai, J.D., & Gray, M.J. (2007). Coping style use predicts posttraumatic stress and complicated grief symptom severity among college students reporting a traumatic loss. *Journal of Counseling Psychology, 54* (3), 344-350.doi: 10.1037/0022-0167.54.3.344

Sharkansky E.J., King, D.W., King, L.A., Wolfe, J., Erickson, D.J.,…(2000). Coping with Gulf War combat stress: mediating and moderating effects. *Journal of Abnormal Psychology, 109*,188–97. doi: 10.1037/0021-843X.109.2.188.

Sheeran, T., & Zimmerman, M. (2002). Screening for posttraumatic stress disorder in a general psychiatric outpatient setting. *Journal of Consulting and Clinical Psychology, 70,* 961–966. doi: 10.1037/0022-006X.70.4.961.

Siegel, D. J. (1995). Memory, trauma and psychotherapy: a cognitive science view. *Journal of Psychotherapy Practice and Research, 4,* 93-122.

Simms, L. J., Watson, D., & Doebbeling, B. N. (2002). Confirmatory factor analyses of posttraumatic stress symptoms in deployed and non-deployed veterans of the Gulf

War. *Journal of Abnormal Psychology, 111*, 637-647. doi: 10.1037/0021-843X.111.4.637.

Skinner, N. & Brewer, N (2000). The dynamics of threat and challenge appraisals prior to stressful achievement events. *Journal of Personality and Social Psychology, 83,* 678-692. doi: 10.1037//0022-3514.83.3.678.

Smith, C.A., & Ellsworth, P.C. (1985). Patterns of cognitive appraisal in emotion. *Attitudes and Social Cognition, 48,* 813-838.

Stanton, A.L., Kirk, S.B., Cameron, C.L., & Danoff-Burg, S. (2000). Coping through emotional approach: Scale construction and validation. *Journal of Personality and Social Psychology, 78* (6), 1150-1169.

Tomaka J., Blascovich J., Kelsey, R.M., Leitten, C.L. (1993). Subjective, physiological, and behavioural effects of threat and challenge appraisal. *Journal of Personality and Social Psychology, 65* (2):248–60.

Tomaka J., Blascovich J., Kibler J., Ernst, J.M. (1997). Cognitive and physiological antecedents of threat and challenge appraisal. *Journal of Personality and Social Psychology*, *73* (1), 63–72.

Ursano, R. J., Fullerton, C. S., Epstein, R. S., Crowley, B., Vance, K., Kao, T., & Baum, A. (1999). Peritraumatic dissociation and posttraumatic stress disorder following motor vehicle accidents. *American Journal of Psychiatry*, *156*(11), 1808–1810.

U.S. Department of Labor (2010).*Occupational outlook handbook, 2010-2011 edition*. Retrieved from: http://www.bls.gov.oco/ocos329.htm.

Wagner, S.L., McFee, J.A., Martin, C.A. (2010). Mental health implications of fire service membership. *Traumatology, 16*, 26-32.doi: 10.1177/1534765610362803.

Watson, D., & Clark, L.A. (1994). The PANAS-X: Manual for the Positive and Negative Affect Schedule—Expanded Form. Iowa City, IA: The University of Iowa.

Weathers, F. W., Litz, B. T., Herman, D. S., Huska, J. A., & Keane, T. M. (1993).*The PTSD Checklist (PCL): Reliability, validity, and diagnostic utility*. Paper presented at the meeting of the International Society for Traumatic Stress Studies, San Antonio, TX.

Weiss D, Marmar C (1997). The impact of event scale-revised. In J Wilson, T Keane (Eds), Assessing Psychological Trauma and PTSD. New York: Guildford.

Werner, H.R., Bates, G.W., Bell, R.C., Murdoch, P., & Robinson, R. (1992). Critical incident stress in Victoria State emergency service volunteers: Characteristics of critical incidents, common stress responses, and coping methods. *Australian Psychologist, 27*.doi: 10.1080/00050069208257604.

Wyler, A. R., Masuda, M., & Holmes, T. H. (1971). Magnitude of life events and seriousness

of illness. *Psychosomatic Medicine, 33,* 115-122.

Zahavi, D. (2005). *Subjectivity and selfhood: Investigating the first-person perspective.* Cambridge MA: The MIT Press.

Zaichowsky, L. D., & Baltzell, A. (2001). Arousal and performance. In R. Singer, H. Hausenblas, & C. Janelle (Eds.).*Handbook of sport psychology* (pp. 362–386). New York: Wiley.

Table 1

Descriptive Statistics for the Study Variables

	Mean or (Mode)*	SD	Cronbach's α
Demographic Characteristics			
Age	33.70	8.13	-
Education[a]	(2)*	1.06	-
Income (US$)	58,678	14,121	-
Firefighter Variables			
Firefighter Calls[b]	674.11	738.11	-
Firefighter Stress	18.69	5.75	.89
Firefighter Years	8.54	6.88	-
Independent/Dependent Variables			
PTSD Symptoms	5.94	7.18	.92
PTSD Symptom Category[c]	(1)*	. 84	
Threat	0	6.25	.76
Challenge	0	7.04	.84
PANAS-X Challenge	0	.68	.85
PANAS-X Threat	0	.66	.83
Problem-focused coping	2.44	.45	.69
Active emotion-focused coping	1.58	.51	.81
Avoidant coping	1.10	.41	.66

Note. *( ) indicates mode. [a]Education: 1 = high school diploma, 2 = technical/vocational school, 3 = associate degree, 4 = bachelor's degree, 5 = master's degree, 6 = doctoral degree. [b]Number of firefighter calls during the previous year. [c]PTSD Symptom Category: 0 = no symptoms, 1 = mild, 2 = moderate, 3 = moderate to severe, 4 = severe

Table 2

Correlation Analyses Among PTSD Symptoms, State Coping, and Demographic Variables

	1	2	3	4	5	6	7	8	9	10	11
1. PTSD Symptoms	-										
2. Number of FF Stressful Events [a]	-.08	-									
3. FF Stress [a]	.01	.67**	-								
4. Years as FF [a]	.09	-.12	-.03	-							
5. Problem-focused[b]	-.10	.03	-.01	.15	-						
6. Active emotion-focused[b]	-.13	-.01	-.02	-.02	.41**	-					
7. Avoidant[b]	-.03	.05	.07	-.12	.10	.37**	-				
8. Age	.06	-.02	.08	.84**	.003	-.26*	-.30**	-			
9. Education	-.03	.12	.02	.07	.15	-.05	-.14	.13	-		
10. Gender	-.09	-.17+	-.17+	.15+	-.03	-.17+	.05	.08	-.14	-	
11. Income	.04	-.01	.04	.37**	.14	-.15	-.09	.43**	.18**	.02	-

Note. [a] FF = firefighter, [b]State coping scales. +p< .10, *p < .05, **p < .01.

Table 3

Correlation Analyses Among PTSD Symptoms, Appraisal, and Situation-Specific Coping

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1. PTSD Symptoms	-														
2. ChallengeComp.[a]	.10	-													
3. Threat Comp.[a]	.15	-.11	-												
4. PANAS-X Threat	.15	.04	.95**	-											
5. PANAS-X Chall.[b]	.11	.93**	-.07	.02	-										
6. ATS Challenge	.06	.73**	-.13	.05	.43**	-									
7. ATS Threat	.05	-.40**	.58**	.28**	-.26**	-.51**	-								
8. Problem[c]	-.10	.40**	-.05	.03	.31**	.41**	-.22*	-							
9. Active emotion[c]	-.13	.21*	.17+	.18+	.18+	.19+	.04	.40**	-						
10. Avoidant[c]	-.03	.04	.35**	.35**	.02	.07	.15	.10	-.39**	-					
11. Reexperiencing	.88**	.16	.12	.13	.14	.14	.02	-.09	-.13	-.01	-				
12. Avoidance	.93**	.07	.12	.11	.08	.02	.06	-.09	-.16	-.06	.70**	-			
13. Arousal	.92**	.06	.17+	.17+	.09	.01	.07	-.11	-.05	-.02	.69**	.84**	-		
14. Funct. Impair.[d]	.33**	.06	.39**	.33**	.10	-.04	.33**	-.17+	.19+	.30**	.33**	.21*	.34**	-	
15. Age	.06	.03	-.12	-.15	.13	-.17	.03	.003	-.28**	-.30**	.03	-.14	.01	.06	-
16. Gender	-.09	.01	.003	-.002	.07	-.10	.02	-.03	-.17+	.05	-.08	-.06	-.11+	.05	-.14

Note. [a]Comp. = Composite measure (ATS and PANAS-X), [b] Chall. = challenge, [c]Situation-specific coping scale, [d] Functional impairment from PTSD symptoms. +p< .10, *p < .05, **p < .01.

Table 4

Results of Regression Model Using Composite Measures of Challenge and Threat

	Problem-Focused Coping				Active emotion-focused				Avoidant Coping			
	β	CI for B	t	p	β	CI for B	t	p	β	CI for B	t	p
Challenge	.39	[0.01, 0.04]	3.97	<.001	.21	[0.001, 0.03]	2.15	.034	.17	[0.00, 0.02]	1.86	.067
Threat	-.01	[-0.01, 0.01]	-0.08	.936	.21	[0.001, 0.03]	2.15	.034	.40	[0.01, 0.03]	4.36	<.001
Age	-.01	[-0.01, 0.01]	-0.06	.956	-.24	[-0.03, -0.003]	-2.46	.016	-.27	[-0.02, -0.003]	-2.95	.004
Gender	-.04	[-0.38, 0.25]	-0.41	.686	-.15	[-0.60, 0.07]	-1.59	.115	.08	[-0.11, 0.27]	.84	.402
R^2 Adj.		.11				.14				.24		
R^2		.15				.18				.27		
F (4, 94)		4.02**				4.81**				8.36**		

Note. CI = Confidence Interval. * p<.05, **p<.01.

Table 5

Results of Regression Model Using PANAS-X Measures of Challenge and Threat

	Problem-Focused Coping				Active-emotion-focused				Avoidant Coping			
	β	CI for B	t	p	β	CI for B	t	p	β	CI for B	t	p
Challenge	.31	[0.08, 0.35]	3.09	.003	.18	[-0.01, 0.27]	1.82	.072	.13	[-0.04, 0.14]	1.38	.172
Threat	.03	[-0.11, 0.16]	.31	.760	.20	[0.004, 0.28]	2.04	.044	.38	[0.09, 0.24]	4.10	<.001
Age	-.03	[-0.01, 0.01]	-.26	.797	-.25	[-0.03, -0.003]	-2.53	.013	-.27	[-0.02, -0.003]	-2.90	.005
Gender	-.06	[-0.41, 0.24]	-.54	.590	-.16	[-0.61, 0.05]	-1.67	.099	.07	[-0.12, 0.27]	.77	.442
R^2 Adj.		.06				.13				.23		
R^2		.10				.17				.26		
F		2.49*				4.65*				7.86**		

Note. CI = Confidence Interval. * p<.05, **p <..01

Table 6

Correlation Analyses Among Appraisal, Pre-reflective/Reflective Coping, and Demographic Variables

	1	2	3	4	5	6	7	8
1. PANAS-X Threat	-							
2. PANAS-X Challenge	.02	-						
3. Challenge Composite	.04	.93**	-					
4. Threat Composite	.95**	-.07	-.11	-				
5. Pre-reflective Coping	.17+	.27**	.33**	.14	-			
6. Reflective Coping	.30**	.02	.04	.29**	.55**	-		
7. Age	-.15	.13	.03	-.12	-.23*	-.27**	-	
8. Gender	-.002	.07	.01	.003	-.12	-.08	.08	-

Note. * $p<.05$, ** $p<.01$

Table 7

Results of Regression Model Using Composite Measures of Challenge and Threat

	Pre-reflective Coping				Reflective Coping			
	β	CI for B	t	p	β	CI for B	t	p
Challenge	.34	[0.01, 0.03]	3.64	<.001	.10	[-0.003, 0.01]	1.08	.285
Threat	.20	[0.001, 0.03]	2.11	.038	.33	[0.01, 0.02]	3.43	.001
Age	-.20	[-0.02, 0.00]	-2.14	.035	-.23	[-0.02, -0.001]	-2.37	.020
Gender	-.11	[-0.47, 0.12]	-1.17	.243	-.06	[-0.25, 0.13]	-.59	.557
R^2 Adj.		.18				.15		
R^2		.21				.19		
F (4, 94)		5.97**				5.20**		

Note. CI = Confidence Interval. * $p<.05$, ** $p<.01$

Table 8

Results of Regression Model Using PANAS-X Measures of Challenge and Threat

	Pre-reflective Coping				Reflective Coping			
	β	CI for B	t	p	β	CI for B	t	p
Challenge	.29	[.07, .32]	3.07	.003	.07	[-.05, .11]	.69	.493
Threat	.19	[.000, .25]	1.99	.050	.33	[.06, .21]	3.38	.001
Age	-.22	[-.02, -.002]	-2.30	.024	-.22	[-.01, -.001]	-2.29	.024
Gender	-.12	[-.49, .10]	-1.30	.197	-.06	[-.25, .13]	-.62	.535
R^2 Adj.		.16				.15		
R^2		.19				.19		
F (4, 94)		5.35**				5.16*		

Note. CI = Confidence Interval. * $p<.05$, ** $p < .01$

Table 9

Mediator Model of the Effects of Functional Impairment on Avoidant Coping through Threat Appraisal (N = 94)

Independent Variable	Proposed Mediator	Dependent Variable	IV >DV[a]	IV >MD[b]	MD >DV[c]	Indirect Effect	Percent Mediation	Sobel p-value	Sobel z
FI	Threat Comp.	Avoidant	.30	.39	.35	.14	47%	0.009	2.62
FI	Threat PANAS	Avoidant	.30	.33	.35	.12	40%	0.011	2.54

Note. FI = Functional impairment from PTSD symptoms, Threat Comp. = composite measure of threat. IV = independent variable, DV = dependent variable, MD = mediator variable.

Figure 1. Model of Threat Appraisal (Composite) Mediating Relationship between Functional Impairment and Avoidant Coping

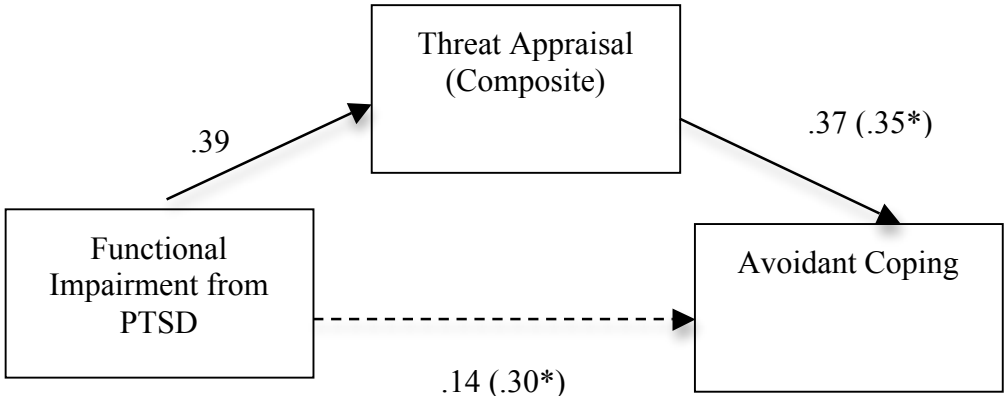
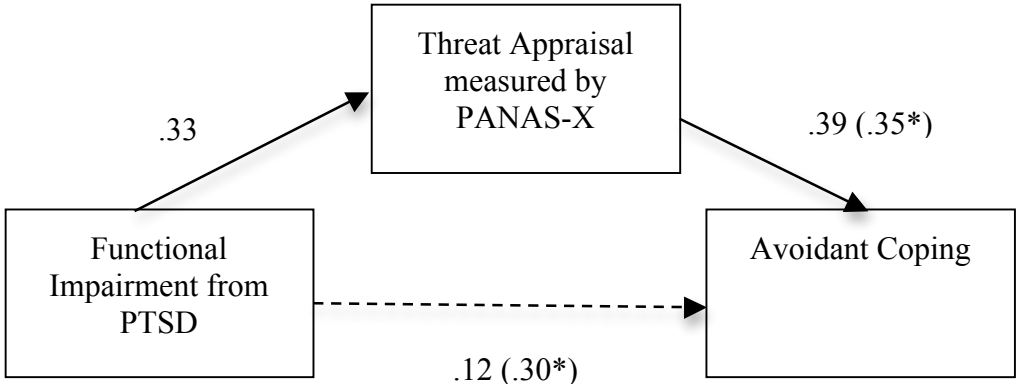


Figure 2. Model of Threat Appraisal Mediating Relationship between Functional Impairment and Avoidant Coping



APPENDICES

Appendix A: Disaster Scenario

Disaster Scenario 2-minute Video Clip

The audio accompanying the clip described a toxic, highly explosive gas and the life-threatening situation facing the firefighters. It commented that they were fighting "a losing battle". They were told (and shown) that suddenly the tanker had exploded and ignited 4,000 gallons of gas. This resulted in molten debris falling on the firefighters. It concluded with a statement that four firefighters had suffered burns, but no one had been killed.

New Mexico Scenario

The New Mexico scenario began with participants being told that "you are taking a break in the lunch room when you get called to an emergency briefing by your supervisor. This is what he tells you and your colleagues." A male voice then told participants that: 12 minutes ago a 60,000 gallon tanker carrying liquefied chlorine gas exploded on the interstate in a collision with a tanker carrying ammonia. Given the location, 200,000 people are in the downwind vapor area which could extend 25 miles. Reports of chlorine gas exposure (e.g. smell of burning skin and breathing difficulties) are coming in. Thousands could die from exposure and anticipated problems resulting from panic (e.g. vehicular accidents). The Centers for Disease Control has told them to expect 5,000 fatalities, 35,000 serious injuries, 100,000 minor injuries and that these casualties will occur within 4 hours. Additionally, 130,000 worried, but well individuals will seek treatment at medical facilities, which will take days to respond to. All

emergency response personnel and health care professionals are reporting for duty and the National Guard has been activated. Please stand by for your orders.

Appendix B: Demographic Questionnaire

Instructions: Please answer the following questions by filling in the blanks or clicking on the appropriate spot.

1. How long have you worked as a firefighter? _____Years _____Months

2. How many calls you have gone out over. Put NA if "not applicable":

    ____your whole career (just estimate)

    ____the past year

    ____the past month

    ____during an average week

3. How many years do you think you will continue to work as a firefighter?_____

4. Have you worked as a paramedic? ____No ____Yes

    If so, how long? _____Years _____Months

5. Have you worked as a police officer? ____No ____Yes

    If so, how long? _____Years _____Months

6. Have you served in the military? ____No ____Yes

    If so, how many years?_____

    If so, what branch(s)?_____

    If so, have you been in combat?_____

7. Are you currently married? ____No ____Yes

    If so, how satisfied are you with your marriage?

    1 = not at all

    9 = extremely

8. How many children do you have?_____

   What are their ages?_____

   How many are your dependents?_____

9. Have you ever been diagnosed with any of the following mental disorder?

   _____Depression

   _____Bipolar Disorder

   _____An Anxiety Disorder If so, what?_____

   _____Any other diagnoses_____

10. Have you ever been treated for a mental disorder (check all that apply)?

    _____Psychotherapy/Counseling

    _____Medication _____If so, what medications?

    _____Hospitalization

    _____Inpatient Substance Abuse

    _____Outpatient Substance Abuse

11. Have you ever practiced any form of meditation? ___No ___Yes

    If yes, what kind of meditation? _____

    If yes, how long have you practiced? ____Years ___Months

Appendix C: Firefighter Stress

Below is a list of traumatic and stressful events that firefighters may experience.THINKABOUT YOUR EXPERIENCE AS A FIREFIGHTER,indicate whether you have experienced each type of event and how stressful the event was for you at the time you experienced it. Rate the incidents that you have experienced on a 0 to 10 point scale where 0 = not stressful at all, 5 = somewhat stressful, and 10 = extremely stressful. If you experienced it more than once, rate how stressful it has been on average.

No Yes 0 1 2 3 4 5 6 7 8 9 10

1. Experience head injury (self)
2. Render aid to dangerous psychiatric patient
3. Render aid to gun shot victim of gang violence
4. Completed suicide hanging
5. Multiple casualty motor vehicle accident (>5 deaths)
6. Sudden infant death incident
7. Render aid to sexual assault victim
8. Witness duty related death of co-worker
9. Adult dead on arrival (DOA) – multiple wounds/injuries
10. Inappropriate dispatch
11. CPR/full arrest-family present
12. Exposure to hazardous chemicals
13. Third degree burn (self)
14. Death of patient after long resuscitation
15. Multiple casualty motor vehicle accident (1-4 deaths)
16. Co-worker firefighter fire fatality (not witnessed)
17. Render aid – attempted suicide/drug overdose

18. Completed gun shot suicide
19. Serious injury to co-worker
20. Render aid to mutilated adult/attempted homicide
21. Experience musculoskeletal strain (self)
22. Fire incident with multiple burn victims
23. Render aid to adult stabbing victim
24. Experience career ending injury (self)
25. Adult (DOA) – natural causes
26. Fracture of extremity (self)
27. Render aid to seriously injured child
28. Treat injured patient who resembles self/spouse
29. Render aid to seriously injured friend/relative
30. Fire incident with multiple deaths
31. Attempted domestic homicide victim
32. Render aid to seriously injured adolescent
33. CPR-patient in cardiac arrest

Appendix D: PTSD

Posttraumatic Diagnostic Scale

Think about all of the events that you have experienced, witnessed, or been confronted with AS A FIREFIGHTER that have involved actual or threatened death or serious injury or threat to the physical integrity of yourself or others.

1. Which of these events has bothered or disturbed you the most IN THE PAST MONTH (briefly describe the event)?

_____

_____

2. How long ago did this event happen?

1 = less than 1 month

2 = 1 to 3 months

3 = 3 to 6 months

4 = 6 months to 3 years

5 = 3 to 5 years

6 = more than 5 years

During this event:

	Yes	No
3. Were you physically injured?		
4. Was someone else physically injured?		
5. Did you think that your life was in danger?		

6. Did you think that someone else's life was in danger?

7. Did you feel helpless?

8. Did you feel terrified?

Below is a list of problems that people sometimes have reported after experiencing a traumatic event. THINK ABOUT THE EVENT YOU IDENTIFIED THAT HAS BOTHERED OR DISTURBED YOU THE MOST IN THE PAST MONTH. Read each one carefully and indicate the response that best describes how often that problem has bothered you IN THE PAST MONTH.

0 = not at all or only one time

1 = once a week or less/once in a while

2 = 2 to 4 times a week/half the time

3 = 5 or more times a week/almost always

9. Having upsetting thoughts or images about the traumatic event that came into your head when you didn't want them to.

10. Having bad dreams or nightmares about the traumatic event.

11. Reliving the traumatic event, acting or feeling as if it was happening again.

12. Feeling emotionally upset when you were reminded of the traumatic event (for example, feeling scared, angry, sad, guilty, etc.).

13. Experiencing physical reactions when you were reminded of the traumatic event (for example, breaking out in a sweat, heart beating fast).

14. Trying not to think about, talk about, or have feelings about the traumatic event.

15. Trying to avoid activities, people, or places that remind you of the traumatic event.

16. Not being able to remember an important part of the traumatic event.

17. Having much less interest or participating much less often in important activities.

18. Feeling distant or cut off from people around you.

19. Feeling emotionally numb (for example, being unable to cry or unable to have loving feelings).

20. Feeling as if your future plans or hopes will not come true (for example, you will not have a career, marriage, children, or a long life).

21. Having trouble falling or staying asleep.

22. Feeling irritable or having fits of anger.

23. Having trouble concentrating (for example, drifting in and out of conversation, losing track of a story on television, forgetting what you read).

24. Being overly alert (for example, checking to see who is around you, being uncomfortable with your back to a door, etc.).

25. Being jumpy or easily startled (for example, when someone walks up behind you).

26. How long have you been experiencing the problems that you reported above?

1 = less than 1 month

2 = 1 to 3 months

3 = more than 3 months

27. How long after the traumatic event did those problems begin?

1 = less than 6 months

2 = 6 or more months

Indicate below how much the problems you rated above interfered with any of the following areas of your life DURING THE PAST MONTH.

0 = not at all

1 = mild interference

2 = moderate interference

3 = severe interference

4= does not apply to me

28. Work
29. Household chores and duties
30. Relationships with friends
31. Fun and leisure activities
32. Schoolwork
33. Relationships with your family
34. Sex life
35. General satisfaction with life
36. Overall level of functioning in all areas or your life

Appendix E: Appraisal

Appraisal Tendency Scale

Instructions: Think about what it would be like to be in the chemical scenario and click on the spot that best indicates your response.

1. How unpleasant or pleasant would it be to be in this situation?

Unpleasant -5 -4 -3 -2 -1 0 1 2 3 4 5 Pleasant

2. To what extent would you feel that no one was responsible for what was happening in this situation?

Not at All 1 2 3 4 5 6 7 8 9 10 11 Extreme

3. To what extent would you feel that you needed to exert yourself to deal with this situation?

Not at All 1 2 3 4 5 6 7 8 9 10 11 Extreme

4. To what extent would you feel that you had the ability to influence what was happening in this situation?

Not at All 1 2 3 4 5 6 7 8 9 10 11 Extreme

5. How well would you understand what would be happening around you in this situation?

Not at All 1 2 3 4 5 6 7 8 9 10 11 Extreme

6. To what extent would you try to shut this event out or consider it further?

Shut it out -5 -4 -3 -2 -1 0 1 2 3 4 5 Consider Further

7. To what extent would you feel that someone other than yourself would be controlling what was happening in this situation?

Not at All 1 2 3 4 5 6 7 8 9 10 11
Extreme

8. How well could you predict what was going to happen in this situation?

Not at All 1 2 3 4 5 6 7 8 9 10 11
Extreme

9. How unenjoyable or enjoyable would it be to be in this situation?

Unenjoyable -5 -4 -3 -2 -1 0 1 2 3 4 5
Enjoyable

10. How responsible would you think that someone other than yourself would be for having brought about the events in this situation?

Not at All 1 2 3 4 5 6 7 8 9 10 11
Extreme

11. How much effort (mental or physical) would you feel this situation required of you to expend?

Not at All 1 2 3 4 5 6 7 8 9 10 11
Extreme

12. To what extent would you feel that circumstances between anyone's control would controlling what was happening in this situation?

Not at All 1 2 3 4 5 6 7 8 9 10 11
Extreme

13. To what extent would you try to divert your attention to this thing or devote your attention from it?

Divert -5 -4 -3 -2 -1 0 1 2 3 4 5
Devote
Attention Attention

14. How uncertain would you be about what would be happening in this situation?

Not at All 1 2 3 4 5 6 7 8 9 10 11
Extreme

15. How responsible would you feel for having brought about the events in this situation?

Not at All 1 2 3 4 5 6 7 8 9 10 11 Extreme

Challenge Items: 1, 3, 4, 11, 13

Threat Items: 1, 3, 6, 12, 14

PANAS-X

Instructions: This scale consists of a number of words and phrases that describe different feelings and emotions. Read each item and then click on the spot that best indicates how you would feel this way if the chemical scenario was actually occurring.

1 2 3 4 5

very slightly a little moderately quite a bit extremely

or not at all

____sad	____active	____alone
____inspired	____angry at self	____enthusiastic
____afraid	____downhearted	____irritable
____lonely	____distressed	____shaky
____blameworthy	____excited	____determined
____strong	____hostile	____frightened
____scornful	____proud	____guilty
____alert	____jittery	____interested
____nervous	____upset	____loathing
____angry	____ashamed	____disgusted
____blue	____scared	____attentive

____disgusted ____dissatisfied

with self with self

Challenge items: **“**inspired”, “strong”, “alert”, “active”, “enthusiastic”, “determined”, “interested”, and “attentive”.Threat items: “afraid”, “angry”, “nervous”, “shaky”, “scared”, “alone”, “dissatisfied with self”, and “frightened”.

Appendix F: State Coping

Brief COPE/Emotional Approach Coping Scale

Instructions: Think about the chemical scenario and indicate the extent to which you would do each of the following when trying to cope with it. Click on the spot that best indicates your response.

0 = I don't do this at all 1 = I do this a little bit 2 = I do some 3 = I do this a lot

1. I take action to try to make the situation better.
2. I give up the attempt to cope.
3. I criticize myself.
4. I think hard about what steps to take.
5. I try to find comfort in my religion or spiritual beliefs.
6. I give up trying to deal with it.
7. I refuse to believe that it has happened.
8. I use alcohol or other drugs to make myself feel better.
9. I pray or meditate.
10. I blame myself for things that happened.
11. I try to come up with a strategy about what to do.
12. I express my negative feelings.
13. I use alcohol or other drugs to help me get through it.
14. I get emotional support from others.
15. I take time to figure out what I'm really feelings.
16. I accept the reality of the fact that it has happened.
17. I make fun of the situation.
18. I get help and advice from other people.
19. I let my feelings come out freely.

20. I get comfort and understanding from someone.

21. I try to see it in a different light, to make it seem more positive.

22. I allow myself to express my emotions.

23. I do something to think about it less, such as going to movies, watching TV, reading, daydreaming, sleeping, or shopping.

24. I realize that my feelings are valid and important.

25. I make jokes about it.

26. I learn to live with it.

27. I concentrate my efforts on doing something about the situation I'm in.

28. I say things to let my unpleasant feelings escape.

29. I look for something good in what is happening.

30. I say to myself "this isn't real."

31. I get advice or help from other people about what to do.

32. I turn to work or other activities to take my mind off things.

Problem-focused coping: 4, 11, 18, 31, 1, 27

Active emotion-focused coping: 16, 26, 17, 15, 19, 22, 15, 24, 21, 29, 14, 20

Avoidant coping: 7, 30, 3, 10, 23, 32, 2, 6, 8, 13

Pre-reflective: 1, 16, 18, 19, 20, 23, 24, 26, 27, 29, 31, 32

Reflective: 2, 3, 6, 7, 8, 10, 13, 15, 17, 21, 22, 30