Published in final edited form as:

J Anxiety Disord. 2012 June ; 26(5): 599–607. doi:10.1016/j.janxdis.2012.02.016.

Personality and the latent structure of PTSD comorbidity

Mark W. Miller and Erika J. Wolf

National Center for PTSD at VA Boston Healthcare System Boston University School of Medicine, Department of Psychiatry Annemarie Reardon, Ashley Greene, Shani Ofrat, Scott McInerney National Center for PTSD at VA Boston Healthcare System

Abstract

This study examined the structure of PTSD comorbidity and its relationship to personality in a sample of 214 veterans using data from diagnostic interviews and the Multidimensional Personality Questionnaire-Brief Form (MPQ-BF; Patrick, Curtin, & Tellegen, 2002). Confirmatory factor analyses supported a three factor model composed of Externalizing, Fear and Distress factors. Analyses that examined the location of borderline personality disorder revealed significant cross-loadings for this disorder on both Externalizing and Distress. Structural equation models showed trait negative emotionality to be significantly related to all three comorbidity factors whereas positive emotionality and constraint evidenced specific associations with Distress and Externalizing, respectively. These results shed new light on the location of borderline personality disorder within the internalizing/externalizing model and clarify the relative influence of broad dimensions of personality on patterns of comorbidity.

Psychiatric disorders co-occur in broad classes that are thought to reflect the fundamental structure of mental illness (Krueger, 1999; Markon, 2010; Watson, 2005). Recent studies suggest that the covariation of the anxiety and unipolar mood disorders can be accounted for by a common factor termed internalizing, which, in many studies, has been subdivided into fear (e.g., panic and phobias) and distress (e.g., depression and generalized anxiety disorder) components (Krueger, 1999; Krueger, Caspi, Moffitt, & Silva, 1998; Krueger, Chentsova-Dutton, Markon, Goldberg, & Ormel, 2003; Krueger, McGue, & Iacono, 2001; Miller, Fogler, Wolf, Kaloupek, & Keane, 2008; Slade & Watson, 2006; Vollebergh et al., 2001). In these studies, a second factor, termed externalizing, has been found to underlie the frequent co-occurrence of the substance-use disorders and antisocial personality disorder (ASPD). Twin-studies have shown these dimensions to be heritable and linked to personality (Krueger et al., 2002; Young, Stallings, Corley, Krauter, & Hewitt, 2000; Wolf, Miller, Krueger, Lyons, Tsuang, & Koenen, 2010). Trait negative emotionality (NEM; the disposition toward negative moods and emotion including anxiety, anger and alienation) has been conceptualized as the primary temperamental substrate for the internalizing disorders (Krueger et al., 2001, Krueger, Caspi, Moffitt, Silva, & McGee, 1996; Clark, Watson, & Mineka, 1994; Clark & Watson, 1991; Watson & Clark, 1984). Low trait positive emotionality (PEM; i.e., the capacity to experience positive emotions and tendencies

Correspondence concerning this article should be addressed to Mark W. Miller, National Center for PTSD (116B-2), VA Boston Healthcare System, 150 South Huntington Avenue, Boston, MA 02130. mark.miller5@va.gov.

Mark W. Miller, National Center for PTSD at VA Boston Healthcare System & Department of Psychiatry, Boston University School of Medicine; Erika J. Wolf, National Center for PTSD at VA Boston Healthcare System & Department of Psychiatry, Boston University School of Medicine; Annemarie Reardon, VA Boston Healthcare System; Ashley Greene, National Center for PTSD at VA Boston Healthcare System; Shani Ofrat National Center for PTSD at VA Boston Healthcare System; Scott McInerney, National Center for PTSD at VA Boston Healthcare System. Funding for this study was provided by National Institute on Mental Health award RO1 MH079806 and a VA Merit Review Grant awarded to Mark W. Miller as well as a VA Career Development Award to Erika Wolf.

towards active involvement in the social and work environments) has been linked to the distress disorders and is widely conceptualized as the personality vulnerability factor that distinguishes depression from anxiety (Brown, Chorpita & Barlow, 1998; Watson, Clark, & Carey, 1988; Watson, Gamez, & Simms, 2005). Constraint (CON; also known as “impulsivity,” involving the tendency to engage in risky behavior and endorse non-traditional values) has long been implicated as the primary temperamental foundation of the externalizing disorders (Krueger et al., 2001; Schwartz, Snidman, Kagan, 1996), however, more recent research suggests that NEM may also contribute substantially to the development and maintenance of psychopathology in this domain (Khan, Jacobson, Gardner, Prescott, & Kendler, 2005; Miller, Vogt, Mozley, Kaloupek, & Keane, 2006; Singh & Waldman, 2010; Wolf et al., 2010).

Miller (2003, 2004) and colleagues have applied this model to a conceptualization of individual differences in the manifestation of posttraumatic psychopathology and heterogeneity in patterns of comorbidity associated with posttraumatic stress disorder (PTSD; e.g., Miller, Greif, & Smith, 2003; Miller, Kaloupek, Dillon, & Keane, 2004; Miller, Fogler, Wolf, Kaloupek & Keane, 2008; Wolf, Miller, Krueger, Lyons, Tsuang, & Koenen, 2010; Miller & Resick, 2007; Wolf, Miller, Harrington & Reardon, in press). The fundamental postulate of their work is that posttraumatic psychiatric distress is the product of traumatic stress operating on temperament-based diatheses that span the spectrum of human variation in vulnerability to psychopathology (Miller, Resick & Keane, 2009; Resick & Miller, 2009). Drawing from Tellegen's (1985) 3-factor model of personality, Miller (2003, 2004) hypothesized that NEM is the primary temperamental risk factor for PTSD, whereas PEM and CON serve primarily to influence the form and expression of post-traumatic responses. Miller predicted that individuals characterized prior to trauma by high NEM combined with low PEM would be most vulnerable to developing internalizing forms of post-traumatic adjustment characterized by marked depressive and anxious symptoms and social withdrawal. In contrast, those with pre-trauma high NEM combined with low CON were expected to be more likely to develop externalizing manifestations of posttraumatic adjustment characterized by problems in the domains of impulsivity, aggression, antisociality, and substance abuse, including higher rates of cluster B personality disorder features (i.e., the “dramatic-emotional” disorders—antisocial, borderline, histrionic, and narcissistic).

Support for these hypotheses was provided by results of a series of studies that used cluster analysis or latent class analysis to identify subtypes based on personality inventories completed by individuals with PTSD symptoms (Flood et al., 2010; Forbes, Elhai, Miller, & Creamer, 2010; Miller et al., 2003; Miller et al., 2004; Miller & Resick, 2007; Rielage, Hoyt, Renshaw, 2010; Sellbom, & Bagby, 2009; Wolf et al., in press). Summarizing across studies, investigators have repeatedly found evidence for a three-group, personality-based typology in which one group constituted a lower pathology cluster and the other two represented more pathological or “complex PTSD” clusters that differed on variables related to externalizing versus internalizing. However, no prior study has simultaneously modeled the hypothesized differential associations between the three personality dimensions (PEM, NEM, and CON) and internalizing and externalizing dimensions of psychopathology.

Internalizing/Externalizing and the Location of Borderline Personality Disorder

Another limitation of prior research in this area is that studies have focused primarily on modeling the structure of Axis I disorders, with the exception that antisocial personality disorder (ASPD) has typically been included as an indicator of externalizing. Though theorists have conjectured that the internalizing/externalizing comorbidity structure may

extend into the domain of personality disorders (e.g., Krueger 2005), few studies have examined the position of personality disorders other than ASPD within this framework. In this study, we explored the location of borderline personality disorder (BPD) not only to fill this gap in the literature but because prior research suggests substantive etiological links between trauma exposure, PTSD, and BPD (e.g., Gunderson & Sabo, 1993; McLean & Gallop, 2003; Shea et al., 2004; Zanarini et al., 1998). Moreover, BPD is a complex disorder defined by a heterogeneous array of symptoms with plausible links to both internalizing and externalizing. Putative externalizing manifestations of BPD include tendencies towards impulsive and violent behavior, shoplifting, displays of anger, and combative relationships. Internalizing manifestations of BPD include withdrawal, depression, anxiety, and poor self-image. In this sense, BPD stands apart from the other personality disorders and for these reasons we chose to focus our analyses on this particular diagnosis.

The heterogeneity of BPD symptomatology is reflected in results of recent investigations of the structural relations between BPD and latent dimensions of comorbidity which have found evidence for a complex structure involving cross-loadings. For example, James and Taylor (2008) and Eaton et al. (2011) tested competing models for the location of BPD and found the best fitting model to be one in which BPD loaded on both distress and externalizing. Similarly, Røysamb et al. (2011) evaluated the structure of lifetime *DSM-IV* Axis I and II disorders in a population-based sample and found BPD to load on factors representing internalizing and externalizing in both confirmatory and exploratory models. Finally, Kendler et al. (2010) evaluated the genetic and environmental structure of data from the same population survey and found that BPD shared genetic liability with Axis I and Axis II externalizing factors, primarily, but also shared somewhat weaker genetic associations with latent internalizing factors. In this study, we aimed to clarify the relationship of BPD symptoms to disorders of the internalizing and externalizing spectra in a trauma-exposed sample of veterans with a high prevalence of PTSD and evaluate the generalizability of these initial findings to this population.

Aims and Hypotheses

The first aim of this study was to replicate the factor structure of comorbidity in a new dataset of veterans with a high prevalence of PTSD. In so doing, we evaluated whether a two (Internalizing, Externalizing) or three (Distress, Fear, Externalizing) factor solution provided better fit to the data and we also tested alternative representations for the location of BPD within the best-fitting model. On the basis of the aforementioned research, we hypothesized that a three-factor solution would provide the best fit to the symptom data and that BPD would show evidence of significant cross-loadings on both Distress and Externalizing. The second aim of the study was to examine the differential associations between the personality dimensions PEM, NEM and CON and each comorbidity factor. Following Miller (2003, 2004), we hypothesized that trait negative emotionality would be significantly related to all three comorbidity factors whereas positive emotionality and constraint would show specific associations with Distress and Externalizing, respectively.

Method

Participants

Participants were 242 veterans between the ages of 18 and 68 recruited from two campuses of VA Boston Healthcare System. All participants were screened for eligibility by telephone and required to meet *DSM-IV* criteria for probable current PTSD based on administration of the PTSD Checklist-Civilian Version (PCL-C; Weathers, Litz, Herman, Huska, & Keane, 1993) using the scoring algorithm described below. The PCL was only used to determine study eligibility; the primary assessment of PTSD was based on a subsequent in-person

clinical interview as described below. Twenty-eight participants were omitted from data analyses for the following reasons: nine were terminated due to problems conforming their behavior to protocol expectations, three were determined by a clinician to have not been exposed to a PTSD Criterion A event as defined by *DSM-IV*, and sixteen withdrew before completing the diagnostic interviews used in these analyses, yielding a final sample of 214.

Of the remaining 214, 90% were male and the mean age was 50.9 ($SD = 10.6$, range: 23-68). Self-reported race and ethnicity were as follows: 171 (79.9%) White, 40 (18.7%) Black or African American, 14 (6.6%) American Indian or Alaskan Native, and 6 (2.8%) were of unknown racial origin (when demographic categories are not mutually exclusive, totals exceed 100%). Eight (3.7%) described their ethnicity as Hispanic or Latino. A majority of the sample ($n = 136$, 63.6%) was unemployed or receiving disability payments, 52 (24.3%) worked full or part-time, 19 (8.9%) were retired, 3 (1.4%) were students, and 4 (1.8%) failed to provide information about employment status. One hundred-eleven (52.1%) reported serving in the Army, 39 (18.4%) in the Navy, 36 (17%) in the Marines, 32 (15.1%) in the Air Force, and 13 (6.1%) in other branches of the military. Reported eras of military service were: 120 (56.1%) Vietnam War era; 24 (11.2%) Operation Desert Storm era; 30 (14%) Operation Iraqi Freedom or Operation Enduring Freedom era; 2 (.9%) Korean War era; 45 (21%) other service eras; and 2 (.9%) failed to indicate service era. The index PTSD Criterion A event was determined by a clinician during the PTSD assessment. Ninety-seven (45.3%) participants endorsed combat as their index trauma, 20 (9.3%) endorsed physical assault, 19 (8.9%) endorsed sexual trauma prior to age 18, 16 (7.5%) endorsed the sudden death of a friend or loved one, and 11 (5.1%) endorsed sexual trauma as an adult as the index trauma. Several other types of index traumas were also reported (e.g., natural disaster, serious accident, being stalked), each occurring in less than 4% of the sample. All participants met criteria for “probable” current PTSD when screened via phone with the PCL (i.e., a study inclusion criterion), however, only 56% of the sample met criteria for current PTSD (and 76% for lifetime PTSD) when evaluated more comprehensively with the Clinician Administered PTSD Scale (CAPS) during the study protocol,

Measures

Clinician Administered PTSD Scale (CAPS; Blake et al., 1990)—The CAPS is a 30-item PTSD diagnostic interview. It assesses the frequency and intensity of the 17 *DSM-IV* (APA, 1994) PTSD symptoms along with five associated features. Frequency and intensity items are rated on a 0 to 4 scale. A diagnosis was assigned if the participant endorsed at least one reexperiencing symptom, three avoidance and numbing symptoms, and two hyperarousal symptoms each with a frequency score of one or greater and an intensity score of two or greater (cf. Weathers, Ruscio, & Keane, 1999). Dimensional severity scores were calculated by summing the frequency and intensity ratings for each of the 17 items (Weathers et al., 1999). Internal consistency of CAPS item severity scores in this study was excellent (Chronbach's alpha coefficient = .87). All CAPS interviews were video-recorded and 31% were reviewed and re-coded by an independent rater for purposes of quality control and estimating diagnostic reliability. Inter-rater reliability for the total current severity score ratings used in these analyses was high (intraclass correlation coefficient = .93).

International Personality Disorder Examination (IPDE; Loranger, 1999)—The 99-item IPDE was used to assess personality disorders. Items on the IPDE are scored on a 0-2 scale and the measure yields both dichotomous (i.e., diagnostic) and dimensional (i.e., severity) scores for each disorder. Published six-month test-retest reliability for the number of criteria met within each PD diagnosis range from .58 to .84 ($M = .71$) and for the dimensional ratings of each diagnosis ranged from .68 to .92 ($M = .78$; Loranger, 1999). Six-month test-retest reliability for the number of criteria met within each PD diagnosis

ranged from .58 to .84 ($M = .71$) and dimensional ratings for each diagnosis ranged from .68 to .92 ($M = .78$; Loranger, 1999). In this study, inter-rater reliability was evaluated for 31% of the interviews of the interviews. Intraclass correlation coefficients for dimensional scores on the antisocial and borderline personality disorder scales were .97 and .95, respectively.

Multidimensional Personality Questionnaire-Brief Form (MPQ-BF; Patrick, Curtin, & Tellegen, 2002)—The MPQ-BF is a 155-item self-report personality inventory derived from the full-length 276-item MPQ (Tellegen, in press; Tellegen & Waller, 2008). Like its longer counterpart (Tellegen, in press), the MPQ-BF is composed of 11 primary trait scales and three higher-order temperament scales assessing NEM, PEM, and CON. The questionnaire includes three validity scales, Variable-Response Inconsistency (VRIN), True-Response Inconsistency (TRIN), and Unlikely Virtues. Data from six participants were omitted from analyses involving the MPQ-BF because they produced invalid response profiles, as defined by Patrick et al. (2002). Psychometric properties of the MPQ-BF are comparable to the full scale and Pearson's product moment correlations between the MPQ-BF and the full-length MPQ for primary trait scales range from .92 to .96 (Patrick et al., 2002).

PTSD Checklist-Civilian Version (PCL-C; Weathers et al., 1993)—The PCL is the most widely used self-report measure of posttraumatic stress disorder (PTSD) in both research and clinical contexts (Elhai, Gray, Docherty, Kashdan, & Kose, 2005). It consists of 17 items that correspond directly to the *DSM-IV* PTSD symptoms, with each item rated on a five-point severity scale. In this study we used the civilian version of the instrument to permit screening for symptoms related to trauma of any type. Probable PTSD was defined using with the *DSM-IV* scoring rule (i.e., at least one B symptom, 3 C symptoms, and two D symptoms rated at a severity of 3 or higher on a five-point likert-like scale, cf. Weathers et al., 1993; Keen, Kutter, Niles, & Krinsley, 2008).

Structured Clinical Interview for *DSM-IV* (SCID; First, Spitzer, Gibbon & Williams, 1994)—Current and lifetime mood disorders, psychotic disorders (screen only), substance use disorders, anxiety disorders, and eating disorders were assessed with the SCID. The SCID yields dichotomous diagnostic ratings for each diagnosis. For this study, which aimed to model the covariation among dimensional diagnostic constructs, we ignored the standard SCID “skip-outs” and instead administered all items in each module. Symptoms within a module were anchored temporally to the same time period to ensure that they co-occurred in a syndromal fashion.

Inter-rater reliability for current dimensional severity scores based on 36% of the SCID interviews was high: the mean intraclass correlation coefficient was .96 and ranged from .89 for OCD to .99 for cocaine dependence. Eating disorders, bipolar disorder, and social phobia were excluded from analyses due to limited variance (i.e., mean values close to the minimum possible score for the module and/or large skewness or kurtosis values).

Procedure

The study was approved and reviewed annually by the appropriate human subjects (IRB) and research committees. Participants were recruited through flyers, clinician referrals, and a database of veterans who had consented to be contacted for research and screened for eligibility over the telephone. Eligible participants provided written informed consent, completed a series of self-report measures, provided a blood sample, and then underwent diagnostic interviews. The study took place over the course of two study sessions (each lasting approximately 3-4 hours) scheduled to occur no more than one week apart. All participants were compensated for their time and effort.

The SCID, IPDE, and CAPS interviews were administered by Doctoral- and Masters-level clinical psychologists and clinical psychology trainees. Interviewers and raters were trained through the study of interview manuals and the viewing and rating of videotapes of previously-recorded interviews. Interviewers and raters were certified as reliable once they rated 3 test recordings which had been scored previously by a consensus team and attained a minimum of 90% diagnostic agreement across all disorders with the scores derived by that team. Approximately one-third of the videotaped interviews were independently coded by a second rater who was blind to the interviewer's ratings. To minimize rater-drift and enhance interview quality, rating discrepancies were discussed in weekly team meetings throughout the course of the study.

Data Analyses

We first compared the fit of two measurement models: (a) a two-factor (i.e., Internalizing and Externalizing) model in which BPD cross-loaded on both factors, and (b) a three-factor model in which Distress was defined by SCID severity scores for major depression (the marker indicator), generalized anxiety, dysthymia, and BPD (measured by the IPDE) while Fear was defined by severity scores on SCID assessed panic disorder with or without agoraphobia (the marker indicator), specific phobia, and obsessive-compulsive disorder. All of these anxiety and unipolar mood disorder variables were set as indicators of Internalizing in the two-factor model. Externalizing was defined in the two- and three-factor models by conduct disorder (the marker indicator; as assessed as part of the ASPD module on the IPDE), adult antisociality (as assessed on the IPDE), substance-use disorders (a composite score derived from the SCID), and BPD. Each IPDE and SCID indicator was based on a dimensional sum of items endorsed within a given diagnostic module with one exception: Due to limited current substance abuse and insufficient score dispersion on any individual substance use disorder module in this sample, for the substance abuse indicator we created a composite dimensional score reflecting the sum of all current alcohol and drug abuse/dependence symptoms. After determining which model provided better overall fit, we evaluated the necessity of the BPD cross-load by eliminating paths and determining if doing so significantly degraded model fit. The robust maximum likelihood estimator (MLR) was employed in all analyses to account for data non-normality and the fit of nested models was compared using a chi-square difference testing approach (following recommendations for computing the chi-square difference test by adjusting for the scaling correction factor employed with robust maximum likelihood estimation; Satorra & Bentler, 1999).

In a second analysis, we used SEM to model hypothesized effects of NEM, PEM (reverse-scored to reflect low PEM), and CON (reverse-scored to reflect disconstraint) on the three comorbidity factors. Specifically, NEM was specified to predict Distress, Fear, and Externalizing while PEM and CON were specified only to predict Distress and Externalizing, respectively. NEM, PEM, and CON were modeled as single indicators corrected for measurement error (using estimates from prior reports of the test-retest¹ reliability of these scales [Tellegen, in press]). In Mplus, this involves setting the value of the indicator residual term and creating a latent variable that the indicator loads on. The raw variance of the latent variable is set by allowing the single indicator to serve as its marker indicator and the standardized estimate of the factor loading is obtained by Mplus based on the formula: total variance = loading squared plus residual variance (see Brown, 2006 for full description of this approach for incorporating error theory when only a single indicator is available). The disturbances of the latent psychopathology variables (i.e., residual

¹Although coefficient alpha is often used as a measure of reliability to specify the degree of unreliability in single indicators corrected for measurement error in SEMs, this was not possible in this case because the higher-order MPQ-BF scales NEM, PEM, and CON are weighted composite scores of lower order trait scales (as opposed to simple item summary scores; see Patrick et al., 2002).

variances not accounted for by the temperament factors) were allowed to correlate, as these factors were expected to be associated with one another over and above the shared effects of personality.

The relative fit of each model was evaluated by comparing overall model chi-square (small and non-significant values are consistent with good model fit), root mean square error of approximation (RMSEA; values .06 are consistent with good model fit), standardized root mean square residual (SRMR; values .08 are consistent with good model fit), comparative fit index (CFI) and Tucker-Lewis index (TLI; values .95 are consistent with good model fit for both CFI and TLI). These are the cut-off scores recommended by Hu & Bentler, 1999, although strict adherence to these scores is not recommended as this is overly conservative (Marsh, Hau, and Wen, 2004). CFI and TLI values .95 can be particularly difficult to achieve in applied datasets (Marsh et al., 2004). We also compared the Akaike information criterion (AIC; 1987) and Bayesian information criterion (BIC; Schwartz, 1978) across models. With these statistics, the model yielding the lower of two comparative values is preferred over a model with higher values.

Results

Confirmatory Factor Analysis (CFA) of Latent Psychopathology Dimensions

Table 1 lists prevalence rates and bivariate associations among disorders modeled in this study. The two (Internalizing/Externalizing) factor model yielded good model fit with all indicators loading significantly on their respective factors (at the $p < .01$ level) and BPD showing a standardized loading of .39 on Internalizing and .61 on Externalizing (both p s < .001). As shown in Table 2, the three (Distress, Fear, Externalizing) factor model yielded significantly better fit relative to the nested two-factor model with all indicators loading significantly (at the $p < .01$ level) on their respective latent variables. This model was retained for further hypothesis testing. We then evaluated the necessity of the BPD loading on Distress by eliminating this path. Doing so resulted in a Heywood case (a parameter estimate with an improper value) in the standardized loading of BPD on Externalizing. This can occur when a model is misspecified and precludes model interpretation because of the potential for bias in the parameter estimates (Chen, Bollen, Paxton, Curran, & Kirby, 2001). Next, we evaluated the necessity of the BPD loading on Externalizing by eliminating this path and retaining only the loading of BPD on Distress. This degraded model fit and, as shown in Table 2, was associated with significantly worse fit compared to the three-factor model with BPD cross-loading on Distress and Externalizing. Given these results, the three-factor model with the BPD cross-load (Model 2a) was retained as the best fitting measurement model.² As shown in Figure 1, all indicators loaded significantly on their respective factors in this model. Fear and Distress correlated with one another at $r = .70$ ($p < .001$) but no other factor correlations were statistically significant.

SEMs of Personality Effects

We next conducted an SEM representing the hypothesized model in which NEM (adjusted for measurement error) was modeled as a predictor of each comorbidity factor while PEM and CON (also adjusted for measurement error) was set to predict only Distress and

²We also tested if BPD might load on the Fear factor, but footnote this result as it was not a part of our hypothesized model testing sequence. When allowed to load on all three latent variables, BPD showed no evidence of an association with Fear ($\beta = .09$, $p = .49$) and nested model testing revealed that eliminating the BPD loading on Fear did not degrade model fit. We also tested the necessity of the BPD cross-load in the two factor model. When the BPD loading on Internalizing was eliminated, the model yielded a Heywood case and when the BPD loading on Externalizing was eliminated, the model yielded very poor fit indices, with all fit indices falling outside of the acceptable range. This pattern of results provides additional support for the necessity of the BPD cross-load on Distress and Externalizing.

Externalizing, respectively. This model fit the data well (see Table 2). As shown in Figure 2, NEM was a significant predictor of Distress ($\beta = .36, p < .001$), Fear ($\beta = .21, p = .008$), and Externalizing ($\beta = .49, p < .001$). PEM (reverse scored) was a significant predictor of Distress ($\beta = .31, p < .001$) while CON (reverse scored) was a significant predictor of Externalizing ($\beta = .21, p = .02$).

We next tested the specificity of the effects observed in the prior model by adding non-hypothesized paths (each in a separate model) to determine if freeing a given non-hypothesized path improved model fit relative to the hypothesized model and to determine if the new path was statistically significant. In the first of these tests, we added the path between CON and Distress. Freeing this path did not improve model fit ($\Delta X^2 = 2.80, \Delta df = 1, p = .09$) and CON was not a significant predictor of Distress ($\beta = .12, p = .09$). In the second test, we added the path between CON and Fear and determined that freeing this path did not improve model fit ($\Delta X^2 = .12, \Delta df = 1, p = .73$) and CON was not a significant predictor of Fear ($\beta = -.03, p = .76$). Next, we tested a model which included PEM as a predictor of Fear; this model did not improve overall fit relative to the hypothesized main effects model ($\Delta X^2 = .01, \Delta df = 1, p = .92$) and the path from PEM to Fear was not significant ($\beta = .00, p = .98$). Finally, we tested the necessity of the path between PEM and Ext and determined that freeing this path also did not improve model fit ($\Delta X^2 = 2.25, \Delta df = 1, p = .13$) nor was the path statistically significant ($\beta = -.12, p = .14$).

Given the findings that NEM was a significant predictor of all three comorbidity factors, we also evaluated whether the parameter estimates for these associations were equivalent by conducting three additional analyses in which we constrained pairs of these paths to be equal to one another. These tests revealed that the strength of the association between NEM and Distress versus Fear, between NEM and Distress versus Ext, and between NEM and Fear versus Ext, were all equivalent, i.e., imposing the constraint that these pairs of paths were equivalent did not damage model fit (Wald X^2 range: .04 – 2.30; p -value range: .13 – .84).

PTSD as a Covariate

We also evaluated the model with PTSD severity (as measured by total score on the CAPS) included as a covariate of the three comorbidity factors. This model fit the data well (chi square = .64.41, $df = 63, p = .43$, RMSEA = .01, SRMR = .04, CFI = 1.0, TLI = 1.0) and results indicated that inclusion of PTSD as a covariate did not alter the pattern of findings with respect to the relationships between NEM, PEM, CON and Distress and Externalizing. However, the strength of the path from NEM to Fear became non-significant ($\beta = .07, p = .38$) with PTSD included in the model. In contrast, NEM remained a significant predictor of Distress ($\beta = .23, p < .001$) and Externalizing ($\beta = .50, p < .001$) while controlling for PTSD. PTSD was a significant covariate of Distress ($\beta = .57, p < .001$) and Fear ($\beta = .57, p < .001$), but not of Ext ($\beta = -.05, p = .60$).

Lower-order Facets of NEM

To clarify the basis for the observed association between NEM and each of the comorbidity factors we also examined the differential relationships between each of the primary trait scales that comprise NEM (Stress Reaction, Alienation, and Aggression; Patrick et al., 2002) and the comorbidity factors. Based on prior research (Patrick, Curtin & Tellegen, 2002; Blonigen et al. 2011), we expected that Stress Reaction would show evidence of specificity for Distress and Fear while Aggression would show a comparatively stronger association with Externalizing. To evaluate this, we ran an additional SEM in which these three primary trait scales were each set to predict the three latent psychopathology dimensions. This model fit the data well (chi square = 50.25, $df = 52, p = .54$, RMSEA = .00, SRMR = .04, CFI = 1.0, TLI = 1.01). Parameter estimates showed Stress Reaction to be a significant predictor of

Distress ($\beta = .41, p < .001$) and Fear ($\beta = .29, p < .001$) but not Externalizing ($\beta = .06, p = .52$). In contrast, Aggression was a significant predictor of Externalizing ($\beta = .42, p < .001$) but not of Distress ($\beta = -.05, p = .57$) or Fear ($\beta = .01, p = .90$). Alienation showed significant associations with Distress ($\beta = .23, p = .004$) and Externalizing ($\beta = .22, p = .01$) but not with Fear ($\beta = .04, p = .72$).

Discussion

The human response to psychological trauma is heterogeneous and associated with a wide variety of disorders, including PTSD, that co-occur according to a definable dimensional structure. This study examined this structure in a sample of trauma-exposed veterans with a high prevalence of PTSD and evaluated hypotheses concerning the relationship between comorbidity factors and dimensions of personality. Prior studies have implicated NEM as the primary personality risk factor for the development of PTSD and its comorbidities (for reviews, see Miller, 2003, 2004; Miller & Harrington, 2011). Consistent with this, results of this study point to a rather ubiquitous role for NEM in post-traumatic psychopathology, including disorders of both the internalizing and externalizing spectra. SEM analyses modeled the relationship of the MPQ's (Tellegen, in press) NEM, PEM and CON factors to a well-established 3-factor (Distress, Fear, and Externalizing) model of comorbidity. Results showed NEM to be a significant—and statistically equivalent—predictor of all three comorbidity factors. This finding diverges somewhat from results of an earlier study by Krueger et al. (2001) who reported a significant association between CON and externalizing but no such relationship between externalizing and NEM. It is consistent, however, with other research that has implicated NEM in the development and maintenance of disorders of both the internalizing and externalizing domains (Khan et al., 2005; Miller, Vogt, Mozley, Kaloupek, & Keane, 2006; Singh & Waldman, 2010; Wolf et al., 2010). Secondary analyses that examined the relationship of each of the three NEM primary trait scales to externalizing suggested that the overall NEM association was accounted for primarily by the aggression and alienation components of the construct. Similarly, Blonigen et al. (2011) reported that aggression and alienation were among the top three MPQ trait scale predictors of score variance on a 100-item inventory of externalizing symptoms. Together, these results suggest a pervasive role for NEM in conferring vulnerability to psychopathology and should raise questions about conceptualizing this higher-order dimension of personality solely as a vulnerability to disorders of the internalizing spectrum.

In contrast to the rather non-specific patterns of association observed for NEM, PEM and CON evidenced select relationships with distress and externalizing, respectively. PEM has long been conceptualized as the personality factor that distinguishes depression from anxiety (Brown, Chorpita & Barlow, 1998; Tellegen, 1985; Watson, Clark, & Carey, 1988; Watson, Gamez, & Simms, 2005; Mineka et al., 1998). Prior studies have found strong associations between the MPQ PEM scales and measures of depression, demoralization, and introversion (e.g., Sellbom & Ben-Porath, 2005; Church, 1994). Consistent with this, results of this study showed PEM to be most strongly associated (inversely) with a latent variable defined by symptoms of major depression, generalized anxiety disorder, and dysthymia (i.e., distress) but no such associations with fear or externalizing were found. This result underscores the role of deficits in behavioral activation and hedonic responding in the psychopathology of disorders in this domain. On the other end of the comorbidity spectrum, CON showed a significant (inverse) relationship with externalizing but no such associations with distress or fear. This finding replicates and extends prior research suggesting that externalizing is fundamentally linked to individual differences in functioning of the brain regulatory system governing behavioral restraint (Krueger & South, 2009).

Given the high prevalence of PTSD in this sample and the moderate positive correlations observed between PTSD and NEM in prior work (e.g., Miller et al., 2006), we also ran the best-fitting model with PTSD included as covariate of each of the three comorbidity factors. Doing so allowed us to estimate the proportion of comorbidity variance accounted for by each personality factor while controlling for the effects of PTSD severity which were substantial in this sample. This analysis revealed two noteworthy findings. First, results showed PTSD to be a significant covariate of both Fear and Distress, but it was not significantly associated with Externalizing. This result diverges somewhat from results of some prior CFA studies that have shown PTSD to be more closely aligned with distress than with fear disorders (e.g., Slade & Watson, 2006; Miller et al., 2008) though other studies have shown significant associations with both (Forbes et al., 2010; Forbes et al., 2011). It also departs from our prior report of a small but significant association between PTSD and externalizing in data from the Vietnam-era Twin Registry (Wolf et al., 2010). Unfortunately, the inclusion of MPQ variables in the present analyses and differences in sample characteristics and methodology complicates such cross-study comparisons. It may be useful in future research to revisit the relationship of PTSD to externalizing using larger samples with higher rates of current drug and alcohol abuse and cluster B personality disorders. The second noteworthy finding from the covariate analysis was that the association between NEM and Fear fell to nonsignificant when PTSD was added to the model (implying significant variance shared between PTSD and NEM in the prediction of fear disorders), but none of the other regressive paths in the model changed in this way.

Results of this study clarify the relationship between traits that underlie the personality-based subtypes of posttraumatic psychopathology described by Miller et al. (2003) and replicated subsequently by his and other research groups (Flood et al., 2010; Forbes, Elhai, Miller, & Creamer, 2010; Miller et al., 2004; Miller & Resick, 2007; Rielage, Hoyt, Renshaw, 2010; Sellbom, & Bagby, 2009; Wolf et al., in press). Each of these studies yielded evidence for an externalizing subgroup defined by low CON and high NEM and characterized by the tendency to express posttraumatic distress outwardly through antagonistic interactions with others and behavior that conflicts with societal norms and values. Across studies, using various measures of personality and psychopathology, externalizers were found to endorse elevated levels of anger and aggression, substance-related problems, and *DSM-IV* Cluster B personality disorder features. In contrast, internalizers, defined by high NEM and low PEM, were characterized by tendencies to direct their posttraumatic distress inwardly through shame, self-defeating/deprecating and anxious processes, avoidance, depression, and withdrawal. Individuals of this type have tended to endorse high rates of comorbid major depression and panic disorder, and schizoid and avoidant personality disorder features. We conceptualize this typology as a class-quantitative model in which personality-based categories (i.e., types) are superimposed on an underlying dimensional structure of traits (cf. Blashfield, 1993; Skinner, 1981). Results of this study clarify the relative contributions of PEM, NEM and CON to internalizing and externalizing patterns of comorbidity.

Location of Borderline Personality Disorder in the Internalizing/Externalizing Model

Findings of this study also help to clarify the location of BPD within the broader structure of common mental disorders and suggest that BPD shares structural associations with disorders of both the distress and externalizing spectra. This result is broadly consistent with results of several prior studies linking BPD to both internalizing and externalizing (Eaton et al., 2010; James & Taylor, 2008; Kendler et al., 2010; Markon, Chmielewski, & Miller, 2011; Røysamb et al., 2011). Comparison of the relative strength of the associations in this study indicated that BPD covaried more strongly with externalizing than distress disorders. This contrasts with results of two prior CFA studies that found a stronger association for BPD

with internalizing than externalizing (James & Taylor, 2008; Eaton et al. 2010) and another one that found equivalent associations with these comorbidity factors (Røysamb et al., 2011). One possible explanation for this difference is that it was a reflection of the gender composition of this sample, which consisted primarily of male veterans. Prior studies have been based on epidemiological samples with an equal balance of men and women. Future research with larger samples might examine the extent to which the factor structure of BPD and other indicators of externalizing vary as a function of sex.

The finding that BPD was associated with both distress and externalizing is consistent with conceptual models of BPD proposing that multiple genetic and temperamental liabilities contribute to the development of this disorder (cf., Eaton et al., 2010). The findings of this study shed new light on the personality dimensions that may be involved, implicating high NEM and low CON primarily. This conclusion is consistent with the composition of a newly developed BPD scale derived from MPQ items that was composed primarily of NEM and CON items (Bornovalova, Hicks, Patrick, Iacono, & McGue, 2011).

Strengths, Limitations, and Conclusions

Strengths of this study included the use of gold-standard structured clinical diagnostic interviews with demonstrated strong inter-rater reliability, the focus on current (as opposed to lifetime) symptoms that were represented dimensionally, the use of latent variable modeling, and careful examination of a hypothesis-driven model of the relationships between personality and posttraumatic psychopathology. The primary limitation of the study was the cross-sectional design which limits inferences about the directionality of the associations between personality and psychopathology variables. However, this aspect of the conceptual model rests on a solid foundation of decades of research demonstrating the stability of personality traits over time and their etiological role in the development and maintenance of psychiatric disorders. The constructs PEM, NEM, and CON have been shown previously to correspond closely to dimensions of temperament identified in studies on infancy and early childhood (Rothbart, Derryberry, & Posner, 1994). Behavior genetics studies have shown them to have substantial heritabilities (e.g., heritability estimates in the .40 - .60 range; Robinson, Kagan, Reznick, & Corley, 1992; Tellegen et al., 1988) and other scales measuring these constructs evidence long-term stability in adulthood (e.g., 6 - 12 year test-retest reliability after age 30 on the order of .70-.80; Costa & McCrae, 1977; Costa & McCrae, 1992; Watson & Walker, 1996). Cross-cultural studies and research on the behavior of non-human primates also support the universality and evolutionary foundation of these traits (McCrae & Costa, 1997; Capitanio, 1999; Capitanio & Widaman, 2005). Thus, while there may be viable alternative representations of the relationships between personality and psychiatric comorbidity, we believe there to be a solid conceptual and empirical basis for modeling personality factors in this study as causal predictors of comorbidity.

In conclusion, this study found that the latent distress, fear, and externalizing dimensions of comorbidity have distinct personality correlates. NEM showed a non-specific pattern of relationship to all three comorbidity factors while PEM and CON evidenced specific associations with distress and externalizing, respectively. BPD showed significant cross-loadings on distress and externalizing. These findings clarify the nature of the relationship between personality and psychopathology in a trauma-exposed sample with a high rate of PTSD and further delineate the structure underlying the heterogeneous patterns of comorbidity associated with posttraumatic stress psychopathology.

References

Akaike H. Factor analysis and the AIC. *Psychometrika*. 1987; 52:317–332. doi:10.1007/BF02294359.

- American Psychiatric Association. Diagnostic and statistical manual of mental disorders. 4th ed.. Author; Washington, DC: 1994.
- Blake DD, Weathers FW, Nagy LM, Kaloupek DG, Klauminzer G, Charney DS, Keane TM. A clinician rating scale for assessing current and lifetime PTSD: The CAPS-1. *The Behavior Therapist*. 1990; 13:187–188.
- Blashfield RK. Variants of categorical and dimensional models. *Psychological Inquiry*. 1993; 4:95–98. doi:10.1207/s15327965pli0402_3.
- Blonigen DM, Patrick CJ, Gasperi M, Steffen B, Ones DS, Arvey RD, do Nascimento E. Delineating the construct network of the Personnel Reaction Blank: associations with externalizing tendencies and normal personality. *Psychological Assessment*. 2011; 23:18–30. doi:10.1037/a0021048. [PubMed: 21171783]
- Bornoalova MA, Hicks BM, Patrick CJ, Iacono WG, McGue M. Development and validation of the Minnesota borderline personality disorder scale. *Assessment*. 2011; 18:234–252. doi: 10.1177/1073191111398320. [PubMed: 21467094]
- Brown, Timothy A.; Chorpita, Bruce F.; Barlow, David H. Structural relationships among dimensions of the DSM-IV anxiety and mood disorders and dimensions of negative affect, positive affect, and autonomic arousal. *Journal of Abnormal Psychology*. 1998; 107:179–192. doi:10.1037/0021-843X.107.2.179. [PubMed: 9604548]
- Capitanio JP. Personality dimensions in adult male rhesus macaques: Predictions of behaviors across time and situation. *American Journal of Primatology*. 1999; 47:299–320. doi:10.1002/(SICI)1098-2345(1999)47:4<299::AID-AJP3>3.0.CO;2-P. [PubMed: 10206208]
- Capitanio JP, Widaman KF. Confirmatory factor analysis of personality structure in adult male rhesus monkeys. *American Journal of Primatology*. 2005; 65:289–294. doi:10.1002/ajp.20116. [PubMed: 15772988]
- Chen F, Bollen KA, Paxton P, Curran PJ, Kirby JB. Improper solutions in structural equation models: Causes, consequences, and strategies. *Sociological Methods & Research*. 2001; 29:468. doi: 10.1177/0049124101029004003.
- Church AT. Relating the Tellegen and five-factor models of personality structure. *Journal of Personality and Social Psychology*. 1994; 67:898–909. doi:10.1037/0022-3514.67.5.898. [PubMed: 7983581]
- Clark LA, Watson D. Tripartite model of anxiety and depression: Psychometric evidence and taxonomic implications. *Journal of Abnormal Psychology*. 1991; 100:316–336. doi: 10.1037/0021-843X.100.3.316. [PubMed: 1918611]
- Clark LA, Watson D, Mineka S. Temperament, personality, and the mood and anxiety disorders. *Journal of Abnormal Psychology*. 1994; 103:103–116. doi:10.1037/0021-843X.103.1.103. [PubMed: 8040472]
- Costa PT, McCrae RR. Age differences in personality structure revisited: studies in validity, stability, and change. *International Journal of Aging and Human Development*. 1977; 8:261–275. [PubMed: 649212]
- Costa PT, McCrae RR. The five-factor model of personality and its relevance to personality disorders. *Journal of Personality Disorders*. 1992; 6:343–359.
- Eaton NR, Krueger RF, Keyes KM, Skodol AE, Markon KE, Grant BF, Hasegan DS. Borderline personality disorder comorbidity: relationship to the internalizing-externalizing structure of common mental disorders. *Psychological Medicine*. 2011; 41:1041–1050. doi:10.1017/S0033291710001662. [PubMed: 20836905]
- Elhai JD, Gray MJ, Docherty AR, Kashdan TB, Kose S. Which instruments are most commonly used to assess traumatic event exposure and posttraumatic effects?: A survey of traumatic stress professionals. *Journal of Traumatic Stress*. 2005; 18:541–545. doi:10.1002/jts.20062. [PubMed: 16281252]
- First, MB.; Spitzer, RL.; Gibbon, M.; Williams, J. Structured Clinical Interview for Axis I *DSM-IV* Disorders.. Biometrics Research; New York: 1994.
- Flood AM, Boyle SH, Calhoun PS, Dennis MF, Barefoot JC, Moore SD, Beckham JC. Prospective study of externalizing and internalizing subtypes of posttraumatic stress disorder and their

- relationship to mortality among Vietnam veterans. *Comprehensive Psychiatry*. 2010; 51:236–242. doi:10.1016/j.comppsy.2009.08.002. [PubMed: 20399332]
- Forbes D, Elhai JD, Miller MW, Creamer M. Internalizing and externalizing classes in posttraumatic stress disorder: A latent class analysis. *Journal of Traumatic Stress*. 2010; 23:340–349. doi: 10.1002/jts.20526. [PubMed: 20564366]
- Forbes D, Lockwood E, Elhai JD, Creamer M, O'Donnell M, Bryant R, McFarlane A, Silove D. An examination of the structure of posttraumatic stress disorder in relation to the anxiety and depressive disorders. *Journal of Affective Disorders*. 2011; 132:165–172. doi:10.1016/j.jad.2011.02.011. [PubMed: 21496930]
- Forbes D, Parslow R, Creamer M, O'Donnell M, Bryant R, McFarlane A, Silove D, Shalev A. A longitudinal analysis of posttraumatic stress disorder symptoms and their relationship with Fear and Anxious-Misery disorders: implications for DSM-V. *Journal of Affective Disorders*. 2010; 127:147–152. doi:10.1016/j.jad.2010.05.005. [PubMed: 20605220]
- Gunderson JG, Sabo AN. The phenomenological and conceptual interface between borderline personality disorder and PTSD. *American Journal of Psychiatry*. 1993; 150:19–27. [PubMed: 8417576]
- Hu L, Bentler PM. Cutoff criteria for fit indexes in covariance structure analysis: Conventional criteria versus new alternatives. *Structural Equation Modeling*. 1999; 6:1–55. doi: 10.1080/10705519909540118.
- James LM, Taylor J. Revisiting the structure of mental disorders: Borderline personality disorder and the internalizing/externalizing spectra. *British Journal of Clinical Psychology*. 2008; 47:361–380. doi:10.1348/014466508X299691. [PubMed: 18503738]
- Keen SM, Kutter CJ, Niles BL, Krinsley KE. Psychometric properties of PTSD Checklist in sample of male veterans. *Journal of Rehabilitation Research and Development*. 2008; 45:465–474. doi: 10.1682/JRRD.2007.09.0138. [PubMed: 18629754]
- Kendler KS, Aggen SH, Knudsen GP, Røysamb E, Neale MC, Reichborn-Kjennerud T. The structure of genetic and environmental risk factors for syndromal and subsyndromal common DSM-IV axis I and all axis II disorders. *American Journal of Psychiatry*. 2011; 168:29–39. doi:10.1176/appi.ajp.2010.10030340. [PubMed: 20952461]
- Kendler KS, Myers JM, Maes HH, Keyes CLM. The relationship between the genetic and environmental influences on common internalizing psychiatric disorders and mental well-being. *Behavior Genetics*. 2011 doi:10.1007/s10519-011-9466-1.
- Khan AA, Jacobson KC, Gardner CO, Prescott CA, Kendler KS. Personality and comorbidity of common psychiatric disorders. *British Journal of Psychiatry*. 2005; 186:190–196. doi:10.1192/bjp.186.3.190. [PubMed: 15738498]
- Krueger RF. The structure of common mental disorders. *Archives of General Psychiatry*. 1999; 56:921–926. doi:10.1001/archpsyc.56.10.921. [PubMed: 10530634]
- Krueger RF, Caspi A, Moffitt TE, Silva PA. The structure and stability of common mental disorders (DSM-III-R): A longitudinal-epidemiological study. *Journal of Abnormal Psychology*. 1998; 107:216–227. doi:10.1037/0021-843X.107.2.216. [PubMed: 9604551]
- Krueger RF, Caspi A, Moffitt TE, Silva PA, McGee R. Personality traits are differentially linked to mental disorders: A multitrait-multidiagnosis study of an adolescent birth cohort. *Journal of Abnormal Psychology*. 1996; 105:299–312. doi:10.1037/0021-843X.105.3.299. [PubMed: 8772001]
- Krueger RF, Chentsova-Dutton YE, Markon KE, Goldberg D, Ormel J. A cross-cultural study of the structure of comorbidity among common psychopathological syndromes in the general health care setting. *Journal of Abnormal Psychology*. 2003; 112:437–447. doi:10.1037/0021-843X.112.3.437. [PubMed: 12943022]
- Krueger RF, Hicks BM, Patrick CJ, Carlson SR, Iacono WG, McGue M. Etiologic connections among substance dependence, antisocial behavior, and personality: Modeling the externalizing spectrum. *Journal of Abnormal Psychology*. 2002; 111:411–424. doi:10.1037/11855-003. [PubMed: 12150417]

- Krueger RF, McGue M, Iacono WG. The higher-order structure of common DSM mental disorders: Internalization, externalization, and their connections to personality. *Personality & Individual Differences*. 2001; 30:1245–1259. doi:10.1016/S0191-8869(00)00106-9.
- Krueger RF, South SC. Externalizing disorders: Cluster 5 of the proposed meta-structure for DSM-V and ICD-11. *Psychological Medicine*. 2009; 39:1061–2070. doi:10.1017/S0033291709990328.
- Loranger, AW. International Personality Disorder Examination: DSM-IV and ICD-10 interviews. Psychological Assessment Resources; Lutz, FL: 1999.
- Markon KE. Modeling psychopathology structure: A symptom-level analysis of Axis I and II disorders. *Psychological Medicine*. 2010; 40:273–288. doi:10.1017/S0033291709990183. [PubMed: 19515267]
- Markon KE, Chmielewski M, Miller CJ. The reliability and validity of discrete and continuous measures of psychopathology: A quantitative review. *Psychological Bulletin*. 2011 doi:10.1037/a0023678.
- Marsh HW, Hau K-T, Wen Z. In search of golden rules: Comment on hypothesis testing approaches to setting cutoff values for fit indexes and dangers in overgeneralizing Hu and Bentler's (1999) findings. *Structural Equation Modeling*. 2004; 11:320–341. doi:10.1207/s15328007sem1103_2.
- McCrae RR, Costa PT Jr. Personality trait structure as a human universal. *American Psychologist*. 1997; 52:509–516. doi:10.1037/0003-066X.52.5.509. [PubMed: 9145021]
- McLean LM, Gallop R. Implication of childhood sexual abuse for adult borderline personality disorder and complex posttraumatic stress disorder. *American Journal of Psychiatry*. 2003; 160:369–371. doi:10.1176/appi.ajp.160.2.369. [PubMed: 12562587]
- Miller MW. Personality and the etiology and expression of PTSD: A three-factor model perspective. *Clinical Psychology: Science and Practice*. 2003; 10:373–393. doi:10.1093/clipsy/bpg040.
- Miller MW. Personality and the development and expression of PTSD. *PTSD Research Quarterly*. 2004; 15:1–7.
- Miller MW, Fogler J, Wolf EJ, Kaloupek DG, Keane TM. The internalizing and externalizing structure of psychiatric comorbidity in combat veterans. *Journal of Traumatic Stress*. 2008; 21:58–65. doi:10.1002/jts.20303. [PubMed: 18302181]
- Miller MW, Greif JL, Smith AA. Multidimensional Personality Questionnaire profiles of veterans with traumatic combat exposure: Externalizing and internalizing subtypes. *Psychological Assessment*. 2003; 15:205–215. doi:10.1037/1040-3590.15.2.205. [PubMed: 12847781]
- Miller, MW.; Harrington, KM. Personality factors in resilience to traumatic stress.. In: Southwick, SM.; Litz, BT.; Charney, D.; Friedman, MJ., editors. *Resilience and mental health: Challenges across the lifespan*. Cambridge University Press; New York: 2011. p. 56-75.
- Miller MW, Kaloupek DG, Dillon AL, Keane TM. Externalizing and internalizing subtypes of combat-related PTSD: A replication and extension using the PSY-5 Scales. *Journal of Abnormal Psychology*. 2004; 113:636–645. doi:10.1037/0021-843X.113.4.636. [PubMed: 15535795]
- Miller MW, Resick PA. Internalizing and externalizing subtypes in female sexual assault survivors: Implications for the understanding of complex PTSD. *Behavior Therapy*. 2007; 38:58–71. doi:10.1016/j.beth.2006.04.00. [PubMed: 17292695]
- Miller MW, Resick PA, Keane TM. DSM-V: Comorbidity studies suggest that PTSD belongs in its own class of traumatic-stress disorders. *British Journal of Psychiatry*. 2009; 194:90. [PubMed: 19118339]
- Miller MW, Vogt DS, Mozley SL, Kaloupek DG, Keane TM. PTSD and substance-related problems: Mediating roles of constraint and negative emotionality. *Journal of Abnormal Psychology*. 2006; 115:369–379. doi:10.1037/0021-843X.115.2.369. [PubMed: 16737401]
- Mineka S, Watson D, Clark LA. Comorbidity of anxiety and unipolar mood disorders. *Annual Review of Psychology*. 1998; 49:377–412. doi:10.1146/annurev.psych.49.1.377.
- Patrick CJ, Curtin JJ, Tellegen A. Development and validation of a brief form of the Multidimensional Personality Questionnaire. *Psychological Assessment*. 2002; 14:150–163. doi:10.1037/1040-3590.14.2.150. [PubMed: 12056077]
- Resick PA, Miller MW. Posttraumatic stress disorder: Anxiety or traumatic-stress disorder? *Journal of Traumatic Stress*. 2009; 22:384–390. doi:10.1002/jts.20437. [PubMed: 19774665]

- Rielage JK, Hoyt T, Renshaw K. Internalizing and externalizing personality styles and psychopathology in OEF/OIF Veterans. *Journal of Traumatic Stress*. 2010; 23:350–357. doi: 10.1002/jts.20528. [PubMed: 20564367]
- Robinson JL, Kagan J, Reznick J, Corley R. The heritability of inhibited and uninhibited behavior: A twin study. *Developmental Psychology*. 1992; 28:1030–1037. doi:10.1037/0012-1649.28.6.1030.
- Rothbart, MK.; Derryberry, D.; Posner, MI. A psychobiological approach to the development of temperament.. In: Bates, JE.; Wachs, TD.; Bates, JE.; Wachs, TD., editors. *Temperament: Individual differences at the interface of biology and behavior*. American Psychological Association; Washington, DC US: 1994. p. 83-116. doi:10.1037/10149-003
- Røysamb E, Kendler KS, Tambs K, Orstavik RE, Neale MC, Aggen SH, Reichborn-Kjennerud T. The joint structure of DSM-IV Axis I and Axis II disorders. *Journal of Abnormal Psychology*. 2011; 120:198–209. doi:10.1037/a0021660. [PubMed: 21319931]
- Satorra A, Bentler PM. A scaled difference chi-square test statistic for moment structure analysis. *Psychometrika*. 2001; 66(4):507–514. doi:10.1007/BF02296192.
- Schwartz CE, Snidman N, Kagan J. Early childhood temperament as a determinant of externalizing behavior in adolescence. *Development and Psychopathology*. 1996; 8:527–537. doi:10.1017/S0954579400007252.
- Schwartz G. Estimating the dimension of a model. *The Annals of Statistics*. 1978; 6:461–464.
- Sellbom M, Bagby RM. Identifying PTSD personality subtypes in a workplace trauma sample. *Journal of Traumatic Stress*. 2009; 22:471–475. doi:10.1002/jts.20452. [PubMed: 19810088]
- Sellbom M, Ben-Porath YS. Mapping the MMPI–2 Restructured Clinical Scales onto normal personality traits: evidence of construct validity. *Journal of Personality Assessment*. 2005; 85:179–187. doi:10.1207/s15327752jpa8502_10. [PubMed: 16171418]
- Shea MT, Stout RL, Yen S, Pagano ME, Skodol AE, Morey LC, Zanarini MC. Association in the course of personality disorders and Axis I disorders over time. *Journal of Abnormal Psychology*. 2004; 113:499–508. doi:10.1037/0021-843X.113.4.499. [PubMed: 15535783]
- Singh AL, Waldman ID. The etiology of associations between negative emotionality and childhood externalizing disorders. *Journal of Abnormal Psychology*. 2010; 119:376–88. doi:10.1037/a0019342. [PubMed: 20455610]
- Skinner HA. Toward the integration of classification theory and methods. *Journal of Abnormal Psychology*. 1981; 90:68–87. doi:10.1037/0021-843X.90.1.68. [PubMed: 7264056]
- Slade T, Watson D. The structure of common DSM-IV and ICD-10 mental disorders in the Australian general population. *Psychological Medicine*. 2006; 36:1593–1600. doi:10.1017/S0033291706008452. [PubMed: 16882356]
- Tellegen, A. Structures of mood and personality and their relevance to assessing anxiety with an emphasis on self-report.. In: Tuma, AH.; Maser, JD., editors. *Anxiety and the anxiety disorders*. Erlbaum; Hillsdale, N.J.: 1985. p. 681-706.
- Tellegen, A. *Manual for the Multidimensional Personality Questionnaire*. University of Minnesota Press; Minneapolis, MN: in press
- Tellegen, A.; Waller, NG. Boyle, GJ.; Matthews, G.; Saklofske, DH.; Boyle, GJ.; Matthews, G.; Saklofske, DH., editors. *Exploring personality through test construction: Development of the Multidimensional Personality Questionnaire.; The SAGE handbook of personality theory and assessment, Vol 2: Personality measurement and testing*. 2008. p. 261-292.
- Vollebergh WAM, Iedema J, Bijl RV, de Graaf R, Smit F, Ormel J. The structure and stability of common mental disorders: The NEMESIS Study. *Archives of General Psychiatry*. 2001; 58:597–603. doi:10.1001/archpsych.58.6.597. [PubMed: 11386990]
- Watson D. Rethinking the mood and anxiety disorders: A quantitative hierarchical model for DSM-V. *Journal of Abnormal Psychology*. 2005; 114:522–536. doi: 10.1037/0021-843X.114.4.522. [PubMed: 16351375]
- Watson D, Clark LA. Negative affectivity: The disposition to experience aversive emotional states. *Psychological Bulletin*. 1984; 96:465–490. doi:10.1037/0033-2909.96.3.465. [PubMed: 6393179]
- Watson D, Clark LA, Carey G. Positive and negative affectivity and their relation to anxiety and depressive disorders. *Journal of Abnormal Psychology*. 1988; 97:346–353. doi: 10.1037/0021-843X.97.3.346. [PubMed: 3192830]

- Watson D, Gamez W, Simms LJ. Basic dimensions of temperament and their relation to anxiety and depression: A symptom-based perspective. *Journal of Research in Personality*. 2005; 39:46–66. doi:10.1016/j.jrp.2004.09.006.
- Watson D, Walker LM. The long-term stability and predictive validity of trait measures of affect. *Journal of Personality and Social Psychology*. 1996; 70:567–577. doi: 10.1037/0022-3514.70.3.567. [PubMed: 8851741]
- Weathers, FW.; Litz, BT.; Herman, DS.; Huska, JA.; Keane, TM. The PTSD Checklist: reliability, validity, & diagnostic utility.. Paper presented at the Annual Meeting of the International Society for Traumatic Stress Studies; San Antonio, TX. 1993.
- Weathers FW, Ruscio AM, Keane TM. Psychometric properties of nine scoring rules for the Clinician-Administered Posttraumatic Stress Disorder Scale. *Psychological Assessment*. 1999; 11:124–133. doi:10.1037/1040-3590.11.2.124.
- Wolf EJ, Miller MW, Harrington K, Reardon A. Personality-based latent classes of posttraumatic psychopathology: Personality disorders and the Internalizing/Externalizing model. *Journal of Abnormal Psychology*. in press. doi:10.1037/a0023237.
- Wolf EJ, Miller MW, Krueger RF, Lyons MJ, Tsuang MT, Koenen KC. Posttraumatic stress disorder and the genetic structure of comorbidity. *Journal of Abnormal Psychology*. 2010; 119:320–331. doi:10.1037/a0019035. [PubMed: 20455605]
- Young SE, Stallings MC, Corley RP, Krauter KS, Hewitt JK. Genetic and environmental influences on behavioral disinhibition. *American Journal of Medical Genetics (Neuropsychiatric Genetics)*. 2000; 96:684–695. doi:10.1002/1096-8628(20001009)96:5<684::AIDAJMG16>3.0.CO;2-G. [PubMed: 11054778]
- Zanarini MC, Frankenburg FR, Dubo ED, Sickel AE, Trikha A, Levin A, et al. Axis I comorbidity of borderline personality disorder. *American Journal of Psychiatry*. 1998; 155:1733–1739. [PubMed: 9842784]

Figure 1.

Confirmatory factor analysis of the comorbidity structure. All loadings and correlations were significant at the $p < .01$ level (most at the $p < .001$ level) except for the correlations between Externalizing and Distress and Fear. Ext = externalizing; Pan/Ag = panic/agoraphobia; Spec = specific phobia; OCD = obsessive-compulsive disorder; MDD = major depressive disorder; Dys = dysthymia; GAD = generalized anxiety disorder; BPD = borderline personality disorder; CD = conduct disorder; AS = adult antisociality; SU = substance use disorders (includes alcohol and drug use disorders).

Figure 2. Structural relationships between the temperament dimensions and latent comorbidity variables. All structural paths between temperament and comorbidity variables were significant at the $p < .05$ level. NEM and CON were correlated with one another at the $p < .01$ level and Distress and Fear were correlated with one another at the $p < .001$ level. PEM and CON were reverse scored. PEM = positive emotionality; NEM = negative emotionality; CON = constraint; Ext = externalizing.

Diagnostic Prevalence of Current Diagnoses and Bivariate Associations among Symptoms Severity Scores and Temperament

Table 1

Variable	Prevalence (%)	PTSD	MDD	Dys	GAD	Panic/Ag	Spec	OCD	Sub-use	CD	Antisoc	BPD	NEM	PEM	CON
Diagnoses															
PTSD	56.3	--													
MDD	21.4	.55	--												
Dys	22.9	.49	.64	--											
GAD	8.6	.38	.44	.37	--										
Panic /Ag	13.0	.43	.43	.34	.44	--									
Spec.	6.2	.16	.23	.18	.20	.25	--								
OCD	2.4	.35	.21	.29	.26	.41	.20	--							
Sub-use	7.7	.01	-.02	-.04	-.08	-.04	.04	.01	--						
CD	N/A	.09	.11	.11	.11	.13	.00	.07	.13	--					
Antisoc	N/A	.01	.02	.05	.07	.04	.08	-.05	.17	.28	--				
BPD	4.3	.37	.32	.34	.31	.27	.14	.20	.10	.29	.48	--			
MPQ-BF															
NEM	N/A	.22	.29	.27	.24	.17	-.01	.10	.03	.31	.34	.45	--		
PEM	N/A	.24	.31	.27	.08	-.02	.03	.10	.08	-.09	-.02	.07	.08	--	
CON	N/A	.11	.16	.18	.11	.06	.00	.08	.11	.17	.24	.17	.20	.00	--

Note. The prevalence of *DSM-IV* defined antisocial personality disorder (i.e., incorporating the conduct disorder and adult antisocial criteria) was 10%. PEM and CON were reverse scored such that higher scores indicate greater personality pathology. Prevalence rate for Panic +/- Ag includes all those who met criteria for panic disorder regardless of whether they also met criteria for agoraphobia; for symptom summary scores used to calculate correlation coefficients, panic and agoraphobia phobia symptoms were summed together. Correlation coefficients .13 are significant at the $p < .05$ level; correlation coefficients .22 are significant at the $p < .001$ level. MPQ-BF = Multidimensional Personality Questionnaire—Brief Form; PTSD = posttraumatic stress disorder; MDD = major depressive disorder; Dys = dysthymia; GAD = generalized anxiety disorder; Ag = agoraphobia; Spec = specific phobia; OCD = obsessive-compulsive disorder; Sub = substance; CD = conduct disorder; Antisoc = adult antisociality; BPD = borderline personality disorder; NEM = negative emotionality; PEM = positive emotionality; CON = constraint; N/A = not applicable.

Table 2

Model Fit and Model Comparisons

Model	Chi Square (df), <i>p</i> -value	RMSEA	SRMR	CFI	TLI	AIC	BIC	Model Comparison	Δ Chi Square (Δ df) [*]
CFAs									
1a. 2 Factor	45.92 (33), <i>p</i> = .07	.04	.05	.96	.95	10824	10929		
2a. 3 Factor, BPD X-loads	30.71 (31), <i>p</i> = .48	.00	.04	1.00	1.00	10812	10924	2a vs. 1a	16.09 (2)
3a. 3 Factor, BPD on Distress	87.19 (32), <i>p</i> < .001	.09	.07	.83	.76	10865	10974	3a vs. 2a	138.12 (1)
SEM									
1b. Main Effects	57.41 (56), <i>p</i> = .43	.01	.05	1.00	1.00	15915	16075		

Note. *DF* = degrees of freedom; RMSEA = root mean square error of approximation; SRMR = standardized root mean square residual; CFI = comparative fit index; TLI = Tucker-Lewis index; AIC = Akaike information criterion; BIC = Bayesian information criterion; CFA = confirmatory factor analysis; SEM = structural equation modeling; BPD = borderline personality disorder; X-load = cross load.

* Chi square differences values greater than 3.84 indicate that the nested model significantly degrades model fit relative to the parent model at the *p* < .05 level.