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Factor structure of the Acute Stress Disorder Scale in a Sample of Hurricane Katrina evacuees

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Abstract

Acute stress disorder (ASD) is a poorly understood and controversial diagnosis (Harvey & Bryant, 2002). The present study used confirmatory factor analysis (CFA) to test the factor structure of the most widely used self-report measure of ASD, the Acute Stress Disorder Scale, in a sample of Hurricane Katrina evacuees relocated to a Red Cross emergency shelter in Austin, Texas. Results indicated that the proposed four-factor structure did not fit the data well. However, an alternate 2-factor model did fit the data well. This model included a second-order Distress factor (onto which the Reexperiencing, Arousal, and Avoidance factors loaded strongly) that was positively correlated with the Dissociation factor. Implications for the ASD construct and its measurement are discussed.

Keywords

acute stress disorder; factor structure; natural disaster; Hurricane Katrina; trauma

Acute stress disorder (ASD) is a poorly understood and controversial diagnosis (Harvey & Bryant, 2002). The nature, uniqueness, utility, and symptom structure of the disorder have been called into question, and changes to its diagnostic criteria (in particular, deemphasizing the role of dissociation; Bryant, 2007) are being considered for DSM-V. Some have even called for ASD to be deleted from DSM-V altogether (e.g., Spitzer, First, & Wakefield, 2007). However, very little empirical research has rigorously assessed ASD symptoms, and none have subjected the theoretical symptom structure to statistical model testing. In the present study, we examine the factor structure of ASD symptoms in a sample of individuals who were temporarily residing in a Red Cross shelter in Austin, TX, having fled their homes in the aftermath of Hurricane Katrina. This Category 3 hurricane, which made landfall in southeast Louisiana on August 29, 2005, was one of the deadliest in US history. While Katrina left a trail of destruction along the Gulf coast from central Florida to Texas, the greatest damage and loss of life occurred inNew Orleans, Louisiana, which flooded following catastrophic levee failures. In the weeks following the disaster, thousands of evacuees were temporarily housed in over 470 Red Cross operated shelters and evacuation centers across the nation (see Brodie, Weltzien, Altman, Blendon, & Benson, 2006; Mills, Edmondson, & Park, 2007).

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Acute stress disorder (ASD) was introduced into the diagnostic nomenclature in 1994 with the publication of the 4th Edition of the Diagnostic and Statistical Manual of Mental Disorders (4th ed.; DSM-IV-TR; American Psychiatric Association [APA], 2000). ASD describes stress reactions occurring within the first month following a traumatic stressor (as defined by Criterion A1 for posttraumatic stress disorder [PTSD]) and represents an attempt to distinguish acutely traumatized individuals likely to develop chronic PTSD from those experiencing more normative and transient stress reactions (Harvey & Bryant, 2002).

As outlined in DSM-IV-TR, ASD is characterized by eight diagnostic criteria. First, for a diagnosis of ASD to be considered, the individual must have experienced “intense fear, helplessness, or horror” (APA, 2000) in response to the personal experience or witnessing of an event involving extreme threat to the self or others (Criterion A). The individual must also display at least three out of the five listed dissociative symptoms (i.e., numbing, reduction in awareness of surroundings, derealization, depersonalization, and dissociative amnesia) (Criterion B). Further, at least one symptom each of reexperiencing (i.e., recurring thoughts, memories, dreams, or flashbacks) (Criterion C), avoidance of trauma-related stimuli (i.e., deliberately staying away from reminders of the trauma) (Criterion D), and anxiety or increased arousal (i.e., increased autonomic nervous system activity) (Criterion E) must be present. Symptoms must cause significant distress or functional impairment (Criterion F) and be present for a minimum of two days within the first month posttrauma (Criterion G). Finally, the disturbance must not be due to the effects of a substance or a general medical condition, or be better accounted for by another psychological disorder (Criterion H).

Studies have found ASD prevalence rates of 10–20% in acutely traumatized individuals (Brewin, Andrews, Rose, & Kirk, 1999; Bryant & Harvey, 1998; Harvey & Bryant, 1998). Often viewed as “early PTSD,” the ASD diagnosis is appropriate only in the first four weeks posttrauma, the timeframe during which PTSD cannot be diagnosed. Beyond this one-month period, an ASD diagnosis can no longer be assigned, and a diagnosis of PTSD must instead be considered. In addition to the difference in temporal windows, however, ASD also differs from PTSD in its emphasis on dissociative phenomena. While PTSD is framed in terms of reexperiencing, avoidance, and arousal, ASD includes the additional criterion dedicated solely to acute dissociative phenomena, described above. These dissociative symptoms represent a major component of the ASD construct; the criterion of at least three such symptoms being necessary for diagnosis is more than the number required in any other single symptom cluster. This difference in emphasis is theoretical, based on the idea that acute trauma-related dissociation impedes appropriate processing of traumatic memories and subsequent adaptation to traumatic stress (Koopman, Classen, & Spiegel, 1994; Bryant, 2003).

Since its introduction, some have suggested that the lack of empirical evidence for ASD and the reliance of the diagnosis on theoretical constructs hinder its usefulness (see Harvey & Bryant, 2002, for a review). The diagnostic criteria for ASD are nearly identical to those for PTSD, except for the focus on acute dissociation in ASD (which has been controversial from the diagnosis’ conception; e.g., Marshall, Spitzer, & Liebowitz, 1999). Indeed, one of the primary arguments for the utility of the diagnosis centers on its ability to predict subsequent PTSD (Marshall et al., 1999).

However, recent research suggests that the ability of the ASD diagnosis to correctly identify individuals who later develop PTSD may be limited. In terms of utility for predicting later PTSD, prospective studies have shown that approximately 80% of trauma survivors meeting ASD criteria go on to meet criteria for PTSD six months later (Brewin et al. Kirk, 1999; Bryant & Harvey, 1998; Harvey & Bryant, 1998), and 75% to 80% 2 years posttrauma (Harvey & Bryant, 2000, 1999). However, not all studies have found ASD diagnostic cutoffs useful in prospectively predicting PTSD diagnosis (e.g., Fuglsang et al., 2004).

Challenges to ASD scores' predictive validity have been made concerning the sensitivity of ASD to PTSD prediction (e.g., Creamer, O'Donnell, & Pattison, 2004). Also, some research has shown that vulnerability and cognitive variables account for more variance than ASD scores in PTSD diagnosis (Kleim, Ehlers, & Glucksman, 2007), and estimates of the relationship of ASD to PTSD are heavily influenced by researchers' decisions about whether to include the dissociation features of the disorder in the ASD diagnosis (e.g., Harvey & Bryant, 1998; see Isserlin, Zerach, & Solomon, 2008, for a brief review). Given that the ASD diagnosis is distinguished from the PTSD diagnosis only by timing and the inclusion of dissociation symptoms, prediction of PTSD from ASD when dissociation symptoms are discounted amounts to predicting PTSD symptoms after one month from PTSD symptoms slightly earlier. In order to establish whether ASD is a worthwhile diagnosis, the purported symptom clusters of ASD must be measured well. Further, the relationship between ASD dissociation symptoms and those that mirror PTSD symptoms must be understood.

Research findings with regard to ASD have been undercut by a lack of diagnostic clarity. For example, in some studies, ASD diagnosis has been determined by combining responses to different measures in order to create a composite resembling the DSM-IV-TR criteria (Brewin et al., 1999; Staab, Grieger, Fullerton, & Ursano, 1996). Other studies have utilized a structured clinical interview (e.g.; Acute Stress Disorder Interview; Bryant, Harvey, Dang, & Sackville, 1998) or theStanford Acute Stress Reaction Questionnaire (Cardena, Classen, & Spiegel, 1991).

The Acute Stress Disorder Scale

In an effort to address the lack of a gold standard in ASD assessment, Bryant, Moulds, and Guthrie (2000) created the Acute Stress Disorder Scale (ASDS), a 19-item self-report inventory based on ASD criteria as laid out by DSM-IV-TR. As is the case with the ASD diagnosis itself, the aim of the ASDS is both the identification of ASD and prediction of risk for subsequent PTSD. In previous research, ASDS scores have shown good reliability (Bryant, Moulds, & Guthrie, 2000). In that study, test-retest reliability for scores over the course of 2 to 7 days was high ($r = .94$ for two assessments), and internal consistency reliability was good for the full scale ($\alpha = .96$) and each of the subscales (α's= .84 to .93). In terms of convergent validity, the ASDS subscales scores have been shown to be strongly correlated (r's= .69, Dissociation to .84, Arousal) with corresponding subscales on the Acute Stress Disorder Interview (ASDI; Bryant, Harvey, Dang, & Sackville, 1998), as both derive items directly from the DSM-IV-TR ASD criteria. ASDS scores have also been strongly correlated with scores on a widely used measure of PTSD symptomatology, the Impact of Events Scale (IES; Horowitz, Milner, & Alvarez, 1979).

Since its introduction, the ASDS has been used in various populations, including individuals referred to a PTSD clinic after exposure to varied trauma and survivors of an Australian bushfire (Bryant et al., 2000), and of traffic accident survivors (Fuglsang et al., 2004). Based on previous research using the ASDS, between 72% and 83% of those who develop ASD go on to meet criteria for PTSD at 6 months posttrauma (Brewin et al., 1999; Bryant & Harvey, 1998) and between 63% and 80% at 2 years posttrauma (Harvey & Bryant, 2002;Harvey & Bryant, 1999). Validation studies revealed that an ASDS cutoff score of 56 correctly identified 91% of people who developed subsequent PTSD and 93% who did not (Bryant & Harvey, 2000). This scoring method had predictive ability superior to a scheme more closely based on the DSM-IV-TR criteria, in which a combined score of ≥ 9 was required for dissociative items.

To date, the ASDS has not been subjected to a rigorous statistical test of its factor structure, a critical step in determining its utility for informing research and interventions. In addition, the ASD construct has not been examined in a sample of disaster victims temporarily residing together in an emergency shelter, a situation that has become increasingly common in the face of widescale disasters (American Red Cross, 2008). In fact, very few studies have assessed ASD in survivors of the same traumatic event (cf. terrorist attack in Israel; Kutz & Dekel, 2006), and we know of none that have used the ASDS. Since the ASDS is designed to reflect the diagnostic criteria for ASD, rigorously assessing the factor structure of the scale in a sample such as this may shed light not only on the scale, but also on the construct itself.

The structure of posttraumatic stress

A few studies have employed exploratory factor analyses (EFA) to probe the structure of acute (within one month post-trauma) posttraumatic stress responses. The initial report on the ASDS included 2 principle components analyses, neither of which was entirely consistent with symptom clusters set forth by DSM-IV; the first was conducted with accident and assault survivors and suggested 3 factors. The first factor included all items from the Reexperiencing, Arousal, and Avoidance subscales, the second consisted of all of the Dissociation items except for amnesia, and the third was only the amnesia item. The second EFA was conducted with brushfire survivors and suggested 4 factors that were not as coherent. In that analysis, Dissociation items seemed to load together (though amnesia again did not load clearly with the subscale), and Reexperiencing and Arousal items also seemed to load together. Thus, the extent to which ASD (or the ASDS) reflects the dimensions specified by the DSM-IV-TR is unclear.

It should be noted that the second of these factor analyses was conducted in a population with heterogeneous trauma experiences, and both populations experienced varied concurrent environmental influences on psychological well-being. The scale's authors note that further studies that include a range of trauma populations are needed to better understand the factor structure of the ASD construct (Bryant et al., 2000). That is, it may be that different types of traumatic experiences are differentially traumatic or more likely to elicit particular patterns of symptoms (see Lancaster, Melka, & Rodriquez, 2009, for a brief discussion).

Cardena and colleagues (2000) reported an EFA of a related measure, the SASRQ, given to 187 firestorm survivors. That analysis did not include avoidance symptoms but suggested that dissociation symptoms were a distinct factor and that reexperiencing and arousal symptoms were largely distinct factors as well. Two of the items (i.e., "I would feel extremely upset if exposed to events that would remind me of an aspect of the stressful event" and "I had a bodily reaction when exposed to reminders of the traumatic event") loaded on the reexperiencing factor but could be construed as symptoms of arousal. It is notable in that study that only 2 percent of the sample reported amnesia, and the item did not load clearly on a single factor.

It is important to note that EFA is an exploratory data analysis technique that does not allow statistical significance testing and is therefore not an ideal means for determining whether the proposed factor structure of the scale fits the observed data. This shortcoming is particularly important for the ASDS because the scale was designed to mirror the DSM-IV-TR criteria for ASD. Thus, if the observed structure of the scale does not fit the diagnostic structure as specified in the DSM-IV-TR, such a finding would hold implications for the construct itself.

Previous confirmatory factor analytic studies of posttraumatic stress responses are useful for suggesting alternative models to the DSM-IV-TR model of ASD. A number of studies have used CFA to examine the structure of PTSD, and those studies are pertinent given the extensive symptom overlap between ASD and PTSD. While DSM-IV implies a three-factor model of PTSD that includes intrusions, avoidance, and hyperarousal, many factor analytic studies have not found support for such a model (see Asmundson, Stapleton, & Taylor, 2004, for a review). Instead, a hierarchical two-factor model with an intrusions/avoidance first-order factor and a hyperarousal/numbing first-order factor serving as indicators of a second-order PTSD factor has garnered empirical support (Buckley, Blanchard, & Hickling, 1998; Taylor, Kuch, Koch, Crockett, & Passey, 1998).

In contrast, four-factor models of PTSD that more closely resemble the DSM-IV conceptualization of ASD have found consistent support (e.g., King, Leskin, King, & Weathers, 1998; Simms, Watson, & Doebbeling, 2002). The King et al. (1998) model includes separate factors for intrusions, avoidance, hyperarousal, and emotional numbing (e.g., feeling distant; in some ways, conceptually similar to dissociation in ASD), though another model (Simms et al., 2002) combines symptoms of arousal and numbing. Most pertinent for the present work is evidence that the structure of PTSD symptoms conforms to the four-factor structure suggested by King et al. (1998) in elderly survivors of a 2004 Florida hurricane (Schinka, Brown, Borenstein, & Mortimer, 2007) and in survivors of community violence whose symptoms were assessed during the acute post-trauma period (Marshall, 2004). Thus, to the extent that research on the structure of PTSD serves as a guide to assessment of the structure of ASD, a four-factor model based on DSM-IV ASD criteria would appear to be a reasonable starting point.

Recently, the first confirmatory factor analysis (CFA) of the structure of acute stress response (Brooks, Silove, Bryant, O'Donnell, Creamer, & McFarlane, 2008) was conducted on data from 587 patients hospitalized for traumatic injury, of whom 44 met criteria for ASD. The CFA was conducted on responses to the Acute Stress Disorder Interview (ASDI; Bryant et al., 1998) which, while consisting solely of dichotomous responses to queries concerning whether a symptom is present or absent, comprises items that are nearly identical to the ASDS and that are also based on DSM-IV criteria. The fit of the 4-factor CFA model was good, and the authors held that the model was good evidence for the 4-factor structure of ASD suggested by DSM-IV. However, correlations among the latent factors Reexperiencing, Avoidance, and Arousal were all between .76 and .91, suggesting a lack of discriminant validity and perhaps the presence of a second-order factor. Because Arousal and Dissociation were also correlated at .77, the authors tested a model in which all four of the first-order latent factors were indicators of a second-order general distress factor. Because the fit statistics for the two models seemed highly similar, the authors opted for the more parsimonious model comprising 4-first order factors. It should also be noted that the amnesia item did not load well onto the Dissociation factor, but was retained in the model nonetheless.

The present study

The present study used confirmatory factor analysis (CFA) to test the factor structure of the ASDS in this sample of Hurricane Katrina evacuees relocated to a Red Cross emergency shelter. This population is ideal for assessing the measurement of the ASD construct because (a) all participants experienced the same trauma (albeit at different levels of exposure), (b) all participants completed the ASDS within the same eight-day window after the experience, and (c) all participants were residing in the same shelter at the time of measurement, limiting environmental dilution of the effects of the traumatic exposure.

In all, we tested three CFA models of the ASDS. Given the paucity of factor analytic studies to date on the structure of ASD in adults, no particular a priori factor structure hypothesis is strongly supported by previous empirical evidence. However, based on the DSM-IV theoretical model and the Brooks et al. (2008) ASDI CFA results, we chose to first test the four-factor structure implied by the four ASD symptom clusters and the four ASDS subscales that reflect them (Model 1; Figure 1). Based on the second EFA of the initial report on the ASDS and empirical considerations from the results of the results of Model 1, we next tested a 3-factor structure in which Reexperiencing and Arousal loaded onto a second-order Distress factor, and Avoidance and Dissociation were separate first-order factors (Model 2; Figure 2). Based on theoretical assertions that Dissociation is a predictor of posttraumatic response rather than a true component of that response, consistent evidence across ASD factor analytic studies suggesting that Dissociation is distinct from the other factors that constitute posttraumatic stress response in the acute period, and empirical considerations from the results of Models 1 and 2, we then tested a 2-factor structure in which Reexperiencing, Arousal, and Avoidance loaded onto a second-order Distress factor and Dissociation was a distinct first-order factor (Model 3; Figure 3).

Method

Participants

132 adult evacuees (56% men, 44% women; mean age of 43 years; range, 20–80 years) from New Orleans and surrounding parishes comprised the sample. Reported racial identification was 74.2% Black, 16.7% non-Hispanic White, 3% multiracial, 1.7% Hispanic, and 2.4% “other.” Eighty-one percent reported a high school diploma or higher, with 22% having completed college or an advanced degree. Income of participants was reported as less than $10,000 (37%), between $10, 000 and $30, 000 (45%) and greater than $30,000 (18%). When given a list of self- or physician-diagnosed mental health problems they may have ever experienced, 47% of all participants reported a previous psychiatric condition (depression, 33%; anxiety, 21%; bipolar disorder, 8%; schizophrenia, 4%; PTSD, 3%; other, 3%), with the distribution of diagnoses evincing a similar pattern across income levels. The sample has been described in greater detail elsewhere (Mills, Edmondson, & Park, 2007).

Sampling and Data Collection

Data collection occurred 12–19 days after Hurricane Katrina made landfall outside New Orleans. Data were collected at the Austin Convention Center, which housed approximately 1600 Hurricane Katrina evacuees. Shelter access was granted to the researchers by the City of Austin and Travis County Emergency Medical Services. Survey booths were set up in 4 different locations within the shelter to increase researcher visibility and to provide a sample that best represented the shelter population. Data were obtained anonymously; therefore, written informed consent was waived. All participants received information in written and verbal form regarding the purpose, risks, and benefits of study participation in compliance with the University of Connecticut Institutional Review Board.

Measures

Acute Stress Disorder symptoms were assessed with the Acute Stress Disorder Scale (ASDS; Bryant et al., 2000), a self-report inventory consisting of 19 items based on criteria for ASD as defined by the DSM-IV-TR TR (APA, 2000). The ASDS contains 4 subscales asked in response to a specific event: Dissociation (5 items; e.g., “During or after Katrina, did you ever feel numb or distant from your emotions?”), Reexperiencing (4 items; e.g., “Have memories of the hurricane kept entering your mind?”), Avoidance (4 items; e.g., “Have you tried not to think about Hurricane Katrina?”), and Arousal (6 items; e.g., “When you are reminded of the disaster, do you sweat or tremble, or does your heart beat fast?”). Participants are asked the extent to which they experienced each item since the Hurricane Katrina disaster. All items are answered on a response scale from 1 (not at all) to 5 (very much). Cronbach’s alpha for the entire scale in this sample was .92.

Data analysis

First, using AMOS 16 (Arbuckle, 2007), a confirmatory factor analysis (CFA) using maximum likelihood estimation was conducted to test the 4-factor model of acute stress disorder as suggested by the four ASDS subscales. Second, an alternative 3-factor model that included a second-order Distress factor (comprised of the Reexperiencing and Arousal factors) correlated with the Avoidance and Dissociation factors was tested. Third, an alternative 2-factor model that included a second-order Distress factor (comprised of the Reexperiencing, Arousal, and Avoidance factors) correlated with the Dissociation factor was tested.

Multiple fit indices were used to assess model fit, and their standard cutoff recommendations (Hu & Bentler, 1999) were employed. The model chi-square statistic was used to determine the fit of each model to the observed data (Bollen, 1989). A non-significant model chi-square (p >.05) suggests good model fit, as it indicates that the model does not differ significantly from the observed data (Kline, 2005). The comparative fit index (CFI) and root-mean-square error of approximation (RMSEA) are based on the non-centrality parameter, and were also used to assess the fit of each model. A CFI greater than .95 and an RMSEA of .05 or less suggest good fit (Hu & Bentler, 1999). The PClose statistic was also used; a PClose value less than .05 suggests that RMSEA is significantly greater than its suggested cutoff of .05 (i.e., test of close fit). Aside from the use of standard measures of model fit, the Akaike Information Criterion, AIC (Akaike, 1974), was used to compare the fit of non-nested models. The model with the lower AIC is the preferred model because it possesses better balance of model fit and parsimony. Modification indexes were used to respecify CFAs in order to isolate covariance between measurement errors and improve model fit.

Diagnostic tests were performed in AMOS 16 (Arbuckle, 2007) to assess whether the data met the requisite normality assumptions of CFA. We reran each model using a bootstrapping method to obtain a Bollen-Stine corrected probability (p) value. Bootstrapping is an approach for estimating standard errors in regression analyses without making any distributional assumptions (Chernick, 1999). This process involves repeatedly resampling the sample population with replacement to approximate what would happen if the entire population were sampled. The number of bootstrap samples drawn for each analysis was set to 2000. The multivariate normality critical ratios were greater than 2.0, indicating multivariate non-normality of the data. Thus, we also report the Bollen-Stine corrected p values for each model. As with the traditional chi square test of model fit, nonsignificant Bollen-Stine corrected p values suggest good model fit.

Missing Data

Prior to conducting confirmatory factor analyses, missing data (4–7 cases on any given item, 15 cases listwise) were replaced using stochastic regression imputation in AMOS 16. This method uses multiple regression to predict missing data points by using available raw data points as predictors, then reintroduces random variability into the imputed data (Little & Schenker, 1995).

Power

Statistical power for the Root Mean Square Error of Approximation (RMSEA) test of close fit (Browne & Cudeck, 1993) was calculated on 146 df (Model 1) (also on 120 df; Model 3) and n=132 with the null hypothesis that RMSEA = .05 and the alternative RMSEA = .08 (MacCallum, Browne, & Sugawara, 1996) using Preacher and Coffman’s (2006) code for calculating power in the R statistical package. Power for the test of close fit in Model 1 was sufficient at .91, and the lowest power was for Model 3 (.86), which was also sufficient. The PClose statistic represents the test of statistical significance (p value) associated with the test of close fit.

Results

Description of ASDS Scores

The mean ASDS score for the sample was 61.61 [SD=19.38; Skew= −.28 (.21); Kurtosis= −.78 (.42)]. Scores ranged from 19 (lowest possible) to 95 (highest possible). Seventy-nine percent (n= 102) met criteria for ASD according to the scoring method that privileges dissociation symptoms as suggested by the scale's authors (Bryant et al., 2000). Sixty-two percent (n= 81) of participants had scores greater than the suggested cutoff for PTSD prediction of 56 (Harvey & Bryant, 2000). Correlations among the ASDS scale items are given in Table 1.

Model 1: Confirmatory factor analysis (CFA) for a 4-factor ASDS

The CFA for the 4-factor ASDS showed that the proposed 4-factor structure of the scale was not a good fit to the data, χ^2 (146) = 310.76, p< .01; χ^2/df= 2.13; Bollen-Stine bootstrap χ^2 p=.02; CFI= .86; RMSEA= .09 (90% CI= .08–.11); AIC= 436.76. Upon examination of the parameter estimates and standardized residuals, however, the lack of fit appeared to be caused by a lack of discriminant validity between the Reexperiencing and Arousal factors (r= .84) and the Reexperiencing and Avoidance factors (r= .71), a problematic indicator of the Dissociation factor (i.e., amnesia for the trauma, β= .31), as well as from unspecified covariance among indicators' measurement error. Modifications to the 4-factor CFA were attempted using modification indexes. Covariance was specified between measurement error in items within the same factor only. Five significant correlations between measurement error terms were retained in the model: between error in items 1–2; 1–5; 11–12; 12–13; 18–19 (r's= .17 to .46; see Table 1 for item content). However, after those modifications, the model was still not an acceptable fit to the data, χ^2 (141) = 242.33, p< .01; χ^2/df= 1.72; Bollen-Stine bootstrap χ^2 p=.14; CFI= .91; RMSEA= .07 (90% CI= .06–.09; PClose= .01); AIC= 340.33. Also, the correlations among Reexperiencing and Arousal (r= .84) and Reexperiencing and Avoidance (r= .75) continued to suggest a lack of discriminant validity.

Model 2: Confirmatory factor analysis for a 3-factor ASDS with a second-order factor

For the 3-factor CFA model, a second-order distress factor whose indicators were the first-order factors Reexperiencing (scaling indicator) and Arousal was specified. Correlations between measurement errors previously suggested by modification indexes and incorporated into the four-factor model were retained.[1] Model fit was essentially unchanged from the four-factor model, χ^2 (142) = 242.35, p< .01; χ^2/df= 1.71; Bollen-Stine bootstrap χ^2 p=.14; CFI= .92; RMSEA= .07 (90% CI= .06–.09; PClose= .01); AIC= 338.35. Model misspecification included a lack of discriminant validity between the second-order Distress factor and the first-order Avoidance factor, as well as unspecified covariance among measurement errors. Modification indexes that suggested specifying correlations between measurement error in indicators of Reexperiencing and Arousal items were accepted, as the two first-order factors were now specified as indicators of a second-order factor. Four additional significant correlations between measurement error terms were retained in the model: between error in items 6–15; 7–15; 9–16; 9–19 (r's= −.27 to .19; see Table 1 for item content). Even with the correlations among measurement errors, the CFA for the 3-factor ASDS with Reexperiencing and Arousal factors loaded onto a second-order Distress factor was not an acceptable fit to the data, χ^2 (138) = 221.82, p< .01; χ^2/df= 1.61; Bollen-Stine bootstrap χ^2 p=.25; CFI= .93; RMSEA= .07 (90% CI= .05–.08; PClose= .04); AIC= 325.82, but was a significant improvement on Model 1, as indicated by its lower AIC value. Upon examination of the

[1]Model fit was poor for Model 2 when the error covariance respecifications to Model 1 were not included, χ^2 (147) = 301.33, p< .01; χ^2/df= 2.05; CFI= .87; RMSEA= .09 (90% CI= .08–.10; PClose= .001); AIC= 387.33.

parameter estimates and standardized residuals, however, the lack of fit appeared to be caused by the continued poor performance of Item 5 on the Dissociation factor, a lack of discriminant validity between the second-order Distress factor and the Arousal factor (r= .78), and unspecified covariance among indicators' measurement error across the Avoidance, Arousal, and Reexperiencing factors.

Model 3: Confirmatory factor analysis for a 2-factor ASDS with a second-order factor

In specifying the 2-factor CFA model, correlations between measurement errors previously suggested by modification indexes were retained.[2] The CFA for the 2-factor ASDS with Avoidance, Reexperiencing, and Arousal factors loaded onto a second-order Distress factor which was correlated with Dissociation was initially not a good fit to the data, χ^2 (139) = 225.77, p< .01; χ^2/df= 1.62; Bollen-Stine bootstrap χ^2 p=.23; CFI= .93; RMSEA= .07 (90% CI= .05–.09; PClose= .03); AIC= 327.77. However, modification indexes suggested correlating error terms across indicators of the first-order Avoidance factor and the other two first-order factors indicating Distress. Four additional significant correlations between measurement error terms were retained in the model: between error in items 6–11; 6–13; 13–16; 13–14 (r's=.17 to .26; see Table 1 for item content). The final model was fit the data reasonably well, χ^2 (135) = 199.89, p< .01; χ^2/df= 1.48; Bollen-Stine bootstrap χ^2 p=.40; CFI= .95; RMSEA= .06 (90% CI= .04–.08; PClose= .16); AIC= 309.88, and its lower AIC value suggested a significantly better fit than Model 2. The three factors that served as indicators of Distress each had standardized loadings on the second-order factor at .75–.98, and the second-order Distress factor was correlated with Dissociation at .66 (Figure 3).[3]

Discussion

Two major criticisms of the ASD diagnosis are that it is based on a theoretical construct rather than empirical evidence of the disorder it purports to describe (see Harvey & Bryant, 2002, for a review), and it elevates a risk factor for PTSD (i.e., dissociation) to a core feature of a new disorder (Marshall et al., 1999). The ASDS is a self-report measure based on the four-factor theoretical ASD construct that has not heretofore been subjected to a rigorous examination of its proposed four-factor structure. The present study assessed the factor structure of the ASDS and found that the proposed four-factor structure (Model 1) was not a good fit to the observed data in this sample. However, a 2-factor model that included a second-order Distress factor (Model 3), on which Reexperiencing, Arousal, and Avoidance loaded strongly, which correlated moderately strongly with a 4-item Dissociation factor fit the data well. In that model, a great deal of the variance in the first-order Reexperiencing, Arousal, and Avoidance factors was explained by the higher-order Distress factor, and error in a number of their indicators was correlated across those three first-order factors. This suggests that, in the immediate wake of a severe traumatic experience, the ASDS appears to capture the degree of distress and PTSD-like symptoms that respondents are feeling, as well as a distinct set of dissociative symptoms. However, distinctions between first-order factors corresponding to symptoms of reexperiencing, arousal, and avoidance are much less clear, as the three first-order factors seem to constitute a higher-order phenomenon. Our findings could reflect problems in the ASD construct itself, the measurement of ASD using the ASDS, or the expression or measurement of ASD in this particular population under these extreme circumstances.

[2]Model fit was poor for Model 3 when the error covariance respecifications to Model 2 were not included, χ^2 (148) = 304.09, p< .01; χ^2/df= 2.05; CFI= .87; RMSEA= .09 (90% CI= .08–.10; PClose= .001); AIC= 388.08.

[3]Based on a reviewer's suggestion, we also tested a model in which the three first-order factors were collapsed so that all items loaded directly on a first-order Distress factor that was correlated with the Dissociation factor. That model was a poor fit to the data, χ^2 (135) = 254.50, p< .01; χ^2/df= 1.89; CFI= .90; RMSEA= .08 (90% CI= .07–.10; PClose= .001); AIC= 364.49.

If our findings are interpreted as indicative of problems with the ASD construct, then the two-factor structure we observed may somewhat strengthen theoretically-based claims that ASD's dissociation component should be discarded in future conceptualizations of acute stress response. That is, given that dissociation is distinct from the core symptoms of PTSD that comprise the rest of the ASD construct, and its inclusion seems to impair prediction of later PTSD relative to prediction models including only the other three subscales (i.e., a major justification for establishing the diagnosis; e.g., Harvey & Bryant, 1998; also see Isserlin, Zerach, & Solomon, 2008, for a brief review), then perhaps it is indeed better thought of as a predictor of posttraumatic stress response rather than a diagnostic feature of ASD. Of course, without the dissociation component, ASD differs little from PTSD aside from the timing of the diagnosis vis-à-vis the traumatic event.

We believe that the lack of distinction between the three first-order symptom factors that comprised the Distress factor may have important implications for the ASD construct, as well as its measurement. First, the possibility that the symptom clusters proposed to constitute ASD are not distinct should be considered. It is possible that in the peri-traumatic period (i.e., the period immediately around the trauma), distinct symptom clusters have not yet arisen, but would become distinct for those who go on to develop PTSD. This interpretation might also hold important implications for understanding why peri-traumatic dissociation is among the strongest and most consistently reported peri-traumatic predictors of later PTSD (Ozer et al., 2003), given that dissociation seems to be the only distinct symptom cluster. However, it should also be noted that in a recent multi-site study of ASD to PTSD prediction, cutoff scores on the Arousal subscale showed the best sensitivity and specificity for subsequent PTSD diagnosis (Bryant, Creamer, O'Donnell, Silove, & McFarlane, 2008).

One could also make the case that the three symptom clusters that loaded onto the second-order Distress factor actually comprise early PTSD symptoms. In that interpretation, dissociation is merely a related phenomenon that may occur alongside PTSD symptoms within the first month post-trauma. If that is the case, then models predicting PTSD symptoms from ASDS scores show stronger relationships when dissociation is not considered because such models predict subsequent PTSD symptoms from the very same PTSD symptoms measured within the first month post-trauma. In this scenario, those relationships are better thought of as estimates of PTSD symptom stability.

In terms of the measurement of ASD using the ASDS, the measure itself seems to perform fairly well across studies, and its factor structure may be more consistent than the initial report's EFAs (Bryant et al., 2000) would suggest. In relation to other studies that used the ASDS, we found a high mean score for the full scale, 61.61 (SD=19.38), as compared to a mean of 44.65 (SD=15.45) for family members of critical care patients (Auerbach et al., 2007), 44.93 (SD=22.24) for accident and assault victims referred to a PTSD clinic (Bryant et al., 2000), and 65.00 (SD=15.50) and 66.46 (SD=13.21) for accident and assault victims *diagnosed with ASD* (Nixon et al., 2008)]. This major discrepancy between sample mean scores without a corresponding discrepancy in score variance suggests that the ASDS is sensitive to a broad range of acute stress responses, and likely reflects both the horrific nature of Katrina and her aftermath and the homogeneity of participants' experiences during the ordeal (see Mills et al., 2007).

In comparison to the only other CFA of ASD symptoms (i.e., using the ASDI; Brooks et al., 2008), our findings for model fit, factor loadings, and intercorrelations among factors were remarkably similar. The similarity is remarkable in that the samples in the two studies were markedly different and the responses on the ASDI are dichotomous, so measurement error in the indicators is not directly comparable to that of our continuous self-report indicators. As in Brooks et al. (2008), our final model fit reasonably well, all of the indicators loaded on their respective factors at expected magnitudes except for Item 5 (amnesia; discussed below), and the three non-Dissociation factors were very highly correlated. Our results differ from Brooks et al. (2008) in that our four-factor model of ASD was not a good fit to the data (in part due to unspecified covariance among measurement error that may not have been present to the same degree in the ASDI's dichotomous indicators), and we did not accept models in which factors were so highly correlated as to suggest a lack of discriminant validity. Thus, while the relationships between the DSM-IV first-order factors and their indicators, as well as among first-order factors, were very similar across our study and Brooks et al. (2008), we believe that our model represents a better estimate of the latent structure of ASD by explicitly modeling the higher-order factor that we believe was present in Brooks et al. (2008).

At the subscale level, most of the indicators performed well. As in Brooks et al. (2008), the only major problem was the dissociative amnesia item of the dissociation subscale (i.e., "Have you been unable to recall important aspects of the disaster?"), a result that was not unexpected given its performance in the initial investigation of the scale (Bryant et al., 2000), as well as that of a similar item in studies investigating the factor structure of PTSD (e.g., Palmieri, Weathers, Difede, & King, 2007). However, measurement errors among items within each of the subscales (except for reexperiencing) were correlated in the present study. For instance, the measurement errors in the two items of the Dissociation factor that tap perceptual irregularities were moderately correlated, suggesting that another latent construct may have been present. While this is not the only plausible explanation, competing explanations such as the presence of shared method variance seem unlikely given that all items represent self-reported symptoms modeled directly on DSM-IV-TR criteria.

This limitation, along with the problematic dissociative amnesia item, suggests that the dissociation subscale (as originally proposed) might be particularly weak as a distinct, unified construct. This further legitimizes controversy over the reliance on dissociative symptoms for the diagnosis of ASD (e.g., Marshall et al., 1999), and arguments that such reliance may inhibit the predictive power of ASD to subsequent PTSD (Kleim, Ehlers, & Glucksman, 2007).

With respect to the possibility that our results were substantially influenced by the population and extreme circumstances from which these data arise, we cannot know the extent to which the measurement issues revealed by these analyses were simply due to unique characteristics of this sample, such as the residence of participants together in a temporary community of fellow survivors or being involved in a highly publicized and political tragedy (Brinkley, 2006). However, it behooves trauma researchers to consider the potential implications of these findings for ASD. We believe it is unlikely that our results merely reveal ASDS measurement problems, given that the items are modeled directly on DSM-IV ASD criteria and that the factor structure of the ASDS conforms so closely to that of the ASDI. We believe that it is more likely that these findings reflect difficulties with the construct of ASD itself. If our results are replicated by researchers studying ASD in other samples, it will be necessary to revisit this diagnostic classification and revise it to conform to the symptoms as they exist in samples of individuals recently exposed to trauma (or discard the diagnosis entirely). Revisions in measurement or diagnostic categorization will lead to a better understanding of the immediate and short-term impact of trauma and may lead to a better understanding of longer-term adjustment trajectories as well.

Limitations of this study must be acknowledged. While it is not unusual, given the difficulty associated with obtaining such data, for factor analytic studies of acute posttraumatic responses to have fewer participants than ideal (e.g., 120 Spanish speakers, Marshall, 2004; 142 breast cancer survivors, Cordova et al., 2000), the rule of thumb most often stated for sample size in CFA is 200 (Hoelter, 1983). Thus, an awareness of the potential influence of small sample size when interpreting of our results is warranted. Our sample size was smaller than ideal, especially given our use of confirmatory factor analysis, however, artificially nonsignificant x^2 values (artificial *good* fit) are associated with smaller sample sizes (Kline, 2005). That is, a significant x^2 suggesting poor model fit is less likely when sample size is small (Kim, 2005), so it is particularly unlikely that sample size was the reason that the four-factor model we tested was not a good fit to the data. The other fit indices we used for the four-factor model are not as heavily influenced by sample size (Bollen, 1990). Indeed, our power estimates for the RMSEA test of close fit suggested that our study possessed ample power to determine whether our models were a close fit to the data. The sample size therefore appeared adequate to examine the fit of the four-factor model, and the within-subscale measurement issues discussed above appear responsible for the poor model fit we observed. Further, the 2-factor model which we found to be a good fit to the data conforms well with one diagnostic use of the scale suggested by its authors (i.e., privilege the dissociation scale in diagnosis while scoring the other subscales together, Bryant et al., 2000) and with previous critiques concerning dissociation's tangential relationship to the rest of the scale in ASD to PTSD prediction models (Harvey & Bryant, 1998), and was remarkably similar to the ASDI CFA discussed above.

Another cautionary note concerns our use of modification indexes to improve model fit through allowing measurement error in indicators within each latent variable to covary. This is potentially problematic for two reasons. First, modification indexes are sample specific and may capitalize on chance covariance to improve fit. Future research should validate the intercorrelations we specified in an independent but comparable sample. Second, although the ability to explicitly model error covariance is a strength of CFA, it is generally preferable to set error covariances to 0 rather than to allow them to covary at all. Also, when error covariances are specified, they should be theoretically justified. Aside from the error covariance discussed above within the Dissociation factor, two primary theoretically justifiable patterns of error covariance were specified within the higher-order Distress factor. First, error in items tapping uncontrollable cognitive sequelae of trauma (i.e. intrusive memories, concentration deficits, and insomnia) covaried with error in items tapping efforts to control triggers for those symptoms (i.e., avoidance of talking about, being reminded of, or feeling emotions related to the trauma). Second, error in the item tapping subjective distress at reminders of the trauma covaried with error in items tapping evidence of distress (i.e., physiological reactivity and concentration deficits). We believe that the error covariances we allowed to vary were theoretically justifiable, and that our strategy of only specifying covariances among error in indicators that comprised a shared higher-order factor strengthens the case for allowing those covariances to vary. However, we are aware that many find specification of error covariances problematic.

A further limitation is that participants in this study were survivors of a very specific, complex, publicized, and ongoing (at the time of measurement) traumatic event, the features of which may have uniquely influenced the presentation of ASD in the sample. We also were unable to follow these individuals over time, so we are unable to speak to the issue of how well the ASDS predicted PTSD in our sample.

In spite of these limitations, the present findings represent the most thorough examination of the factor structure of the ASDS to date and provide important information on this scale, which has implications for the ASD construct itself. Future research is needed to expand this line of research, potentially by revising either how the ASD construct is generally measured or how it is theorized to express itself in the special case of victims of mass trauma such as natural disasters. Indeed, future research is needed to determine the utility of the diagnostic category itself.

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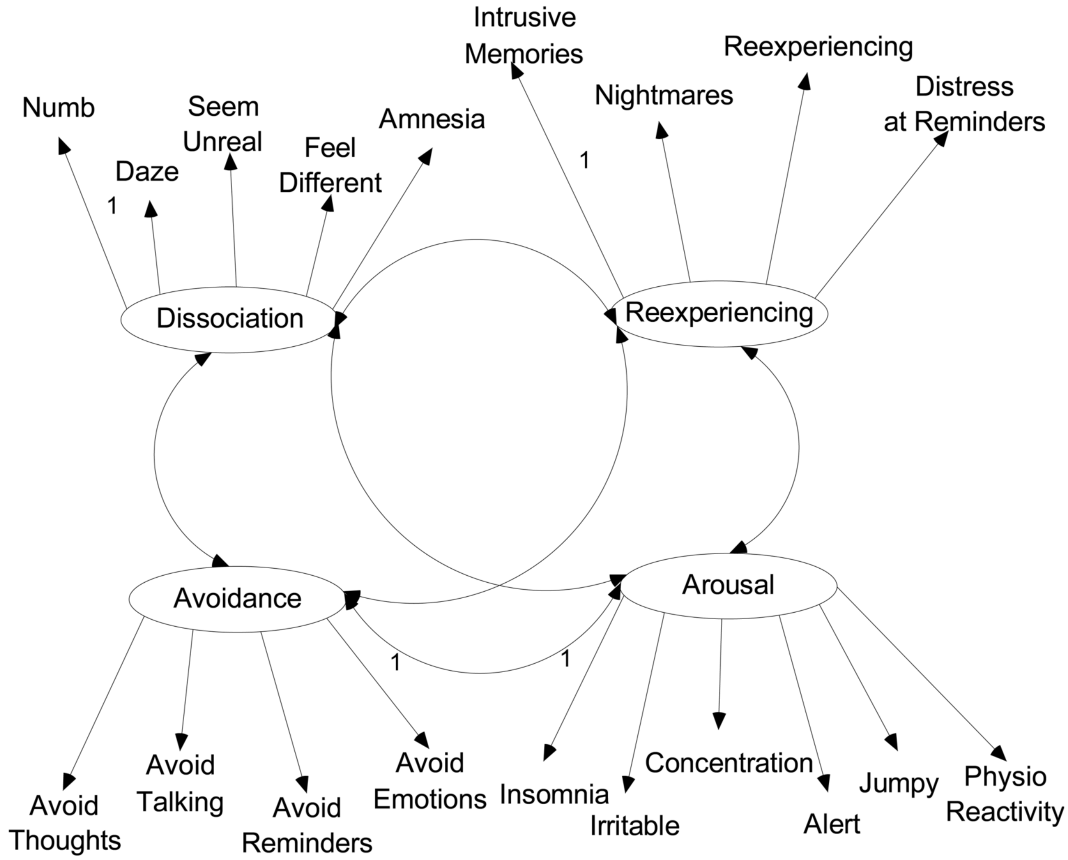

Figure 1.
Model 1: Diagram of Model 1, a four-factor CFA of the ASDS.

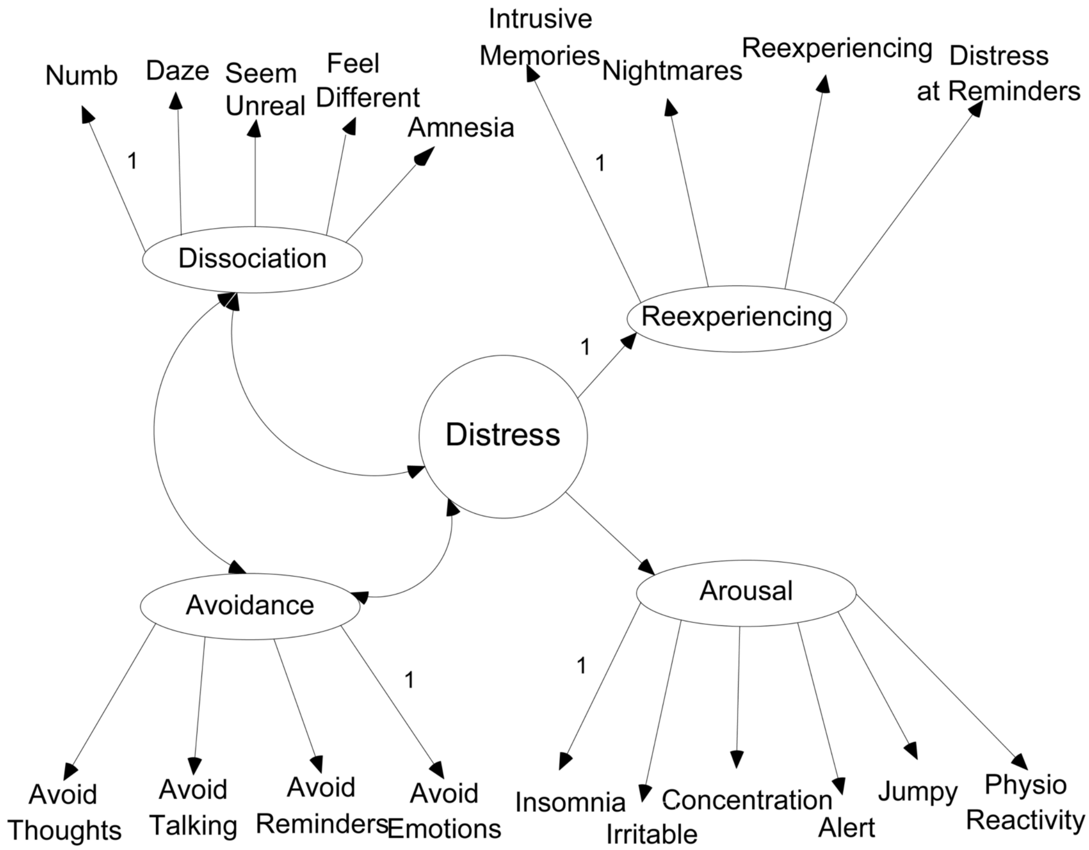

Figure 2.
Model 2: Diagram of Model 2, a three-factor CFA of the ASDS.

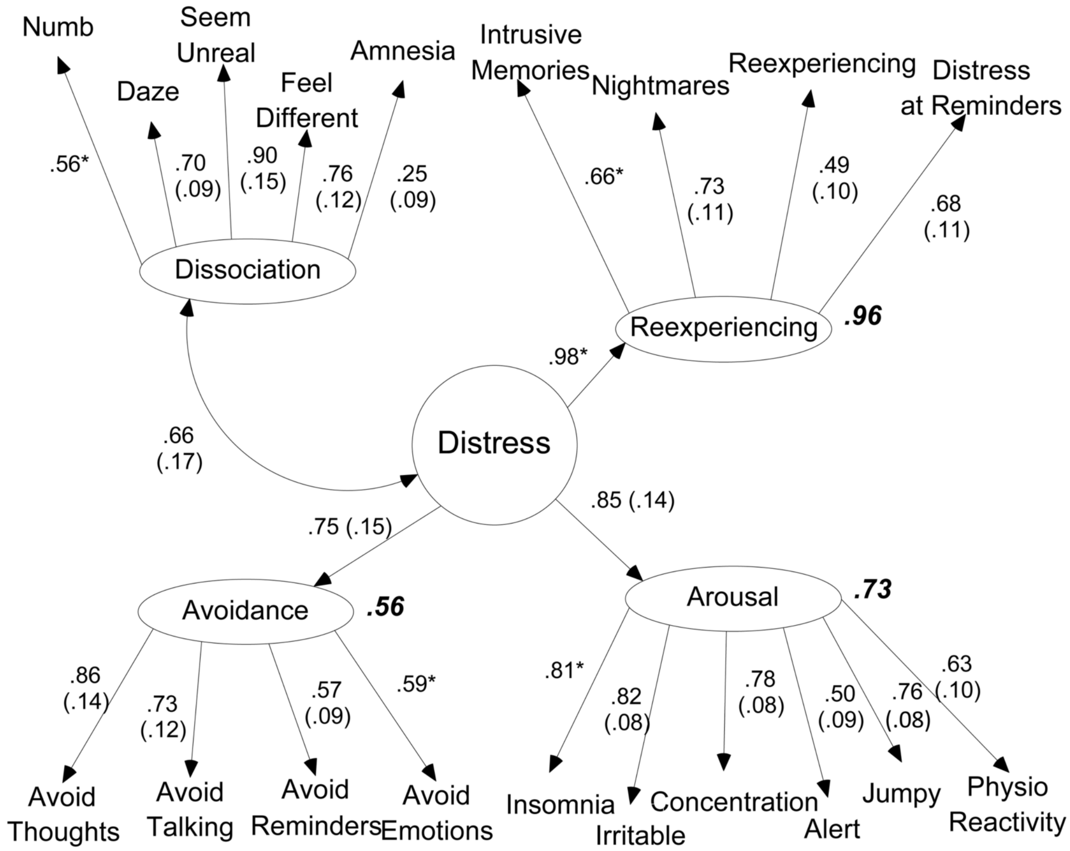

Figure 3.

Model 3: Model 3, the final two-factor CFA of the ASDS. Bold, italicized values represent proportion of variance explained in the latent variable. All other values represent standardized parameter estimates with their corresponding standard error in parentheses. Arrows represent factor loadings, curved lines represent correlations. Factor loadings marked with an asterisk represent marker variables fixed to 1.

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Table 1

Correlations among ASDS items

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
1. Numbness	-																	
2. Dazed	.66	-																
3. Seem unreal	.47	.63	-															
4. Feel different	.48	.50	.69	-														
5. Amnesia	.28	.18	.17	.27	-													
6. Intrusive memories	.34	.37	.44	.34	.16	-												
7. Nightmares	.23	.37	.40	.30	.21	.50	-											
8. Reexperiencing	.08	.05	.10	.09	.02	.31	.43	-										
9. Distress at reminders	.30	.26	.45	.40	.24	.40	.45	.44	-									
10. Avoid thinking	.32	.39	.49	.31	.23	.43	.37	.32	.53	-								
11. Avoid talking	.29	.33	.40	.24	.21	.47	.30	.26	.36	.66	-							
12. Avoid reminders	.23	.20	.38	.18	.10	.24	.21	.23	.31	.50	.62	-						
13. Avoid emotions	.34	.25	.32	.26	.17	.44	.27	.27	.42	.50	.41	.52	-					
14. Insomnia	.31	.42	.40	.29	.22	.40	.56	.26	.40	.43	.34	.35	.46	-				
15. Irritability	.20	.30	.39	.28	.16	.52	.46	.28	.44	.43	.41	.33	.39	.68	-			
16. Concentration	.27	.38	.27	.23	.17	.43	.48	.30	.30	.39	.30	.23	.45	.66	.68	-		
17. Alert	.31	.25	.41	.27	.13	.42	.34	.13	.38	.25	.29	.18	.30	.38	.42	.34	-	
18. Jumpy	.29	.36	.37	.35	.23	.36	.61	.35	.45	.32	.24	.27	.35	.62	.55	.62	.42	-
19. Physio reactivity	.32	.33	.33	.30	.24	.31	.53	.40	.50	.45	.33	.23	.37	.48	.48	.48	.28	.65