Elaboration on Posttraumatic Stress Disorder Diagnostic Criteria: A Factor Analytic Study of PTSD Exposure to War or Terror

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ABSTRACT

Background: In societies facing prolonged exposure to war and terror, empirical research provides mixed support for the posttraumatic stress disorder (PTSD) symptom clusters groupings identified by the Diagnostic and Statistical Manual (DSM-IV-TR) as re-experiencing the event, avoidance and emotional numbing, and hyperarousal.

Method: This study examines the validity of the PTSD symptom clusters in elements of Israeli society exposed to man-made trauma. Survivors (N=2,198) of seven different war and terror-related traumas were assessed using a DSM-IV-TR based PTSD inventory. Four confirmatory factor analytic models were compared.

Results/Conclusions: The most acceptable model was a correlated model consisting of four factors of re-experiencing, avoidance, emotional numbing, and hyperarousal. DSM-IV-TR avoidance empirically split into active avoidance and emotional numbing. These results corroborate knowledge and suggest that in Israel, where stressors are ongoing, the PTSD symptom clusters may be reformulated in DSM-5 to consist of re-experiencing, active avoidance, emotional numbing and hyperarousal.

INTRODUCTION

According to the Diagnostic and Statistical Manual IV-TR (1), PTSD is an anxiety disorder that consists of 17 symptoms grouped into three clusters: re-experiencing the event (e.g., distressing dreams and flashbacks); avoidance and numbing (e.g., avoidance of trauma reminders and restricted range of affect); and hyperarousal (e.g., sleep disturbances and irritability). The symptom cluster classifications are based primarily on clinical field trails and expert consensus, rather than on empirical evidence (2). Among the proposed DSM-5 changes (www.dsm5.org/), it is suggested that criterion C (i.e., the persistent avoidance of stimuli associated with the trauma and numbing of general responsiveness) be altered. A proposed DSM-5 change is to retain the avoidance symptoms in criterion C, and add a new criterion D, named “Negative alterations in cognitions and mood that are associated with the traumatic event(s)” This will consist of symptoms of emotional numbing and other cognitive changes, such as shifts in world assumptions. Accordingly, the present time is particularly appropriate to empirically examine and assess the validity of the existing PTSD symptom clusters.

Avoidance and emotional numbing theoretically represent two separate factors that reflect different ways of adjusting to adversity (3, 4). Avoidance constitutes an effortful emotional process employed to actively curtail intrusive symptoms. It serves as a strategic way to escape or minimize aversive emotional states induced by exposure to trauma-related stimuli that threaten to intrude on awareness. Emotional numbing refers to diminished responsiveness to the external world and is thought to be an automatic biological response to an extended state of uncontrollable hyperarousal.

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The first study of the structure of a DSM-based PTSD assessment examined 524 treatment-seeking male military veterans (5). Those results show that PTSD consists of four symptom clusters: re-experiencing, avoidance, emotional numbing, and hyperarousal. These results have been subsequently replicated in groups suffering from various traumas (e.g., 6, 7). For example, one study employed confirmatory factor analysis (CFA) to examine PTSD symptom structure across three veteran samples. CFA demonstrates that a four-factor structural model including re-experiencing, avoidance, numbing, and hyperarousal is superior to five alternate models, including the DSM-IV three-factor PTSD diagnostic model (7). Another study employed CFA to examine PTSD symptom structure among a representative sample of U.S. active duty military personnel (N=15,593). Findings show that a four-factor model consisting of re-experiencing, avoidance, emotional numbing and hyperarousal factors was superior to four alternative models (8). These results suggest that emotional numbing is appropriate to include in the DSM as a distinct PTSD cluster. This is consistent with the proposed changes currently under consideration for the DSM-5 (www.dsm5.org/).

In contrast to the aforementioned findings (e.g., 5), other factor analytic studies identify dysphoria, rather than emotional numbing, as the fourth factor (e.g., 9, 10). For instance, analysis of PTSD in a sample of 1,896 deployed Gulf War veterans and 1,799 nondeployed controls has identified four correlated factors of re-experiencing, avoidance, hyperarousal, and dysphoria as the best fitting model (11). These findings are consistent with a meta-analysis of 40 PTSD studies (N=14,827) that used DSM-based PTSD assessments (12).

Empirical research indicates that both prominent four-factor models of PTSD are a good model fit (5, 11). Meta-analysis has shown: re-experiencing, avoidance, hyperarousal, and dysphoria factors are slightly superior (12). The dysphoria factor includes emotional numbing-related symptoms (e.g., loss of interest) as well as certain symptoms from the hyperarousal cluster (e.g., sleep disturbance). Dysphoria may reflect a non-specific, general-distress factor that is common across anxiety and mood disorders (11). Generally, however, inconsistent results may be due to differences in analytic approach, type of trauma or the use of different PTSD measures (12). Moreover, a clear consensus regarding model superiority is yet to be reached since even Yufik and Simms’ (12) meta-analysis only provided tentative support for their model (13).

Rarely do prior studies examine the structure of PTSD in societies faced with ongoing prolonged exposure to war and terror. Most study participants in prior meta-analyses of the structure of PTSD came from Western nations (e.g., 12) and so did not face ongoing prolonged exposure to war or terror. In Israel, between September 2000 and January 2006 Israeli society was exposed to over 13,000 terror attacks, including suicide bombings, shootings, and mortar attacks (14). During this period, approximately 0.1% of the Israeli population was injured or killed. In the U.S.A. this would equate to approximately 31,000 people. Therefore, Israeli population serves as an example of a society that has been consistently exposed to acts of terror and may be used to highlight responses to continuous stressors (e.g., 15).

The current study aims to compare the confirmatory factor analytic models of PTSD that have received the most empirical support by examining a large group of Israelis who survived a war or terror-related traumatic events. These are (a) re-experiencing, avoidance, numbing and hyperarousal and its hierarchical counterpart (e.g., 5); and (b) re-experiencing, avoidance, numbing, dysphoria and hyperarousal and its hierarchical counterpart (e.g., 11, 12).

**METHOD**

**PARTICIPANTS AND PROCEDURE**

The present study was based on seven samples (N=2,198) that all consisted of participants who had man-made trauma (war, captivity or terror-related) and completed the PTSD assessment in full with regard to the specific type of trauma to which they were exposed. All participants signed an informed consent form and they were informed that their anonymity would be preserved. Ethical approval to conduct the current research was obtained from the Israeli Defense Forces and Tel Aviv University Human Subjects Ethics Committee. The mean age of the total sample was 36.99 (SD=12.76) and 34.3% (N=750) were female. Sample I included 157 male Israeli veterans aged 29.71 (SD=5.72) who were active front-line combatants during the second Lebanon War during 2006 which lasted approximately one month (16). Sample II was based on 459 college students on average aged 24.18 (SD=3.52) of whom 70.3% (N=317) were females. These participants had been exposed to prolonged intense missile attacks from the Gaza Strip (17). Sample III consisted of 248 Israeli ex-residents of Gush Katif aged on average 35.43 (SD=12.02) of whom 63.7% were females (N=158).
During their time in Gush Katif they were continuously exposed to terror and missile attacks, and were forcefully relocated by the Israeli authorities as their land was handed over to the Palestinian authorities (18). Sample IV included 594 Israeli civilians and army personnel aged 26.03 (SD=4.00) of whom 215 (36.2%) were females. They were residents of Northern Israel who were subjected to 34 days of intense direct missile attacks during the second Lebanon War (19). Sample V included 145 male ex-prisoners of wars (POWs) aged 57.71 (SD=4.9) who were held in captivity for an average time of 2.6 months in Egypt and Syria during the Yom Kippur War in 1973 and were assessed in 2008 (Solomon and Zerach, under review). Sample VI included 475 male war veterans aged on average 46.98 (SD=2.67) who took part in active combat in the ongoing first Lebanon War that began in 1982 and ended in 1985 were assessed 20 years after the war (20). Sample VII included 120 civilians from south Israel who were continuously exposed to intense missile attacks from the Gaza Strip during 2008 (unpublished manuscript) of whom 50% were females, aged from 17 to 29. For further demographic and procedural information please see the aforementioned studies.

PTSD SYMPTOMS ASSESSMENT

All seven samples were assessed with the DSM-IV (21) based PTSD Inventory (22). This Hebrew inventory consists of 17 statements corresponding to the 17 PTSD symptoms listed in the DSM-IV (21). Participants indicated for each statement the extent to which they have suffered from the symptom during the previous month, regarding their specific war-related or terror-related traumatic events, on a 4-point scale ranging from 1 (“not at all”) to 4 (“I usually did”). The PTSD inventory was administered twice within a 1-week interval to 20 soldiers. The percentage of agreement was 82.3%, indicating high test–retest reliability (23). The test-retest reliability of this inventory has been reported at .93 reflecting internal consistency (α=0.93; 24). It has been reported to have high convergent validity when compared with diagnoses based on structured clinical interviews conducted by trained psychiatrists and mental health professionals (φ=0.48–0.61; 23, 25). The scale is widely used in Israel and has good psychometric properties according to a review of PTSD inventories (26).

STATISTICAL ANALYSIS

Prior to analysis the data were analyzed to assess whether missing values were missing completely at random or systematically. Confirmatory factor analysis was computed using the LISREL 8 structural equation modeling software package (27). Fit indices were compared of the four models that consisted of four factors and their hierarchical counterparts. Model fit was examined with the following fit indices: χ², Root Mean Square Error of Approximation (RMSEA), Normed Fit Index (NFI), Non-normed Fit Index (NNFI), Comparative Fit Index (CFI), Standardized Root Mean Square Residual (SRMR), and Expected Cross-validation Index (ECVI). The χ² goodness of fit index assesses whether or not there is a significant discrepancy between the estimated model and actual data. Statistically significant χ² values highlight that the model and data differ and thus are indicative of a poorly fitting model. This is likely given a large sample size. Thus we examined both incremental and absolute fit indices.

Absolute fit indices, such as the RMSEA and SRMR, aim to assess how well the theoretical model reproduces the data. The SRMR expresses the average discrepancy between observed and expected correlations across all parameter estimates in a model. It ranges from 0 to 1, with lower values indicating better model fit. The RMSEA assesses the extent to which the model, with unknown but optimally chosen parameter values, would fit the population covariance matrix if it were available. Unlike most fit indices, 90% confidence intervals are available to supplement point estimates for the RMSEA and the ECVI. The ECVI is a way to assess the likelihood that the model cross-validates similar-size samples from the same population. The model with the lowest ECVI value has the greatest potential for replication. The precision of the estimated ECVI value is accounted for by reporting 95% confidence intervals. Both the RMSEA and ECVI include non-centrality parameters. Incremental fit indices measure the proportionate improvement in model fit by comparing a target model with more restricted nested baseline model. The CFI is based on the non-central Chi-square distribution and ranges from 0 and 1, with higher values indicating better model fit. The CFI penalizes small samples and so accounts for sample size. The NFI represents the proportion of total covariance among the observed variables that is explained by a target model when using the null model as a baseline model (28). The NNFI elaborates on the NFI by penalizing for additional parameters.

Due to the skewed distribution of the items, weighted least squares was used with dichotomized items following past recommendations (13; see Table 1; namely categories of absent and rare, or sometimes and frequent symptoms),
no error terms were set to correlate with factors based on post-hoc improvement fit indices, and all factors fixed. These are the models consisting of re-experiencing, avoidance, hyperarousal and either numbing or dysphoria based on Yufik and Simms (12). Specifically, the King et al. (5) four-factor model maintains a traditional emotional numbing factor, whereas in the Simms et al. (11) model the Hyperarousal factor has two items (D4 and D5), and Dysphoria consists of 7 items (D1–D3, and C3–C7). The models were compared based on the Akaike Information Criterion (AIC) where smaller values indicate a better model fit and χ² comparisons between hierarchical and correlated models. The best-fitting model was identified and the loadings termed structural coefficients and reliability reported. These procedures followed a prior PTSD confirmatory factor analytic study recommendations (13, 29). The best-fitting model was identified and the loadings termed structural coefficients and reliability reported.

RESULTS
Collectively, 2,404 people were assessed of whom 206 (8.5%) had missing values. The missing value pattern significantly deviated from the assumption of being completely missing at random (Littel’s MCAR test: χ²=976.52, DF=775, p=.00). This may reduce the generalizability of the results and so imputation would be inappropriate (30). Thus across the samples 2,198 people completed all 17 PTSD items. The mean age of the sample was 36.99 (SD=12.76) and 34.3% (N=750) were female. Descriptive statistics of the sample 17 PTSD symptom items were computed and presented in Table 1.

The confirmatory factor analytic models are presented in Table 2. These results suggest that the best fitting model is a correlated model with four factors consisting of re-experiencing, avoidance, emotional numbing, and hyperarousal (5). This model had the lowest χ² although this fit index was significant (meaning poor model fit) due to the large sample size. Although model fit was moderate, across fit indices the hierarchical model was the best fit to the model (highest CFI and GFI, and lowest AIC, ECVI, NNFI and RMSEA). The point estimates for King et al. (5) were better than the other models since the ECVI and RMSEA confidence intervals did not overlap, except for their corresponding hierarchical models. Comparison between models showed that both

| Table 1. Descriptive statistics and structural coefficients based on a 5-factor confirmatory factor analysis consisting of re-experiencing, avoidance, numbing and hyperarousal |
|-----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|
| Item            | M   | SD  | Re-experiencing | Avoidance | Numbing | Hyperarousal | α Reliability |
| B1. Intrusive thoughts of trauma | 2.25 | -1.07 | 0.91 |         |         |         |         |
| B2. Recurrent dreams of trauma | 1.81 | -1.02 | 0.92 |         |         |         |         |
| B3. Flashbacks | 2.08 | -1.08 | 0.87 |         |         |         |         |
| B4. Emotional reactivity to trauma cues | 2.36 | -1.15 | 0.90 |         |         |         |         |
| B5. Physiological reactivity to trauma cue | 1.71 | -1.01 | 0.90 |         |         |         |         |
| C1. Avoiding thoughts of trauma | 1.98 | -1.09 | 0.87 |         |         |         |     .77     |
| C2. Avoiding reminders of trauma | 1.75 | -1.02 | 0.89 |         |         |         |         |
| C3. Inability to recall aspects of trauma | 1.63 | -0.93 | 0.69 | 0.81 |         |         |         |
| C4. Loss of interest | 1.81 | -1.03 | 0.89 |         |         |         |         |
| C5. Detachment | 1.82 | -1.00 | 0.87 |         |         |         |         |
| C6. Restricted affect | 1.63 | -0.94 | 0.85 |         |         |         |         |
| C7. Sense of foreshortened future | 1.84 | -1.04 | 0.82 |         |         |         |         |
| D1. Sleep disturbance | 1.96 | -1.11 | 0.88 |         |         |         |     .87     |
| D2. Irritability | 2.01 | -1.06 | 0.85 |         |         |         |         |
| D3. Difficulty concentrating | 1.93 | -1.07 | 0.84 |         |         |         |         |
| D4. Hypervigilance | 1.99 | -1.11 | 0.85 |         |         |         |         |
| D5. Exaggerated startle response | 2.16 | -1.15 | 0.86 |         |         |         |         |

correlated models were superior than their hierarchical counterparts (model 4a: \(\chi^2=39.12, df=2, p<.01; \chi^2=34.14, df=2, p<.01\)). Results of examination of these fit indices closely resemble earlier research (29). In addition, the AICs indicated that the best fitting model was the King et al.'s (5) correlated model and thus is consistent with the superiority of correlated models of PTSD (12).

The loadings of each symptom on each factor of this model are presented in Table 1. For example, PTSD symptoms 1 through 5 (thoughts, nightmares, flashbacks, psychological and physiological reactions) loaded on factor 1, thus factor 1 was termed Re-experiencing. All loadings were statistically significant (\(p<.01\)) and the reliability was satisfactory (31-33), since for all scales Cronbach's \(\alpha\) exceeded .70. Thus collectively the current results highlight that PTSD has acceptable reliability and validity, represented by a hierarchical model with four symptom clusters consisting of re-experiencing, avoidance, emotional numbing, and hyperarousal. The results therefore are most consistent with King et al.'s (5) correlated model of PTSD as consisting of re-experiencing, avoidance, numbing, and hyperarousal.

**DISCUSSION**

Based on a large sample of Israeli survivors of man-made trauma including war veterans, ex-POWs and civilians exposed to terror attacks, the current study compares four competing models of symptom clusters of PTSD. The results show that the moderately best fitting model is a correlated model with four factors consisting of re-experiencing, avoidance, emotional numbing, and hyperarousal, supporting King et al. (5). This empirical evidence suggests that the current understanding and formulation of DSM-IV PTSD, as assessed by the current self-report PTSD Inventory (22), does not best capture the structure of symptoms among people who were exposed to war or terror-related trauma in Israel.

The current results are consistent with a growing body of empirical studies reporting empirical deviation from the three factor expert-based conceptualization in DSM-IV-TR (1). The study findings are inconsistent with Simms et al. (11) four factor hierarchical model consisting of re-experiencing, avoidance, hyperarousal, and dysphoria in war, captivity and terror-related trauma. Dysphoria may not fit into the DSM-IV-TR PTSD conceptualization as it is a too broad and nonspecific distress factor in comparison with emotional numbing. Specifically, emotional numbing refers to chronic long-term results of an ongoing state of anxiety (e.g., restricted range of affect), while dysphoria includes both components of emotional anaesthesis but also components that may not reflect chronic PTSD (e.g., angry outbursts).

The current study is consistent with past research (e.g., 5, 29), pointing to a four factor correlated model consisting of re-experiencing, avoidance, numbing, and hyperarousal. This conceptualization of PTSD appears to be the most appropriate explanation of PTSD. It provides...
an acceptable fit among Israelis who have experienced war, captivity or terror-related trauma, and across prior study samples. Other studies that report the same findings are based on samples exposed to: armed combat (7), sexual assault (34), refugee torture (35), a hurricane (36), and occupational trauma (37).

The current four-factor findings are consistent with theories proposing that avoidance and emotional numbing have two separate mechanisms. For instance, avoidance serves as an escape strategy from trauma-related stimuli that may intrude on awareness, whereas emotional numbing refers to diminished responsiveness to the external world and is thought to be an automatic biological response due to hyperarousal (3). Also empirical evidence supports this distinction showing that avoidance and numbing differ in their response to treatment (38) and in relation to prognosis (39; see 40 for further review).

LIMITATIONS

Several limitations are associated with the current study. Symptom severity was assessed via self-report and not clinical interviews. Past research (22), however, has shown that the PTSD instrument used in this study has good psychometric properties of reliability and convergent validity (23, 25). Also, the items are DSM-IV based and are almost identical to the 17 statements of the military version of the PTSD Checklist (PCL-M: 41). Finally, although our study had insufficient power to examine each discrete form of trauma, the DSM does differentiate between trauma types. Future analyses are nonetheless warranted to replicate the current findings by examining large samples that focus on specific forms of trauma and different cultures.

CONCLUSIONS

Based on the comparison of competing PTSD conceptual models in war, captivity and terror-related trauma victims, the current study makes three contributions. First, it is appropriate to split PTSD criterion C into active avoidance and emotional numbing as separate symptom clusters among people exposed to war, captivity or terror. Second, treatment may focus on specific expressions (the four distinct factors) of PTSD. Third, if replication is the sine qua non for accepting a hypothesis, the current findings reinforce past research (e.g., 5) by uniquely indicating that PTSD in a society consistently exposed to war and terror consists of four correlated factors reflecting symptom clusters. Based on the current results, past research, and the biological and emotional differences between numbing and avoidance (3, 4), the current findings support the DSM-5’s (www.dsm5.org/) suggestion to retain the avoidance symptoms in criterion C and add a new criterion D consisting of symptoms of emotional numbing.

Contribution of each author:
Moshe Bensimon conducted the literature review, drafted the manuscript, data interpretation, and critical manuscript review. Stephen Z. Levine conducted data analysis and gave critical manuscript feedback. Gadi Zerach gave critical manuscript and critical manuscript review. Einat Stein assisted in data collection and critical manuscript feedback. Vlad Svetlicky assisted in data collection and critical manuscript review. Zahava Solomon – study instigation, design, statistical interpretation and critical manuscript review. All authors approved the final version of the document.

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