

# Separating Common from Unique Variance Within Emotional Distress: An Examination of Reliability and Relations to Worry

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**Background:** High comorbidity rates among emotional disorders have led researchers to examine transdiagnostic factors that may contribute to shared psychopathology. Bifactor models provide a unique method for examining transdiagnostic variables by modelling the common and unique factors within measures. Previous findings suggest that the bifactor model of the Depression Anxiety and Stress Scale (DASS) may provide a method for examining transdiagnostic factors within emotional disorders. **Aims:** This study aimed to replicate the bifactor model of the DASS, a multidimensional measure of psychological distress, within a US adult sample and provide initial estimates of the reliability of the general and domain-specific factors. Furthermore, this study hypothesized that Worry, a theorized transdiagnostic variable, would show stronger relations to general emotional distress than domain-specific subscales. **Method:** Confirmatory factor analysis was used to evaluate the bifactor model structure of the DASS in 456 US adult participants (279 females and 177 males, mean age 35.9 years) recruited online. **Results:** The DASS bifactor model fitted well (CFI = 0.98; RMSEA = 0.05). The General Emotional Distress factor accounted for most of the reliable variance in item scores. Domain-specific subscales accounted for modest portions of reliable variance in items after accounting for the general scale. Finally, structural equation modelling indicated that Worry was strongly predicted by the General Emotional Distress factor. **Conclusions:** The DASS bifactor model is generalizable to a US community sample and General Emotional Distress, but not domain-specific factors, strongly predict the transdiagnostic variable Worry.

*Keywords:* bifactor, tripartite, comorbidity, transdiagnostic, worry

## Introduction

The high rates of comorbidity among emotional disorders (i.e. mood and anxiety disorders) has led to a greater emphasis on examining factors that may be common to both domains. Transdiagnostic factors are shared between multiple forms of psychopathology, contributing to specific disorders as well as comorbidity between disorders. Increased empirical understanding of transdiagnostic factors is both theoretically and clinically important as new therapeutic interventions are developed to address comorbidity and these common variables (Drost et al., 2014). Although worry has typically been associated with anxiety, recent theories suggest that it may be related to emotional disorders in general (Drost et al., 2014) and may have relatively

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equal associations with anxiety, depression and stress (Olatunji et al., 2010). Psychometrically addressing this issue involves simultaneously estimating the relations of Worry to both general emotional distress (GED) and specific distress factors that are partialled on the GED. Whereas the Depression Anxiety Stress Scale (DASS) has been traditionally analysed using a three-factor structure for specific distress, the DASS bifactor model (Gomez, 2013) permits such an evaluation.

The present study sought to replicate the bifactor model of the DASS within a US adult sample utilizing confirmatory factor analysis (CFA). Second, the study evaluated the bifactor scale reliabilities to determine the portion of reliable variance accounted for by the general and domain-specific factors. Finally, using structural equation modelling (SEM) the present study examined the differential relations of these DASS factors to Worry.

## Method

### *Participants*

Participants were 456 English speaking US adults (mean age 35.9 years,  $SD_{\text{age}} = 12.7$ ) of 18 years of age or older. The sample consisted of 279 females (61.2%), 177 males (38.8%), with 79.2% identifying as Caucasian, 6.4% African-American, 5.9% Hispanic, 5.0% Asian, and 3.5% other. In addition, 37.3% of participants reported being diagnosed with or treated for anxiety, worry, or panic.

### *Procedure*

Ethical approval for procedures was obtained from the Texas Tech University (TTU) Human Research Protection Program (HRPP; no. 505082). The authors assert that all procedures contributing to this work complied with ethical standards of the TTU HRPP and the Helsinki Declaration of 1975, and its most recent version. Participants were recruited using Mechanical Turk which guided interested participants to the online survey website where, after providing consent, they completed a battery of distress measures and were monetarily compensated for their time (US\$.30).

### *Materials*

*Depression Anxiety Stress Scale (DASS).* The DASS is a 42-item public-domain self-report questionnaire measuring depression, anxiety and stress. In the present study, subscale descriptives were: Depression mean = 10.84,  $SD = 10.85$ ,  $\alpha = 0.96$ ; Anxiety mean = 8.29,  $SD = 8.43$ ,  $\alpha = 0.93$ ; Stress mean = 14.45,  $SD = 10.37$ ,  $\alpha = 0.95$ .

*Penn State Worry Questionnaire (PSWQ).* The PSWQ is a 16-item public-domain self-report measure of severity and controllability of worry. In the present study, mean = 50.65,  $SD = 16.27$ ,  $\alpha = 0.95$ .

## Results

All analyses were conducted within MPlus version 7.11 (Muthén and Muthén, 2012) using weighted least squares means and variances method (WLSMV) (please refer to online full report for more details of statistical analyses and results).

### *Bifactor replication*

The bifactor model of the DASS (Gomez, 2013) was replicated utilizing CFA. Due to the ordinal nature of the DASS response scales, items were modelled as categorical indicators. Global fit indices suggested good model fit,  $\chi^2(777) = 1642.67, p < .000$ , RMSEA = 0.05 [0.046, 0.053], CFI = 0.98 (Hu and Bentler, 1999). Furthermore, only items 9 ( $\lambda_{\text{anxiety}} = 0.10$ , 'Anxious') and 30 ( $\lambda_{\text{anxiety}} = 0.03$ , 'Fear of being thrown') demonstrated non-significant loadings on their respective unique factor after accounting for the GED factor. On average, items from the Depression, Anxiety and Stress scales made roughly comparable contributions to the GED factor.

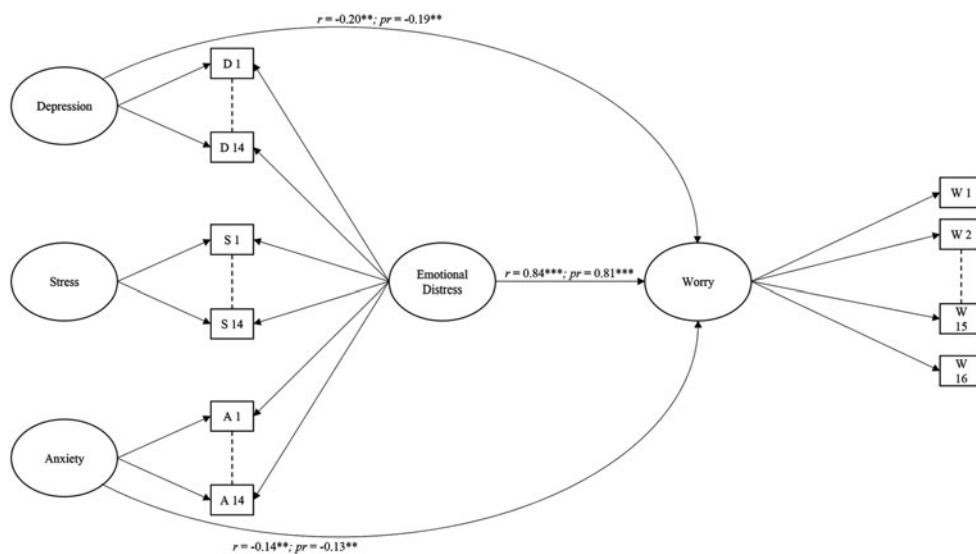
Furthermore, while the traditional oblique three-factor model ( $M = 3$ ) with Depression, Anxiety and Stress demonstrated adequate fit  $\chi^2(819) = 3828.48, p < .000$ , RMSEA = 0.09, CFI = 0.92, the DIFFTEST suggested that the bifactor model demonstrated significantly better fit ( $\chi^2_{\text{diff}}(42) = 944.87, p < 0.01$ ). Overall, this provided initial support for the generalizability and replicability of the DASS bifactor model to an unselected adult sample.

### *Factor reliability*

Coefficient omega was calculated to provide a model-based estimate of internal consistency reliability that is more appropriate for congeneric tests than coefficient alpha (Rodriguez et al., 2015). Omega was found to be high for all scales with estimates of 0.99, 0.98, 0.96 and 0.97 for the GED, Depression, Anxiety and Stress factors, respectively. Furthermore, omega hierarchical was high (0.90), suggesting that the GED factor accounted for a large portion of the reliable variance in total scores. In contrast, omega hierarchical subscale was low to moderate for the residualized factors Depression (0.28), Anxiety (0.15) and Stress (0.19). Overall, whereas the GED factor accounted for a majority of the variance in the item scores, the Depression, Anxiety and Stress factors still accounted for a modest proportion of the residual variance in items.

### *Relation with Worry*

The relations of the latent constructs of Worry to GED, Depression, Anxiety and Stress were estimated utilizing SEM and results from the DASS bifactor model. In the initial model, GED was modelled as an exogenous latent variable predicting Worry. This initial model demonstrated good fit  $\chi^2(1552) = 2641.01, p < .000$ , RMSEA = 0.04 [0.037, 0.042], CFI = 0.96. Adding paths from Worry to both Depression ( $\chi^2_{\text{diff}}(1) = -9.396, p < 0.01$ ) and Anxiety ( $\chi^2_{\text{diff}}(1) = -5.194, p = 0.02$ ) but not to Stress ( $\chi^2_{\text{diff}}(1) = 0.80, p = 0.37$ ) significantly improved fit. However, constraining the partial paths from Depression and Anxiety to Worry to be equal significantly decreased model fit ( $\chi^2_{\text{diff}}(1) = 5.61, p = 0.02$ ).



**Figure 1.** The structural model of relations between Emotional Distress, Depression, Anxiety, Stress and Worry.  $r$  = standardized bivariate regression coefficients;  $pr$  = standardized partial regression coefficients (i.e. partial correlations); D = DASS Depression item; A = DASS Anxiety item; S = DASS Stress item; W = PSWQ item.  $^{**}p < 0.01$ ,  $^{***}p < 0.001$ .

Thus the final model included GED ( $pr = 0.81$ ,  $p < 0.001$ ), Depression ( $pr = -0.13$ ,  $p = 0.002$ ) and Anxiety ( $pr = -0.19$ ,  $p = 0.002$ ), but not Stress, as significant incremental predictors of Worry. The final model demonstrated good fit,  $\chi^2(1550) = 2622.72$ ,  $p < .000$ , RMSEA = 0.04 [0.036, 0.042], CFI = 0.96 and is shown in Fig. 1. Similarly, bivariate analyses indicated GED ( $r = 0.84$ ,  $p < 0.001$ ), Depression ( $r = -0.14$ ,  $p = 0.002$ ) and Anxiety ( $r = -0.20$ ,  $p = 0.002$ ) but not Stress ( $r = 0.01$ ,  $p = 0.91$ ) significantly predicted Worry. This suggests the relation of GED with Worry was substantially stronger than that of either Depression or Anxiety.

Whereas researchers may wish to examine worry as a predictor of distress, this would have led to multiple, bivariate relations that may overestimate the variance accounted for by each distress construct, both general and unique. By utilizing Worry as the dependent variable, the paths were estimated simultaneously and therefore each represents the partial relation to Worry after accounting for the other types of distress. For example, the final path from Anxiety to Worry represents the unique variance in Worry accounted for by Anxiety after controlling for GED and Depression; thus providing a more conservative estimate of the relation that is disorder specific. Furthermore, while the data provides a means of examining the inter-individual relations between these constructs at a single time point, directionality cannot be inferred from cross-sectional data. Thus the direction of the estimation becomes less important.

## Discussion

Results supported and replicated the bifactor model for the DASS, promoting its generalizability in a US community population. Reliability estimates for the GED factor and

the three domain-specific factors (i.e. Depression, Anxiety and Stress) were all strong ( $>0.96$ ). Furthermore, the omega hierarchical and omega hierarchical subscale estimates indicated that the GED factor accounted for a substantial portion of the reliable variance in total scores whereas the Depression, Anxiety and Stress factors only accounted for modest portions of the reliable variance. This result is not surprising given that these three specific factors are estimated using residualized scores based on fewer items than the GED factor (Rodriguez et al., 2015). Additionally, the item loadings for the Bifactor and  $M = 3$  Depression factors demonstrated a strong correlation ( $r = .94$ ), suggesting that these two factors are assessing similar configurations of item loadings. In contrast, the  $M = 3$  Anxiety and Stress item loadings are more strongly correlated with their item loadings on the Bifactor GED factor than the specific factors (see Table 1 of full online report.) These results are consistent with the lower proportion of reliable variance in the bifactor Anxiety and Stress specific scales (see above). Although this suggests that the GED factor and its relations may be reliably interpreted, it also suggests exercising caution when interpreting the three domain-specific scores.

This study also examined the relations between worry and the common (i.e. GED) and unique (i.e. Depression, Anxiety and Stress) factors of the bifactor DASS model. General Emotional Distress was a large, positive incremental predictor of Worry while Depression and Anxiety were small, negative incremental predictors. That is, worry is primarily correlated with non-specific emotional distress. These results further support the notion that worry is a transdiagnostic variable and not necessarily domain specific. The reason for the negative partial relation of worry with the two specific scales is unclear and may reflect noise or error on these residualized factors; however, the bivariate relations disqualify suppressive effects as an explanation. Interestingly, this result seems to further support the transdiagnostic role of worry.

Although our results support the replicability of the bifactor model proposed by Gomez (2013), there may be alternative models with comparable fit. Another potential limitation is the modest omega hierarchical subscale coefficients of the Depression, Anxiety and Stress factors. These estimates limit the confidence in a specific conclusion about the relationship of these subscales with other variables. Of course, due to the cross-sectional nature of the data, directionality of the relations cannot be determined. Finally, although participants included in this study had self-reported symptoms of depression, anxiety and worry, future studies should examine the generalizability of the bifactor model of the DASS in clinical populations. Replication within a sample of individuals with diagnosed emotional disorders, including comorbid anxiety and depression, may be particularly enlightening.

## Conclusions

The results of this study provide initial support for the validity of the bifactor model of the DASS within a US community sample and provide estimates of the reliability of the resulting general and domain-specific factors. Furthermore, this is the first study to examine relations between these factors and a theoretically related construct, worry. Although low omega hierarchical subscale estimates prevented subscale specific inferences from being made, overall findings further support the idea that worry is a transdiagnostic factor shared across specific dimensions of distress and perhaps different emotional disorders and may partly explain their comorbidity.

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### Supplementary material

To view supplementary material for this article, please visit <https://doi.org/10.1017/S1352465817000777>

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