PTSD symptom dimensions and their relationship to functioning in World Trade Center responders

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ABSTRACT

Post-traumatic stress disorder (PTSD) symptoms are common among responders to the 9/11 attacks on the World Trade Center and can lead to impairment, yet it is unclear which symptom dimensions are responsible for poorer functioning. Moreover, how best to classify PTSD symptoms remains a topic of controversy. The present study tested competing models of PTSD dimensions and then assessed which were most strongly associated with social/occupational impairment, depression, and alcohol abuse. World Trade Center responders ($n=954$) enrolled in the Long Island site of the World Trade Center Health Program between 2005 and 2006 were administered standard self-report measures. Confirmatory factor analysis confirmed the superiority of four-factor models of PTSD over the *DSM-IV* three-factor model. In selecting between four-factor models, evidence was mixed, but some support emerged for a broad dysphoria dimension mapping closely onto depression and contributing strongly to functional impairment. This study confirmed in a new population the need to revise PTSD symptom classification to reflect four dimensions, but raises questions about how symptoms are categorized. Results suggest that targeted treatment of symptoms may provide the most benefit, and that treatment of dysphoria-related symptoms in disaster relief workers may have the most benefit for social and occupational functioning.

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1. Introduction

Responders to the 9/11 attacks on the World Trade Center were exposed to significant physical and emotional trauma during the rescue, recovery, and clean-up efforts (Landrigan et al., 2004; Neria et al., 2011). Surveys following the attacks document that a substantial proportion of responders, from 5.8% to more than 20%, report symptoms consistent with the diagnosis of post-traumatic stress disorder (PTSD) (Evans et al., 2006; Perrin et al., 2007; Jayasinghe et al., 2008; Stellman et al., 2008; Evans et al., 2009; Berninger et al., 2010a; Berninger et al., 2010b; Chiu et al., 2011; Cukor et al., 2011; Luft et al., 2012). Moreover, many World Trade Center responders show evidence of impairment in occupational (Evans et al., 2006; Evans et al., 2009; Berninger et al., 2010a; Berninger et al., 2010b) and social functioning, (Evans et al., 2006; Stellman et al., 2008; Evans et al., 2009; Berninger et al., 2010a; Berninger et al., 2010b) as well as higher rates of depression and substance abuse (Galea et al., 2002; Ahern and Galea, 2006; Stellman et al., 2008; Evans et al., 2009; Neria et al., 2011). These findings are

consistent with the broader PTSD literature showing that trauma exposure often leads to serious psychological, somatic, and/or behavioral changes (e.g., Roberts et al., 1982; Stein et al., 1997; Zatzick et al., 1997; Riggs et al., 1998; Breslau, 2001; Krakow et al., 2001; Kuhn et al., 2003; Breslau et al., 2004; Smith et al., 2005; Nemeroff et al., 2006; Schnurr et al., 2006; Kibler et al., 2009).

Although several studies documented an association between PTSD and severity of impairment, few studies have addressed which specific dimensions of PTSD predict worse functioning, and none that we are aware of has considered this issue in disaster responders. This question is important for theoretical reasons: it can shed light on the link between symptoms and functioning and validate the classification of PTSD symptoms (Elhai and Palmieri, 2011). It also has practical importance for treating individuals who assisted in the clean-up and recovery after 9/11, as well as for recovery workers involved in other disasters.

Studies that examined functional correlates of *Diagnostic and Statistical Manual of Mental Disorders, Fourth Edition, Text Revision* (*DSM-IV TR*; American Psychiatric Association, 2000) three-dimensional symptom clusters suggest that avoidance/numbing is more strongly associated with impaired functioning compared to hyperarousal and reexperiencing (Riggs et al., 1998; North et al., 1999; Samper et al., 2004; Miller et al., 2008; Rona et al., 2009),

although one study (Norman et al., 2007) found the opposite. Other studies that have looked at the avoidance and numbing dimensions separately find that numbing is most associated with lower life satisfaction and functioning (Palmieri and Fitzgerald, 2005; Lunney and Schnurr, 2007).

Most existing studies looking at how specific dimensions affect functioning have relied on the *DSM-IV* nosology. Mounting evidence, however, challenges the validity of this three-dimension model in favor of four dimensions (see Elhai and Palmieri, 2011 for a review) or even five dimensions (Elhai et al., 2011; Pietrzak et al., 2012). Yufik and Simms (2010) performed a meta-analysis of 40 studies looking at the factor structure of PTSD symptoms and found that four-factor models consistently outperformed the three-factor *DSM-IV* model in describing how symptoms cluster. The best established alternatives to *DSM-IV* are the King et al. (1998) model and Simms et al. (2002) model. Both of them contain reexperiencing and avoidance dimensions (see Table 1). However, King et al. splits the remaining items between a numbing dimension (C3–C7) and a hyperarousal dimension (D1–D5). In contrast, Simms et al. broadened the King model's numbing dimension (C3–C7) to include three additional items D1–D3 (i.e., sleep problems, irritability, and concentration problems) that were part of the hyperarousal dimension in the King et al. model. This new dimension was relabeled Dysphoria and was thought to reflect symptoms of dysphoria or general distress, as opposed to symptoms unique to PTSD. In creating this new factor, Simms et al. were guided by structural models (e.g., Mineka et al., 1998) that had long attempted to reconcile the high rates of overlap between depressive and anxiety disorders. These theories posited the existence of a nonspecific component shared by both types of disorders, namely a general distress component. Simms et al. argued that items D1–D3 are not particularly unique to hyperarousal, but that they (along with items C3–C7) more likely reflect the general, nonspecific distress component observed in structural models. It is noteworthy that the *DSM-5* (APA, 2013) PTSD criteria continues to place these three items within the hyperarousal dimension, consistent with the King et al. model but in contrast to the model suggested by Simms et al.

Evidence for the superiority of one four-factor model over another has been mixed. In confirmatory factor analysis (CFA) studies, both models fit generally similar. Results from Yufik and Simms (2010) meta-analysis suggest more support for their model. Moreover, longitudinal studies show the Simms et al. (2002) factor structure remains stable across time, an important piece of evidence to support their model (Baschnagel et al., 2005; Krause et al., 2007). Palmieri et al. (2007), however, suggest that the method of assessment matters, with more support for the King et al. model when clinician-administered measures are used rather than self-report instruments. Although such differences in CFA fit exist, the bulk of CFA research finds the differences in fit between these models to be modest.

The overwhelming majority of previous studies of this issue have relied on CFA alone. Although important, exclusive reliance on fit indices is not the optimal method of validating one model over the other; rather, evidence of convergent and discriminant validity is required and can provide decisive evidence for a model, even in cases where that model has a worse fit. A few previous studies have considered clinical correlates of the different dimensions, but findings have been mixed (Marshall et al., 2010; Miller et al., 2010; Palmieri et al., 2007). The present study attempts to look at not only the internal factor structure of PTSD, but the relationship of dimensions to external variables.

In particular, the present study uses data from World Trade Center responders to address two aims: the first is to use CFA to compare the relative merits of different PTSD models (i.e., *DSM-IV* three-factor model, Simms et al. four-factor model, and King et al. four-factor model). For comparison purposes, a single factor model will also be included given that symptoms tend to be highly correlated (Yufik and Simms, 2010) and given that this is the implicit model suggested when clinicians or researchers rely on only a single PTSD score to assess PTSD severity. We hypothesized that the Simms et al. model would show the best fit. The second aim is to determine which PTSD dimensions are most strongly associated with social and work functioning, as well as alcohol abuse and depression. We hypothesized that the dysphoria and numbing dimensions would show the closest links with depression. Given that previous results using the *DSM-IV* PTSD structure have implicated the avoidance/numbing dimension as most associated with impaired functioning, we hypothesized that dimensions consisting of those symptoms would be the most associated with worse functioning and alcohol abuse.

2. Method

2.1. Participants

Participants were 954 patients who had an initial examination at the Long Island site of the World Trade Center Health Program (Moline et al., 2008) between October, 2005 and September, 2006 and completed the PTSD symptom inventory described below. A total of 1,025 patients were seen at the clinic for the first time during that interval, but 71 (6.9%) were missing PTSD inventory and have been excluded. The World Trade Center Health Program was established in 2002 to provide medical monitoring and treatment for World Trade Center rescue and recovery workers. Care is provided at seven clinics in New York and New Jersey. Participants must have worked or volunteered as part of the rescue, recovery, restoration, or cleanup of the World Trade Center sites and not be participating in other federally-funded World Trade Center health programs (Herbert et al., 2006). Recruitment into the program involves extensive, ongoing outreach efforts (e.g., media articles, union meetings, mailings, and approximately 50,000 telemarketing calls in diverse languages). We note that this is a treatment-seeking sample, representing consecutive admissions to the Long Island clinic.

Table 1
Item mapping for confirmatory factor analysis models.

DSM-IV PTSD symptom	One-factor	*DSM-IV* three-factor	King et al. four-factor	Simms et al. four-factor
B1. Intrusive thoughts of trauma	P	R	R	R
B2. Recurrent dreams of trauma	P	R	R	R
B3. Flashbacks	P	R	R	R
B4. Emotional reactivity to trauma cues	P	R	R	R
B5. Physiological reactivity to trauma cues	P	R	R	R
C1. Avoiding thoughts of trauma	P	A/N	A	A
C2. Avoiding reminders of trauma	P	A/N	A	A
C3. Inability to recall aspects of trauma	P	A/N	N	D
C4. Loss of interest	P	A/N	N	D
C5. Detachment	P	A/N	N	D
C6. Restricted affect	P	A/N	N	D
C7. Sense of foreshortened future	P	A/N	N	D
D1. Sleep disturbance	P	H	H	D
D2. Irritability	P	H	H	D
D3. Difficulty concentrating	P	H	H	D
D4. Hypervigilance	P	H	H	H
D5. Exaggerated startle response	P	H	H	H

Note. Factors on which symptoms were loaded: P, general PTSD; R, reexperiencing; A, avoidance; N, emotional numbing; H, hyperarousal; D, dysphoria.