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Examining the Underlying Dimensions of Posttraumatic Stress Disorder and Major Depressive Disorder Using the Proposed DSM-5 Diagnostic Criteria

by

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Submitted to the Graduate Faculty as partial fulfillment of the requirements for the Doctor of Philosophy Degree in Psychology

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An Abstract of

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This study examined the relationship between the underlying factors of major depressive disorder (MDD) and the revised diagnostic symptom criteria of posttraumatic stress disorder (PTSD) for the fifth edition of the Diagnostic and Statistical Manual (DSM-5). Additionally, this study investigated the goodness-of-fit of the PTSD model proposed for DSM-5 and tested a model alteration which included a dysphoria factor. A total of 266 University of Toledo college students with a trauma history participated in the study. Subjects completed a modified version of the Stressful Life Events Screening Questionnaire to assess for trauma exposure which is consistent with the DSM-5’s diagnostic criteria for trauma exposure. In addition, subjects completed the PTSD Checklist (PCL) modified for the DSM-5 diagnostic criteria, and the Patient Health Questionnaire-9 (PHQ-9) for assessing depression. Confirmatory factor analyses were conducted to evaluate the goodness-of-fit of the DSM-5 PTSD model and the dysphoria model, as well as a depression model using the PHQ-9, and a combined PTSD-MDD model. Results indicate that all four models demonstrate adequate to excellent fit. The
proposed *DSM-5* PTSD model demonstrated superior fit over the *DSM-5*-adapted PTSD dysphoria model. Wald’s tests of parameter constraints were used to test the relationship between PTSD’s and MDD’s factors and indicated that PTSD's negative alterations in arousal factor and avoidance factor were more strongly related to depression's somatic factor than non-somatic factor; PTSD's negative alterations in cognitions and mood factor was more strongly related to depression's non-somatic factor than its somatic factor. This study furthers a nascent line of research examining the relationship between PTSD’s and MDD’s factors in order to better understand the nature of the high comorbidity rates between the two disorders and provides an initial analysis of the new diagnostic criteria for PTSD.
Acknowledgements

This dissertation would not have been possible without the guidance and encouragement from my mentor, Dr. Jon Elhai. I have thrived as a graduate student and researcher due to Dr. Elhai’s continuous support, high expectations, and the knowledge and skills he has provided to me over the past five years. I would also like to acknowledge my committee members, Drs. Laura Seligman, Jason Rose, Marijo Tamburrino and Scott Molitor, for their advice and suggestions throughout this process.

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Chapter One

Literature Review

A. Introduction

The substantial comorbidity between Posttraumatic Stress Disorder (PTSD) and Major Depressive Disorder (MDD) has been well documented. For instance, the National Comorbidity Survey (NCS) conducted by Kessler and colleagues found that 48% of individuals diagnosed with PTSD were also diagnosed with major depression in their lifetimes (Kessler, Sonnega, Bromet, Hughes, & Nelson, 1995), and in the NCS Replication 55% of individuals with PTSD were diagnosed with major depression in their lifetimes (Elhai, Grubaugh, Kashdan, & Frueh, 2008). A nascent line of research has involved an examination of the latent factors - or underlying symptom dimensions - between PTSD and MDD to determine if the comorbidity rates can be explained in terms of the relationships between specific latent factors of the disorders. Only a handful of studies have been conducted that examine the relationship between MDD’s and PTSD’s factors, but this line of research has provided promising leads into the nature of the comorbidity between these two disorders. However, this is a new line of research and as such there are many unanswered questions regarding the relationship between PTSD and MDD’s latent factors. It is especially questionable how well these previous studies will generalize to the PTSD model being proposed for the fifth edition of the *Diagnostic and Statistical Manual of Mental Disorders (DSM-5)*. The proposed study will evaluate the relationship of the *DSM-5* PTSD model’s latent factors with the latent factors of MDD, thus expanding upon a new line of research. This study will also provide an initial analysis of the fit of the *DSM-5* PTSD model and will compare this model to a modified
PTSD model which includes a dysphoria factor. This study focuses on the relationship between PTSD's and MDD's factors given that MDD has the highest comorbidity rates with PTSD with the exception of alcohol abuse/dependence among males.

**B. Background Information**

Both PTSD and MDD are relatively common mental disorders. It is estimated that the lifetime prevalence of PTSD is 8% (American Psychiatric Association, 2001; Kessler, et al., 1995) and 16.6% for MDD (Kessler, Berglund, Demler, Jin, Merikangas et al., 2005). Exposure to a traumatic event in itself is a common experience with 60.7% of male and 51.2% of female subjects in the National Comorbidity Survey endorsing at least one traumatic event (Kessler, et al., 1995). A study on the prevalence of civilian traumas and PTSD found a higher rate of trauma exposure among women, with 68.8% of female subjects endorsing at least one traumatic event (Resnick, Kilpatrick, Dansky, Saunders, & Best, 1993).

A meta-analysis conducted by Brewin, Andrews, and Valentine (2000) examined various risk factors for PTSD. The study found that the strongest risk factors for PTSD were a lack of social support (weighted $r = .40, p < .001$) and life stress (weighted $r = .32, p < .05$; posttrauma variables). The next strongest risk factor was trauma severity (weighted $r = .23, p < .001$). The other variables investigated in this meta-analysis were pretrauma variables such as gender, race, previous traumas, and previous psychiatric history which also reliably predicted PTSD (weighted $rs$ ranged from .05 to .19 and all significant at the $p < .05$ level), but did not demonstrate as strong of effect sizes as the variables that operated during or after the trauma. Similarly, another meta-analysis conducted by Ozer, Best, Lipsey and Weiss (2003) found that the strongest predictor of
PTSD was peritraumatic dissociation (weighted $r = .35$) followed by perceived social support (weighted $r = -.28$) and perceived life threat and peritraumatic emotional response (weighted $rs = .26$). The remaining variables were pretrauma variables such as history of prior trauma, and psychological problems prior to the trauma. These variables also demonstrated reliable, but small effect sizes (all weighted $rs = .17$). All variables were significant at the $p < .05$ level.

A prospective longitudinal study conducted by Lewinsohn, Hoberman, and Rosenbaum (1988) examined the risk factors for unipolar depression from a community sample of nearly 10,000 adults. This study found that younger age, female gender, previous episodes of depression, the presence of depressogenic cognitions, elevated levels of depression, and elevated levels of stress predicted the occurrence of depression approximately one year after an initial interview among subjects who were not depressed during the first interview.

Several causal pathways have been proposed to explain the nature of the comorbidity between PTSD and MDD. For example, it has been proposed that pre-existing major depression increases the risk of developing PTSD following a traumatic event (Breslau, Davis, Peterson, & Schultz, 1997; Bromet, Sonnega, & Kessler, 1998). Another hypothesis is that PTSD increases the risk for the first occurrence of a major depressive episode (Breslau, et al., 1997; Kessler, et al., 1995).

Previous research has shown that individuals with comorbid depression and PTSD generally experience greater impairment compared to those who develop only one disorder following a traumatic event, and that these individuals experience more distress, greater role impairment, and remit less readily after six months compared to individuals
who only suffer from PTSD (Blanchard, Buckley, Hickling, & Taylor, 1998). Another study found that individuals with MDD and PTSD were more likely to experience more severe depression, more suicidal ideation and have less social support compared to individuals who were only diagnosed with MDD (Campbell, Felker, Liu, Yano, Kirchner et al., 2007).

C. PTSD-MDD Comorbidity

Several theories have been proposed to explain the significant comorbidity rates between PTSD and MDD. For instance, some researchers have pointed to the overlapping symptoms between DSM-IV MDD and PTSD (i.e., difficulties with sleep, concentration and anhedonia) and have suggested that removing the overlapping items may reduce comorbidity rates (Spitzer, First, & Wakefield, 2007). However, a study by Elhai et al. (2008) found instead that removing overlapping items had negligible effects on comorbidity rates (after removing overlapping items, comorbidity rates dropped nominally from 54.72% to 54.41% in the NCS Replication dataset). Similar results were found in a study by Grubaugh, Long, Elhai, Frueh, and Magruder (2010) which used a military sample, and a study conducted by Ford, Elhai, Ruggiero, and Frueh (2009) which used an adolescent sample from the National Survey of Adolescents. Although item overlap does not appear to be responsible for the comorbidity between PTSD and depression, some of the somatic items of depression have been found to be most related to PTSD's constructs (Biehn, Contractor, Elhai, Tamburrino, Fine et al., 2013; Elhai, Contractor, Palmieri, Forbes, & Richardson, 2011). Therefore, it may be that it is the similarity between PTSD's factors and depression's somatic factor that is responsible for this apparent contradiction.
Another prevailing hypothesis regarding the high PTSD-depression comorbidity is that there is a shared underlying latent mechanism behind depression and PTSD. Watson (2005, 2009) proposed that mood and anxiety disorders are defined by a higher order negative affect factor which subsumes a broad range of negative emotional states including fear, anger, and sadness. Watson proposed that this higher order factor accounts for the high rates of comorbidity among mood and anxiety disorders. Thus, negative affect may account for the substantial comorbidity rates between depression and PTSD. As discussed below, PTSD has a robust, empirically-supported latent factor of dysphoria that is conceptually similar to the general negative affect construct (Simms, Watson, & Doebbeling, 2002). In a study conducted by Simms et al. (2002) the researchers found that the dysphoria factor correlated .80 with depression scale measures, whereas the dysphoria factor correlated between .51 and .61 with other PTSD measures indicating that the PTSD dysphoria factor is more related to depression than it is to PTSD.

Furthermore, in Watson's tripartite model of mood and anxiety disorders which is comprised of bipolar, distress, and fear factors, both PTSD and MDD are a part of the distress disorders factor. Watson noted that disorders that fall into the same factor are expected to have higher comorbidity rates compared to disorders that are a part of other factors. However, it should be noted that PTSD displayed relatively weak factor loadings for the distress factor (the factor loading for PTSD on the distress factor was only -.39 compared to the other factors which had factor loadings that ranged from -.64 to -.83), and Watson suggests that the dysphoria factor is primarily responsible for PTSD's placement in the distress factor.
Factor analysis is a relatively under-utilized approach to examining issues of comorbidity between mental disorders. The use of factor analysis can help to elucidate the nature of comorbidity by examining which underlying factors of a disorder are more highly correlated with factors of another similar mental disorder. This line of research can be used to test the construct validity of a disorder (e.g., its uniqueness as a disorder) in a more refined manner than by examining comorbidity between crudely measured, observed diagnostic variables.

D. Confirmatory Factor Analysis

Confirmatory factor analysis is a form of structural equation modeling in which a model that is comprised of latent (i.e., unobserved or exogenous) variables and observed variables is analyzed using an a priori approach. A model is specified prior to data collection and the data are fitted to the specified model and fit statistics are used to determine how well the data fit the model. This approach is superior to post hoc (e.g., exploratory factor analysis) approaches because sample-specific features of the data can influence the fit of the model (Kline, 2010).

The steps for completing a CFA study are as follows: 1) Specify the model. The hypothesized model to be analyzed is represented by a diagram or as a series of equations. 2) Model identification. It is necessary to determine if a model can be derived by a unique estimate of every model parameter. 3) Select measures and collect data. 4) Evaluate model fit using fit statistics. The data are fitted to the model to determine how well the model explains the data. Models with poor fit statistics are respecified. 5) Interpret parameter estimates including the factor intercorrelations, factor means, factor
loadings, and error terms to determine if the estimates of the model parameters are meaningful. 6) Consider equivalent or near-equivalent models and determine if the model tested is superior to other theoretically possible models.

Model specification (step 1) should include potential causal variables that are expected to influence the construct under investigation. Model specification is limited by model complexity, or the total number of parameters than can be estimated. The total number of parameters that can be estimated is limited by the number of observations, or the number of entries in the sample covariance matrix in lower diagonal form. The following rule calculates the number of observations: \( v(v + 1)/2 \), where \( v \) is the number of observed variables. The difference between the number of observations and the number of the model's parameters is the model degrees of freedom, represented by the following equations: \( df_M = p - q \).

Figure 1.1 displays a standard CFA model with two latent factors (A and B) with 6 indicators (X1 - X6). This model represents the hypothesis that indicators X1-X3 measure factor A and that indicators X4-X6 measure factor B and that factors A and B covary. Each indicator also has an error term (E1 - E6). The lines with single arrowheads represent presumed causal effects and are called factor loadings and are interpreted as regression coefficients. The numeral (1) which is next to each path are the scaling constants that assigns a metric to the factors and is necessary for model identification. A correlation matrix with standard deviations is derived from the observed variables (X1-X6).
The next step of conducting a CFA involves model identification, which evaluates whether it is theoretically possible to derive a unique set of model parameter estimates. There are two necessary, but insufficient requirements for model identification: 1) The model degrees of freedom must be at least zero \((d_{f_M} \geq 0)\); and 2) Every latent variable (including the residual terms) must be assigned a scale (metric). The first requirement can be met by a "just-identified" or saturated model in which there is a unique solution to the model, but this model does not test a particular hypothesis. An "over-identified" model \((d_{f_M} = 0)\) has more observations than parameters. An over-identified model may not perfectly reproduce the data, which has important implications for model testing. The second requirement of scaling latent variables can be accomplished by creating a unit loading identification constraint, which means that the path coefficient for the direct effect of a measurement error is fixed to equal 1, and fixing the unstandardized loading for the direct effect of any indicators to equal 1. An additional requirement for identifying
a standard CFA model that is pertinent to this study, is that a standard CFA model with factors that are greater than or equal to 2, must have 2 or more indicators per factor in order to be identified (Kline, 2010).

After the model is specified, the population parameters are estimated in order to minimize the differences between the observed and estimated population covariance matrices. Maximum-likelihood estimation is predominately used, which is an iterative procedure which minimizes the differences between the sample variance/covariance matrix and the estimated population variance matrix. Once the CFA model has been specified and estimated, the model is then evaluated using fit statistics in order to determine if the fit of the covariance matrix implied by the specified model is close enough to the sample covariance matrix that the differences might be reasonably considered to be due to sampling error (Kline, 2010).

E. PTSD’s Factor Structure

PTSD’s factor structure has largely been validated using the symptom criteria of PTSD from the *DSM-IV-TR* (4th edition- Text Revision; American Psychiatric Association, 2001). The *DSM-IV-TR* organizes the 17 symptoms of PTSD into three symptom clusters of Reexperiencing, Avoidance/Numbing, and Hyperarousal (see Table 1.1). In this model, five reexperiencing symptoms are mapped onto the reexperiencing factor, two avoidance and five numbing symptoms are mapped onto the avoidance/numbing factor, and the five hyperarousal symptoms are mapped onto the hyperarousal factor. This tripartite model has been extensively analyzed using confirmatory factor analysis (CFA), and research demonstrates that two other models of PTSD demonstrate superior fit (reviewed in Elhai & Palmieri, 2011). One of these better
fitting models is the emotional numbing model proposed by King, Leskin, King, and Weathers (1998) which organizes the 17 PTSD symptoms into four intercorrelated factors of reexperiencing, avoidance, numbing, and hyperarousal (see Table 1.1). This model is essentially identical to the DSM-IV-TR’s model of PTSD except that the avoidance and numbing symptoms are separated into their own separate factors. In this model, the five reexperiencing symptoms continue to be mapped onto the reexperiencing factor, the two avoidance items are mapped onto their own avoidance factor and the five numbing symptoms map onto their own numbing factor, and the five hyperarousal symptoms continue to be mapped onto the hyperarousal factor. The disaggregation of the avoidance and emotional numbing symptoms is consistent with the theoretical and empirical findings which suggest that these two constructs represent distinct constructs within PTSD. PTSD researchers note that although effortful avoidance and numbing are both coping mechanisms which alleviate painful emotional reminders of the trauma, the underlying process is thought to be different. For example, Foa and colleagues (1992) theorized that avoidance is regulated by a conscious and effortful process to escape intrusive symptoms, while numbing is mediated by a more unconscious mechanism to diminish emotional pain.

Consistent with this theory, empirical studies have provided further evidence suggesting that these two PTSD constructs should not be combined together into a single category and should instead be regarded as two distinct mechanisms. In addition to factor analytic research finding that avoidance and numbing constitute different factors, there are several other lines of research that support this conceptualization of PTSD. For example, in their review, Asmundson, Stapleton, and Taylor (2004) noted that numbing
and avoidance have different correlations with other psychological constructs, are differentially affected by PTSD treatment, and have different effects on the prognosis of PTSD.

The other PTSD model to obtain empirical and theoretical support is the dysphoria model proposed by Simms, Watson, and Doebbeling (2002). This model is similar to the emotional numbing model except that three hyperarousal symptoms (difficulty concentrating, difficulty sleeping, and irritability) are combined with the emotional numbing items to form an eight factor dysphoria construct (see Table 1). Thus the remaining hyperarousal factor in the dysphoria model contains only two of the emotional numbing model’s hyperarousal items. In this model, the five reexperiencing symptoms continue to be mapped onto the reexperiencing factor, the avoidance symptoms map onto an avoidance factor, the five numbing and three hyperarousal items are mapped onto a dysphoria factor, and the two remaining hyperarousal symptoms are mapped onto a hyperarousal factor. Simms and colleagues (2002) noted that recent theories of anxiety disorders posit that there is a general distress or negative affectivity component which includes symptoms of insomnia, irritability, and impaired concentration. Many theorists have suggested that the substantial comorbidity that exists among anxiety disorders can be explained by these negative affectivity or dysphoria symptoms (Watson, 2005, 2009). Both four-factor PTSD models have been extensively studied using CFA and have demonstrated good fit among different trauma-exposed samples and when using a variety of PTSD instruments (reviewed in Elhai & Palmieri, 2011; Yufik & Simms, 2010). Specifically, the King model (1998) demonstrated superior fit in trauma-exposed samples.
Table 1

DSM-IV-TR PTSD Models

<table>
<thead>
<tr>
<th>PTSD Symptom</th>
<th>DSM-IV</th>
<th>Emotional Numbing</th>
<th>Dysphoria</th>
</tr>
</thead>
<tbody>
<tr>
<td>B1: Intrusive thoughts</td>
<td>R</td>
<td>R</td>
<td>R</td>
</tr>
<tr>
<td>B2: Nightmares</td>
<td>R</td>
<td>R</td>
<td>R</td>
</tr>
<tr>
<td>B3: Reliving trauma</td>
<td>R</td>
<td>R</td>
<td>R</td>
</tr>
<tr>
<td>B4: Emotional cue reactivity</td>
<td>R</td>
<td>R</td>
<td>R</td>
</tr>
<tr>
<td>B5: Physiological cue reactivity</td>
<td>R</td>
<td>R</td>
<td>R</td>
</tr>
<tr>
<td>C1: Avoidance of thoughts</td>
<td>A/N</td>
<td>A</td>
<td>A</td>
</tr>
<tr>
<td>C2: Avoidance of reminders</td>
<td>A/N</td>
<td>A</td>
<td>A</td>
</tr>
<tr>
<td>C3: Trauma-related amnesia</td>
<td>A/N</td>
<td>N</td>
<td>D</td>
</tr>
<tr>
<td>C4: Loss of interest</td>
<td>A/N</td>
<td>N</td>
<td>D</td>
</tr>
<tr>
<td>C5: Feeling detached</td>
<td>A/N</td>
<td>N</td>
<td>D</td>
</tr>
<tr>
<td>C6: Feeling numb</td>
<td>A/N</td>
<td>N</td>
<td>D</td>
</tr>
<tr>
<td>C7: Hopelessness</td>
<td>A/N</td>
<td>N</td>
<td>D</td>
</tr>
<tr>
<td>D1: Difficulty sleeping</td>
<td>H</td>
<td>H</td>
<td>D</td>
</tr>
<tr>
<td>D2: Irritable/angry</td>
<td>H</td>
<td>H</td>
<td>D</td>
</tr>
<tr>
<td>D3: Difficulty concentrating</td>
<td>H</td>
<td>H</td>
<td>D</td>
</tr>
<tr>
<td>D4: Overly alert</td>
<td>H</td>
<td>H</td>
<td>H</td>
</tr>
<tr>
<td>D5: Easily startled</td>
<td>H</td>
<td>H</td>
<td>H</td>
</tr>
</tbody>
</table>

Note: R: Reexperiencing; A: Avoidance; N: Numbing; H: Hyperarousal; D: Dysphoria

of the elderly (Schinka, Brown, Borenstein, & Mortimer, 2007), medical patients (Naifeh, Elhai, Kashdan, & Grubaugh, 2008), cancer survivors (DuHamel, Ostrof, Ashman, Winkel, Mundy et al., 2004), community violence victims (Marshall, 2004), sexually harassed women (Palmieri & Fitzgerald, 2005), refugees (Palmieri, Marshall, & Schell, 2007), college students (Elhai, Gray, Docherty, Kashdan, & Kose, 2007), and veterans (Biehn, Elhai, Fine, Seligman, & Richardson, 2012; McDonald, Beckham, Morey, Marx, Tupler et al., 2008). Additionally, the dysphoria model (2002) demonstrated superior fit in trauma-exposed samples of college students living in New York at the time of the 9/11 terrorist attack (Baschnagel, O’Connor, Colder, & Hawk, 2005), victims of whiplash
(Elklin & Shevlin, 2007), intimate partner violence victims (Krause, Kaltman, Goodman, & Dutton, 2007), disaster workers exposed to ground zero (Palmieri, Weathers, Difede, & King, 2007), the bereaved (Boelen, van den Bout, & de Keijser, 2003), and deployed and non-deployed veterans (Simms, et al., 2002). However, it is important to note that the observed variables and latent factors of both models correspond with the DSM-IV-TR’s conceptualization of PTSD.

F. Depression’s Factor Structure

There is less research regarding the factor structure of MDD, and the resulting factor structure often differs depending on which depression instrument was used to assess depressive symptoms. One commonly used depression measure that has been factor analyzed is the Patient Health Questionnaire-9 (PHQ-9). The PHQ-9 is self-report measure of depression and maps directly onto the DSM-IV symptom criteria for a major depressive episode (MDE) (Kroenke, Spitzer, & Williams, 2001). Studies that used the PHQ-9 to analyze depression’s factor structure have found support for a unidimensional depression model (Baas, Cramer, Koeter, Van de Lisdonk, Van Weert et al., 2011; Cameron, Crawford, Lawton, & Reid, 2008; Dum, Pickren, Sobell, & Sobell, 2008; Huang, Chung, Kroenke, Delucchi, & Spitzer, 2006; Kalpakjian, Toussaint, Albright, Bombardier, Krause et al., 2009) and a two-factor model (Krause, Bombardier, & Carter, 2008; Krause, Reed, & McArdle, 2010; Richardson & Richards, 2008).

Only one known study has empirically tested the several PHQ-9 depression factor models using CFA (Elhai, Contractor, Tamburrino, Fine, Prescott et al., 2012). Using a large epidemiological sample of military soldiers, this study compared four competing PHQ-9 models of depression, including a unidimensional model, and several two-factor
models with items loading onto a somatic or non-somatic factor. This study found the most support for a two-factor model proposed by Krause, Reed, and McArdle (2010), with one factor comprising five somatic items (sleep changes, appetite disturbances and feeling tired, difficulty concentrating and psychomotor changes) and the other factor primarily based on four non-somatic or affective items (anhedonia, depressed mood, suicidal thoughts, and feelings of worthlessness or guilt) (see Table 2).

Table 2

*Krause’s Major Depressive Disorder Model*

<table>
<thead>
<tr>
<th>Depression Symptom</th>
<th>Factor</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Depressed mood</td>
<td>Non-Somatic</td>
</tr>
<tr>
<td>2. Loss of interest</td>
<td>Non-Somatic</td>
</tr>
<tr>
<td>3. Weight loss/weight gain</td>
<td>Somatic</td>
</tr>
<tr>
<td>4. Insomnia/hypersomnia</td>
<td>Somatic</td>
</tr>
<tr>
<td>5. Psychomotor retardation or agitation</td>
<td>Somatic</td>
</tr>
<tr>
<td>6. Loss of energy</td>
<td>Somatic</td>
</tr>
<tr>
<td>7. Feelings of worthlessness</td>
<td>Non-Somatic</td>
</tr>
<tr>
<td>8. Difficulty concentrating</td>
<td>Somatic</td>
</tr>
<tr>
<td>9. Suicidal ideation</td>
<td>Non-Somatic</td>
</tr>
</tbody>
</table>

A meta-analysis conducted by Shafer (2006) examined the factor structure of the Beck Depression Inventory (Beck, Ward, Mendelson, Mock, & Erbaugh, 1961), Center for Epidemiological Studies-Depression Scale (CES-D) (Radloff, 1977), Hamilton Rating Scale for Depression (HRSD) (M. Hamilton, 1960; M. Hamilton, 1967), and Zung Self-Rating Depression Scale (SDS) (Zung, 1965). The meta-analysis found the strongest support for the four-factor model of the CES-D which was comprised of factors of "depressive affect," "positive affect," "somatic complaints and retarded activity," and "interpersonal problems" (Radloff, 1977). Shafer noted that the three-factor structure of the BDI which comprised negative attitudes toward self, performance impairment, and
somatic disturbances (Beck, Steer, & Garbin, 1988) also had strong support. It should be noted that the meta-analysis found that all four measures were comprised of a general depression factor and somatic symptoms factor.

**G. Factor Analysis of Models that Combine MDD and PTSD Factors**

Factor analytic studies which examined the covariation between PTSD’s and depression’s latent factors have found that PTSD’s factors have correlated most strongly with depression’s somatic factor. This finding has recently led PTSD researchers to hypothesize that it is the somatic aspect of these disorders that is contributing to their high comorbidity (Elhai, Contractor, et al., 2011).

This burgeoning line of research has thus far utilized the Simms et al. (2002) dysphoria model of PTSD to examine the latent factors of depression and PTSD. This is because the Simms model comprises a dysphoria factor which is conceptually similar to depression. One study which conducted a factor analysis of depression (somatic and non-somatic) and PTSD (reexperiencing, avoidance, dysphoria, and hyperarousal) found that both dysphoria and hyperarousal correlated significantly more strongly with the somatic factor of depression ($r_s = .69$ and $.51$, respectively) compared to the non-somatic factor of depression (Biehn, et al., 2013).

Similar results were found in a study that analyzed the factor structure of PTSD and depression. Specifically, this study found that the PTSD dysphoria factor demonstrated a strong relationship with the CES-D’s depressive affect ($r = .77$) and somatic problems ($r = .84$) factors, compared to the positive affect ($r = -.45$) and interpersonal problems ($r = .65$) factors (Elhai, Contractor, et al., 2011).
In both of these studies on the PTSD-MDD factor structure, PTSD’s dysphoria factor and depression’s somatic factor demonstrate the strongest intercorrelation. However, it is important to note that other PTSD factors also show strong and significant correlations with depression’s somatic factor. For example, in the study by Biehn et al. (2013), both the hyperarousal and avoidance factor correlated significantly with the somatic factor (rs = .51 and .43). Interestingly, the non-somatic factor of depression from Krause’s (2010) depression model has not demonstrated to correlate more strongly with any PTSD factor compared to the somatic factor. In the CES-D study conducted by Elhai et al. (2011) depression factors that are non-somatic in nature (e.g., the depressive affect factor and interpersonal problems factor) only demonstrated significant correlations with the dysphoria factor of PTSD.

It is especially important to study the combined factor structure of PTSD and depression rather than the factor structure of each disorder in isolation given that previous research has found that PTSD and depression following a traumatic event may represent the same construct (Elhai, Carvalho, Miguel, Palmieri, Primi et al., 2011; O’Donnell, Creamer, & Pattison, 2004). Specifically, the O’Donnell et al. study found that individuals who develop PTSD and depression following a traumatic event are indistinguishable from individuals who develop solely PTSD based on several predictor variables whereas individuals who develop depression alone could be differentiated by several variables from individuals who develop comorbid PTSD and depression. The authors of this study concluded that the psychopathology in the aftermath of a traumatic event is best conceptualized as a general traumatic stress factor and that conceptualizing PTSD and depression as separate disorders following a traumatic event may be
inaccurate. Similar results were obtained in the Elhai, Carvalho et al. (2011) study that found a single latent underlying dimension behind PTSD and depression.

**H. DSM-5’s Model of PTSD**

When the newest edition of the *DSM* is released in 2013, there will be several significant changes to the diagnostic criteria for PTSD including changes to the traumatic stressor criterion, separation of avoidance symptoms into its own symptom cluster, and a substantially expanded symptom cluster of negative alterations in mood and cognitions based on the emotional numbing cluster. In addition, it has been proposed that PTSD will be placed in a new diagnostic category entitled ‘Trauma and Stressor Related Disorders’ rather than being placed in the Anxiety Disorders category (Friedman, Resick, Bryant, Strain, Horowitz et al., 2011).

Although changes to the traumatic stressor criterion (Criterion A) will not affect the symptom structure of PTSD, it will affect eligibility for a PTSD diagnosis. In the *DSM-IV* the traumatic stressor criterion was separated into objective (A1) and subjective (A2) components. The A1 criterion involved experiencing or witnessing an event that involved actual or threatened bodily harm or death, and the A2 criterion stated that the event must have evoked intense fear, helplessness, or horror at the time of the event. The A criterion was criticized for being too broad to remain meaningful (Elhai, Kashdan, & Frueh, 2005; McNally, 2003). Perhaps in response to these concerns, the traumatic stressor criterion has been tightened and the A2 criterion (feelings of intense helplessness, fear or horror at the time of the event) has been removed in the *DSM-5* proposal. The new criteria does not permit the witnessing of a traumatic event through
media exposure to qualify as a traumatic event unless if the exposure is work related (Friedman, Resick, Bryant, & Brewin, 2011).

Only minor changes in wording have been proposed to the intrusions symptom cluster. The intrusion symptom criterion includes involuntary distressing memories or dreams of the traumatic event, flashbacks, intense or prolonged psychological distress at internal or external cues of the traumatic event, and marked physiological reaction to reminders of the traumatic event. These symptoms are mostly unchanged from *DSM-IV* criteria (Friedman, Resick, Bryant, & Brewin, 2011).

In *DSM-IV*, the avoidance symptoms were placed with the numbing symptoms to form a larger avoidance/numbing symptom cluster. As discussed earlier, empirical research does not support the notion that avoidance and numbing symptoms form a unitary construct. As such, the avoidance symptoms now form their own separate symptom cluster (Criterion C) in the *DSM-5* proposal. Avoidance symptoms include avoidance of internal reminders (thoughts, feelings, physical sensation) or external reminders (people, places, conversations) of the traumatic event. There are two avoidance symptoms in the proposed *DSM-5* PTSD diagnostic criteria and these symptoms have remained mostly unchanged from the *DSM-IV*.

A new symptom cluster entitled ‘Negative alterations in cognitions and mood’ (Criterion D) has been proposed for the *DSM-5* PTSD diagnostic criteria. Symptoms include psychogenic amnesia, persistent and exaggerated negative expectations about oneself, others, or the world, persistent distorted blame of self or others about the cause or consequences of the traumatic event(s), pervasive negative emotional state, diminished interest, feeling detached from others, and an inability to experience positive emotions.
Many of these symptoms fell into the emotional numbing symptom cluster of the *DSM-IV*, but the symptoms related to blame and persistent negative emotional states are new to the diagnostic criteria. This symptom cluster now has a greater emphasis on depressive content in addition to the emotional numbing symptoms so it may be thought of as a hybrid between the emotional numbing factor of the King et al. (1998) model and the dysphoria factor of the Simms model (2002).

The final symptom cluster ‘Alterations in arousal and reactivity’ (Criterion E) is similar to the *DSM-IV*’s hyperarousal symptom cluster. Symptoms include reckless behavior, irritability or aggressiveness, hypervigilance, exaggerated startle response, problems concentrating, and sleep disturbance. The symptom of recklessness is new to the diagnostic criteria of PTSD, leaving the remaining symptoms relatively unchanged from the *DSM-IV*’s hyperarousal criterion.

A study by Elhai and colleagues (2012) investigated the proposed changes to the diagnostic criteria of PTSD, evaluating the *DSM-5* model using CFA and determining changes in PTSD prevalence rates. The goodness-of-fit statistics from the CFA indicated that the *DSM-5*’s model fit the data well. They reported that the factor loadings of the symptoms loaded well onto their respective factors, with factor loadings ranging from .68 to .93. The researchers examined model alterations including specifying the reckless behavior item to load onto the negative alterations in mood and cognitions factor, and a five factor model which split the three newly proposed negative alterations in mood and cognitions symptoms into a unique factor. Neither model variation resulted in a superior fit to the data above the *DSM-5* proposed model.
I. Study Aims and Research Questions

The proposed study will use CFA to analyze the factor structure of PTSD and MDD according to the *DSM-5*’s symptom criteria for these disorders. The following research questions will be investigated: (1) Do factor analytic results support the proposed *DSM-5* symptom criteria for PTSD? (2) Does a model alteration which has three items from the negative alterations in arousal cluster (difficulty sleeping, difficulty concentrating, and irritability) instead loading onto the negative alterations in mood and cognitions (forming a broader dysphoria factor) fit the data better than the *DSM-5* model? The reckless behavior item will remain within the negative alterations in arousal cluster based on a previous study which tested whether this item loaded better on the arousal or dysphoria factor and found that it fit better in the arousal factor (Elhai, Miller, et al., 2012). (3) What is the relationship between the latent factors of the *DSM-5*’s PTSD model with major depression’s latent factors?

Several hypotheses were tested. First, it was hypothesized that the *DSM-5* PTSD model would demonstrate good fit, given that a recent study which examined this model found that the model fit the data well (Elhai, Miller, et al., 2012). It was also hypothesized that the dysphoria model may fit the data better given the widespread empirical support for the dysphoria model when using the *DSM-IV-TR*’s PTSD symptoms (Yufik, et al., 2010). Second, it was expected that PTSD’s negative alterations in arousal factor will correlate more strongly with depression’s somatic factor compared to its non-somatic factor given the item overlap between these two factors (i.e., difficulty sleeping and difficulty concentrating) and because of the somatic focus of the arousal factor (Biehn, et al., 2013). Third, it was further hypothesized that in contrast to
depression’s somatic factor, the depression non-somatic factor will correlate more strongly with PTSD’s mood and cognitions factor given that the latter two constructs both tap into negative affect. Fourth and finally, it was hypothesized that the avoidance factor will correlate more strongly with the somatic factor, and the reexperiencing factor will not correlate more strongly with either the somatic or non-somatic factors given recent empirical findings. These hypotheses are based on a study conducted by Biehn et al. (2013) which also investigated the relationship between PTSD and depression factors and found that PTSD's avoidance factor was more related to depression's somatic factor and that reexperiencing was not differentially related to either somatic or non-somatic factors (Biehn, et al., 2013). (See Table 3 for a list of proposed comparisons).

Table 3

*Correlations tested with Wald's Chi-Square test*

<table>
<thead>
<tr>
<th>Correlation 1</th>
<th>Direction</th>
<th>Correlation 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Negative Alterations in Arousal with Somatic</td>
<td>&gt;</td>
<td>Negative Alterations in Arousal</td>
</tr>
<tr>
<td>Negative Alteration in Mood &amp; Cognitions with Non-Somatic</td>
<td>&gt;</td>
<td>with Mood &amp; Cognitions with Somatic</td>
</tr>
<tr>
<td>Reexperiencing with Somatic</td>
<td>=</td>
<td>Reexperiencing with Non-Somatic</td>
</tr>
<tr>
<td>Avoidance with Somatic</td>
<td>&gt;</td>
<td>Avoidance with Non-Somatic</td>
</tr>
</tbody>
</table>
Chapter 2
Method

A. Subjects

Participants were University of Toledo’s undergraduate psychology research subject recruited to partake in this online study. Subjects were recruited through the University of Toledo’s Sona Systems webpage, linking them to the web survey which was posted on the PsychData website. PsychData is a company that provides an internet-based platform for data collection to researchers, with a site license held by UT’s department of psychology. Data are stored on PsychData’s remote computer servers.

A pre-screening survey was required from all students registered with the university’s Sona Systems webpage. All students were administered a question from the Structured Clinical Interview for DSM-IV (SCID) (First, Spitzer, Gibbon, & Williams, 1996) PTSD module which inquires whether the respondent has been exposed to a traumatic event and provides some examples for possible traumas. Only subjects who endorse the screening question were eligible for study participation. A study found that the sensitivity of this trauma screen was 65.5% and specificity was 87.2% in a college sample (Elhai, Franklin, & Gray, 2008). This pre-screen was used only to establish study eligibility; trauma exposure and PTSD were more comprehensively assessed in the actual web survey protocol discussed below.

B. Materials.

a. Demographic Survey. Information regarding the subjects’ gender, age, ethnicity, education, employment, relationship status, and household income was collected.
b. Stressful Life Events Screen Questionnaire (SLESQ). The SLESQ (Goodman, Corcoran, Turner, Yuan, & Green, 1998) was used to assess traumatic event exposure. The SLESQ is a behaviorally specific self-report scale and includes 12 DSM-IV PTSD Criterion A1 traumatic stressors. For the purpose of this study, only the presence of traumas was queried, rather than additionally inquiring about characteristics of each traumatic event. A probing question was added to the witnessed exposure item to clarify whether the traumatic event was witnessed exclusively through electronic media. Furthermore, the question regarding repeated or extreme exposure to gruesome or horrific details of trauma was modified to query if the trauma was experienced exclusively through electronic media, and whether it occurred through one’s occupation so that it is consistent with the DSM-5’s diagnostic criteria. The modified SLESQ was used in a previous study examining the prevalence rates of PTSD using the DSM-5 diagnostic criteria (Elhai, Miller, et al., 2012). After completing the SLESQ, respondents were asked to nominate their most distressing traumatic event (if endorsing more than one) for later PTSD inquiry.

c. PTSD Checklist. The PCL (Weathers, Litz, Herman, Huska, & Keane, 1993) is a commonly used PTSD self-report measure (Elhai, Gray, Kashdan, & Franklin, 2005). Weathers adapted the PCL so that the items map directly onto the DSM-5’s symptom criteria for PTSD. Respondents indicated how distressed they were by each symptom over the past month by rating items on a five-point Likert-type scale (1 = “not at all” to 5 = “extremely”) (Weathers, Litz, Keane, Palmieri, Marx et al., 2010). The original PCL has demonstrated adequate reliability ($\alpha = .94$; test-retest $r = .88$) in various trauma-exposed populations (Ruggiero, Del Ben, Scotti, & Rabalais, 2003). The psychometric
properties of the PCL are reviewed in articles by McDonald and Calhoun (2010) and Wilkins et al. (2011). There is only one version of the PCL available to assess PTSD according to the DSM-5 (as compared to the PCL for the DSM-IV that has a military, civilian, and specific trauma versions). In this study participants were asked to anchor their ratings of items to their worst trauma.

**d. Patient Health Questionnaire-9.** Participants completed the PHQ-9 (Spitzer, Williams, Kroenke, Linzer, Verloin deGruy III et al., 1994). Traditionally, the PHQ-9 measures depression symptoms over the previous two weeks based on DSM-IV major depressive episode symptom criteria. However for this study, the instructions were modified in order to query depression symptoms during the past month – in accordance with the time-frame used for the PCL above. The PHQ-9 uses a Likert-type scale with four response options ranging from 0 = “Not at all” to 3 = “Nearly every day” to assess symptom severity. A study by Kroenke et al. (2001) examined the validity of using the PHQ-9 to detect and assess for depression, and found that internal consistency ranged from .86 to .89. Diagnostic validity was demonstrated in detecting an MDD diagnosis based on structured diagnostic interviews. Lastly, construct validity was reflected in the association of PHQ-9 severity scores and measures of functional status, number of disability days and difficulties based on symptoms (Kroenke, et al., 2001). There have been no proposed changes to the diagnostic criteria for MDD for the DSM-5 so no modifications of this measure were necessary.

**C. Exclusion Criteria and Missing Data**

A total of 519 subjects participated in the survey. There were 237 who endorsed no traumatic events and 15 who failed to respond to the item inquiring about their index
trauma, and these subjects were excluded from the data analysis. There was one additional subject who did not answer any items on the PCL and PHQ-9 and was excluded as well, leaving an effective dataset of 266. A power analysis based on 100 degrees of freedom determined that a minimum sample size of 132 would be needed to obtain a power or .80 (MacCallum, Browne, & Sugawara, 1996), and thus the sample of 266 provides sufficient power to conduct the CFA analyses.

Data were screened for missing data. There were nominal amounts of missing data from the PCL and PHQ-9 items. There were 236 (88.4%) complete cases from the PCL and 249 (93.3%) complete cases from the PHQ-9. Thirty participants were missing between 1 and 4 PCL items and 18 participants were missing between 1 and 2 PHQ-9 items. Missing data was treated using maximum likelihood (ML) procedures using the Mplus software (Graham, 2009).

D. Analyses

a. CFA Analyses. A total of 4 CFA analyses were conducted using Mplus 6.1 software. First, the proposed DSM-5 PTSD model was tested, and then the model alteration which has three items from the negative alterations in arousal factor loading onto a dysphoria factor was tested. See Table 4 for the PTSD models specification. Next, Krause's depression model of somatic and non-somatic factors was tested (see Table 4). Finally, a combined 6 factor model of the DSM-5 PTSD model and Krause's depression model was tested. For all CFA analyses, error covariances were fixed to zero, and factor variances were fixed to 1 to scale the factors within the model. All tests were two-tailed, with alpha set at .05, and all the factors were allowed to correlate.
Table 4

**DSM-5 PTSD Models**

<table>
<thead>
<tr>
<th>PTSD Symptoms</th>
<th>DSM-5</th>
<th>DSM-5-Dysphoria</th>
</tr>
</thead>
<tbody>
<tr>
<td>B1: Intrusive thoughts</td>
<td>R</td>
<td>R</td>
</tr>
<tr>
<td>B2: Nightmares</td>
<td>R</td>
<td>R</td>
</tr>
<tr>
<td>B3: Flashbacks</td>
<td>R</td>
<td>R</td>
</tr>
<tr>
<td>B4: Emotional cue reactivity</td>
<td>R</td>
<td>R</td>
</tr>
<tr>
<td>B5: Physiological cue reactivity</td>
<td>R</td>
<td>R</td>
</tr>
<tr>
<td>C1: Avoidance of thoughts</td>
<td>A</td>
<td>A</td>
</tr>
<tr>
<td>C2: Avoidance of reminders</td>
<td>A</td>
<td>A</td>
</tr>
<tr>
<td>D1: Trauma-related amnesia</td>
<td>NAMC</td>
<td>D</td>
</tr>
<tr>
<td>D2: Negative beliefs</td>
<td>NAMC</td>
<td>D</td>
</tr>
<tr>
<td>D3: Distorted blame</td>
<td>NAMC</td>
<td>D</td>
</tr>
<tr>
<td>D4: Persistent negative emotional state</td>
<td>NAMC</td>
<td>D</td>
</tr>
<tr>
<td>D5: Lack of interest</td>
<td>NAMC</td>
<td>D</td>
</tr>
<tr>
<td>D6: Feeling detached</td>
<td>NAMC</td>
<td>D</td>
</tr>
<tr>
<td>D7: Inability to experience positive emotions</td>
<td>NAMC</td>
<td>D</td>
</tr>
<tr>
<td>E1: Irritable/angry</td>
<td>AA</td>
<td>D</td>
</tr>
<tr>
<td>E2: Reckless behavior</td>
<td>AA</td>
<td>H</td>
</tr>
<tr>
<td>E3: Hypervigilance</td>
<td>AA</td>
<td>H</td>
</tr>
<tr>
<td>E4: Easily startled</td>
<td>AA</td>
<td>H</td>
</tr>
<tr>
<td>E5: Difficulty concentrating</td>
<td>AA</td>
<td>D</td>
</tr>
<tr>
<td>E6: Difficulty sleeping</td>
<td>AA</td>
<td>D</td>
</tr>
</tbody>
</table>

Note. R = Reexperiencing; A = Avoidance; N = Numbing; H = Hyperarousal; NM = Negative Alterations in Mood and Cognitions; AA = Alterations in Arousal; D = Dysphoria.

The PCL and PHQ-9 items were treated as ordinal since these measures have five or fewer response options (Elhai & Palmieri, 2011; Flora & Curran, 2004; Wirth & Edwards, 2007). Therefore, polychoric covariances matrices were created (rather than Pearson covariance matrices) and probit regression coefficients were used. Weighted least squares estimation with a mean and variance-adjusted chi-square (WLSMV) was used for model estimation, which is the preferred estimation for ordinal items (Flora, et al., 2004; Wirth, et al., 2007).
The following goodness-of-fit statistics were used to determine how well the model fits the sample data: the model chi-square test, root mean square error of approximation (RMSEA), comparative fit index (CFI), and Tucker-Lewis index (TLI). A chi-square value of zero or near zero indicates that the null-hypothesis of a correct model fit is not rejected. The established benchmark of an RMSEA value of .06 or less to indicate a close approximate fit and values between .06-.08 to indicate a reasonable error of approximation, and values of .10 or greater indicate poor fit are used to evaluate model fit. CFI and TLI values of .90 or greater were used to indicate a reasonably good fit, and values greater than .95 indicate excellent fit. These empirically-based benchmarks are discussed in several reviews (Hu & Bentler, 1998, 1999; Kline, 2010).

In order to determine whether the DSM-5’s PTSD model or the DSM-5 dysphoria model fits the data better, Bayesian Information Criterion (BIC) values were analyzed by recomputing analyses using ML estimation treating the ordinal variables as continuously scaled items. Because the models are non-nested (i.e., they are not subsets of each other) the traditional chi-square difference test is inappropriate in this case. The BIC values from the two models were subtracted, and a 10-point BIC difference would indicate that there is a 150:1 likelihood that the model with the lower BIC value fits best. A difference of 6 to 10 points indicates “strong” support for the model with a lower BIC value, and a difference greater than 10 points indicates “very strong” support (Raftery, 1995).

b. Wald’s Chi-square Test of Parameter Constraints. For the combined PTSD-MDD model, Wald’s chi-square test of parameter constraints were used to test whether specific PTSD model factors are more highly correlated with either the non-somatic or somatic factors of the depression model. See Section 1.8 and Table 1.3 for the list of pairs
of correlations that were tested. A chi-square value with a significance level of $p < .05$ indicates that the difference in the pair of correlations is different from 0.
Chapter 3

Results

A. Demographic Results

The majority of participants were female \((n = 194; 72.7\%)\). The average age of participants was 20.59 \((SD = 5.64)\). The majority of participants were either Caucasian \((n = 203; 76.0\%)\) or African American \((n = 62; 23.2\%)\). The remaining participants were either Native American \((n = 14; 5.2\%)\), Hawaiian/Pacific Islander \((n = 2; 0.7\%)\), or Asian \((n = 7; 2.6\%)\). There were 29 \((10.9\%)\) who identified themselves as having a Hispanic or Latino ethnic background. Nearly half of the participants were employed part-time \((n = 132; 49.4\%)\) while 82 participants stated they were unemployed students \((30.7\%)\), and 21 stated they were employed full-time \((7.9\%)\). Most participants were currently single \((n = 206; 77.2\%)\), while 50 participants were living with a significant other \((18.7\%)\), and 7 were married \((2.6\%)\). Most participants had a household income of less than $15,000 \((n = 74; 27.7\%)\). The average years of schooling completed was 12.97 \((SD = 1.21)\).

The most distressing traumatic event endorsed by participants was the death of a family member or close friend \((n = 116; 43.4\%)\), followed by being present when someone was killed or seriously injured \((n = 24; 9.0\%)\), and rape \((n = 18; 6.7\%)\). The average PCL score for participants was 42.91 \((SD = 17.94)\) and the average PHQ-9 score was 16.22 \((SD = 6.10)\). Kroenke, et al. (2001) reported that PHQ-9 scores greater than 10 result in a sensitivity of 88% and a specificity of 88% for detecting MDD. Participants
were asked how much distress (anxiety, worry, sadness, frustration, grief, anger, guilt, or shame) they have experienced about the event in the past month on a 6 point scale, with 6 indicating more distress. The average rating of distress was 3.80 with a standard deviation of 1.35.

B. CFA Results

Both the DSM-5 PTSD model and the dysphoria model adequately fit the data. The chi-square test of model fit was significant for all CFA models (DSM-5 PTSD model: $\chi^2_M (164) = 436.83, p < .0001$; the dysphoria model: $\chi^2_M (164) = 457.64, p < .0001$; Krause's depression model: $\chi^2_M (26) = 117.913, p < .0001$; and the combined PTSD-depression model: $\chi^2_M (362) = 776.691, p < .0001$) indicating that the data covariation model used in these analyses does not perfectly correspond to the predicted model covariation matrix. This finding is unsurprising due to the large sample size of the study as discussed above (see Table 5).

The approximate fit indexes indicated adequate to excellent fit for all models. Specifically, the CFI and TLI values all fell above .96 among all models (values greater than .95 indicate excellent fit), while RMSEA values were approximately .08 for both PTSD models (indicating an adequate fit), greater than .10 for Krause's depression model (indicating poor fit), and .066 for the combined model (indicating adequate fit (see Table 5 for exact fit indices). BIC values were calculated in order to compare the two PTSD models. The DSM-5 PTSD model had the lower BIC value with a differences of 14.38 points, indicating that the odds are greater than 150:1 odds that the DSM-5 PTSD model fits the data better. See Table 6 for BIC values.
Table 5

*Fit Statistics*

<table>
<thead>
<tr>
<th>Fit Statistics</th>
<th>DSM-5 PTSD Model</th>
<th>Dysphoria</th>
<th>Krause's Depression Model</th>
<th>Combined PTSD-Depression Model</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chi-Square</td>
<td>( \chi^2 (164) = 436.83 )</td>
<td>( \chi^2 (164) = 457.64 )</td>
<td>( \chi^2 (26) = 117.913 )</td>
<td>( \chi^2 (362) = 776.691 )</td>
</tr>
<tr>
<td>RMSEA</td>
<td>.079</td>
<td>.082</td>
<td>.115</td>
<td>.066</td>
</tr>
<tr>
<td>CFI</td>
<td>.973</td>
<td>.971</td>
<td>.974</td>
<td>.965</td>
</tr>
<tr>
<td>TLI</td>
<td>.969</td>
<td>.967</td>
<td>.963</td>
<td>.961</td>
</tr>
</tbody>
</table>

Table 6

*BIC Values*

<table>
<thead>
<tr>
<th>Model</th>
<th>BIC Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>DSM-5</td>
<td>14389.607</td>
</tr>
<tr>
<td>Dysphoria</td>
<td>14403.989</td>
</tr>
<tr>
<td>Difference</td>
<td>14.382</td>
</tr>
</tbody>
</table>

C. Wald Tests of Parameter Constraint Results

The hypothesis that the negative alterations in arousal would correlate more strongly with depressions somatic \( (r = .783) \) than the non-somatic factor \( (r = .712) \) was confirmed, \( \chi^2 (1) = 4.889, p = .027 \), as was the hypothesis that the negative alterations in mood and cognitions correlated more strongly with depression's non-somatic factor \( (r = .763) \) than with the somatic factor \( (r = .689) \), \( \chi^2 (1) = 6.744, p = .009 \). Unexpectedly, avoidance correlated more strongly with the somatic \( (r = .573) \) than non-somatic factor \( (r = .478) \), \( \chi^2 (1) = 6.448, p = .011 \), and the correlation between reexperiencing and somatic \( (r = .602) \) was not significantly greater than the correlation between reexperiencing and non-somatic \( (r = .551) \), \( \chi^2 (1) = 2.021, p = .155 \). See Table 7 for the results of Wald's Chi-
Square Parameter results and Table 8 for a list of factor correlations between PTSD's and depression's factors.

Table 7

**Correlations between somatic vs. non-somatic factors with PTSD factors**

<table>
<thead>
<tr>
<th>Correlation between factors</th>
<th>r value</th>
<th>Wald's Chi-Square</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reexperiencing and Somatic Reexperiencing and Non-Somatic</td>
<td>.602</td>
<td>$\chi^2 (1) = 2.021, p = .155$</td>
</tr>
<tr>
<td>Avoidance and Somatic Avoidance and Non-Somatic</td>
<td>.573</td>
<td>$\chi^2 (1) = 6.448, p = .011$</td>
</tr>
<tr>
<td>N.A.M.C. and Somatic N.A.M.C. and Non-Somatic</td>
<td>.689</td>
<td>$\chi^2 (1) = 6.744, p = .009$</td>
</tr>
<tr>
<td>N.A.A. and Somatic N.A.A. and Non-Somatic</td>
<td>.783</td>
<td>$\chi^2 (1) = 4.889, p = .027$</td>
</tr>
</tbody>
</table>

Note: N.A. M. C. = Negative alterations in Mood and Cognitions; N. A. A. = Negative alterations in Arousal

Table 8

**Factor Correlations**

<table>
<thead>
<tr>
<th></th>
<th>Re-ex.</th>
<th>Avoid.</th>
<th>N.A.M. C.</th>
<th>A.A.</th>
<th>Non-Som.</th>
<th>Somatic</th>
</tr>
</thead>
<tbody>
<tr>
<td>Re-ex.</td>
<td>.851</td>
<td>.782</td>
<td>.798</td>
<td>.551</td>
<td>.602</td>
<td></td>
</tr>
<tr>
<td>Avoid.</td>
<td>.727</td>
<td>.706</td>
<td>.478</td>
<td>.573</td>
<td></td>
<td></td>
</tr>
<tr>
<td>N.A.M. C.</td>
<td>.905</td>
<td>.763</td>
<td>.689</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>A.A.</td>
<td>.712</td>
<td></td>
<td>.783</td>
<td></td>
<td></td>
<td>.914</td>
</tr>
<tr>
<td>Non-Som.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Somatic</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Note: Re-ex = Reexperiencing; Avoid = Avoidance; N.A. M. C. = Negative alterations in Mood and Cognitions; A. A. = Alterations in Arousal; Non-Som. = Non-Somatic
Chapter 4

Discussion

A. The relationship between PTSD and MDD

This study provided an initial analysis of DSM-5’s PTSD model and insight into the relationship between PTSD and MDD. The results for the DSM-5 PTSD model are promising. The fit statistics for the proposed DSM-5 model fell in the adequate to excellent range. Although the model revision with a dysphoria factor also demonstrated adequate to excellent fit, the BIC difference test provides strong support that the DSM-5 model fit the data better. This suggests that the symptoms of difficulty sleeping, difficulty concentrating, and irritability are better explained by the hyperarousal construct than a dysphoria construct.

It should be noted, however, that the fit indices for the DSM-5 PTSD model and the dysphoria model were very similar, so even though the BIC values indicate that the DSM-5 PTSD model provides a better fit, the data still support the dysphoria model conceptualization of PTSD (Yufik, et al., 2010). Although this study found a superior fit for the DSM-5 PTSD model, it should be noted that a study by Biehn, et al. (2012) which examined differences in the factor structure between trauma-exposed veterans with and without a PTSD diagnosis found that the PTSD models fit better among the no-PTSD group compared to veterans with PTSD. That paper noted that researchers should be cautious when deriving conclusions on PTSD's factor structure when a predominately non-clinical trauma sample has been used. Therefore, future studies which compare the
DSM-5 PTSD model with alternate models should utilize a clinical sample of trauma-exposed individuals in order to ensure the results of the data generalize to the target population (i.e., individuals with clinical impairment following a trauma).

Wald's chi-square test of parameter constraints provided many unique insights into the comorbidity between the proposed DSM-5 PTSD model and depression. These tests indicated that there were strong correlations between PTSD's and depression's factors (ranging from .48 - .78). As expected, PTSD's alterations in arousal and avoidance factors correlated more strongly with depression's somatic factor. It is unsurprising that the negative alterations in arousal factor correlated more strongly the somatic factor given that most symptoms within that factor are somatic in nature (e.g., difficulty sleeping, difficulty concentrating, exaggerated startle response). This finding is also consistent with a previous study conducted by Biehn, et al. (2013) which found that PTSD's hyperarousal factor correlated more strongly with depression's somatic factor.

It was expected that the correlation between reexperiencing and depression's somatic factor would be greater than the correlation between reexperiencing and non-somatic factors, based on a pervious study (Biehn, et al., 2013), however, this hypothesis was not supported. The reexperiencing factor is comprised of both somatic symptoms (e.g., physiological reminders of trauma) and non-somatic symptoms (e.g., emotional reminders of trauma, intense recollections of the trauma), which could be responsible for the lack of significant correlations. Furthermore, the study by Biehn et al. (2013) utilized a military sample who had experienced combat-related trauma, and combat-related reexperiencing symptoms may be more physiologically distressing (Frueh, Grubaugh,
Elhai, & Buckley, 2007) than reexperiencing symptoms that are largely related to the
death of a loved one (the predominate index trauma in this study).

Also contrary to the initial hypotheses, the correlation between PTSD's avoidance
factor and depression's somatic factor was greater than the correlation between avoidance
and non-somatic factors. Since the diagnostic alterations to PTSD's reexperiencing and
avoidance symptoms are minor, it seems likely that the difference in results between this
study and the study by Biehn, et al. (2013) are due to differences in the sample rather
than differences in the DSM-5 diagnostic criteria. For instance, this study included a
college student sample where the most frequently reported distressing traumatic event
was the unexpected death of a loved one whereas the study by Biehn et al. (2013) utilized
a military sample who was older, predominately male, and experienced combat-related
traumas. It is possible that specific trauma populations could respond to PTSD symptom
clusters in different ways. For instance, trauma exposed college students may be able to
utilize non-adaptive avoidance strategies more readily given the less structured
environment they are living in whereas soldiers continuing to serve in the military may
not be able to avoid trauma-related reminders that are associated with the military given
their on-going military service.

It is interesting to note, that three out of the four PTSD symptoms clusters have
been found to be more significantly more related to depression's somatic factor between
this study and the study by Biehn, et al. (2013). Taken together, these results highlight the
important relationship between PTSD's factors and depression's somatic factor. However,
these results also highlight the need for further studies on the relationship between PTSD
and depression in order to determine if the significant correlations between PTSD's
factors of reexperiencing and avoidance with depression's somatic factor are due to sample characteristics or the nature of the comorbidity between PTSD and depression.

There was also a strong correlation between the negative alterations in cognitions and mood factor with depression's non-somatic factor, and this correlation with non-somatic is significantly greater than PTSD’s correlation with depression's somatic factor. There are conceptual similarities between these factors which explains this significant correlation (e.g., anhedonia, hopelessness). The negative alterations in mood and cognitions is similar to the dysphoria factor (i.e., most items relate to negative affectivity), but with the somatic symptoms of dysphoria removed (e.g., difficulty sleeping, difficulty concentrating). Furthermore, the new items that were added to the diagnostic criteria for PTSD are related to negative affect and cognitive depression, and these alterations also make this factor more related to depression's non-somatic factor. Future studies could compare the relationship between depression's factors with dysphoria versus negative alterations in mood and cognitions in order to determine the role the 'dysphoric arousal' items (i.e., difficulty sleeping, difficulty concentrating, irritability) have on the correlation between the somatic factor and dysphoria (Elhai, Biehn, Armour, Klopper, Frueh et al., 2011).

Taken together, these results indicate that both the non-somatic and somatic factors are strongly related to PTSD symptom clusters. Thus, clinicians providing trauma-focused treatment to individuals with comorbid PTSD and depression will likely observe that depression symptoms should improve as treatment progresses, however, the reverse may not occur. In fact, a study by Aderka, Foa, Applebaum, Shafran and Gilboa-Schechtman (2011) investigated the interrelationship of PTSD and depression symptoms
among children and adolescents who were being treated with prolonged exposure and found that changes in PTSD symptoms accounted for 64% of change in depression symptoms, but that changes in depression accounted for only 11% of changes in PTSD symptoms. A similar study conducted by Liverant, Suvak, Pineles, and Resick (2012) found a more contemporaneous relationship between PTSD and depression symptoms in a study of cognitive processing therapy on PTSD and depression symptoms among women.

B. Clinical Implications

This study has important implications for DSM-5. Results support the construct validity of PTSD in the DSM-5 and add to the other favorable results of this diagnosis from other studies that have investigated the proposed diagnostic alterations to the DSM-5 (Elhai, Miller, et al., 2012; Regier, Narrow, Clarke, Kraemer, Kuramoto et al., 2013). For instance, a study by Regier, et al. (2013) which presented the results of the DSM-5 field trials found that PTSD demonstrated the second best reliability estimate of the diagnoses investigated (kappa = .69). Interestingly, the reliability of major depressive disorder fell in the questionable range of agreement (kappa = .25). The study by Elhai, Miller, et al. (2012) also examined model alterations to the DSM-5's PTSD model and also found that the proposed PTSD model exhibited the best fit to the data.

Given that the new diagnostic criteria for PTSD has substantial relationships with both of depression's somatic and non-somatic factors, clinicians should expect an increase in the comorbidity between PTSD and depression. Clinicians should also be cognizant of these relationships when assessing trauma-exposed individuals in order to improve their differential diagnoses. The recommendations of Schillaci, Yanasak,
Adams, Dunn, Rehm et al. (2009) on differential diagnoses of PTSD are even more relevant with the additional depressive symptoms added to the diagnostic criteria for PSTD in the *DSM-5*. In particular, when assessing the symptoms of difficulty concentrating and difficulty sleeping (symptoms of PTSD's negative alterations in arousal and depression's somatic symptoms) and anhedonia (a symptoms of depression's non-somatic factor a symptom of PTSD's negative alterations in cognitions and mood factor) clinicians should attempt to determine if these symptoms were present prior to the trauma (suggesting that the symptoms are more related to depression) or if they originated since the trauma (suggesting that the symptoms are more related to PTSD). Clinicians should also be encouraged to carefully analyze the underlying cause of the symptoms that are representative of both PTSD and depression in order to determine if it more related to depression or PTSD. For example, if a client states that he or she is having difficulty sleeping a clinician should assess if this symptom is due to depressive rumination or due to an inability to relax at night because of a need to stay alert for danger or a need to check windows or locks for protection. Furthermore, clinicians should expect that if a trauma-exposed client is exhibiting frequent and intense negative alterations in arousal and avoidance symptoms then that client will also most likely have distressing somatic symptoms of depression. Likewise, frequent and intense negative alterations in cognitions and mood symptoms will most likely be accompanied by frequent and intense non-somatic symptoms of depression. By keeping in mind these relationships, clinicians can be more confident that their treatment and assessment of depression and PTSD is more accurate and thorough and they can avoid artificially inflating the comorbidity between PTSD and depression.
C. Limitations and Future Directions

This study is one of the first studies to examine the relationship between the latent factors of depression and PTSD. However, this study utilized a non-clinical college sample for analyses, and thus the results of this study may not generalize to a sample of patients with more severe depression and PTSD, as discussed above. Also, it should be noted that self-report measures of PTSD and depression were used so it is not possible to obtain a clinical diagnosis of PTSD or depression. Other limitations that are inherent in using self-report measures also apply to this study, including potential problems with response validity, social desirability, memory recall, etc. Despite these limitations, this study provides an insight into the comorbidity between two of the more frequently occurring mental disorders and provides support for the revised diagnostic criteria for PTSD.

Future studies should replicate this study using a clinical sample to assess if the same relationships between PTSD and depression symptoms emerge. Structured diagnostic instruments would also aid this line of research by providing a more accurate diagnostic picture of these disorders. Future studies should also analyze a five-factor 'dysphoric arousal' model of PTSD proposed by Elhai, Biehn, et al. (2011) which found that the PTSD symptoms of irritability, difficulty concentrating, and difficulty sleeping form their own unique factor termed. This model of PTSD has demonstrated superior fit over both the emotional numbing and dysphoria models (Armour, Elhai, Richardson, Ractliffe, Wang et al., 2012; Wang, Long, Li, & Armour, 2011; Wang, Zhang, Shi, Zhou, Li et al., 2011), and future studies should determine if this model also demonstrates superior fit over the DSM-5 PTSD model.
D. Conclusion

In conclusion, this study found that the proposed DSM-5 PTSD model demonstrated adequate to good fit in a sample of trauma-exposed college students. Strong correlations were observed between PTSD and depression factors. In particular, PTSD's negative alterations in arousal factor demonstrated a strong relationship with depression's somatic factor which was stronger than its relationship with depression's non-somatic factor. PTSD's negative alterations in mood and cognitions factor more strongly related to depression's non-somatic factor than to depression's somatic factor. Further, the avoidance factor showed a stronger relationship to depression's somatic factor than to depression's non-somatic factor. These findings provide insight into the construct validity of DSM-5’s PTSD diagnosis.
References


Goodman, L., Corcoran, C., Turner, K., Yuan, N., & Green, B. L. (1998). Assessing traumatic event exposure: General issues and preliminary findings for the


Huang, F. Y., Chung, H., Kroenke, K., Delucchi, K. L., & Spitzer, R. L. (2006). Using the Patient Health Questionnaire-9 to measure depression among racially and


Appendix A

Study Materials

Demographics Survey

Please answer the following survey questions honestly. Please try to answer every question.

1. What is your gender?  ☐ Male (1)  ☐ Female (2)

2. What is your current age?  _______

3. How many years of schooling have you completed, starting with first grade? _____
   (e.g., graduated high school = 12; graduated college = 16)

4. What is your current employment status?  ☐ Part time (1)  ☐ Full time (2)
   ☐ Retired (3)  ☐ Unemployed (4)
   ☐ Unemployed Student (5)

5. What is your current relationship status?
   ☐ Single (1)
   ☐ Living with Significant Other (2)
   ☐ Married (3)
   ☐ Divorced, Separated, or Widowed (4)

6. What is your ethnic background?
   ☐ Hispanic or Latino (1)
   ☐ Not Hispanic or Latino (2)
   ☐ Unknown (3)

7. What is your racial background? (check ALL that apply)
   ☐ Caucasian or White (1)
   ☐ African American or Black (2)
   ☐ Asian (3)
   ☐ American Indian or Alaskan Native (4)
   ☐ Native Hawaiian/other Pacific Islander (5)
   ☐ Unknown (6)
8. What is your current annual household income?

- ☐ Less than $15,000 (1)
- ☐ $15,000 to $24,999 (2)
- ☐ $25,000 to $34,999 (3)
- ☐ $35,000 to $49,999 (4)
- ☐ $50,000 to $64,999 (5)
- ☐ $65,000 to $79,999 (6)
- ☐ $80,000 or higher (7)
Stressful Life Events Screening Questionnaire

This questionnaire asks about many different types of stressful life events. These kinds of events can be frightening or distressing to almost everyone. During your life, have any of the following events ever happened to you? (For each question, please check the answer choice that applies to you)

1. Have you ever had a life threatening illness?
   Yes____  No____

2. Were you ever in a life-threatening illness?
   Yes____  No____

3. Were you ever in a life-threatening accident?
   Yes____  No____

4. Was physical force ever used against you in a robbery or mugging?
   Yes____  No____

5. Has an immediate family member, romantic partner or VERY CLOSE friend died as a result of accident, homicide, or suicide?
   Yes____  No____

6. When you were a child or more recently, did anyone (parent, other family member, romantic partner, stranger or someone else) ever succeed in PHYSICALLY FORCING you to have intercourse, or oral or anal sex against your wishes OR when you were in some way helpless?
   Yes____  No____

7. Other than experiences described in the previous item, has anyone ever used physical force or threat to TRY to make you have intercourse, oral or anal sex against your wishes OR when you were in some way helpless?
   Yes____  No____

8. Other than experiences mentioned in the previous two items, has anyone ever ACTUALLY TOUCHED private parts of your body or made you touch theirs against your wishes, OR when you were in some way helpless?

   Yes____  No____
9. When you were a child, did a parent, caregiver or other person ever slap you repeatedly, beat or otherwise attack or harm you?

Yes____  No____?

10. Other than the experiences mentioned in the previous item, have you ever been kicked, beaten, slapped around or otherwise physically harmed by a romantic partner, date, sibling, family member, stranger or someone else?

Yes____  No____?

11. Other than the experiences already covered, has anyone ever THREATENED you with a weapon, like a knife or gun?

Yes____  No____?

12. Have you ever been present when another person was killed, seriously injured, or sexually or physically assaulted?

Yes____  No____?

If so, was it only on TV, a movie, a picture or the internet?

Yes____  No____?

13. Have you experienced repeated or extreme exposure to gruesome or horrifying details of another person’s death, serious injury, or sexual violation (for example, repeatedly witnessing body parts after a serious accident, disaster, or violent conflict; or repeatedly being exposed to the details of child abuse)?

Yes____  No____?

If so, was it only on TV, a movie, a picture or the internet?

Yes____  No____?

Was it related to your work or occupation?  Yes____  No____?

14. Have you ever been in any other situation where you were seriously injured or your life was in danger (e.g., involved in military combat or living in a war zone)?

Yes____  No____?

Please describe______________________________________________________________
15. The events listed below correspond to the stressful event items queried above. If any of these events happened to you, CHECK the ONE event (only 1) that HAS CAUSED YOU THE MOST DISTRESS IN THE PAST MONTH. We realize that if you experienced one (or more) of these events, they may not cause you distress now. But please select the one event that is worse than the other (even if it doesn’t cause you a lot of distress). If none of these events happened to you, check “None” at the bottom of this list.

________________________________________________________________________

1. Life-threatening illness
2. Life-threatening accident
3. Physical force/weapon used
4. Family member/close friend died
5. Physical force used to have sex
6. Physical force/threat to try to have sex
7. Childhood: Touched your body private parts
8. Parent/caregiver physically harmed you
9. Partner/date, etc. physically harmed you
10. Threatened with a weapon
11. Present when someone was killed, injured, or assaulted
12. Repeated exposure to vivid trauma details
13. Other situation: seriously injured/life in danger
14. None of these events happened to me

________________________________________________________________________

(a) When did this event (first) occur? (your age): ____________________

(b) When did this event last occur? (your age): ____________________

(c) Did you experience intense fear, helplessness or horror when it happened?  

  yes1 / no2

(d) **How much distress** (anxiety, worry, sadness, frustration, grief, anger, guilt or shame) have you felt about this event in the past month? **(Check the best answer)**

  None happened to me1  No Distress2  Slight Distress3  Moderate Distress4  Considerable Distress5  Extreme Distress6

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PHQ-9

Since the time of the trauma, how often have you been bothered by any of the following problems in the past month?

<table>
<thead>
<tr>
<th>Problem</th>
<th>Not at all</th>
<th>Several Days</th>
<th>More than half the days</th>
<th>Nearly every day</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Little interest or pleasure in doing things</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>2. Feeling down, depressed, or hopeless</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>3. Trouble falling or staying asleep, or sleeping too much</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>4. Feeling tired or having little energy</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>5. Poor appetite or overeating</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>6. Feeling bad about yourself or that you are a failure or have let yourself or your family down</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>7. Trouble concentrating on things, such as reading the newspaper or watching television</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>8. Moving or speaking so slowly that other people could have noticed. Or the opposite being so fidgety or restless that you have been moving around a lot more than usual</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>9. Thoughts that you would be better off dead, or of hurting yourself</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
</tbody>
</table>