Archives of Psychiatric Nursing 28 (2014) 301–304

Contents lists available at ScienceDirect

Archives of Psychiatric Nursing

journal homepage: www.elsevier.com/locate/apnu

The Factor Structure of Posttraumatic Stress Disorder Symptoms in Patients With Traumatic Spinal Cord Injuries

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A B S T R A C T

The current study investigated the factor structure of posttraumatic stress disorder (PTSD) symptoms in a sample of 256 patients with traumatic spinal cord injuries (SCI) in China. The confirmatory factor analysis results showed that a five-factor model composed of intrusion, avoidance, emotional numbing, dysphoric arousal, and anxious arousal fits the data significantly better than the tripartite *DSM-IV* model and the two well-supported four-factor models, and the C3 symptom (inability to recall important aspect of the trauma) loaded weakly on its corresponding factor. Implications and limitations for the results are discussed.

Traumatic spinal cord injuries (SCI) are mainly caused by life-threatening traumatic events such as road traffic accident, fall, industrial accident, and sporting activity (Webster & Kennedy, 2007), which may potentially convey an elevated risk for the development of posttraumatic stress disorder (PTSD). Indeed, it has been previously reported that the estimated prevalence of PTSD ranges between 7 and 61.8% of SCI populations (Hatcher, Whitaker, & Karl, 2009; Migliorini, Tonge, & Taleporos, 2008; Nielsen, 2003), which highlights the need to monitor and treat PTSD symptoms following traumatic SCI in clinical settings. Nurses in most clinical settings are increasingly caring for clients with PTSD. Therefore, it is especially important for nurses to monitor PTSD symptoms as nurses serve in evaluating, supporting, and encouraging roles (Olszewski & Varrasse, 2005).

Research on PTSD and SCI primarily used measures designed to capture the diagnostic criteria of PTSD listed in the fourth revision of the *Diagnostic and Statistical Manual of Mental Disorders* (*DSM-IV*, American Psychiatric Association, 1994). According to the *DSM-IV*, the criteria of PTSD are composed of 17 clinical symptoms which are further organized into three clusters: intrusion (criterion B), effortful avoidance and emotional numbing (criterion C), and hyperarousal (criterion D). This tripartite phenotypic model of PTSD is constructed mainly based on expert consensus, and has been widely criticized for lack of empirical support. During the past decades, an increasing number of confirmatory factor analytic (CFA) studies have consistently demonstrated that the tripartite model fails to account for the underlying PTSD factor structure, and empirical support converged on two alternative four-factor models (cf., Elhai & Palmieri, 2011; King, King, Orazem, & Palmieri, 2006). These models include the four-factor numbing model of King, Leskin, King, and Weathers (1998), which is composed of intrusion, effortful avoidance, emotional numbing, and hyperarousal clusters, and the four-factor dysphoria model of Simms, Watson, and Doebbeling (2002), which is composed of intrusion, effortful avoidance, dysphoria, and hyperarousal clusters (see Table 1 for symptom mappings). The recently released *DSM-5* generally adopted the four-factor numbing model with addition of several new symptoms (APA, 2013). However, two recent meta-analytic studies evidenced a slight advantage of the four-factor dysphoria model to the four-factor numbing model (Gootzeit & Markon, 2011; Yufik & Simms, 2010).

The main difference between the two models is the placement of PTSD's D1–D3 symptoms (i.e., sleep disturbance, irritability, and difficulty concentrating) in either the hyperarousal cluster in King's model or the dysphoria cluster in Simms's model. Recently, based on prior theoretical work (Watson, 2005) and empirical evidence (Shevlin, McBride, Armour, & Adamson, 2009), Elhai et al. (2011) further specified that the D1–D3 symptoms differ conceptually both the hyperarousal and dysphoria symptoms, and proposed a five-factor model which is composed of intrusion, effortful avoidance, emotional numbing, dysphoric arousal, and anxious arousal clusters (see Table 1 for symptom mappings). Numerous recent CFA studies have demonstrated the superiority of the novel five-factor model to the tripartite model of *DSM-IV* and the four-factor models in nationally representative samples (Armour, Carragher, & Elhai, 2013) and samples exposed to a range of traumatic events including domestic violence (Elhai et al., 2011), natural disaster (Armour, Raudzah Ghazali, & Elklit, 2013; Pietrzak, Van Ness, Fried, Galea, & Norris, 2012; Wang, Li,

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http://dx.doi.org/10.1016/j.apnu.2014.05.008
0883-9417/

Table 1
Symptom Mapping for Confirmatory Factor Analysis.

sPCL items	Model 1	Model 2	Model 3	Model 4
B1. Intrusive thoughts	I	I	I	I
B2. Nightmares	I	I	I	I
B3. Flashbacks	I	I	I	I
B4. Emotional reactivity	I	I	I	I
B5. Physical reactivity	I	I	I	I
C1. Avoidance of thoughts	A/N	A	A	A
C2. Avoidance of reminders	A/N	A	A	A
C3. Amnesia for aspects	A/N	N	D	N
C4. Loss of interest	A/N	N	D	N
C5. Feeling distant	A/N	N	D	N
C6. Feeling numb	A/N	N	D	N
C7. Foreshortened future	A/N	N	D	N
D1. Sleep disturbance	H	H	D	DA
D2. Irritability	H	H	D	DA
D3. Difficulty concentrating	H	H	D	DA
D4. Hypervigilance	H	H	H	AA
D5. Exaggerated startle	H	H	H	AA

NOTE. The items were from the PTSD checklist. I = intrusion; A/N = avoidance/numbing; H = hyperarousal; A = avoidance; N = numbing; D = dysphoria; DA = dysphoric arousal; AA = anxious arousal.

et al., 2011), violent riot (Wang, Zhang, et al., 2011), and war (Armour et al., 2012; Pietrzak, Tsai, Harpaz-Rotem, Whealin, & Southwick, 2012).

Examining factor structure underlying PTSD symptom is pertinent for guiding effective assessment and treatment of this disorder. Despite the high prevalence of PTSD among traumatic SCI patients, to our knowledge, there were no studies examining the factor structure of PTSD in this high risk population. In so doing, this study investigated the factor structure of PTSD in a sample of inpatients with traumatic SCI.

METHODS

Procedures

This study was conducted from October 2010 to March 2011 in the China Rehabilitation Research Center, China. All data were collected in by the investigators including trained psychiatrists and clinical psychologist.

Participants

Subjects included 256 traumatic SCI patients who were receiving rehabilitation treatment in the hospital. Most subjects were male (n = 221, 86.3%) with a mean age of 37.9 years (SD = 10.3, range: 16–63). Regarding educational level, 37 (14.5%) subjects completed college, 125 (48.8%) completed high school (including equivalency), and 94 (36.7%) did not complete high school. Of the subjects, 105 (41.0%) were caused by road traffic accident, 69 (27.0%) were caused by fall; 59 (23.0%) were caused by industrial accident, 5 (2.0%) were caused by sporting activity, and 18 (7.0%) were caused by other accidents. With respect to the extent of injury, 112 (43.8%) subjects were quadraplegic, and 144 (56.2%) were paraplegic, with a mean time of 24.2 months (SD = 44.9, range: 4–289) since injury.

Measures

Demographic and medical information includes: name, gender, age, education level, cause of injury, extent of injury, and time since injury.

The PTSD Checklist–Specific Stress Version (PCL-S) (Weathers, Litz, Herman, Huska, & Keane, 1993) was use to assess PTSD symptoms. The PCL is an easily administrated PTSD measure consisting of 17 items that corresponds directly to the *DSM-VI* PTSD symptoms. Each item is rated on a 5-point Likert scale ranging from 0 (not at all) to 5 (extremely) to reflect a particular symptom during the last month. As one of the most widely used PTSD measures, its reliability and validity have been well documented (McDonald & Calhoun, 2010; Wilkins, Lang, & Norman, 2011). Regarding the Chinese version of the PCL, it also has demonstrated sound psychometric properties (Wu, Chan, & Yiu, 2008; Yang, Yang, Liu, & Yang, 2007). In the current study, the PCL items were responded in terms of the injury, and were inquired and filled in by the investigators. The Cronbach's α was 0.89 for the total scale in this sample.

Statistical Analysis

Descriptive statistics were computed with SPSS (version 19.0 for windows). CFA was performed with Mplus (version 7.0) to test four competing models of PTSD symptoms: the tripartite *DSM-IV* model (model 1), the four-factor numbing model of King et al. (1998) (model 2); the four-factor dysphoria model of Simms et al. (2002) (model 3), and the five-factor dysphoric arousal model of Elhai et al. (2011) (model 4) (see Table 1 for item mappings).

An initial multivariate normality test indicated that the data were not multivariate normal, χ^2 (2, N = 256) = 806.89, $p < 0.001$. Thus, we implemented robust maximum likelihood estimation with a mean-adjusted, scaled Satorra–Bentler chi-square statistic (S-B χ^2; Satorra & Bentler, 1988) in CFAs to correct for non-normality. In all measurement models estimated, error covariances were fixed to zero, and factors were permitted to correlate. Four goodness of fit indices were used to evaluate measurement models, including the comparative fit index (CFI), and the Tucker–Lewis index (TLI), the root-mean square error of approximation (RMSEA), and the standardized root mean square residual (SRMR). According to Hu and Bentler (1998, 1999), CFI and TLI $\geq$ .95, RMSEA $\leq$ .06, and SRMR $\leq$ .08 indicate an excellent fit, and CFI and TLI $\geq$ .90, RMSEA $\leq$ .08, and SRMR $\leq$ .08 indicate an acceptable fit. For further model selection, the corrected scaled χ^2 difference test (Satorra & Bentler, 2001) was conducted to compare the nested models (i.e., model 4 versus models 1, model 2, and model 3, and model 2 versus models 1), and the Bayesian information criterion (BIC) (Schwarz, 1978) was used to compare non-nested models (i.e., model 3 versus models 1and model 2). As suggested by Raftery (1995), a difference in BIC of 6–10 yields strong evidence, and a difference greater than 10 yields very strong evidence in favor of the model with the smaller BIC value.

RESULTS

The mean score on the PCL was 37.5 (SD = 12.9, range: 17–79) for the current sample. According to previous studies using civilian trauma victim samples in Western countries (McDonald & Calhoun, 2010) and in China (Li et al., 2010), probable PTSD cases may be best identified by a cutoff score of 44 on the PCL. On the basis of this criterion, 69 (27.0%) subjects were identified as probable PTSD cases.

Goodness of fit indices for four competing models are presented in Table 2. Model 2 (the four-factor numbing model) and model 4 (the five-factor dysphoric arousal model) achieved excellent fit, and model 1 (the tripartite *DSM-IV* model) and model 3 (the four-factor dysphoria model) only achieved an acceptable fit. Regarding non-nested models comparison, model 2 demonstrated superiority to both model 1 ($\triangle$BIC = −70.1) and model 3 ($\triangle$BIC = −24.58). With respect to nested models comparison, model 4 was found to significantly fit the data better than model 1 [$\triangle$S-Bχ^2 (7, 256) = 79.91, $p < 0.001$], model 2 [$\triangle$S-Bχ^2 (4, 256) = 17.23, p = 0.002] and model 3[$\triangle$S-Bχ^2 (4, 256) = 37.87, $p < 0.001$], and model 2 fits the data significantly better than model 1 [$\triangle$S-Bχ^2 (3, 256) = 67.72, $p < 0.001$]. In summary, the results evidenced model 4 as the best fit model. Table 3 presents the standardized factor loadings and factor correlations for the five-factor PTSD model. It should be noted that although the C3 symptom (inability