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Longitudinal Factor Structure of Posttraumatic Stress Symptoms Related to Intimate Partner Violence

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Confirmatory factor analysis (CFA) studies have suggested that a model of posttraumatic stress disorder (PTSD) that is characterized by 4 factors is preferable to competing models. However, the composition of these 4 factors has varied across studies, with 1 model splitting avoidance and numbing symptoms (e.g., D. W. King, G. A. Leskin, L. A. King, & F. W. Weathers, 1998) and the other including a dysphoria factor that combines numbing and nonspecific hyperarousal symptoms (L. J. Simms, D. Watson, & B. N. Doebbeling, 2002). Using the PTSD Checklist (F. W. Weathers, B. T. Litz, D. S. Herman, J. A. Huska, & T. M. Keane, 1993) and CFA, the authors compared these models with competing models. A model of PTSD with 4 intercorrelated factors of Intrusions, Avoidance, Dysphoria, and Hyperarousal was found superior among 396 medical patients who screened positive for intimate partner violence (IPV) and 405 women seeking services for IPV. Structural invariance testing indicated that this 4-factor model remains stable across service setting and time.

Keywords: PTSD, factor structure, longitudinal invariance, intimate partner violence, numbing

The *Diagnostic and Statistical Manual of Mental Disorders* (4th ed.; *DSM–IV*; American Psychiatric Association, 1994) characterizes posttraumatic stress disorder (PTSD) by three distinct symptom clusters, including (a) reexperiencing or intrusions of the event (Criterion B; e.g., intrusive thoughts, nightmares), (b) avoiding reminders of the event and emotional numbing (Criterion C; e.g., avoiding thoughts, restricted affect), and (c) hyperarousal (Criterion D; e.g., exaggerated startle, sleep problems). Recent studies have brought into question this three-factor model of the disorder, indicating that PTSD may be better represented by four factors (e.g., King, Leskin, King, & Weathers, 1998; Simms, Watson, & Doebbeling, 2002). However, the proposed composition of these four factors has varied across studies, and there remains little consensus as to the associations among the symptom clusters and their relationship to an overarching construct of PTSD, called a second-order factor. In addition, the majority of these studies have been conducted with military samples, limiting their generalizability. Finally, little work has examined the longitudinal factor structure of a model of PTSD. Research on the development, maintenance, and psychosocial consequences of PTSD would benefit from further consensus on a structural model that holds up across diverse populations, traumatic stressors, and time.

Structural Studies of PTSD

Several exploratory factor analysis (EFA) studies (e.g., Simms & Watson, 1999; Taylor, Kuch, Koch, Crockett, & Passey, 1998) and confirmatory factor analysis (CFA) studies (e.g., Asmundson et al., 2000; King et al., 1998; Marshall, 2004; Simms et al., 2002) have suggested alternative compositions of the PTSD symptom clusters than that defined in the *DSM–IV*, ranging from two to four clusters. We focus here on EFA and CFA studies that included measures that correspond directly to the 17 *DSM–IV* symptoms.[1]

Two-Factor PTSD Model

Theoretical models of PTSD have long suggested a two-factor solution in which the disorder is characterized by reciprocal relationships between symptom dimensions (e.g., Foa, Zinbarg, & Rothbaum, 1992; Horowitz, 1986). For instance, Foa et al. (1992) proposed that avoidance and numbing involve two separate trauma response mechanisms: Avoidance is described as an effortful process engaged in by the survivor to cope with the reexperiencing symptoms, whereas numbing represents an automatic response to

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[1] Findings from studies that included measures that do not correspond directly to the *DSM–IV* PTSD criteria, such as the Impact of Event Scale (Horowitz, Wilner, & Alvarez, 1979), have provided similar evidence for the following review (e.g., Amdur & Liberzon, 2001; Anthony, Lonigan, & Hecht, 1999).

the overstimulation of the endogenous opioid system that results from chronic hyperarousal. Thus, a structural model is posited that has two intercorrelated factors, one encompassing the reexperiencing and avoidance symptoms and the other corresponding to the hyperarousal and numbing symptoms. EFA studies of peacekeepers and motor vehicle accident survivors have provided empirical support for the two-factor model (e.g., Taylor et al., 1998). However, studies that have used CFA, a more powerful and direct method of comparing hypothesized factor models (Floyd & Widaman, 1995), have not found the two-factor solution to stand up in comparison with increasingly sophisticated models of PTSD, including several four-factor models.

Four-Factor PTSD–Numbing Model

Although the *DSM–IV* posits three PTSD symptom clusters, converging theoretical and empirical evidence has suggested a four-factor model that splits the Criterion C symptoms of avoidance and emotional numbing onto separate factors (see Asmundson, Stapleton, & Taylor, 2004, for a review). For instance, Litz (1992) described emotional numbing as a phenomenon distinct from effortful avoidance. In addition, several CFA studies have evaluated and compared a four-factor model of PTSD (i.e., with separate factors of Intrusions, Avoidance, Numbing, and Hyperarousal) with competing models in the literature, including a one-factor model (all 17 symptoms loaded on a single PTSD factor), variants of the two-factor model described above, and the three-factor model defined in the *DSM–IV* (e.g., Asmundson et al., 2000; Asmundson, Wright, McCreary, & Pedlar, 2003; DuHamel et al., 2004; King et al., 1998; Marshall, 2004; Palmieri & Fitzgerald, 2005). Consistently, findings from these studies indicate that this four-factor model provides a better fit to the data than the one-, two-, and three-factor models. This four-factor intercorrelated model is henceforth referred to as the *PTSD–numbing model*.

PTSD–Numbing Second-Order Model

A variant of the PTSD–numbing model, one with a second-order factor of PTSD, has also been proposed and compared with the previously articulated models (e.g., Asmundson et al., 2000, 2003; King et al., 1998). This model portrays the disorder as a unified syndrome characterized by four distinct symptom clusters of intrusions, avoidance, numbing, and hyperarousal. Empirical support for this model has been equivocal. Most studies have demonstrated moderate to high intercorrelations of the separate PTSD factors (e.g., King et al., 1998), and one study found a model with a second-order PTSD factor to fit the data better than the intercorrelated PTSD–numbing model (Asmundson et al., 2000). However, most studies have found the PTSD–numbing model to fit better than its second-order counterpart (Asmundson et al., 2003; DuHamel et al., 2004; King et al., 1998; Marshall, 2004; Palmieri & Fitzgerald, 2005).

Theoretically, it is important to identify whether the symptom clusters of PTSD are best conceptualized as separate but intercorrelated or as part of a single disorder, because these different frames of reference would have varying methodological and clinical implications. For example, a model in which the separate factors of PTSD are highly correlated but not representative of a single underlying dimension would suggest that more emphasis be placed on assessing and treating the distinct symptom cluster scores (Watson, 2005). In addition, it might argue for considering possible subtypes of PTSD in which individuals display different patterns of symptom combinations (King et al., 1998; Watson, 2005). Indeed, clinical reports suggest that the presentation of PTSD varies substantially across patients because of different symptom combinations and high rates of comorbidity with other anxiety and depressive disorders (Kessler, Sonnega, Bromet, Hughes, & Nelson, 1995; Simms et al., 2002).

Four-Factor PTSD–Dysphoria Model

Drawing on prior EFA studies of PTSD (e.g., Simms & Watson, 1999; Taylor et al., 1998) and recent evidence that the mood and anxiety disorders share a nonspecific factor of general distress or dysphoria (e.g., Mineka, Watson, & Clark, 1998), Simms et al. (2002) proposed an alternative four-factor model of PTSD. This model, henceforth referred to as the *PTSD–dysphoria model*, includes three factors representing symptoms specific to PTSD and many of the anxiety disorders (i.e., Intrusions, Effortful Avoidance, and Hyperarousal) and a fourth factor representing Dysphoria, which combines traditional markers of numbing with the nonspecific hyperarousal symptoms (i.e., sleep disturbance, irritability, and impaired concentration). Simms et al. (2002) found support for the superiority of the PTSD–dysphoria model compared with all other first-order models proposed in the literature among the largest sample yet to be submitted to CFA for PTSD, including 3,695 deployed and nondeployed Gulf War veterans. Baschnagel, O'Connor, Colder, and Hawk (2005) also found the PTSD–dysphoria model to fit better than a number of other first-order models (including each of those described here) among a sample of undergraduates following the September 11th terrorist attacks. However, Palmieri and Fitzgerald (2005) found the PTSD–numbing model slightly superior to the PTSD–dysphoria model in a sample of women exposed to sexual harassment.

PTSD–Dysphoria Second-Order Model

A four-factor PTSD–dysphoria model with a second-order PTSD factor has only been considered in one previous study. Palmieri and Fitzgerald (2005) found the PTSD–dysphoria model to evidence a better fit than its second-order counterpart. However, neither of these models fit as well as the PTSD–numbing model in their study. Theoretically, it is important to identify whether the PTSD–dysphoria model would be better characterized with a second-order factor for the same reasons as described for the PTSD–numbing second-order model.

Current Study

The current study contributes to the literature on the structure of PTSD in two important ways. First, in this study we evaluated and compared competing models of PTSD among an understudied trauma population: low-income minority women exposed to intimate partner violence (IPV). Previous CFA studies have focused mostly on military (e.g., Asmundson et al., 2000; King et al., 1998; Simms et al., 2002) or medical patient (Asmundson et al., 2003; Cordova, Studts, Hann, Jacobsen, & Andrykowski, 2000; DuHamel et al., 2004) samples. Thus, to date, no data exist regarding

the symptom structure of PTSD related to IPV, and previous CFA studies have largely neglected minority women. Therefore, this study included two samples of primarily low-income minority survivors: (a) a sample of women who screened positive for IPV while visiting primary or urgent care medical settings ($N = 396$) and (b) a sample seeking shelter or protective services or criminal prosecution specifically for IPV ($N = 405$).

On the basis of the literature reviewed, the following six models were evaluated and compared in each sample separately: (a) a two-factor model, with factors of Intrusions–Avoidance and Hyperarousal–Numbing (two-factor model); (b) the three-factor model described in the *DSM–IV*, including factors of Intrusions, Avoidance–Numbing, and Hyperarousal (three-factor model); (c) the PTSD–numbing model, with intercorrelated factors of Intrusions, Avoidance, Numbing, and Hyperarousal (PTSD–numbing first-order model); (d) the PTSD–numbing model with a second-order factor of PTSD (PTSD–numbing second-order model); (e) the PTSD–dysphoria model with intercorrelated factors of Intrusions, Avoidance, Dysphoria, and Hyperarousal (PTSD–dysphoria first-order model); and (f) the second-order PTSD–dysphoria model (PTSD–dysphoria second-order model).

The second way the study contributes to the PTSD literature is that we examined the longitudinal structural invariance of PTSD. Although mean levels of PTSD symptoms have been found to reduce over time among trauma survivors (e.g., Blanchard, Jones-Alexander, Buckley, & Forneris, 1996), little research has explored whether the factor structure (pattern of factor loadings) as measured by the PTSD Checklist—Civilian Version (PCL) remains stable across time. The factor structure of PTSD indicates the cognitive frame of reference of the respondent with regard to his or her PTSD symptoms. In order to accurately examine changes in PTSD symptom cluster levels over time, it is first necessary to establish that the frame of reference of respondents is stable over time (Vandenberg & Lance, 2000). Furthermore, establishing longitudinal measurement invariance is a natural prerequisite to modeling change over time through techniques such as latent growth curve analysis (Vandenberg & Lance, 2000). Because different symptom dimensions are believed to impact one another over time (e.g., Litz, 1992; Schell, Marshall, & Jaycox, 2004), it may be that the best fitting structure of PTSD varies over the course of the disorder or becomes unstable as some individuals recover and others experience an exacerbation or fluctuation of various symptom combinations.

Only one study has examined the structural invariance of the symptoms of PTSD over time. Baschnagel et al. (2005) found the PTSD–dysphoria first-order model to represent the best fitting model compared with several other first-order models examined in the literature (including those described here) at two time points: 1 and 3 months after the September 11th terrorist attacks. However, a formal test of longitudinal invariance suggested that the strength of the factor loadings changed significantly over time. Unfortunately, the authors did not report the fit statistics of the constrained model, nor did they report what particular loadings were noninvariant, limiting our ability to interpret the meaningfulness of the nonequivalence over time. In the present study, we explored the longitudinal invariance of the best fitting model of PTSD identified in the study samples across two time points: first, approximately within 3 months following exposure to IPV and, second, around 1 year thereafter.

Method

Participants

Sample 1. Sample 1 consisted of 396 women who were recruited for a longitudinal study of IPV while visiting medical care facilities, including hospital emergency rooms, urgent care clinics, obstetrics and gynecology clinics, and other inpatient and outpatient units. Mean age of participants was 31 years ($SD = 10.16$ years). Ninety-five percent identified as African American, 1% as Latina, and 4% as from other groups. Most participants (68.6%) had completed at least Grade 12, and average annual income ranged between $14,000 and $15,000. Although all participants reported IPV within the last year, over half (64.2%) reported their most recent IPV exposure as having occurred within the last 3 months. Only baseline data from Sample 1 was available for the current study. Sample 1 is henceforth referred to as the *IPV sample*.

Sample 2. Sample 2 consisted of 405 women who were recruited to participate in a separate longitudinal study of IPV from one of three sites at which they were seeking services for violence at the hands of a current or former male partner. Thus, Sample 2 is referred to as the *IPV–services* sample. Sites included the following: (a) a shelter for battered women ($n = 68$, 16.7%), (b) a domestic violence protection order court ($n = 219$, 54.2%), and (c) a domestic violence criminal court ($n = 118$, 29.1%). Mean age of participants was 33 years ($SD = 8.59$ years). Eighty-one percent identified as African American, 13% as Caucasian, 1% as Latina, and 5% as from other groups. Most participants (74%) had completed at least Grade 12, and 66% had incomes of less than $15,000. In contrast to the IPV sample, the majority of the IPV–services sample at baseline (68%) reported their most recent IPV exposure as having occurred within the last month. Intensive tracking methods described by Rumptz, Sullivan, Davidson, and Basta (1991) were used to maintain contact with participants. At 1-year follow-up, 80% of the IPV–services sample ($n = 326$) had been retained, which is unusually high for longitudinal studies with high-risk populations. Participants who were retained at 1 year did not differ from those who were not retained on any of the study variables except for violence severity reported at baseline, $F(1, 399) = 8.07$, $p < .005$, Cohen's $d = .29$: Retained participants reported less IPV severity at baseline ($M = .39$, $SD = .25$) than participants who were not retained ($M = .46$, $SD = .24$). The majority of the IPV–services sample at 1 year (69%) reported no violence exposure within the last 6 months.

Procedure

All participants were recruited by trained research assistants, who were women enrolled in master's-level degree programs or pursing doctorate degrees. They received approximately 20 hr of training, which included training about IPV and its effects, hospital or court policies and procedures, administration of the screens and interviews, confidentiality procedures, and safety protocols. Initial contact with potential participants involved describing the study and conducting a brief screen to ensure eligibility. To participate in the study, a woman had to be a victim of IPV perpetrated by a man who was a current or former intimate partner (*index partner*), speak English, and show no signs of alcohol or drug intoxication or significantly impaired mental status at the time of initial contact.

After participants gave their informed consent, they were administered baseline questionnaires. Each participant was advised that a researcher would subsequently contact her by telephone at specified intervals. She was asked to provide contact information for purposes of follow-up and to answer a series of questions about how to maximize her safety during subsequent contacts.

The baseline interview and questionnaire required approximately 60 min, and participants were paid $20 for their time. The majority of the IPV sample completed the questionnaire by interview at the medical facility at which they were recruited. However, a subsample ($n = 15$) were unable to finish the interview at that time and completed it over the phone at a later date. Participants in the IPV–services sample completed the questionnaire either on their own in a private room (58%) or by interview (14%), according to their preference. Those who were willing to participate in the study but unable to do so at the time were offered the questionnaire to return by mail via a stamped envelope (28%). Method of administration was unrelated to IPV severity and level of PTSD symptoms (all $ps > .05$). Follow-up telephone interviews lasted approximately 60 min, and participants were compensated $20 for each subsequent interview and $50 for the final one. The comparability of telephone versus in-person assessments has been supported in previous research, especially for diagnosing anxiety disorders such as PTSD (Dansky, Saladin, Brady, Kilpatrick, & Resnick, 1995; Rohde, Lewinsohn, & Seeley, 1997).

PTSD Measures

To assess PTSD symptoms, we used the PCL (Weathers, Litz, Herman, Huska, & Keane, 1993). This measure requires participants to indicate on a 5-point Likert scale ranging from 1 (*not at all*) to 5 (*extremely*) the degree of distress they have experienced for each of the 17 PTSD symptoms listed in the *DSM–IV*. The PCL was completed specifically with regard to participants' experiences of domestic violence in the past year. In a study of victims of motor vehicle accidents or sexual assault (Blanchard et al., 1996), the PCL demonstrated good internal reliability (Cronbach's alpha = .94), temporal stability ($r = .96$), and convergence with the Clinician Administered PTSD Scale (CAPS; Blake et al., 1990), a structured interview for PTSD ($r = .93$). Responses can be summed for a total PTSD symptom score as well as for subscale scores. Cronbach's alpha for the PCL was very good ($\alpha = .93$; average inter-item $r = .44$) in the current study. Probable cases of PTSD can also be estimated. According to Weathers et al. (1993), a symptom is considered as meeting the threshold criterion if an individual reports that it bothered her moderately, quite a bit, or extremely (i.e., an endorsement of 3 or greater on the Likert scale). If a person meets the threshold criteria for one or more intrusive symptoms, three or more avoidance–numbing symptoms, and two or more hyperarousal symptoms, he or she is categorized as meeting *DSM–IV* symptom criteria for PTSD. Using these guidelines, 68% of the IPV sample and 70% of the IPV–services sample met criteria for a probable diagnosis of PTSD according to the *DSM–IV*.

Data Analytic Strategy

Preanalysis evaluation of data and measurement models. Preanalysis data inspection and CFAs were conducted using EQS 6.1 (Bentler, 2004). Table 1 presents univariate statistics for the 17 PCL items across samples. As shown, no substantial departure from normality was found at the individual item level. However, there was significant multivariate nonnormality according to Mardia's (1970) coefficient for multivariate kurtosis in both samples (mean of two samples = 68.44, $p < .001$). Thus, adjustments to the fit statistics were made through use of the robust maximum likelihood estimation method, the Yuan–Bentler scaled chi-square

Table 1
Descriptive Statistics of PCL Items by Sample

		IPV sample				IPV–services sample baseline				IPV–services sample 1 year			
DSM–IV	PTSD symptom	*M*	*SD*	Skew	Kurt	*M*	*SD*	Skew	Kurt	*M*	*SD*	Skew	Kurt
B1	Intrusive thoughts	2.79	1.47	0.16	−1.35	3.16	1.42	−0.14	−1.25	1.87	1.27	1.30	0.45
B2	Recurrent dreams	2.14	1.41	0.87	−0.67	2.55	1.47	0.41	−1.26	1.50	0.99	2.09	3.68
B3	Flashbacks	2.24	1.43	0.76	−0.84	2.44	1.49	0.52	−1.20	1.49	1.06	2.21	3.80
B4	Emotional reactivity	2.94	1.45	0.09	−1.33	3.10	1.53	−0.12	−1.47	1.92	1.31	1.25	0.28
B5	Physical reactivity	2.35	1.50	0.62	−1.11	2.62	1.54	0.32	−1.40	1.70	1.17	1.64	1.58
C1	Avoiding thoughts	2.87	1.54	0.04	−1.52	2.84	1.50	0.11	−1.41	2.03	1.49	1.09	−0.40
C2	Avoiding reminders	2.50	1.54	0.43	−1.36	2.57	1.50	0.37	−1.31	1.75	1.31	1.52	0.83
C3	Amnesia for aspects	1.81	1.23	1.36	0.62	2.26	1.47	0.71	−0.99	1.45	1.05	2.24	3.70
C4	Loss of interest	2.52	1.52	0.45	−1.30	2.69	1.53	0.26	−1.42	1.71	1.25	1.60	1.26
C5	Detachment	2.90	1.53	0.06	−1.46	2.79	1.56	0.17	−1.48	1.82	1.31	1.37	0.50
C6	Restricted affect	2.46	1.54	0.50	−1.27	2.67	1.55	0.25	−1.45	1.69	1.25	1.68	1.47
C7	Foreshortened future	2.40	1.47	0.56	−1.12	2.77	1.50	0.15	−1.39	1.66	1.20	1.71	1.66
D1	Sleep disturbance	2.95	1.57	0.04	−1.53	3.31	1.51	0.34	−1.30	2.17	1.49	0.89	−0.73
D2	Irritability	2.96	1.47	−0.03	−1.35	2.94	1.47	0.04	−1.34	1.96	1.38	1.18	−0.04
D3	Difficulty concentrating	2.74	1.43	0.21	−1.26	3.06	1.43	−0.07	−1.27	1.99	1.36	1.09	−0.15
D4	Hypervigilance	2.88	1.54	0.10	−1.46	3.19	1.53	−0.22	−1.42	2.01	1.46	1.09	−0.37
D5	Exaggerated startle	2.72	1.53	0.27	−1.39	3.24	1.51	−0.27	−1.35	1.91	1.38	1.23	0.02

Note. B1–D5 are *DSM–IV* cluster letters and item numbers. *DSM–IV* = *Diagnostic and Statistical Manual of Mental Disorders* (4th ed.); PTSD = posttraumatic stress disorder; PCL = Posttraumatic Stress Disorder Checklist; IPV = intimate partner violence; Skew = item skewness; Kurt = item kurtosis.

(Y–Bχ^2; Yuan & Bentler, 1999), and robust standard errors were calculated. The Y–Bχ^2 is analogous to the Satorra–Bentler scaled chi-square (S–B χ^2; Satorra & Bentler, 1994), except that it represents a technical advancement by allowing for missing data. Nevertheless, the S–B χ^2 is also reported to facilitate a comparison of study findings with previous CFA studies. In addition, a number of other goodness-of-fit indices were used that are less affected by sample size, including the root-mean-square error of approximation (RMSEA; Browne & Cudeck, 1993), the comparative fit index (CFI; Bentler, 1990), and the Akaike information criterion (AIC; Akaike, 1987). The RMSEA takes into account the error of approximation in the population and evaluates how well the model would fit the population covariance matrix with unknown but optimally chosen parameter values. The CFI is a normed fit index that adjusts for the degrees of freedom. The AIC is recommended primarily as an unbiased index with which to compare the fit of different models. These fit indexes were also adjusted for nonnormality by incorporating the Y–Bχ^2 into their calculations. Thus, we refer to them as *robust estimates* (i.e., R–RMSEA, R–CFI, and R–AIC).

On the basis of guidelines suggested by Hu and Bentler (1999), the following criteria for evaluating fit were used in the current study: R–RMSEA values of .08 or less indicated adequate fit, whereas values of .06 or less signified excellent fit. For R–CFI, values of .90 and greater reflected adequate fit, and values of .95 and greater indicated excellent fit. Lower R–AIC values indicate better fit to the observed data. We relied on visual comparisons of the fit indices to establish model superiority.

Missing data procedures. Nine participants in the IPV sample, 27 in the IPV–services baseline sample, and 7 in the IPV–services 1-year sample were missing one of the PCL items. In addition, one participant in the IPV sample and one in the IPV–services baseline sample were missing five PCL items. Examination of the missing data patterns across samples suggested that the patterns were similar and appeared to be missing at random. Most likely there were more missing data among the IPV–services baseline sample than the other samples because of differences in measurement administration: A large proportion of the IPV–services baseline sample (86%) completed the questionnaires on their own (alone in a room or by mail-in packet), whereas the other samples completed the questionnaires mostly by interview.

To deal with the complexities of missing data, we used an advanced missing data procedure, maximum likelihood estimation with EM algorithm (MLE; Jamshidian & Bentler, 1999), using EQS 6.1. This procedure uses all available data points in a database to generate the best possible first- and second-order moment estimates. To accomplish this, MLE maximizes the casewise likelihood of the observed data by using parameter estimates only for the data that that individual brings to the study (McArdle & Bell, 2000). MLE has been shown to generate a vector of means and a covariance matrix among the variables that is less biased and more efficient than other missing data procedure methods, such as listwise or pairwise deletion (Wothke, 2000). Thus, this procedure, implemented using the Y–B χ^2, allowed all participants to be included in the data analyses at baseline for the two samples and at 1-year follow-up for the IPV–services sample.

Results

CFA

The correlation matrices of PCL items for the IPV sample and the IPV–services sample (at baseline and 1-year follow-up) are presented in Appendix A and Appendix B, respectively.

Fit indices for each of the models tested in the IPV sample appear in Table 2. Consistent with prior research, the models with four first-order factors evidenced better fit to the data than the two- and three-factor models. Specifically, the two- and three-factor models provided adequate fit to the data. In contrast, the PTSD–numbing and PTSD–dysphoria first-order models demonstrated excellent fit according to the R–CFI and R–RMSEA, and the R–AIC was substantially lower for these models than the two- and three-factor ones. Visual comparison of the PTSD–numbing and PTSD–dysphoria first-order models demonstrated that the PTSD–dysphoria first-order model evidenced superior fit.

The PTSD–numbing and PTSD–dysphoria second-order models also evidenced adequate to excellent fit across indices, and their R–AIC values were lower than the two- and three-factor models. However, visual comparisons of these models to their first-order counterparts suggested that these models did not fit as well. Overall then, the PTSD–dysphoria first-order model enjoyed the most empirical support in the IPV sample.

To cross-validate these findings, we examined the fit indices for the six models in the IPV–services sample. The same pattern of results emerged in the cross-validation sample at both baseline and 1-year follow-up (see Table 2). Specifically, at both time points, the PTSD–dysphoria first-order model provided a superior fit compared with all other models, followed by its second-order counterpart.

Standardized and unstandardized factor loadings for the PTSD–dysphoria first-order model are presented in Table 3 by sample and time of assessment. All factor loadings were moderate to high and significant (all $ps < .05$), ranging from .51 to .92. Loadings on the Dysphoria factor were uniformly strong across samples (range = .65–.81), suggesting that the combination of traditional numbing items from Cluster C with the more general distress items from Cluster D represents a reasonable unified cluster. Table 3 also contains indexes of the relationships among factors. The factor correlations were moderate to high across samples: Mean intercorrelations were .73, .74, and .82 in the IPV sample, the IPV–services sample at baseline, and the IPV–services sample at 1 year, respectively. Reliability coefficient rho for the PTSD–dysphoria model was calculated using EQS 6.1 in the IPV sample ($\rho = .935$), the IPV–services sample at baseline ($\rho = .956$), and the IPV–services sample at 1 year ($\rho = .950$); all indicated excellent model reliability.

Structural Invariance

To more systematically evaluate the stability of the factor structure of the best fitting model identified above (i.e., the PTSD–dysphoria first-order model) across samples and time, we conducted two separate factorial invariance analyses. Factor structure invariance of this model was evaluated between (a) the IPV sample and the IPV–services sample at baseline and (b) the IPV–services sample at baseline and the IPV–services sample at 1 year.

Table 2
Goodness-of-Fit Indices and Model Comparisons for Tested Models

Model	*df*	χ^2	Y–Bχ^2	S–Bχ^{2a}	R–AIC	R–CFI	R–RMSEA	R–RMSEA 90% CI
IPV (N = 396)								
Two-factor	118	384.86	298.57	300.98	62.57	.930	.062	.053–.071
Three-factor	116	375.68	289.22	291.09	57.22	.933	.061	.053–.070
PTSD–numb first order	113	302.44	233.64	235.35	7.64	.953	.052	.042–.061
PTSD–numb second order	115	324.13	249.76	251.68	19.76	.948	.056	.047–.065
PTSD–dys first order	**113**	**291.01**	**232.97**	**228.84**	**6.97**	**.954**	**.052**	**.042–.061**
PTSD–dys second order	115	283.78	237.43	233.23	7.43	.953	.052	.042–.061
IPV–services baseline (N = 405)								
Two-factor	118	553.64	404.13	404.03	168.12	.923	.077	.069–.086
Three-factor	116	463.88	341.68	341.05	109.68	.939	.069	.061–.078
PTSD–numb first order	113	365.05	270.59	269.51	44.59	.958	.059	.050–.068
PTSD–numb second order	115	389.31	289.07	288.46	59.07	.953	.061	.053–.070
PTSD–dys first order	**113**	**314.66**	**239.01**	**235.22**	**13.01**	**.965**	**.052**	**.042–.061**
PTSD–dys second order	115	347.53	257.81	253.58	27.81	.960	.054	.045–.063
IPV–services 1 year (N = 326)								
Two-factor	118	364.43	184.23	187.50	−51.77	.957	.041	.029–.053
Three-factor	116	411.84	304.99	200.65	72.99	.935	.071	.061–.080
PTSD–numb first order	113	319.09	159.96	163.54	−66.04	.970	.036	.022–.048
PTSD–numb second order	115	349.89	175.01	178.40	−54.99	.961	.040	.027–.051
PTSD–dys first order	**113**	**269.79**	**143.05**	**141.32**	**−82.95**	**.983**	**.028**	**.008–.041**
PTSD–dys second order	115	278.79	148.60	145.96	−81.40	.980	.029	.012–.042

Note. All χ^2, Y–Bχ^2, and S–Bχ^2 statistics were significant at $p < .001$. Boldface rows signify best fitting model in each sample. Y–Bχ^2 = Yuan–Bentler scaled chi-square; S–Bχ^2 = Satorra–Bentler scaled chi-square; R–AIC = robust Akaike information criterion; R–CFI = robust comparative fit index; R–RMSEA = robust root-mean-square error of approximation; CI = confidence interval; IPV = intimate partner violence; PTSD = posttraumatic stress disorder; PTSD–numb = PTSD–numbing; PTSD–dys = PTSD–dysphoria.
[a] S–Bχ^2 does not allow for missing data. Thus, based on listwise deletion, the following *Ns* were used in calculating the S–Bχ^2: IPV = 386, IPV–services baseline = 377, IPV–services 1 year = 319.

We examined three aspects of invariance in the current study. The first was configural invariance (Horn & McArdle, 1992), which requires the factor pattern to have the same factor configuration across samples or time, but the size of the loadings, the correlations between the factors, and the uniquenesses are allowed to vary. The second was metric invariance, which requires not only the same factor configuration, but also equal magnitudes of factor loadings across samples or time. The third was phi invariance, in which factor correlations are constrained to be equivalent across samples or time, in addition to configural and metric invariance. Other types of structural invariance can be tested, including constraining residual variances and item intercepts to be equivalent (Vandenberg & Lance, 2000). However, we chose not to test these parameters because residual errors are rarely found to be invariant in applied data sets (Horn & McArdle, 1992). Furthermore, we anticipated that item intercepts would vary across samples and over time. Specifically, individuals seeking services for IPV were expected to have higher levels of distress than those not seeking services at baseline. In terms of levels of distress over time, we expected symptom levels to decrease from baseline to 1 year in the IPV–services sample, as this group was involved in some type of IPV intervention at baseline, and previous research suggests that, on average, PTSD symptoms decline markedly over the weeks and months following exposure even when there is no formal clinical intervention (e.g., Blanchard et al., 1996).

Invariance across samples. As demonstrated above, configural invariance was found across the IPV sample and the IPV–services sample at baseline, as the PTSD–dysphoria first-order model was found superior in both samples. To test for metric and phi invariance of the PTSD–dysphoria first-order model across samples, we constrained all factor loadings and correlations to be equivalent across the two samples and evaluated this model for overall model fit. The multi-group analysis showed that the factor loadings and intercorrelations were highly invariant across the two samples, with the fully constrained model producing excellent fit statistics: Y–Bχ^2(245, N = 801) = 528.64, R–RMSEA = .038 (R–RMSEA confidence interval = .034–.042), R–CFI = .954, R–AIC = 38.64. These results indicated that the factor loadings and intercorrelations of the PTSD–dysphoria first-order model were invariant across samples of battered women who differed in IPV help-seeking behaviors and community settings (medical vs. legal–social).

Invariance over time. Configural invariance of the PTSD–dysphoria first-order model over time was also established above, as this model was found superior at both baseline and 1-year follow-up among the IPV–services sample. To test for metric and phi invariance of the model across time, we constrained all factor loadings and correlations to be equivalent over time and evaluated the constrained model for overall model fit. Results indicated that the fully constrained model characterized the data excellently: Y–Bχ^2(517, N = 405) = 856.67, R–RMSEA = .040 (R–RMSEA confidence interval = .035 – .045), R–CFI = .964, R–AIC = –177.33, suggesting full metric and phi invariance.

Discussion

Replicating the findings of Simms et al. (2002) and Baschnagel et al. (2005), we found in the current study that a reconfigured

Table 3
Factor Loadings and Factor Relationships of the PTSD–Dysphoria Model

DSM–IV item & factor	Intrusions			Avoidance			Dysphoria			Hyperarousal		
	IPV	IPV–S base	IPV–S 1 yr	IPV	IPV–S base	IPV–S 1 yr	IPV	IPV–S base	IPV–S 1 yr	IPV	IPV–S base	IPV–S 1 yr
						Weights[a]						
B1	.72/1.00	.80/1.00	.81/1.00									
B2	.71/.94 (.06)	.83/1.07 (.04)	.74/.71 (.08)									
B3	.75/1.02 (.06)	.78/1.01 (.05)	.73/.76 (.08)									
B4	.78/1.07 (.06)	.80/1.08 (.04)	.83/1.06 (.08)									
B5	.80/1.13 (.07)	.82/1.10 (.05)	.79/.91 (.08)									
C1				.65/1.00	.78/1.00	.75/1.00						
C2				.87/1.33 (.10)	.87/1.11 (.06)	.68/.79 (.09)						
C3							.46/1.00	.54/1.00	.55/1.00			
C4							.76/2.03 (.24)	.75/1.46 (.12)	.75/1.61 (.23)			
C5							.76/2.04 (.23)	.78/1.53 (.13)	.74/1.66 (.25)			
C6							.65/1.76 (.22)	.73/1.42 (.12)	.71/1.53 (.24)			
C7							.72/1.87 (.24)	.72/1.36 (.12)	.73/1.50 (.21)			
D1							.64/1.78 (.23)	.73/1.38 (.13)	.73/1.88 (.28)			
D2							.65/1.69 (.21)	.76/1.41 (.13)	.76/1.81 (.26)			
D3							.71/1.79 (.21)	.78/1.40 (.12)	.80/1.88 (.26)			
D4										.60/1.00	.79/1.00	.74/1.00
D5										.83/1.36 (.14)	.92/1.16 (.06)	.83/1.05 (.08)
						Factor correlations[b]						
Intrusions	**1.11**	**1.30**	**1.05**	.85	1.05	.91	.47	.71	.78	.67	.99	.98
Avoidance	.80	.78	.87	**1.00**	**1.38**	**1.05**	.41	.73	.68	.57	.81	.90
Dysphoria	.79	.79	.82	.73	.78	.72	**1.30**	**.63**	**.86**	.37	.71	.83
Arousal	.68	.72	.88	.61	.57	.81	.71	.74	.82	**.86**	**1.44**	**1.18**

Note. PTSD = posttraumatic stress disorder; *DSM–IV* = *Diagnostic and Statistical Manual of Mental Disorders* (4th ed.); IPV = intimate partner violence sample; IPV–S base = IPV services sample at baseline; IPV–S 1 yr = IPV services sample at 1-year follow-up.
[a] Standardized followed by unstandardized loadings, with Yuan-Bentler scaled standard errors in parentheses. The first item within each factor was fixed at 1.00 to establish the scale; hence, there are no standard errors for these four items. All loadings are significant at $p < .05$. [b] Bolded values along the diagonal represent factor variances; upper triangle contains covariances; lower triangle contains correlations, all of which are significant at $p < .05$.

model of PTSD, one that accounts for the high comorbidity between PTSD and depression, provided the best fit to the data compared with competing models of PTSD, including the three-factor model defined in the *DSM–IV*. The reconfigured model posits four intercorrelated symptom dimensions, including (a) intrusive symptoms, (b) avoidance of trauma reminders, (c) dysphoria, and (d) hyperarousal. It is important to note that our sample differed from those of Simms et al. (2002) and Baschnagel et al. (2005) in terms of gender, ethnicity, socioeconomic status, and trauma type. Not only did the same model emerge as superior in our sample of low-income, mostly minority women exposed to IPV, but it also successfully cross-validated in a similar sample that was seeking protective or legal services for IPV.

To our knowledge, this is the first study that examined the factor structure of PTSD among a sample of women exposed to IPV, which is surprising given that the prevalence of PTSD in shelter samples of battered women ranges from 45% to 84% (Jones, Hughes, & Unterstaller, 2001). Confirmation of the relevance of a four-factor intercorrelated model of PTSD among this traumatized population highlights the value of assessing and treating its distinct dimensions among IPV survivors seeking services in social service and health care settings.

Although the three-factor model of PTSD defined in the *DSM–IV* provided adequate model fit across samples, the PTSD–dysphoria first-order model consistently demonstrated superior fit indices that were in the excellent, rather than adequate, range. In contrast to the three-factor *DSM–IV* model, the PTSD–dysphoria model allocates greater attention to a dysphoria cluster that subsumes traditional numbing symptoms (i.e., loss of interest, detachment, restricted affect, and sense of foreshortened future) and a subset of symptoms originally loaded on the hyperarousal factor (i.e., sleep disturbance, irritability, and impaired concentration). As noted by Simms et al. (2002), de-emphasizing emotional numbing diverges from previous work on PTSD; both theoretical and structural studies have posited numbing as a factor independent of avoidance symptoms (Asmundson et al., 2000, 2003; King et al., 1998), with some unique predictive validity for the development of PTSD (Feeny, Zoellner, Fitzgibbons, & Foa, 2000) and other long-term psychosocial problems, such as revictimization (Krause, Kaltman, Goodman, & Dutton, 2006). The current study, as well as those of Simms et al. (2002) and Baschnagel et al. (2005), did not support the superiority of a PTSD model that posits numbing as a unique factor. Direct comparisons of the PTSD–dysphoria model to the four-factor model with emotional numbing as a distinct cluster repeatedly found the PTSD–dysphoria model to prevail in terms of model fit.

The present data suggest that the PTSD–dysphoria first-order model remains relatively stable over time in configuration. Indeed, we found that this model fit the data better than the two-, three-, and alternative four-factor models at 1-year follow-up in the IPV–services sample. In addition, invariance testing indicated that item loadings and factor correlations remain equivalent over a 1-year period. These findings indicate that change in observed scores can be more directly attributed to change in the enduring latent constructs (Byrne, Shavelson, & Muthén, 1989; Floyd & Widaman, 1995; Penz & Chou, 1994). Thus, trauma researchers can be reasonably confident that changes in the subscales of the PTSD–dysphoria model indicate changes in the latent levels of their constructs over time, at least as measured by the PCL.

Across samples and time, we found the intercorrelated PTSD–dysphoria model preferable to its second-order counterpart. This finding is consistent with the majority of CFA studies that have evaluated the PTSD–numbing second-order model (Asmundson et al., 2003; DuHamel et al., 2004; King et al., 1998; Marshall, 2004) and the one study that examined the PTSD–dysphoria second-order model (Palmieri & Fitzgerald, 2005). Identifying four cohesive and replicable symptom factors of PTSD that are highly correlated but not representative of a single underlying dimension suggests that more emphasis be placed on assessing the distinct symptom cluster scores and considering possible subtypes of PTSD in which individuals display different patterns of symptom combinations (King et al., 1998; Watson, 2005). The findings might also suggest that clinicians work with their clients to develop a hierarchy of distress by symptom cluster that can be used to tailor the sequencing of intervention strategies. Further research is needed to examine the role of the separate symptom clusters and possible patterns of cluster combinations that may impact treatment planning, interventions, and long-term prognosis (Simms et al., 2002).

It should be noted that the current study relied on a single self-report measure of posttraumatic stress symptoms, the PCL; thus, the findings may address only the structure and stability underlying the PCL rather than the nature of PTSD. However, the finding that the intercorrelated PTSD–numbing model was superior to the two-factor model and a second-order PTSD–numbing model replicated the findings of King et al. (1998), who used a clinical diagnostic interview, the CAPS, to investigate the structure of PTSD. In addition, participants in our study were administered the PCL in different formats at baseline (e.g., paper-and-pencil questionnaire) and follow-up (telephone interview). Future CFA and longitudinal structure invariance studies of PTSD symptoms might examine and compare self-report measures with structured interviews and telephone interviews. In addition, the PTSD–dysphoria and PTSD–numbing models had factors with only two items. Creating subscales of constructs with such few items may lead to measures with low reliability. Thus, further research and diagnostic assessment efforts are needed to increase the number of items designed to tap constructs such as avoidance and hyperarousal for the PTSD–dysphoria model.

In sum, in the current study we found support for a model of PTSD that seems to remain fairly stable across service setting and time. It is important to note that this model reorganizes the traditional PTSD symptoms to include four intercorrelated factors, one (Intrusions) that seems fairly specific to PTSD, two (Avoidance and Hyperarousal) that are common across anxiety disorders, and one (Dysphoria) that overlaps broadly with both depressive and anxiety disorders (Simms et al., 2002). A model of PTSD that differentiates symptoms that are specific to the disorder and ones that overlap with other anxiety and depressive disorders provides further support for recent hierarchical models of anxious and depressive symptomatology (e.g., Mineka et al., 1998) that emphasize commonalities among emotional disorders rather than differences. High comorbidity rates between mood and anxiety disorders (76% for lifetime diagnoses; Brown, Campbell, Lehman, Grisham, & Mancill, 2001) have led many theoreticians and researchers to argue for an underlying dimension of dysphoria that gives rise to the heterogeneity in the expression of specific emo-

tional disorder symptoms, such as PTSD, panic attacks, and depression (Barlow, Allen, & Choate, 2004).

In terms of refining the criteria of PTSD in the next iteration of the *DSM*, these results and developing theoretical approaches to psychopathology pose a dilemma. Some have suggested that in order to improve differential diagnosis, symptom clusters that are more specific to a disorder (e.g., intrusive symptoms in PTSD) be weighted more heavily than those (e.g., dysphoria) that add little to differentiate it from other disorders (Simms et al., 2002). Alternatively, it has been proposed that the *DSM–V* should turn to a more dimensional description of the emotional disorders that would better account for common underlying components (Barlow et al., 2004; Kupfer, First, & Regier, 2002; Watson, 2005). Perhaps requiring symptoms that address common underlying dimensions of dysphoria, avoidance, and hyperarousal as well as unique dimensions of PTSD, such as intrusions and emotional numbing, may be a useful way of organizing symptom structures and compromising between these diagnostic approaches.

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Appendix A

Correlations Between PTSD Checklist (PCL) Items for the IPV Sample

PCL item	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
1. Intrusive thoughts	—															
2. Recurrent dreams	.59	—														
3. Flashbacks	.56	.55	—													
4. Emotional reactivity	.56	.50	.59	—												
5. Physical reactivity	.50	.58	.57	.63	—											
6. Avoiding thoughts	.34	.29	.31	.50	.43	—										
7. Avoiding reminders	.48	.43	.52	.55	.59	.56	—									
8. Amnesia for aspects	.30	.34	.26	.30	.39	.32	.41	—								
9. Loss of interest	.46	.42	.45	.45	.51	.35	.51	.41	—							
10. Detachment	.46	.39	.50	.46	.47	.35	.45	.37	.65	—						
11. Restricted affect	.32	.38	.38	.38	.38	.31	.41	.28	.47	.52	—					
12. Foreshortened future	.48	.43	.44	.39	.50	.36	.46	.29	.53	.50	.52	—				
13. Sleep disturbance	.35	.36	.39	.35	.42	.31	.40	.21	.44	.45	.35	.50	—			
14. Irritability	.38	.30	.34	.44	.42	.34	.37	.22	.45	.44	.43	.46	.49	—		
15. Difficulty concentrating	.41	.30	.37	.38	.45	.29	.37	.29	.51	.52	.44	.48	.51	.58	—	
16. Hypervigilance	.29	.31	.29	.34	.30	.28	.35	.25	.27	.29	.30	.33	.27	.26	.31	—
17. Exaggerated startle	.38	.39	.40	.43	.49	.31	.42	.25	.38	.43	.37	.46	.40	.38	.46	.50

Note. All correlations are significant at $p < .01$. PTSD = posttraumatic stress disorder; IPV = interpersonal violence.

Appendix B

Correlations Between PTSD Checklist (PCL) Items for the IPV–Services Sample at Baseline (Below Diagonal) and 1-Year Follow-Up (Above Diagonal)

PCL item	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
1. Intrusive thoughts	—	.64	.60	.70	.60	.48	.40	.40	.55	.46	.42	.53	.46	.48	.54	.48	.57
2. Recurrent dreams	.70	—	.56	.61	.59	.42	.44	.49	.48	.36	.39	.52	.43	.39	.46	.42	.53
3. Flashbacks	.60	.70	—	.59	.60	.35	.36	.37	.54	.40	.46	.47	.43	.48	.50	.57	.50
4. Emotional reactivity	.67	.66	.64	—	.63	.55	.46	.40	.54	.44	.47	.48	.48	.53	.54	.55	.60
5. Physical reactivity	.64	.66	.62	.66	—	.48	.45	.40	.54	.48	.51	.53	.46	.49	.52	.54	.66
6. Avoiding thoughts	.43	.47	.49	.50	.58	—	.51	.33	.42	.30	.33	.35	.28	.37	.33	.40	.48
7. Avoiding reminders	.53	.55	.51	.55	.63	.68	—	.32	.37	.31	.29	.33	.25	.26	.34	.30	.43
8. Amnesia for aspects	.34	.39	.40	.37	.45	.36	.46	—	.48	.36	.39	.45	.38	.34	.41	.38	.41
9. Loss of interest	.47	.45	.44	.48	.55	.52	.61	.52	—	.57	.53	.53	.52	.57	.55	.51	.52
10. Detachment	.46	.49	.47	.47	.52	.46	.52	.38	.64	—	.62	.52	.52	.55	.62	.47	.52
11. Restricted affect	.42	.45	.41	.44	.51	.43	.48	.42	.57	.69	—	.57	.50	.52	.53	.43	.42
12. Foreshortened future	.45	.49	.45	.50	.54	.44	.49	.36	.50	.57	.53	—	.55	.54	.56	.45	.47
13. Sleep disturbance	.48	.48	.45	.47	.49	.45	.47	.34	.48	.54	.46	.54	—	.61	.63	.53	.48
14. Irritability	.45	.45	.48	.47	.47	.47	.48	.37	.55	.55	.50	.53	.66	—	.68	.48	.45
15. Difficulty concentrating	.51	.47	.44	.49	.53	.47	.45	.41	.55	.58	.55	.54	.62	.66	—	.46	.59
16. Hypervigilance	.46	.46	.39	.44	.45	.35	.3	.27	.40	.45	.39	.51	.46	.43	.55	—	.61
17. Exaggerated startle	.55	.54	.50	.53	.57	.41	.46	.36	.48	.50	.43	.54	.53	.53	.56	.72	—

Note. All correlations are significant at $p < .01$. PTSD = posttraumatic stress disorder; IPV–services sample = sample of women seeking services for interpersonal violence.

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