



Elucidating dimensions of posttraumatic stress symptoms and their functional correlates in disaster-exposed adolescents



Jennifer A. Sumner^{a, *}, Robert H. Pietrzak^{b, c}, Carla Kmett Danielson^d, Zachary W. Adams^d, Kenneth J. Ruggiero^{e, f}

^a Department of Epidemiology, Columbia University Mailman School of Public Health, 722 W. 168th St, New York, NY 10032, USA

^b Clinical Neurosciences Division, National Center for Posttraumatic Stress Disorder, Veterans Affairs Connecticut Healthcare System, 950 Campbell Ave, West Haven, CT 06516, USA

^c Department of Psychiatry, Yale University School of Medicine, 300 George St, Suite 901, New Haven, CT 06511, USA

^d Department of Psychiatry and Behavioral Sciences, Medical University of South Carolina, 67 President St, MSC 861, 2nd Fl. IOP South Building, Charleston, SC 29425, USA

^e College of Nursing, Medical University of South Carolina, 99 Jonathan Lucas St, MSC 160, Charleston, SC 29425, USA

^f Ralph H. Johnson VA Medical Center, 109 Bee St, Charleston, SC 29401, USA

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ABSTRACT

The aim of this study was to elucidate the dimensional structure of posttraumatic stress disorder (PTSD) and potential moderators and functional correlates of this structure in disaster-affected adolescents. A population-based sample of 2000 adolescents aged 12–17 years ($M = 14.5$ years; 51% female) completed interviews on post-tornado PTSD symptoms, substance use, and parent–adolescent conflict between 4 and 13 months ($M = 8.8$, $SD = 2.6$) after tornado exposure. Confirmatory factor analyses revealed that all models fit well but a 5-factor dysphoric arousal model provided a statistically significantly better representation of adolescent PTSD symptoms compared to 4-factor dysphoria and emotional numbing models. There was evidence of measurement invariance of the dysphoric arousal model across gender and age, although girls and older adolescents aged 15–17 years had higher mean scores than boys and younger adolescents aged 12–14 years, respectively, on some PTSD dimensions. Differential magnitudes of association between PTSD symptom dimensions and functional correlates were observed, with emotional numbing symptoms most strongly positively associated with problematic substance use since the tornado, and dysphoric arousal symptoms most strongly positively associated with parent–adolescent conflict; both correlations were significantly larger than the corresponding correlations with anxious arousal. Taken together, these results suggest that the dimensional structure of tornado-related PTSD symptomatology in adolescents is optimally characterized by five separate clusters of re-experiencing, avoidance, numbing, dysphoric arousal, and anxious arousal symptoms, which showed unique associations with functional correlates. Findings emphasize that PTSD in disaster-exposed adolescents is not best conceptualized as a homogenous construct and highlight potential differential targets for post-disaster assessment and intervention.

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1. Introduction

On average, a disaster occurs somewhere in the world every day (Norris et al., 2002), and most have effects beyond the immediate impact. Although many individuals are resilient or recover quickly after a disaster, a substantial percentage experiences adverse

mental health outcomes, with posttraumatic stress disorder (PTSD) being the most common (Furr et al., 2010; Galea et al., 2005; Norris et al., 2002). Although PTSD is often considered a homogenous diagnostic entity in epidemiologic studies, there is increasing interest in the nature of the underlying dimensional structure of this disorder (Elhai et al., 2013; Yufik and Simms, 2010), as well as how dimensional aspects of PTSD relate to clinical and functional outcomes in trauma-exposed populations (Boelen and Spuij, 2013; Pietrzak et al., 2010). This approach to classifying psychopathology aligns with contemporary scientific efforts in psychiatry, such as the National Institute of Mental Health Research Domain Criteria

* Corresponding author. Tel.: +1 212 342 0401; fax: +1 212 342 5168.

E-mail addresses: js4456@columbia.edu, jennifer.sumner@gmail.com (J.A. Sumner).

(NIMH RDoC) project, that aim to classify mental disorders based on dimensions of observable behavior (Cuthbert and Insel, 2013).

Although the *Diagnostic and Statistical Manual of Mental Disorders, 4th edition (DSM-IV; American Psychiatric Association, 2000)* characterizes PTSD using a 3-factor model with re-experiencing, avoidance/numbing, and hyperarousal factors, it is well established that this model is inferior to alternative 4- and 5-factor models of PTSD symptoms (Elhai and Palmieri, 2011; Yufik and Simms, 2010). The 4-factor dysphoria model has factors for re-experiencing, avoidance, hyperarousal, and dysphoria symptoms, with the dysphoria factor defined by symptoms reflecting nonspecific aspects of emotional disorders, such as insomnia and irritability (Simms et al., 2002). The numbing model separates avoidance and emotional numbing symptoms into distinct factors, resulting in re-experiencing, avoidance, numbing, and hyperarousal factors (King et al., 1998). The main distinction between the two 4-factor models is whether three hyperarousal items, namely *DSM-IV* Criterion D, item 1 (D1; difficulty falling/staying asleep), D2 (irritability/anger), and D3 (difficulty concentrating), are indicators of dysphoria (as in the dysphoria model) or hyperarousal (as in the numbing model). Meta-analytic evidence suggests that both 4-factor models characterize PTSD symptoms well, and one model has not received consistent support over the other (Yufik and Simms, 2010). Accordingly, the recently published *DSM-5* PTSD criteria include a 4-factor model of symptoms that is most similar to the numbing model (American Psychiatric Association, 2013). Recently, a 5-factor dysphoric arousal model has been developed that separates hyperarousal symptoms into those reflecting dysphoric arousal (i.e., symptoms of agitation and restlessness) and anxious arousal (i.e., fear-based arousal symptoms), resulting in re-experiencing, avoidance, numbing, dysphoric arousal, and anxious arousal factors (Elhai et al., 2011). The dysphoric arousal model has been found to be superior to the two 4-factor models across numerous adult samples, including veterans (Harpaz-Rotem et al., 2014; Pietrzak et al., 2012) and nationally representative samples (Armour et al., 2013).

Most research on the symptom structure of PTSD has been conducted in adults, although a small literature has explored this issue in youth, with a few investigations of disaster-exposed youth. Findings are consistent with the adult literature and have supported the dysphoria and numbing models over the *DSM-IV* model (Ayer et al., 2011; Bennett et al., 2014; Elhai et al., 2013). Of the studies comparing the 4- and 5-factor models in youth, all have supported the dysphoric arousal model as the best-fitting model (Bennett et al., 2014; Elhai et al., 2013; M. Wang et al., 2012, 2013; L. Wang et al., 2011a, 2011b; R. Wang et al., 2013).

Despite initial evidence that PTSD symptoms in youth manifest as separate re-experiencing, avoidance, numbing, dysphoric arousal, and anxious arousal dimensions, understanding of PTSD symptom structure in disaster-exposed youth is limited in three important ways. First, virtually all studies of the dysphoric arousal model in disaster-exposed youth have been conducted in Chinese adolescent earthquake survivors (e.g., M. Wang et al., 2013; L. Wang et al., 2011b). It is unknown whether extant findings apply to youth from other cultural backgrounds exposed to other types of natural disasters. Second, the extent to which gender and age moderate the latent structure of PTSD symptoms in disaster-exposed adolescents is unclear. PTSD is more prevalent in girls than boys after a disaster (Furr et al., 2010), and some studies have found that post-disaster PTSD prevalence in youth increases with age (Garrison et al., 1995). Examining mean differences in PTSD symptoms across gender and age groups assumes a common underlying symptom structure (Hukkelberg, 2014), but gender and age are understudied moderators of PTSD symptom structure, particularly in disaster-exposed youth. Although some age- and gender-related

differences in the dysphoric arousal model were observed in a national clinical sample of trauma-exposed youth, overall neither age nor gender emerged as a robust moderator of PTSD symptom structure (Contractor et al., 2013). Furthermore, neither gender nor age significantly moderated PTSD symptom structure in Indian youth after a terrorist attack (Contractor et al., 2014). However, a recent study found evidence for some gender differences in factor loadings and factor variances/covariances of the dysphoric arousal model in a sample of juvenile-justice-involved youth (Bennett et al., 2014). Only one study each has examined measurement invariance in PTSD symptom structure in disaster-exposed youth across gender (M. Wang et al., 2013) and age (Anthony et al., 1999), with evidence for at least some degree of invariance across these characteristics. Third, understanding of how different PTSD dimensions relate to measures of functioning is limited. A recent review highlighted the importance of validating distinct PTSD dimensions against functional correlates rather than solely relying on model fit statistics for understanding the nature of posttraumatic psychopathology (Elhai and Palmieri, 2011). Few studies of disaster-exposed youth have employed such validation approaches, and the handful that have primarily examined measures of depression and anxiety (e.g., Anthony et al., 1999; L. Wang et al., 2011b). Adolescence is a critical developmental period for the adoption of substance misuse behaviors (Viner et al., 2012), and it is characterized by increased parent-child conflict (Steinberg and Morris, 2001). However, little is known about how PTSD symptom dimensions relate to these outcomes.

We addressed these under-examined issues by investigating the dimensional structure of PTSD symptoms in a population-based sample of adolescents exposed to the tornadoes in Alabama and Joplin, MO in the spring of 2011. Based on evidence of the superiority of the 5-factor dysphoric arousal model in adolescent earthquake survivors (e.g., L. Wang et al., 2011b; R. Wang et al., 2013), we hypothesized that this model, rather than either 4-factor model, would provide the optimal representation of PTSD symptoms. We also investigated whether gender and age moderated the best-fitting model of PTSD symptom structure. Furthermore, given that disasters impact numerous domains of functioning (Galea et al., 2005), and PTSD in adolescents has been associated with psychosocial impairments, including substance use disorders and interpersonal difficulties (Giaconia et al., 1995), we assessed whether the underlying PTSD dimensions exhibited differential magnitudes of association with two developmentally-informed measures of functioning: 1) problematic substance use; and 2) parent-adolescent conflict.

2. Method

2.1. Disaster characteristics

The spring of 2011 was one of the most active and deadly tornado seasons in United States history. During April 2011, 758 tornadoes touched down, primarily in Mississippi, Alabama, and Georgia, breaking the record for the greatest number of tornadoes in one month (National Oceanic and Atmospheric Administration, 2011). Most tornado-related fatalities and injuries occurred between April 25–28 (321 fatalities), with damage estimated at \$6 billion. On May 22, 2011, the deadliest single tornado in the United States since 1950 hit Joplin, Missouri. At least 160 people were killed, 750 were injured, and over 9000 homes and businesses were destroyed.

2.2. Procedure

Two thousand families with adolescents aged 12–17 years were recruited from areas affected by the April 25–28 or May 22

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