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The Underlying Role of Negative Affect in the Association between PTSD, Major Depressive Disorder, and Generalized Anxiety Disorder

Brianna M. Byllesby[1] · **Ruby Charak**[2] · **Tory A. Durham**[1] · **Xin Wang**[3] · **Jon D. Elhai**[1,3]

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Abstract Clinicians and researchers have found differential diagnosis to be difficult, particularly for conceptually similar disorders. One category of particular interest has been distress or internalizing disorders, theorized to be related via an underlying construct of generalized distress or negative affect. The present study attempted to address the comorbidity of three distress disorders - posttraumatic stress disorder (PTSD), major depressive disorder (MDD), and generalized anxiety disorder (GAD) - using latent analyses by controlling for the variance attributable to negative affect. The sample consisted of 265 trauma-exposed individuals who completed self-report measures of PTSD, MDD, GAD, and negative affect. Confirmatory factor analysis was used to test initial model fit. Next, the model was re-computed, controlling for negative affect by regressing negative affectivity at the item-level. Results indicated that a significant amount of variance within and between these diagnostic categories is attributable to negative affect at both the item- and factor-level. The hypothesis that MDD's non-somatic/affective factor and the GAD factor would have the highest attenuations in factor loadings after controlling for negative affect was supported. Therefore, negative affect significantly influences the co-occurrence of PTSD, MDD, and GAD clinically, emphasizing the need for transdiagnostic interventions for trauma victims.

✉ Jon D. Elhai
contact@jon-elhai.com; http://www.jon-elhai.com/contact-info

[1] Department of Psychology, University of Toledo, Mail Stop #948, 2801 W. Bancroft St., Toledo, OH 43606-3390, USA

[2] Department of Psychology, University of Nebraska at Lincoln, Lincoln, NE, USA

[3] Department of Psychiatry, University of Toledo, Toledo, OH, USA

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Comorbidity between PTSD, MDD, and GAD

Comorbidity between various mental disorders can create challenges for researchers and clinicians (e.g. differential diagnosis, understanding variance). Posttraumatic stress disorder (PTSD) in particular demonstrates strong comorbidity with several mood and anxiety disorders, namely major depressive disorder (MDD) and generalized anxiety disorder (GAD) (e.g. Biehn et al. 2013a; Contractor et al. 2014; Durham et al. 2015), and the issue of comorbidity between MDD and GAD is long standing (e.g. Gorman 1996; Sartorius et al. 1996). Comorbidity is reported to be 48–55 % between PTSD and MDD (Elhai et al. 2008a; Kessler et al. 1995; Rytwinski et al. 2013), 15–17 % between PTSD and GAD (Kessler et al. 1995), and approximately 60 % between MDD and GAD (Kessler et al. 2005). In one sample of veterans, about half of the sample reported lifetime triple comorbidity of PTSD, depression, and anxiety (Ginzburg et al. 2010).

Generally speaking, comorbidity between mental disorders is associated with several problems. For example, comorbidity between PTSD and MDD specifically is associated with more functional and chronic impairment, delayed response to treatment, poorer treatment outcomes, generally greater illness burden (reviewed in Angelakis and Nixon 2015), and higher dropout rates for treatment (Bryant et al. 2003). Comorbid PTSD and MDD has been associated with more difficulties in psychosocial functioning (Ginzburg et al. 2010). The relationship between PTSD and MDD is robust and has been found in studies based on symptom severity (Ginzburg et al. 2010), latent level associations (Biehn et al. 2013a, b; Elklit

et al. 2010), and diagnostic comorbidity prevalence rates (Elhai et al. 2008a; Kessler et al. 1995; Spinhoven et al. 2014), which lends evidence to the strength of their association in a variety of samples (reviewed in Rytwinski et al. 2013).

The co-occurrence between PTSD and GAD is examined less frequently in the literature. A few studies that examine the co-occurrence between PTSD and GAD indicate that negative post-trauma cognitions, such as negative thoughts about oneself or the world, and self-blame are possible maintaining factors in this association (Beck et al. 2015). Further, presence of an additional diagnosis (e.g., substance use, mood disorder) was more strongly associated with comorbid PTSD and GAD (Milanak et al. 2013). PTSD symptom severity has also been associated with more severe general anxiety (Durham et al. 2015; Grant et al. 2008; Naifeh et al. 2012) in military veterans (Durham et al. 2015), motor vehicle accident victims (Grant et al. 2008), and substance dependent inpatients (Naifeh et al. 2012).

MDD and GAD commonly co-occur, with some research studies demonstrating that depression develops subsequent to anxiety, while others support the reverse temporal sequencing (Hofmann et al. 2010). Regardless, there are significant consequences of the co-occurrence of these disorders. For instance, comorbid depression and anxiety is related to several negative outcomes such as impairment in health related quality of life (Mittal et al. 2006), and physiological responses (Hofmann et al. 2010). The issues raise questions in regard to diagnostic specificity, symptom reliability, and differential diagnosis (to name a few) and thus illustrate the importance of examining these comorbid relationships.

Observed and Latent Level Explanations for Comorbidity

Within the *DSM-5*, there are many shared symptoms between PTSD, MDD, and GAD (American Psychiatric Association 2013). The following symptoms are diagnostic of both PTSD and MDD: sleep disturbances, difficulty concentrating, anhedonia, and general negative emotionality (e.g. low mood, irritability). Considering that one needs at least five out of the nine symptoms to meet criteria for an MDD diagnosis, and four of those symptoms could potentially also be attributed to a PTSD diagnosis, this highlights the extent of overlapping symptoms between the two disorders. PTSD and GAD share several symptoms as well: difficulty concentrating, sleep problems, and irritability. Likewise, with the overlap between PTSD and MDD, one needs three out of the six symptom criteria to meet a GAD diagnosis, arguably all of which could be difficult to tease apart from the PTSD symptoms.

The aforementioned problem with overlapping symptoms prompted researchers to assume that perhaps it was merely shared symptomatology that was contributing to the high comorbidity rates between mood and anxiety disorders (Spitzer et al. 2007). This theory has been examined empirically at the observed level, by removing overlapping symptoms between these disorders, and examining the resulting comorbidity rates. Multiple studies have indicated that comorbidity rates did not significantly decrease upon removal of the overlapping symptoms, thus indicating there is more to the relationship between PTSD and MDD aside from mere overlapping symptomatology. This has been demonstrated in adult (Elhai et al. 2008a; Grubaugh et al. 2010) and child populations (Ford et al. 2009). However, in regard to GAD and MDD, one study did demonstrate that comorbidity was significantly influenced by symptom overlap (Zbozinek et al. 2012). These conflicting results prompt further investigation.

One such follow up to the overlapping symptoms theory posits that perhaps certain factors of MDD, GAD, and PTSD explain the relationship, which has been examined empirically via latent variable modeling. Although dependent upon the measure used, examinations of MDD's factor structure utilizing the PHQ-9 (Kroenke et al. 2001) generally produced two factors: 1) somatic and 2) non-somatic (Baas et al. 2011; Biehn et al. 2013a; Contractor et al. 2014; Tsai et al. 2014). Similarly, GAD's factor structure has been well-established to produced one factor using the GAD-7 (Dear et al. 2011; Lowe et al. 2008; Spitzer et al. 2006).

PTSD's factor structure is a bit more inconclusive however, with four- (American Psychiatric Association 2013; King et al. 1998; Simms et al. 2002), five- (Elhai et al. 2011), six- (Liu et al. 2014; Tsai et al. 2015) and seven- (Armour et al. 2015) factor representations supported in the extant literature. The majority of studies to date have examined PTSD using its four-factor structure, either based on the emotional-numbing model (King et al. 1998), or the dysphoria model (Simms et al. 2002). The recent *DSM-5* PTSD factor structure is based on the emotional numbing model of PTSD and proposes four distinct diagnostic criteria, namely, intrusions, avoidance, negative alterations in cognition and mood (NACM), and alterations in arousal and reactivity (AAR; American Psychiatric Association 2013). The amendments to the nosology of PTSD in *DSM-5* also include the addition of three symptoms—negative expectations of oneself/world/others, distorted blame, and reckless behavior. With these changes to PTSD's diagnostic criteria in *DSM-5*, the latent relationships between PTSD, MDD, and GAD using the new system require further research in order to help better explain the high co-occurrence of these disorders clinically.

Research studies have examined the latent factor structures of PTSD, MDD, and GAD together. For example, Grant et al. (2008) found the best latent model fit for the three constructs was as three correlated but distinct factors. Others have examined the relationships between the factors of PTSD, MDD, and GAD. Consistently, PTSD's dysphoria/numbing factor

has been found to be a non-specific component with relationships with depression and anxiety (Armour et al. 2011; Armour and Shevlin 2009; Palmieri et al. 2007; Price and van Stolk-Cooke 2015).

Role of Negative Affectivity

One explanation for diagnostic comorbidity, and one that influenced the present study, is the notion that there is a shared component of negative affect underlying mood and anxiety disorders (Watson 2009). The tripartite model of emotions specifies a general component—i.e., *negative affectivity* or general level of emotional distress—that represents the shared influence between anxiety and depression (Clark and Watson 1991). It further specifies two factors, namely, physiological hyperarousal, common to anxiety disorders, and low positive affect, common to depression. It is an extension of the two-factor model of affect—negative affect and positive affect—proposed by Watson and Tellegen (1985). The positive association between negative affect, depression, and anxiety is attributable to negative affect being a non-specific dimension common to most emotional disorders (Mineka et al. 1998; Watson et al. 2011).

As aforementioned, studies often assess the overlap between PTSD and other disorders via disorder-specific scales as a proxy for assessing the underlying common factor of *negative affectivity* or general distress (Byllesby et al. 2016; Durham et al. 2015; Price and van Stolk-Cooke 2015). These studies document the co-occurrence between PTSD and other disorders, however they do not explicitly specify if negative affect is the underlying reason for the comorbidity. Hence, in order to understand the role of negative affect in the association between disorders it becomes pertinent to use specific measures designed to gauge negative affect. For this reason here, we used negative affect items of the PANAS (Watson et al. 1988; see measures section).

The present study aims to address this gap in the literature regarding disorder-specific measures of distress disorders and the proposed underlying dimension of negative affect that accounts for the relationship between disorders in a sample of trauma-exposed individuals. By examining the relationships between latent factors of the three distress disorders of interest (PTSD, MDD, and GAD) before and after accounting for the effects of negative affect, we can investigate how these relationships and potential comorbidity can be accounted for by an underlying dimension that accounts for significant variance between them. Although several models exist that represent the latent factor structure of PTSD, the present study utilized the *DSM-5* four-factor model, as we were interested in the diagnostic symptom structure of PTSD and how this related to MDD and GAD diagnoses. The current study expanded upon prior research by examining the influence of negative affect on *DSM-5* PTSD, MDD, and GAD using latent factors in a sample of trauma-exposed individuals. This is the only study to our knowledge that has attempted to investigate these disorder relationships while accounting for their proposed underlying mechanism of relationship, negative affectivity.

Primarily we anticipated that the factor loadings for the individual observed items would significantly decrease after negative affect was regressed on each. We also hypothesized that the factors would have strong relationships with each other prior to the inclusion of negative affect, and it was expected that these correlations would significantly decrease once negative affect was accounted for. Third, it was hypothesized that PTSD's NACM factor, MDD's affective/non-somatic factor, and the single factor of GAD would have the highest attenuation of factor loadings after controlling for negative affect as they are theorized to have non-specific components of distress (Armour et al. 2011; Armour and Shevlin 2009; Grant et al. 2008; Simms et al. 2002). In contrast, PTSD's intrusion factor would have the least attenuation of factor loading as it is hypothesized to be more specific to PTSD and not general distress (Simms et al. 2002).

Methods

Participants and Procedure

Participants were undergraduate students recruited from a Midwestern public university to complete an online survey for class credit. Students who did not wish to participate in the research studies were given the option to write a brief research paper instead. The study was conducted as a web-based survey on a secure platform. The initial sample consisted of 563 students who selected "yes" on the SCID PTSD trauma screen (see below), of which 19 opted out before providing any data. Of these potential participants, 268 subjects did not endorse a most distressing trauma on a subsequent, more comprehensive trauma screen we administered - the Stressful Life Events Screening Questionnaire - and were therefore excluded. Of those endorsing a most distress trauma, nine were excluded for endorsing a trauma inconsistent with *DSM-5* criteria: three witnessed a death or assault through electronic media only, and six were exposed repeatedly to traumatic content through media only but not as an aspect of their occupation. Two individuals were further eliminated for missing data (see below), producing a final sample of 265 trauma-exposed individuals.

The most commonly reported most distressing traumatic events were the death of a close family member or friend as a result of accident, homicide, or suicide (n = 109, 41.1 %), being physically forced to have sex (n = 23, 8.7 %), and being present when someone was killed, injured, or assaulted (n = 22, 8.3 %). The average length of time since the index

trauma was 3.41 years (*SD* = 4.28). The trauma-exposed sample consisted mostly of females (*n* = 180, 67.9 %), with an average of 20.55 years old (*SD* = 5.58, Range = 18–56). The racial and ethnic composition was mostly white or Caucasian (*n* = 218, 82.3 %), followed by African American (*n* = 52, 19.6 %), Hispanic (*n* = 25, 9.4 %), American Indian (*n* = 10, 3.8 %), Asian American (*n* = 5, 1.9 %), and unknown/other (*n* = 9, 3.4 %), with subjects allowed to endorse all that applied. Most subjects were employed part time (*n* = 137, 51.7 %) or an unemployed student (*n* = 96, 36.2 %) and single (*n* = 139, 52.5 %) or in a relationship/not living together (*n* = 88, 33.2 %).

Measures

Structured Clinical Interview for DSM-IV (SCID) PTSD Trauma Screen The SCID trauma screen (First et al. 2002) is part of a structured diagnostic interview for Axis I diagnoses. It is a single question that precedes the PTSD module of the SCID and probes for potential exposure to a traumatic event by providing examples of potentially traumatic events. Only subjects who answered affirmatively to experiencing at least one of the listed events in this question were eligible to participate. The SCID PTSD trauma screen has shown 65.5 % sensitivity, 87.2 % specificity, and 72.3 % diagnostic power in a similar undergraduate sample (Elhai et al. 2008b).

Stressful Life Events Screening Questionnaire (SLESQ) The SLESQ (Goodman et al. 1998) is a self-report measure assessing lifetime exposure to potentially traumatic events. It includes 12 categories of potentially traumatic events that meet *DSM-IV* PTSD's Criterion A1, as well as an "other" category. For this study, the SLESQ was modified to be consistent with *DSM-5* criteria for a traumatic event (Elhai et al. 2012). Similarly, this modified SLESQ included a prompt at the end of the survey to nominate a most distressing traumatic event, and subjects were instructed to keep this event in mind when rating PTSD symptoms. Goodman et al. (1998) found the SLESQ to have good test-retest reliability across the traumatic event categories (mean kappa value of .73), and good convergent and concurrent validity (*r* = .77) when compared to a more extensive trauma exposure interview.

PTSD Checklist for DSM-5 (PCL-5) The PCL-5 (Weathers et al. 2013) is a self-report measure examining PTSD symptom severity anchored to a specific traumatic event. The scale consists of 20 items that have been adapted to map on to the *DSM-5* diagnostic criteria (Weathers et al. 2013). Subjects are asked to rate the amount of distress over the past month on a five-point Likert-type scale (0 = "Not at all" to 4 = "Extremely"). Previous studies using the PCL-5 suggest it has excellent internal consistency (Armour et al. 2015; Durham et al. 2015) and convergent validity compared to the Posttraumatic Stress Diagnostic Scale (PDS), *r* = .90 (Blevins et al. 2012). The current sample had excellent internal consistency, Cronbach's alpha = .95.

Patient Health Questionnaire-9 (PHQ-9) The PHQ-9 (Kroenke et al. 2001) is a self-report measure of depressive symptoms from the larger PRIME-MD diagnostic instrument. Depressive symptoms are rated for the previous month on a four-point Likert-type scale (0 = "Not at all" to 3 = "Nearly every day") consisting of nine items that map on to the *DSM-IV* diagnostic criteria for major depression. Kroenke et al. (2001) found the PHQ-9 had good internal consistency (Cronbach's alphas ranged from .86 to .89), test-retest reliability (*r* = .84), and construct validity based on a more thorough interview. The present sample had good internal consistency, Cronbach's alpha = .88.

Generalized Anxiety Disorder 7-item Scale (GAD-7) The GAD-7 (Spitzer et al. 2006) is a self-report measure of generalized anxiety symptoms derived from the larger PRIME-MD instrument. Anxiety symptoms are rated for the past month on a four-point Likert-type scale (0 = "Not at all" to 3 = "Nearly every day") consisting of nine items that map on to the *DSM-IV* diagnostic criteria for GAD. The GAD-7 has good internal consistency, with Cronbach's alpha = .92, and test-retest reliability, with an intraclass correlation of .83 (Spitzer et al. 2006). Spitzer et al. (2006) also found it to have good validity when compared to both structured interviews and other self-report measures of anxiety (e.g. Beck Anxiety Index *r* = .72). Internal consistency was good in the present sample, Cronbach's alpha = .90.

Positive and Negative Affect Schedule (PANAS) The PANAS (Watson et al. 1988) is a 20-item scale consisting of two mood scales to measure both positive and negative affect. Subjects are asked to rate the extent to which they had experienced each emotion over the previous month on a five-point Likert-type scale (1 = "Very slightly or not at all" to 5 = "Very much"). Only the negative affect (NA) scale was used in the present study. The NA scale of the PANAS has been found to have good test-retest reliability over an eight-week interval (*r* = .71), internal consistency (coefficient alpha = .87), and external validity compared to the Beck Depression Inventory (BDI) and STAI State Anxiety Scale, *r*s = .58 and .51, respectively (Watson et al. 1988). The current sample's Cronbach's alpha = .885.

Data Analyses

Data were screened for missing data. Individuals who were missing more than 50 % of item responses on any of the measures used for the main analyses (PCL-5, PHQ-9, GAD-7, PANAS) were excluded. Two individuals were excluded

based on these criteria. Missing data were minimal, with 86 % (n = 228), missing no items on the PCL-5, 95 % (n = 251) missing no items on the PHQ-9, 97 % (n = 257) missing no items on the GAD-7, and 95 % (n = 251) missing no items on the PANAS-NA. Additional missing data were estimated using maximum likelihood estimation and a pairwise present approach.

Confirmatory factor analyses (CFA) were conducted using Mplus 7 software. Items were treated as ordinal because they had five or fewer response options (Wirth and Edwards 2007). Therefore, a polychoric covariance matrix and probit regression coefficients were generated, and robust weighted least squares estimation with a mean- and variance-adjusted chi-square (WLSMV) was used for each CFA. Residual error covariances were fixed to zero, and factor variances were fixed to one. For goodness of fit, comparative fit index (CFI), Tucker-Lewis index (TLI), and root mean square error of approximation (RMSEA) were used to determine how well the model fit the sample data. For RMSEA, 90 % confidence intervals were reported. Excellent model fit is characterized by benchmark values for CFI and TLI ≥ .95 and RMSEA ≤ .06 (Hu and Bentler 1999). Separate CFAs were conducted to test model fit for 1) the *DSM-5* four-factor model of PTSD (intrusion, avoidance, NACM, AAR), 2) two-factor model of MDD (somatic, non-somatic), and 3) one-factor model of GAD. Then, we tested 4) a combined seven-factor model examining the goodness-of-fit indices for this model with PTSD, MDD, and GAD.

For the full seven-factor model, each of the items of PTSD, GAD, and MDD were regressed on the observed, continuous negative affect variable comprising the total score from the PANAS negative affect subscale (see Fig. 1). This method statistically controls for negative affect for each of the observed distress disorder indicator variables, such as in Elklit et al. (2010). By partitioning out negative affect at the item level, we could determine if the factor loadings of the indicator variables change significantly after the non-specific component of each item is controlled for and only the unique variance of each item is allowed to load onto its specified factor. Negative affect was used as an observed, continuous variable. Standardized factor loadings and regression coefficients between the negative affect variable and distress disorder items are examined. Any significant differences between the factor loadings and factor correlation before and after controlling for negative affect were tested using the Aroian z-test (Aroian 1947), using a Bonferroni-Holm correction to control for Type I error (Holm 1979). Using the Aroian z-test, we were able to determine if the correlation between two factors (e.g., intrusion and avoidance) differs significantly from the same correlation after partitioning out negative affect. The average attenuations of factor loadings and attenuations in factor correlations were calculated.

Results

The mean PCL score was 24.53 (SD = 18.22), and about a third (n = 94, 35.5 %) met criteria for probable PTSD, based on the *DSM-5* diagnostic algorithm (adapted for *DSM-5* from Cook et al. 2003). The mean PCL score for individuals with probable PTSD was 44.12 (SD = 12.77) compared to 13.76 (SD = 9.88) for those not meeting criteria for probable PTSD. The mean PHQ-9 score was 8.81 (SD = 6.20), and the mean GAD-7 score was 8.10 (SD = 5.63). Using cut-off scores of 10 for both the PHQ-9 (Kroenke et al. 2001) and GAD-7 (Spitzer et al. 2006), 41.9 % (n = 94) of the sample met criteria for

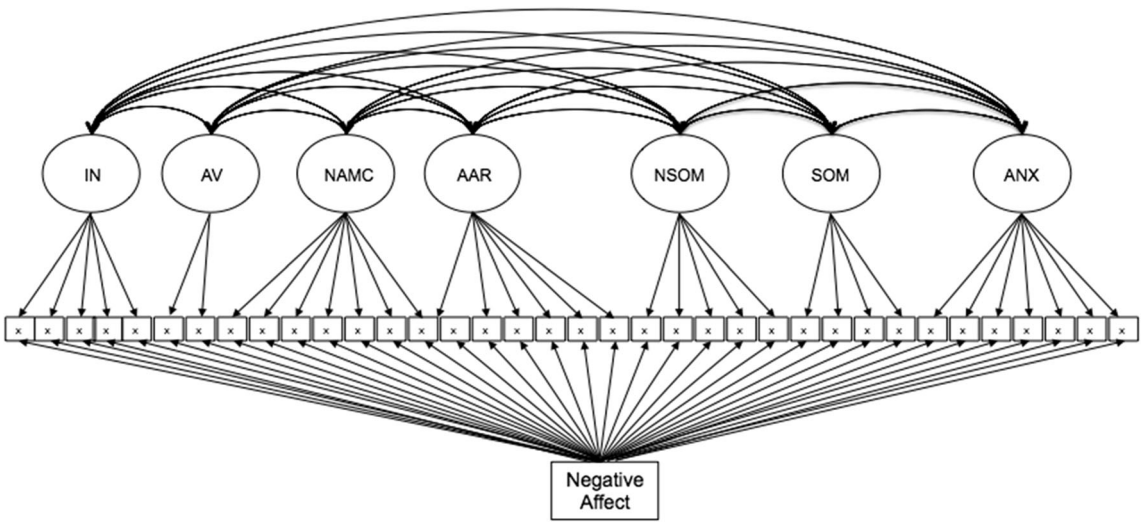

Fig. 1 Seven-factor model of distress disorders and negative affect. *Note.* IN = Intrusion; AV = Avoidance; NAMC = Negative alterations in mood and cognition; AAR = Alterations in arousal and reactivity; NSOM = Non-somatic depression; SOM = Somatic depression; ANX = Generalized anxiety; Each "x" indicates a distress disorder item from the PCL, PHQ-9, or GAD-7

MDD, and 35.1 % (n = 93) of the sample met criteria for GAD. Twenty-two percent of the trauma-exposed sample met criteria for both probable PTSD and probable MDD (n = 59), 54 (20.4 %) had both probable PTSD and probable GAD, 75 (28.3 %) had both probable MDD and probable GAD, and 17 % (n = 45) met criteria for probable PTSD, MDD, and GAD. The mean negative affect total score was 25.30 (SD = 8.62). Additionally, very little data was missing, with 86.1 % to 97.0 % the sample having complete data for each measure.

Four CFAs were conducted to test the model fit for the PTSD, MDD, GAD, and combined models. First, the four-factor *DSM-5* PTSD model indicated good fit, robust χ^2 (164, N = 265) = 460.029, $p < .0001$, CFI = .967, TLI = .961, RMSEA = .083 (90 % CI = .074–.091). Next, the two-factor MDD model indicated good fit, robust χ^2 (26, N = 265) = 104.461, $p < .0001$, CFI = .970, TLI = .959, RMSEA = .107 (90 % CI = .086–.129). Third, the single factor GAD indicated good fit, robust χ^2 (14, N = 265) = 80.288, $p < .0001$, CFI = .985, TLI = .977, RMSEA = .134 (90 % CI = .106–.163). Finally, the full seven-factor model of PTSD, MDD, and GAD (without the PANAS-negative affect) displayed good fit, robust χ^2 (573, N = 265) = 1117.713, $p < .0001$, CFI = .956, TLI = .952, RMSEA = .060 (90 % CI = .055–.065).

Next, the seven-factor model of PTSD, MDD, and GAD was examined for model fit after controlling for PANAS-negative affect as a covariate. This produced a model with adequate fit, robust χ^2 (573, N = 265) = 1079.476, $p < .0001$, CFI = .932, TLI = .922, RMSEA = .058 (90 % CI = .053–.063). The standardized factor loadings before and after controlling for negative affect are presented in Table 1. All item level differences statistically significant using the Bonferroni-Holm correction, except for one somatic MDD symptom (trouble falling or staying asleep). Further, Table 2 presents the difference between the factor correlations with and without the inclusion of negative affect, as well as the z-test values. All factor relationships decreased significantly in magnitude after accounting for negative affect except the relationships between (1) intrusion and avoidance, (2) avoidance and NACM, and (3) avoidance and AAR. Factor correlations and their changes after controlling for negative affect are presented in Table 3, as well as the average factor loading attenuations.

Discussion

The present study aimed to examine latent relationships between the distress disorders of PTSD, MDD, and GAD by controlling for the theorized underlying dimension of negative affect. Because the shared variance attributed to negative affect is theorized to underlie the comorbidity between these three disorders, controlling for negative affect allowed for the disorder-specific factor and item variance to be examined while accounting for its effect. Overall, 17 % of the participants reported comorbid PTSD, GAD, and MDD, reflecting the high relevance of the comorbidity of these disorders and need for research examining their underlying shared variance.

In accord with our first hypothesis, after controlling for negative affect, all items except one had significant attenuations in factor loadings. Therefore, all the items that constitute the diagnostic symptoms of PTSD, MDD, and GAD (except "trouble falling or staying asleep" on MDD's somatic factor) have significant variance accounted for by negative affect, which supports the theory that these disorders are comorbid largely due to the shared latent variance associated with negative affectivity or distress (Watson 2009; Watson et al. 2008). The highest attenuation was for the GAD item "nervous, anxious, on edge," which loaded on the negative affect factor. That particular item is highly related to the specific items queried on the PANAS-NA (e.g. items such as feeling nervous, jittery, alert, etc.), which could indicate this finding may be an artifact of the conceptualization of negative affect utilized in the present study.

We also hypothesized that all seven factors would be highly related to each other prior to the inclusion of negative affect, and that these correlations would significantly decrease after accounting for negative affect in the model. Our hypothesis was supported such that all seven factors of the proposed model were highly correlated (rs ranging from .495 to .909), indicating shared variance underlying these constructs. The intercorrelations between all the factors decreased significantly after negative affect was controlled for, except for three relationships that were factors of PTSD: (1) avoidance and intrusion, (2) avoidance and NACM, and (3) avoidance and AAR. Noteworthy is that all factor correlations between distress disorders significantly decreased after accounting for negative affect, although the associations remained significant. Findings indicate that much of the association or comorbidity between PTSD, GAD and MDD is attributable to the underlying component of negative distress (e.g., Brown 2007; Brown et al. 1998).

Additionally, we proposed that PTSD's NACM factor, MDD's non-somatic factor, and the GAD factor would have the highest attenuations in factor loadings after controlling for negative affect. Consistent with this hypothesis, the non-somatic (or affective) MDD factor and the GAD factor had the greatest factor attenuations, −.291 and −.304, respectively. The NACM factor of PTSD did not change as drastically, although the difference was still significant. Findings suggest that non-somatic MDD and GAD are more consistent with the conceptualization of a common distress dimension underlying distress disorders leading to comorbidity, whereas the affect component of *DSM-5* PTSD (i.e., NACM) is less related to negative affect as measured in this study (Elklit et al. 2010).

Table 1 Standardized factor loadings for model, with loadings from model including negative affect in parentheses

Disorder	Item	Factor	Disorder's Symptom Factor Loading	NA's Factor Loading
PTSD	Intrusive thoughts	IN	.848 (.690)	(.472)
PTSD	Nightmares	IN	.739 (.636)	(.373)
PTSD	Reliving trauma	IN	.816 (.713)	(.413)
PTSD	Emotional cue reactivity	IN	.854 (.779)	(.398)
PTSD	Physiological cue reactivity	IN	.786 (.604)	(.461)
PTSD	Avoidance of thoughts	AV	.885 (.835)	(.344)
PTSD	Avoidance of external reminders	AV	.899 (.783)	(.400)
PTSD	Trauma-related amnesia	NACM	.623 (.461)	(.392)
PTSD	Negative beliefs	NACM	.812 (.615)	(.514)
PTSD	Distorted blame	NACM	.760 (.613)	(.446)
PTSD	Persistent negative emotional state	NACM	.857 (.670)	(.524)
PTSD	Lack of interest	NACM	.843 (.691)	(.480)
PTSD	Feeling detached	NACM	.881 (.726)	(.498)
PTSD	Inability to experience positive emotions	NACM	.893 (.715)	(.523)
PTSD	Irritability/anger	AAR	.861 (.690)	(.502)
PTSD	Recklessness	AAR	.767 (.587)	(.464)
PTSD	Hypervigilance	AAR	.702 (.549)	(.425)
PTSD	Easily startled	AAR	.740 (.514)	(.506)
PTSD	Difficulty concentrating	AAR	.861 (.668)	(.531)
PTSD	Difficulty sleeping	AAR	.769 (.649)	(.412)
MDD	Lack of interest	NSOM	.787 (.595)	(.543)
MDD	Depressed mood	NSOM	.900 (.606)	(.669)
MDD	Trouble sleeping	SOM	.751 (.715)†	(.394)
MDD	Fatigue	SOM	.794 (.651)	(.489)
MDD	Appetite change	SOM	.720 (.543)	(.467)
MDD	Feelings of worthlessness	NSOM	.848 (.428)	(.704)
MDD	Difficulty concentrating	NSOM	.760 (.529)	(.507)
MDD	Psychomotor retardation or agitation	SOM	.780 (.434)	(.545)
MDD	Suicidal ideation	NSOM	.825 (.569)	(.589)
GAD	Nervous, anxious, on edge	ANX	.829 (.402)	(.715)
GAD	Unable to control worry	ANX	.907 (.604)	(.665)
GAD	Worrying too much	ANX	.882 (.586)	(.659)
GAD	Trouble relaxing	ANX	.830 (.584)	(.614)
GAD	Restlessness	ANX	.796 (.594)	(.529)
GAD	Easily annoyed or irritable	ANX	.783 (.484)	(.616)
GAD	Feeling afraid of future	ANX	.745 (.390)	(.607)

PTSD Posttraumatic stress disorder, *MDD* Major depressive disorder, *GAD* Generalized anxiety disorder, *NA* Negative affect, *IN* Intrusion, *AV* Avoidance, *NACM* Negative alterations in cognition and mood, *AAR* Alterations in arousal and reactivity, *NSOM* Non-somatic, *SOM* Somatic, *ANX* Anxiety; All effects statistically significant using Bonferroni-Holm correction except loading identified by †

PTSD's previous placement in the distress disorders category was frequently called into question due to being characterized by both distress and fear components (Lockwood and Forbes 2014; Rosen and Lilienfeld 2008; Spitzer et al. 2007). In contrast to the negative mood and cognitions and arousal changes, the factor correlations involving PTSD's intrusion and avoidance factors experienced less change after controlling for negative affect. Findings suggest that intrusion and avoidance factors are more specific to PTSD and trauma-related symptoms compared to the other two factors of PTSD. The non-specific nature of NACM and AAR factors has been shown in previous research (Biehn et al. 2013a; Contractor et al. 2014; Simms et al. 2002) and is also represented in the various empirical models of PTSD's factor structure (Liu et al. 2014; Tsai et al. 2015). Notably, the NACM and AAR factors had lesser attenuation relative to the factors of

Table 2 Factor correlations and correlations after controlling for negative affect with Aroian z-test values

Factors	Correlation 1	Correlation 2	z value
IN-AV	0.806	0.747	1.71
IN-NACM	0.873	0.810	2.50*
IN-AAR	0.855	0.781	2.59*
IN-SOM	0.511	0.244	3.61*
IN-NSOM	0.553	0.257	4.12*
IN-ANX	0.562	0.273	4.07*
AV-NACM	0.744	0.673	1.64
AV-AAR	0.698	0.608	1.80
AV-SOM	0.495	0.319	2.43*
AV-NSOM	0.506	0.309	2.72*
AV-ANX	0.500	0.310	2.62*
NACM-AAR	0.909	0.858	2.70*
NACM-SOM	0.561	0.277	4.00*
NACM-NSOM	0.672	0.395	4.54*
NACM-ANX	0.583	0.219	5.09*
AAR-SOM	0.695	0.491	3.66*
AAR-NSOM	0.623	0.275	5.12*
AAR-ANX	0.632	0.298	5.01*
SOM-NSOM	0.797	0.613	4.31*
SOM-ANX	0.831	0.706	3.57*
NSOM-ANX	0.863	0.628	6.49*

IN Intrusion, *AV* Avoidance, *NACM* Negative alterations in cognition and mood, *AAR* Alterations in arousal and reactivity, *NSOM* Non-somatic, *SOM* Somatic, *ANX* Anxiety; Correlation 1 = the original correlation value prior to the inclusion of negative affect; Correlation 2 = correlation coefficient after controlling for negative affect; * indicates the difference is statistically significant using Bonferroni-Holm correction

MDD and GAD. This suggests that although PTSD has a significant portion of variance attributable to negative affect, none of the four factors of PTSD have the same magnitude of relationship to negative affect as compared to the other disorders (i.e. GAD and MDD). This finding is slightly inconsistent with previous findings. Using the PANAS, Charak et al. (2014) found that the four factors of PTSD were not differentially related to negative affect, although they used the dysphoria model of PTSD instead of the *DSM-5* model. In this study, correlations between PTSD factors and negative affect ranged from 0.52–0.65. In a study using observed variables, negative affect correlated to anxiety and depression at similar magnitudes, .60–.65 and .44–.60, respectively (Crawford and Henry 2004). These studies have examined the correlations between distress disorder constructs and negative affect, but our findings may differ because of the use of latent variables, the statistical analyses used to account for negative affect, and use of disorder-specific measures.

Table 3 Absolute differences between factor correlations after controlling for negative affect and average item-level factor loading attenuations by factor

	IN	AV	NACM	AAR	SOM	NSOM	ANX
IN	–						
AV	.059	–					
NACM	.063*	.071	–				
AAR	.074*	.090	.051*	–			
SOM	.267*	.176*	.284*	.204*	–		
NSOM	.296*	.197*	.277*	.348*	.184*	–	
ANX	.287*	.190*	.364*	.334*	.125*	.235*	–
Average	−.124	−.083	−.168	−.174	−.187	−.291	−.304

IN Intrusion, *AV* Avoidance, *NACM* Negative alterations in cognition and mood, *AAR* Alterations in arousal and reactivity, *NSOM* Non-somatic, *SOM* Somatic, *ANX* Anxiety; * indicates the difference is statistically significant using Bonferroni-Holm correction

Although not a specific hypothesis, we found that the comorbidity between these three disorders was high, which is in line with previous research (Angelakis and Nixon 2015; Mineka et al. 1998; Zbozinek et al. 2012). With the advent of *DSM-5* publication, disorder categorization and differential diagnosis are especially salient research questions, which require continued research attention. Similar to the results of Contractor et al. (2015), our results suggest that PTSD, MDD, and GAD all have high levels of emotional distress common to distress disorders, and are therefore related, but each is distinct in terms of their specific factors. Therefore, despite their shared variance, these diagnoses are unique enough to differentiate statistically and clinically, although the latter proves to be more difficult. Comorbidity between disorders can complicate differential diagnosis, negatively influence treatment outcomes, and cause more functional and chronic impairment (Angelakis and Nixon 2015). The current empirically-supported treatments for trauma are disorder-specific, and they only target PTSD symptoms via exposure, which requires emotional engagement (e.g., Foa et al. 1991; Resick and Schnicke 1992). Therefore, these treatments may not adequately address the full extent of psychological symptomatology experienced by individuals with comorbid diagnoses following trauma exposure. Future treatment for emotional disorders should work towards procedures that are transdiagnostic and help alleviate negative affectivity across different presentations of distress, instead of targeting specifically PTSD, depressive, or anxious symptoms.

The following limitations should be considered when interpreting the current findings. First, in order to examine the association between all three disorders (PTSD, GAD, and MDD) only trauma-exposed individuals were included in the present sample, as potential trauma exposure is considered a prerequisite to probing about PTSD symptoms. Second, measures used in the present study were self-report, which can increase response bias. No clinical interviews or diagnostic instruments were used, but instead cut off scores were used to estimate probable diagnoses. Our sample had a relatively

low prevalence of individuals exceeding the cut off scores for probable diagnoses, which may indicate that our sample had mild symptomatology. Thus results may not generalize as well to more symptomatic or clinical samples. Additionally, the sample consisted of undergraduate students, who were mostly young adults and relatively homogenous with regard to demographic characteristics. Although a convenience sample, it is an appropriate sample to utilize while conducting a new research design. Further, PTSD, MDD, and GAD symptoms can frequently co-occur with other disorders, such as substance use or panic disorder, but these symptoms were not controlled for in the present study.

Despite these limitations, the current study has positive contributions. The sample consisted of a large trauma-exposed group using disorder-specific measures for three common distress disorders. We examined the latent relations between these disorders instead of observed variables or comorbidity rates only. A latent variable design depicts a pure representation of the variables of interest as the measurement error and latent variance are accounted for statistically. In addition such a design allows examination of the theoretical underlying mechanism proposed to be responsible for comorbidity between distress disorders (i.e. negative affect). To the best of our knowledge, this is the first study which attempts to investigate changes in parameter estimates in a joint latent model with PTSD factor structure based on *DSM-5*, GAD, and MDD after controlling for negative affect.

Future research should attempt to replicate these results using longitudinal data instead of the cross-sectional data collected for the present study. By using longitudinal data, the relationship between distress disorders can be examined over time in order to determine their co-occurrence over time, as well as the stability of their relationship with negative affect. The temporal stability of these latent relationships would be another interesting future research topic. Future research should also consider other potential dimensions underlying their relationships besides negative affect, or possibly their relationship to other latent predisposing factors such as anxiety sensitivity or maladaptive coping.

Compliance with Ethical Standards

Conflict of Interest Brianna M. Byllesby, Ruby Charak, Tory A. Durham, Xin Wang and Jon D. Elhai declare that they have no conflict of interest.

Experiment Participants All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards.

Informed Consent Informed consent was obtained from all individual participants included in the study.

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