Reconceptualizing the Factor Structure of the Depression Anxiety Stress Scales (DASS) for Traumatic Brain Injury

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Abstract

We used contemporary factor analytic procedures to assess whether the Depression Anxiety Stress Scales (DASS) can reliably differentiate depression, anxiety, and stress in individuals with TBI. One-hundred and thirty-six adults (Mage = 38.51 years; 77.94% male) with moderate-severe TBI completed the DASS42. Various confirmatory factor models were estimated for both the DASS21 and DASS42, with a focus on novel statistical indices derived from bifactor modeling. Bifactor modeling revealed a dominant general distress factor, accounting for 89% of the systematic variance in DASS21 total scores. Specific depression, anxiety, and stress factors added little specific information when holding the general factor constant, accounting for only 11–27% of residual systematic variance in the subscale scores. Omitting the specific factors and instead treating the DASS21 as a unidimensional measure introduced minimal bias in parameter estimates. However, some multidimensionality was apparent when considering individual items, particularly from the depression scale. Additionally, first- and second-order factor models indicated that the specific factors were not well-differentiated from one another or from the general factor. These findings extended to the DASS42. In conclusion, scores on the DASS after TBI predominately reflect a single underlying latent variable of general distress, providing support for using the total score over the three conventional scales.

*Keywords:* anxiety, bifactor model, confirmatory factor analysis, depression, general distress, reliability

Individuals with traumatic brain injury (TBI) experience higher rates of mental health disorders, most commonly depressive (14–47%) and anxiety disorders (2–38%; Alway et al., 2016; Osborn et al., 2014, 2016). These disorders are highly comorbid after TBI (~70%; Alway et al., 2016; Gould et al., 2011b; Whelan-Goodinson et al., 2009) and are associated with poorer outcomes, including decreased quality of life and reduced functional outcomes (Azouvi et al., 2016; Gould et al., 2011a; Grauwmeijer et al., 2018). Emotional problems may be overlooked in early TBI rehabilitation (Andelic et al., 2021) and can persist for decades post-injury (Andelic et al., 2018; Koponen et al., 2002).

Early post-injury identification of individuals experiencing depressive and anxiety disorders is important for accessing timely treatment. Short self-report questionnaires are more convenient and commonly employed than structured clinical interviews to identify problems with depression and anxiety after TBI (Osborn et al., 2014, 2016). The Depression Anxiety Stress Scales (DASS; Lovibond & Lovibond, 1995a) are a popular screening tool, with shorter (DASS21) and longer (DASS42) versions. Albeit not a diagnostic tool, the DASS comprises three scales used to measure levels of depression, anxiety, and stress symptoms, with higher scores indicating higher risk for emotional disorders (Lovibond & Lovibond, 1995b). While the three scales are theoretically and statistically related, separate scores for depression, anxiety, and stress are typically used (Lovibond & Lovibond, 1995a). The DASS anxiety and depression scales have demonstrated convergent (Beck Anxiety Inventory *r* = .81; Beck Depression Inventory *r* = .74, respectively) and discriminant validity (Beck Anxiety Inventory *r* = .58; Beck Depression Inventory *r* = .54, respectively) compared with similar scales (Lovibond & Lovibond, 1995a).

In a TBI sample, the exploratory factor structure of the DASS42 broadly aligned with the conventional three-factor scoring, whereas results for the DASS21 did not closely correspond (Wong et al., 2013). For example, four items from the DASS21 stress scale loaded primarily on the same factor as all depression items. In this same TBI sample, the depression and stress scales were both highly sensitive to mood and anxiety disorders diagnosed via structured clinical interview, while the anxiety scale had a higher sensitivity for predicting a mood disorder than an anxiety disorder (Dahm et al., 2013). These findings raise doubts about whether the DASS can reliably discriminate between depression and anxiety symptoms as discrete constructs after TBI. Instead, the authors speculated whether the DASS might measure a single, higher-order factor of general distress in TBI, possibly related to the stressful, life-changing nature of the injury (Dahm et al., 2013). However, a higher-order general distress factor was not modeled in these previous investigations.

The hierarchical structure of the DASS can be assessed using a bifactor modeling (Chen et al., 2006). This approach, a type of factor analysis, represents the latent variable structure of a psychometric instrument simultaneously at two levels of resolution: a general factor, onto which all items load (indexed by the total score), and numerous specific factors, onto each of which a subset of items loads (indexed by individual scale/subscale scores). Unlike a higher- or second-order factor model, the general factor in a bifactor model directly influences all items (rather than being mediated by first-order factors); thus, the unique contributions of the general and specific factors are teased apart completely (Bornovalova et al., 2020). Bifactor modeling is therefore well-suited to assessing the viability of the total and subscale scores of psychometric instruments (Bonifay et al., 2017).

To our knowledge, one previous study estimated a bifactor model of the DASS in a TBI sample. Focusing on model fit indices (e.g., the Comparative Fit Index), Randall and colleagues (2017) found that the bifactor model of the DASS21 fit the data better than unidimensional, two-factor, and first-order three-factor models, concluding the DASS21 is a sound measure of specific depression, anxiety, and stress symptoms, as well as general distress in TBI. However, various researchers have raised concerns about interpreting bifactor models based solely on these fit indices, which may lead to erroneous conclusions (e.g., Bonifay et al., 2017; Bornovalova et al., 2020; Greene et al., 2022; Stanton et al., 2023). Due to their relatively large number of parameters and increased flexibility to accommodate noise or error, bifactor models nearly always perform well according to fit indices, even when they have been explicitly misspecified in simulation studies (Eid et al., 2017; Greene et al., 2019; Reise et al., 2016). In particular, bifactor models tend to still have good fit in the presence of very small, non-significant, or even negative specific factor loadings (Eid et al., 2017).

To this end, further inspection of the bifactor model in the TBI study by Randall and colleagues (2017) shows that the DASS21 items loaded consistently more strongly on the general factor (0.35 ˂ λ< 0.76) than on the specific depression, anxiety, and stress factors (0.07 < λ< 0.53). This may indicate a substantial influence of the general factor on the DASS data structure after TBI, cautioning against interpretation of the individual scale scores in this population (Reise et al., 2007). Despite a well-fitting bifactor model, however, the authors did not scrutinize the pattern of factor loadings, a pattern which raises concerns about the reliability of the specific factors in the presence of the general factor.

To avoid this potential misinterpretation of bifactor models, researchers are proposing the use of *bifactor statistical indices* to interrogate these models more closely. These indices, derived from the pattern of factor loadings, formally quantify the relative reliability of the general and specific factors in the bifactor model through the *omega hierarchical coefficient* (ω*h*), along with the degree of unidimensionality of the data through the *explained common variance* (ECV), *percentage uncontaminated correlations* (PUC), and *average relative parameter bias* (ARPB; Forbes et al., 2021; Rodriguez et al., 2016a, 2016b). In summary, a large ω*h* value for the general factor and relatively smaller ω*h* values for the specific factors (ω*hs*) suggest that the specific factors add little meaningful information beyond that provided by the general factor. Furthermore, high ECV and PUC, accompanied by low ARPB, indicate that the data structure can be considered essentially unidimensional, adequately captured by a single factor alone. When a bifactor model is applied to a psychometric instrument and the above conditions are met, it may be concluded that the instrument does not reliably discriminate between different specific facets (e.g., depression, anxiety, and stress), as most variance in the instrument’s scores reflects a single underlying factor (Reise et al., 2007; Rodriguez et al., 2016a).

To date, these bifactor statistical indices have not been utilized to assess the hierarchical structure of the DASS in TBI. To demonstrate the prior application of this methodology, a large number of studies in non-TBI populations, employing the ω*h* bifactor statistical index, have revealed that the DASS data structure comprises a dominant general distress factor, accounting for 82–96% of the systematic (error-free) variance in participants’ total scores (Bottesi et al., 2015; Chen et al., 2023; Gomez et al., 2020; Jovanović et al., 2021; Kia-Keating et al., 2018; Koğar & Koğar, 2023; Marshall et al., 2018; Mihic et al., 2021; Moore et al., 2017; Murphy et al., 2023; Naumova, 2022; Peixoto et al., 2022; Shaw et al., 2017; Zanon et al., 2021). These studies also found relatively small ω*h* values for the specific factors (depression ω*hs* = .03–32, anxiety ω*hs* = .01–.20, stress ω*hs* = .003–.22), cautioning against using the conventional three-factor scoring and supporting the use of the total score instead.

Careful evaluation of the DASS is important to ensure its appropriate use and interpretation in measuring emotional problems after TBI. In the present study, we build upon Randall and colleagues’ (2017) previous work by employing bifactor statistical indices to interrogate the hierarchical structure of the DASS in TBI more closely. Our aim was to evaluate the factor-based reliability and dimensionality of the DASS in TBI utilizing novel bifactor statistical indices, establishing whether the individual scale scores (separately measuring depression, anxiety, and stress symptoms) add meaningful information beyond that provided by the total score (measuring general distress), or alternatively, whether using the DASS as a unidimensional measure is more justified in this population.

We formed two hypotheses. First, we hypothesized that at least 80% of the systematic variance in DASS21 and DASS42 total scores would be explained by the general distress factor. After controlling for the general factor, we expected the specific factors to have limited reliability (< 50% of residual systematic variance in the subscale scores would be explained by the respective specific factors). Second, we hypothesized that the DASS21 and DASS42 would be essentially unidimensional, adequately captured by a single factor alone (≥ 70% of the explained common variance across all items and ≥ 70% of inter-item correlations would be attributable to the general factor).

**Method**

**Participants**

We analyzed data from 136 individuals who completed the DASS42. Participants were individuals with moderate-severe TBI recruited from consecutive inpatient admissions to a rehabilitation hospital as part of a larger longitudinal study investigating psychiatric disorders after TBI (Alway et al., 2016; Gould et al., 2011b). Participants received rehabilitation as part of a no-fault accident compensation scheme. Written informed consent was obtained from participants or their guardian and the study was conducted in compliance with relevant hospital and university ethics committees.

Participants were Australian residents who had sustained a moderate-severe TBI as defined by the Mayo Classification System, having at least one of the following: worst 24-hour Glasgow Coma Scale score ≤ 12, post-traumatic amnesia duration ≥ 24 hours, and intracranial abnormality on acute computed tomography scan (Malec et al., 2007). Participants were required to have adequate English and cognitive abilities to complete the research interview, as determined by their treating neuropsychologist. Individuals with another neurological condition in addition to their TBI (e.g., stroke) were excluded, but individuals were not excluded on the basis of any pre-injury psychiatric disorders.

## Materials

The DASS42 is a self-report screening tool comprising three 14-item scales measuring the frequency of symptoms of depression, anxiety, and stress experienced over the past week (Lovibond & Lovibond, 1995a).Responses on the DASS are measured on a 4-point Likert scale (0 = *did not apply to me at all*; 3 = *applied to me very much, or most of the time).* Scale scores are obtained by summing together item responses pertaining to that scale. Higher scores indicate higher levels of depression, anxiety, or stress symptoms.

The DASS21 is a short-form version of the original DASS42, comprising three 7-item scales (Lovibond & Lovibond, 1995a). It is standard practice to double DASS21 scale sum-scores to allow comparison with the DASS42 (Lovibond & Lovibond 1995a), retaining the same severity cut-offs across the versions. All DASS21 items are part of the DASS42, so scores can be derived from the long version.

## Procedure

Medical files were accessed to obtain demographic and injury-related data. The DASS42 (allowing extraction of DASS21 scores) was administered within a neuropsychological test battery as part of a broader psychiatric study (Gould et al., 2014). Research interviews were completed face-to-face at a private, quiet location.

## Data Analysis

Data analyses were completed using R, version 4.0.4 (R Core Team, 2021) and the packages *lavaan*, version 0.6.5 (Rosseel, 2012), *BifactorIndicesCalculator*, version 0.2.2 (Dueber, 2021), and *subscore*, version 3.3 (Dai et al., 2022).

### Factor Model Estimation

In contrast to common practice in the literature, the goal of this study was not to find the ‘best-fitting’ model of the DASS but rather to evaluate whether the ongoing use of the individual DASS scales is justifiable in TBI. To answer our specific research question, we focused on estimating confirmatory unidimensional and bifactor models of the DASS. Analyses were performed on both versions of the DASS to evaluate whether the increase in items in the 42-item version would result in greater reliability of the specific factors and greater multidimensionality. In the unidimensional models, each item loaded on only a single, general factor – ‘general distress’. In the bifactor models, each item loaded on the general distress factor and on one of three specific factors corresponding to the conventional depression, anxiety, and stress scales. To achieve complete separation of the systematic variance due to the general and specific factors, factors were set as orthogonal in the bifactor model, with inter-factor correlations constrained to zero. For completeness, we also estimated first- and second-order factor models for both the DASS21 and DASS42. All models were estimated using maximum likelihood estimation (Finney & DiStefano 2006). Diagrams illustrating each type of factor model are depicted in Figure 1.

**Figure 1***Factor Models of the DASS Estimated in the Current Study*

A diagram of a diagram

Description automatically generated with medium confidence*Note*. In the bifactor model (Panel B), the general factor directly influences items. In contrast, the general factor’s influence in the second-order model (Panel D) is mediated via the specific factors, making this model unable to completely tease apart the unique contributions of the general and specific factors. The specific factors are uncorrelated in the bifactor model (Panel B) but correlated in the first-order model (Panel C). The second-order model (Panel D) is simply a parametrization of the first-order model, with the higher-order general distress factor capturing the inter-factor correlations from the first-order model. Equivalent models were estimated for the DASS42.

### Model Fit Indices

As previously stated, traditional model fit indices are known to be biased in favor of bifactor models, and over-reliance on these statistics can lead to erroneous conclusions in factor analytic studies (Greene et al., 2022). Therefore, we avoided focusing narrowly on traditional model fit indices. Nevertheless, for transparency, we present model fit statistics for all factor models. Models were deemed to have close fit if the Root Mean Square Error of Approximation (RMSEA) was < .06 and the Comparative Fit Index (CFI) and Tucker Lewis Index (TLI) were > .95. Acceptable fit was defined as RMSEA < .08, CFI > .90, and TLI > .90 (Awang, 2012; Byrne, 1994; Hu & Bentler, 1999). Note that the general factor in the second-order factor model simply recapitulates the correlations between the depression, anxiety, and stress factors in the first-order model, so these models have equivalent fit. Statistical comparison of fit between the unidimensional, bifactor, and first-/second-order factor models was performed based on the *χ*2 statistic (lower values are better). For each DASS21 model, we had satisfactory power to reject the hypothesis of a very close fit to the population covariance matrix based on the RMSEA (α = .05, *n* = 136, null RMSEA = .01, alternative RMSEA = .05): 87% power for the unidimensional model (*df* = 189), 86% power for the first- and second-order factor models (*df* = 186), and 83% power for the bifactor model (*df* = 168). RMSEA-based power was higher for the DASS42 models due to increased degrees of freedom (MacCallum et al., 1996).

### Factor Loading Patterns and Inter-Factor Correlations

Instead of focusing narrowly on model fit indices, we interrogated the hierarchical structure of the DASS more closely, scrutinizing the factor loading patterns. We assessed the salience of the fully standardized factor loadings using the following criteria: ≥ .71 = ‘excellent’, ≥ .63 = ‘very good’, ≥ .55 = ‘good’, ≥ .45 = ‘fair’, ≥ .32 = ‘poor’, ˂ .32 = ‘very low’ and inadequate (Tabachnick et al., 2019). Given our specific research question regarding the viability of the DASS total and individual scale scores, we were particularly focused on inspecting and comparing loadings from the bifactor and unidimensional models. Additionally, we considered the inter-factor correlations in the first- and second-order factor models, with *r* ≥ .75 raising concerns about whether the factors were sufficiently differentiated (Farrell, 2010; Greene et al., 2022). We computed bootstrapped 95% confidence intervals (CIs) for the factor loadings to gauge the level of confidence in our conclusions.

### Bifactor Statistical Indices

The main analyses, forming the basis of our hypotheses, involved computing the previously introduced bifactor statistical indices, derived from factor loadings in the bifactor models (ω*h*, ω*hs*, ECV, S-ECV, PUC) in combination with the unidimensional models (ARPB). These novel indices were employed to formally quantify the relative reliability of the DASS general and specific factors (ω*h*, ω*hs*) and the extent to which the DASS can be used as a unidimensional instrument (ECV, S-ECV, PUC, ARPB). Refer to Table 1 for a definition of each index computed. We also investigated possible sources of multidimensionality of the DASS21 and DASS42 at the individual item level (rather than factor level) by examining the item-level explained common variance (I-ECV) and the relative parameter bias (RPB). We considered individual items as having a meaningful association with their respective specific factor if: 1) at least 15% of the common variance at the item level was attributable to the specific factor (i.e., I-ECV < 85%) and the item’s loading on the general factor changed by at least 10% when not including the specific factors in the model (i.e., RPB ≥ 10%).

The bifactor statistical indices in Table 1 are focused on assessing the appropriateness of interpreting the DASS as a unidimensional measure (i.e., evaluating the general factor). An equally important question is determining if the data are multidimensional enough to justify interpreting the individual scale scores (i.e., evaluating the specific factors). These scenarios are not mutually exclusive; it is possible that interpretation of both the DASS total score and one or more of the individual scale scores is justified from a psychometric perspective (Dueber & Toland, 2023). To address this, we supplemented our bifactor analysis by calculating the *value-added ratio* (VAR) for each DASS scale, assessing whether the observed depression, anxiety, and stress scale scores (with measurement error) explained more variance in the true scale scores (without measurement error) than the observed total score. Using a previous heuristic from the literature, a VAR value > 1.1 would indicate that the individual DASS scale in question explains a meaningful amount of true scale variance beyond the total score, supporting its interpretation (Feinberg & Wainer, 2014).

**Table 1**

*Summary of Bifactor Statistical Indices*

|  |  |  |
| --- | --- | --- |
| Bifactor statistical index | Definition | Interpretation |
| Coefficient omega hierarchical (ω*h*) | Systematic (error-free) variance in total scores attributable to the general factor. | ω*h* ≥ .80 sufficient for reliability of the general factor. ω*h* < .50 indicates insufficient reliability such that the general factor is not recommended for use in practice (Reise et al., 2013; McDonald, 1999). |
| Coefficient omega hierarchical subscale (ω*hs*) | Systematic (error-free) variance in subscale scores uniquely associated with the specific factor, when holding variance attributed to the general factor constant. | ω*hs* ≥.75 sufficient for reliability of the specific factor*.* ω*hs* < .50 indicates insufficient reliability such that the specific factor is not recommended for use in practice (Reise et al., 2013; McDonald, 1999). |
| Explained common variance (ECV) | Proportion of common variance across all items that is explained by the general factor. | ECV≥.70 sufficient for unidimensionality (Stucky & Edelen, 2014) |
| Explained common variance subscale (S-ECV) | Proportion of common variance across items of a subscale explained by the specific factor, after removing variance due to the general factor. | S-ECV ≥.70 signifies the uniqueness of a specific factor above and beyond the general factor (Forbes et al., 2021) |
| Percentage uncontaminated correlations (PUC) | Proportion of correlations between items attributable to the general factor. | PUC≥ .70 sufficient for unidimensionality (Forbes et al., 2021). |
| Average parameter bias (APB) | Proportional difference in item loadings on the general factor between the unidimensional model (not containing the specific factors) and the bifactor model (containing the specific factors). | ARPB < .10 sufficient for unidimensionality, indicating minimal undue bias towards the unidimensional model (Muthén et al., 1987). |

# Results

## Participants

A description of the study participants is provided in Table 2. Consistent with the large proportion of motor vehicle-related collisions, the sample largely comprised young-adult males with 12 years of education. As part of the larger longitudinal study of psychiatric disorders (Alway et al., 2016; Gould et al., 2011b), many participants previously took part in a clinical interview, on average two months post-injury, to assess the pre-injury presence of DSM-IV Axis I disorders (using the Structured Clinical Interview for DSM-IV Axis I Disorders [SCID]; First et al., 2002). Of the participants in the current study who completed the pre-injury SCID interview (*n* = 104), 44.23% had experienced a psychiatric disorder, most often an alcohol- or substance-related disorder, at some stage prior to their TBI.

## DASS21 and DASS42 Descriptive Statistics

The mean DASS scores for depression, anxiety, and stress symptoms fell within the mild severity range, indicating mildly elevated symptomatology in our TBI sample compared to the general population. A considerable proportion of individuals in this sample exhibited severe to extremely severe symptoms of depression, anxiety, and stress (Table 3). The inter-scale correlations for the DASS were strong (*r* = .66–.83, all *p*-values < .001; Table 4), meaning that participants with one elevated score were likely to have other elevated scores.

**Table 2**

*Participant Demographic and Injury Characteristics (n = 136)*

|  |  |  |  |
| --- | --- | --- | --- |
| Participant characteristic | *n* | M (SD) / % | Median (range) |
| Sex | 136 |  |  |
| Male | 106 | 77.94% | - |
| Female | 30 | 22.06% | - |
| Age (years) | 136 | 38.51 (15.29) | 35.4 (18–78) |
| Years of education | 136 | 12.56 (2.72) | 12 (6–20) |
| Cause of injury | 136 |  |  |
| Motor vehicle collision | 91 | 66.91% | - |
| Pedestrian hit by motor vehicle | 18 | 13.24% | - |
| Fall | 17 | 12.50% | - |
| Other | 10 | 7.35% | - |
| Time post-injury (years) | 135 | 1.97 (2.68) | 1.23 (0.17–25.54) |
| Worst 24-hour GCS score | 128 | 8.68 (4.33) | 8.5 (3–15) |
| Mild (13–15) | 42 | 32.81% | - |
| Moderate (9–12) | 22 | 17.19% | - |
| Severe (3–8) | 64 | 50.00% | - |
| PTA duration (days) | 127 | 23.14 (23.04) | 18 (0 – 121) |
| Mild (<24 hours) | 2 | 1.57% | - |
| Moderate (1–7 days) | 34 | 26.77% | - |
| Severe (> 7 days) | 91 | 71.65% | - |
| CT brain result | 124 |  |  |
| Intracranial abnormality present | 115 | 92.74% | - |
| No intracranial abnormality found | 9 | 7.26% | - |

*Note.* M = mean; SD = standard deviation; GCS = Glasgow Coma Scale; PTA = post-traumatic amnesia; CT = computed tomography.

**Table 3**

*DASS Descriptive Statistics (n = 136)*

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| DASS score | M *(SD)* | Range | Normal (%) | Mild (%) | Moderate (%) | Severe (%) | Extremely Severe (%) |
| DASS21 |  |  |  |  |  |  |  |
| Depression | 12.10 (11.37) | 0–42 | 50.74 | 8.09 | 17.65 | 9.56 | 13.97 |
| Anxiety | 7.96 (8.40) | 0–36 | 55.15 | 8.82 | 19.85 | 2.94 | 13.24 |
| Stress | 15.81 (11.20) | 0–42 | 52.21 | 6.62 | 17.65 | 15.44 | 8.09 |
| Total | 35.87 (28.10) | 0–104 | - | - | - | - | - |
| DASS42 |  |  |  |  |  |  |  |
| Depression | 12.24 (11.22) | 0–40 | 51.47 | 7.35 | 16.91 | 11.03 | 13.24 |
| Anxiety | 8.04 (7.78) | 0–30 | 56.62 | 11.03 | 13.24 | 5.88 | 13.24 |
| Stress | 16.06 (11.17) | 0–41 | 50.74 | 8.82 | 17.65 | 14.71 | 8.09 |
| Total | 36.35 (27.67) | 0–104 | - | - | - | - | - |

*Note.* DASS21 = Depression Anxiety Stress Scales 21-item version; DASS42 = DASS 42-item version; M = mean; SD = standard deviation. DASS21 raw scores are doubled to allow comparison with the full version (possible individual scale range = 0–42; possible total score range = 0–126). While emotional distress is inherently dimensional, the DASS manual offers a set of (somewhat arbitrary) cut-off scores, used for describing the severity of distress relative to the general population. As can be seen, DASS21 and DASS42 scores were very similar.

**Table 4**

*DASS Inter-Scale Correlations (n = 136)*

|  |  |  |  |
| --- | --- | --- | --- |
| DASS21 | Depression | Anxiety | Stress |
| Depression | - |  |  |
| Anxiety | .66\* | - |  |
| Stress | .80\* | .71\* | - |
| DASS42 | Depression | Anxiety | Stress |
| Depression | - |  |  |
| Anxiety | .68\* | - |  |
| Stress | .83\* | .73\* | - |

*Note*. Inter-scale correlations were calculated between the raw scale scores using the Pearson’s coefficient, *r*.

\* *p* < .001

**DASS21 Factor Analyses**

### Model Fit Indices

While not the primary focus of this study, Table 5 provides model fit indices for the DASS21 unidimensional, first/second-order, and bifactor models. According to these indices, the unidimensional model had a poor fit, while the other models showed marginal but significantly improved fit compared to the unidimensional model (*p*-values < .05). The bifactor model demonstrated a slightly better *χ*2 fit statistic than the first- and second-order factor models, but the difference did not quite meet the threshold for statistical significance (*p* = .051). Although further interrogation is necessary, these fit indices suggest that neither the unidimensional nor conventional three-factor model provide a good representation of the DASS21 data structure in TBI.

**Table 5**

*DASS21 Model Fit Statistics*

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Factor model | *df* | *χ*2 | CFI | TLI | RMSEA |
| Unidimensional | 189 | 520.377a,b | .818 | .798 | .114 |
| First- and second-order | 186 | 371.646a | .898 | .885 | .086 |
| Bifactor | 168 | 342.883b | .904 | .880 | .087 |

*Note*. *df* = degrees of freedom; CFI = comparative fit index; TFI = Tucker-Lewis Index; RMSEA = root mean square error of approximation. Subscripts indicate statistically significant differences in model fit.

aThe first- and second-order factor models had significantly better fit than the unidimensional model based on the *χ*2 statistic.

bThe bifactor model had significantly better fit than the unidimensional model based on the *χ*2 statistic.

### Factor Loading Patterns and Inter-Factor Correlations

Instead of narrowly focusing on traditional model fit indices, we next scrutinized the factor loading patterns for the DASS21, with an emphasis on the unidimensional and bifactor models (Figure 2). The factor loading CIs were mostly reasonable. However, estimates of specific factor loadings in the bifactor model were notably less precise, and some CIs for the bifactor model were exceptionally wide (Supplemental Table S1). This aligns with the observation in bifactor models of psychopathology that specific factors often do not capture reliable portions of variance independent of the general factor (Eid et al., 2017). Moreover, particularly wide CIs were observed for less strongly endorsed and positively skewed items (e.g., Item 4, breathing difficulty: M = 0.46, *Z*skew = 1.54), underscoring a methodological limitation related to the distribution of certain DASS items.

For both the bifactor and unidimensional models, loadings on the general distress factor were ‘very good’ on average (unidimensional model: mean λ= .68, range = .43–.84; bifactor model: mean λ= .65, range = .44–.83). Loadings on the specific factors in the bifactor model were weaker, on average ‘poor’ for depression (mean λ = .43; range = .29–.59) and ‘very low’ and inadequate for anxiety (mean λ = .23; range = –.05–.78) and stress (mean λ = .28; range = .03–.61). There were also non-significant and negative specific factor loadings for anxiety and stress, suggesting that these items were in particular only indicators of general distress. As depicted in Figure 2, the combination of consistently strong loadings on the general factor and weaker/inadequate loadings on the specific factors suggested a relative dominance of the general factor underlying the DASS21 in TBI. The factor loadings for all four estimated DASS21 models, alongside their 95% CIs, can be found in the Supplemental Materials (Tables S1–S3).

Additionally, inspecting the inter-factor correlations in the first- and second-order factor models raise reservations about the distinctiveness of the depression, anxiety, and stress factors. In the first-order model, the correlations between the depression, anxiety, and stress factors were very strong (*r* = .74–.87). Similarly, in the second-order factor model, the higher-order general distress factor was correlated at .89 with depression (79% variance explained), .83 with anxiety (69% variance explained), and .98 with stress (96% variance explained). This suggests that, in TBI, the DASS21 depression, anxiety, and stress factors are not well-differentiated from one another or from the general distress factor (Farrell, 2010). Particularly, the specific stress factor in this study was essentially statistically indistinguishable from a general distress construct.

**Figure 2***DASS21 Item Loadings in the Bifactor and Unidimensional Models (n = 136)*

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*Note.* **A.** Item factor loadings on general distress in the DASS21 unidimensional model. **B.** Item factor loadings on general distress and on depression, anxiety, and stress in the DASS21 bifactor model. Loadings are fully standardized. Bar colors relate to loading strength (Green = ‘good’ to ‘excellent’; Yellow = ‘fair’ to “good”; Orange = ‘poor’; Red = negative loadings). Loading strength on the *x*-axis is depicted as absolute magnitude, whilst the direction (negative/positive) is depicted as the color saturation in accordance with the legend. Inadequate factor loadings (λ < .32; Tabachnick et al., 2019) are depicted by the vertical red dotted line. This figure reveals that items typically loaded stronger on the general distress factor than on their respective specific factor. DASS = Depression Anxiety Stress Scales

### Bifactor Statistical Indices

To formally quantify the relative reliability of the DASS21 general and specific factors, we computed omega hierarchical reliability coefficients (ω*h*). Consistent with our inspection of the factor loadings, 89% of the systematic variance in DASS21 total scores was attributable to the general factor (ω*h* = .89), reflecting good reliability (ω*h* ≥ .80 sufficient). After controlling for the general factor, little residual systematic variance in the individual scale scores was attributable to the specific depression (ω*hs* = .27), anxiety (ω*hs* = .11), and stress factors (ω*hs* = .13), reflecting relatively lower reliability (ω*hs* ≥ .50 required). The high ω*h*and relatively small ω*hs* values indicate that the DASS21 did not reliably capture more specific constructs beyond general distress but rather comprised a dominant general distress factor.

We used another set of bifactor statistical indices to assess the dimensionality of the DASS21. The explained common variance (ECV) indicated that 75% of common variance across all items was attributable to the general factor (ECV ≥.70 sufficient for unidimensionality). Similarly, the percentage of uncontaminated (PUC) correlations indicated that 70% of correlations between items were attributable to the general factor (PUC ≥ .70 sufficient for unidimensionality). An insignificant proportion of common variance was explained by the specific factors after controlling for the general factor (S-ECVDepression = .11; S-ECVAnxiety = .07; S-ECVStress = .07; S-ECV ≥ .70 sufficient for unique specific factors), and according to the value-added ratios (VARs), the individual scale scores did not add value beyond the total score (VARDepression = 0.97; VARAnxiety = 0.90; VARStress = 0.93; VAR > 1.1 desirable for added value of subscales). We compared the unidimensional and bifactor models of the DASS21, calculating the average relative parameter bias (ARPB) to quantify the effect of not modeling the specific factors. The ARPB was .09, meaning that the loadings on the general factor differed on average by only 9% between the unidimensional and bifactor models, thereby suggesting minimal undue bias towards the unidimensional model (ARPB < .10 sufficient for unidimensionality).

Taken together, the ECV, PUC and ARPB values suggest that the DASS21 could be used as a unidimensional measure. Despite this, the DASS21 unidimensional model had a poor fit (Table 5). Therefore, there may be some multidimensionality in the DASS21 data structure, but this was not adequately captured by the conventional three-factor scoring. We investigated possible sources of multidimensionality at the level of individual items using item-level explained common variance (I-ECV) and relative parameter bias (RPB; see Supplemental Table S4 for statistics). Items found to have a meaningful association with their respective specific factor (based on ECV < 85 and RPB ≥.10) in the DASS21 were: 3(no positive feeling), 10 (nothing to look forward to), 13 (down-hearted and blue), 16 (unable to be enthusiastic), 17 (not worth much as a person) 18 (rather touchy) and 21 (life was meaningless). Items 3, 10, 13, 16, 17, and 21 belong to the depression scale and relate to a broad range of depressive symptomatology such as anhedonia, hopelessness, dysphoria, lack of interest/involvement, self-deprecation, and devaluation of life. Item 18 is part of the stress scale and is intended to reflect irritability/over-reactivity (Lovibond & Lovibond, 1995b).

## DASS42 Results

We repeated the above analyses with the DASS42. A detailed account of the results can be found in Supplemental Appendix 2, including Supplemental Tables S6–S10. Briefly, the results were the same. Within the bifactor model, there was a dominant general distress factor (ω*h* = .90), while the specific factors had lower reliability when holding the general factor constant (depression ω*hs* = .22; anxiety ω*hs* = .29; stress ω*hs* = .07). The ECV, S-ECV, and ARPB showed the DASS42 could be considered essentially unidimensional, and the VARs indicated that the individual scale scores did not add meaningful value beyond the total score. However, the PUC was slightly below our *a priori* threshold for unidimensionality (PUC = .68; ≥ .70 sufficient for unidimensionality), and as with the DASS21, unidimensional model fit was poor (Supplemental Table S9). The first- and second-order factor models similarly showed that the DASS42 specific factors were poorly differentiated from one another (*r* = .73–.86) and from the general factor (*r* = .83–.98). Individual-item analysis highlighted similar depression scale items to the DASS21 as the main sources of multidimensionality.

# Discussion

This is the first study of which we are aware to critically evaluate the internal structure of the DASS for individuals with TBI using novel bifactor statistical indices. As hypothesized, the internal structure DASS21 comprised a dominant general distress factor, while the individual scales added little specific information beyond that provided by the total score. Our second hypothesis was also supported: the DASS21 was essentially unidimensional, with minimal bias in parameter estimates introduced by omitting the three specific factors. The DASS21 specific factors were not well-differentiated from one another or from the general factor. However, at the same time, unidimensional model fit was poor and individual-item analysis suggested some items, particularly from the depression scale, contributed multidimensionality to the DASS21 data structure. Our results were similar for the DASS42, suggesting that the increase in items did not provide greater reliability of the specific factors or greater multidimensionality. Our findings suggest the conventional three-factor scoring of the DASS21 and DASS42 may be questionable for individuals with TBI.

Our findings differ somewhat from previous studies of the DASS which have used different factor analytic procedures. Other researchers may have arrived at different conclusions as they relied on biased model fit indices (Henry & Crawford, 2005;Gomez, 2013; Randall et al., 2017; Sinclair et al., 2012; Wong et al., 2013). A previous well-fitting bifactor model of the DASS in a TBI sample was interpreted as evidence supporting use of the individual scales (Randall et al., 2017). However, factor loadings in this analysis showed that most items (~80%) were inadequate indicators of specific depression, anxiety, or stress (λ < .32) in the context of a general distress factor. Given that traditional model fit indices are biased toward bifactor models (Bornovalova et al., 2020), further scrutiny of the DASS scales is warranted.

In this regard, our findings do align with studies which have employed bifactor statistical indices to interrogate the hierarchical structure of the DASS more closely. Our results fall within the ranges of previously reported omega hierarchical reliability coefficients obtained in non-TBI samples: general distress ω*h* in TBI = .88 (previous studies = .82–.96), depression ω*hs* in TBI = .27 (previous studies .03–.32), anxiety ω*hs* in TBI = .11 (previous studies .01–.20), and stress ω*hs* in TBI = .13 (previous studies = .003–.22), highlighting the relative dominance of the DASS general factor across different populations (Bottesi et al., 2015; Chen et al., 2023; Gomez et al., 2020; Jovanović et al., 2021; Kia-Keating et al., 2018; Koğar & Koğar, 2023; Marshall et al., 2018; Mihic et al., 2021; Moore et al., 2017; Murphy et al., 2023; Naumova, 2022; Peixoto et al., 2022; Shaw et al., 2017; Zanon et al., 2021). Our dimensionality results are also consistent with the values previously reported in non-TBI samples, including a large meta-analysis: ECVGeneral Distress in TBI = .75 (previous studies = .70–.97), S-ECVDepression in TBI = .11 (previous studies = .08–.24), ECVAnxiety in TBI = .07 (previous studies = .06–.21), ECVStress in TBI = .07 (previous studies = .02–.11), and ARPB in TBI = .09 (previous study = .05), indicating that, across different populations, the DASS can be considered essentially unidimensional, adequately captured by a single factor alone (Chen et al., 2023; Gomez et al., 2020; Jovanović et al., 2021; Kia-Keating et al., 2017; Koğar & Koğar, 2023; Moore et al., 2017; Murphy et al., 2023; Naumova, 2022; Shaw et al., 2017; Yeung et al., 2020; Zanon et al., 2021).

Aspects of the TBI experience may lead to high rates of diverse and non-specific psychopathological symptoms, potentially contributing to the limited discriminability of the conventional DASS scales and dominance of the general factor in this population. In particular, sustaining a moderate-severe TBI is an often stressful, life-altering event; such events are known to produce non-specific elevations in various psychopathological symptoms (Dahm et al., 2013; Hankin et al., 2016). Besides the injury’s highly stressful nature, individuals with moderate-severe TBI have elevated levels of other risk factors shared across psychiatric diagnoses, including low self-esteem, cognitive impairments (especially executive dysfunction), emotional dysregulation, avoidance behaviors, abnormalities in the brain’s emotional processing circuitry, and neuroinflammation (Feiger et al., 2022; Carroll & Coetzer, 2011; Gracey et al., 2016; Huey et al., 2016; Shields et al., 2016; Whiting et al., 2017). Additionally, some DASS items overlap with the direct physiological consequences of the injury; for example, the depression scale item about difficulty initiating may be endorsed due to executive dysfunction and apathy resulting from TBI, rather than the presence of a depressive syndrome. However, it bears repeating that our bifactor statistical indices align with values obtained from previous studies in non-TBI, predominately non-clinical samples. Hence, we attribute our findings not solely to the unique experiences of the TBI population but also to the psychometrics of the DASS more generally.

**Potential Utility of the DASS Depression Scale in TBI**

Among the conventional DASS scales, our study identified the depression scale as the best performing after accounting for the general factor’s influence. Using standard benchmarks in the literature, the depression scale did not index a sufficiently reliable, coherent specific factor in TBI for either the DASS21 or DASS42. However, it is noteworthy that this scale exhibited stronger item loadings and higher ω*hs*, S-ECV, and VAR values compared to the anxiety and stress scales, with the exception that the DASS42 anxiety scale had the highest *ω*hs value. Furthermore, item-level analysis (i.e., I-ECV and RPB) suggested that multidimensionality within the DASS data structure in TBI may be mostly attributed to depression scale items, including those addressing anhedonia, hopelessness, lack of interest/involvement, self-deprecation, and devaluation of life.

These findings align with previous evaluations of the DASS in non-TBI samples, suggesting that the instrument shows potential for differentiating depression from more generalized emotional distress (Mihic et al., 2021; Moore et al., 2017; Naumova, 2022). A systematic review also supported the superiority of the DASS depression scale, finding that it was the only DASS21 scale with high-quality evidence of criterion validity (Lee et al., 2019). Moreover, an earlier study using an overlapping TBI sample to our current study found that the DASS depression scale was significantly more sensitive at detecting SCID-diagnosed mood disorders than the depression subscale of the Hospital Anxiety and Depression Scale (HADS; Dahm et al., 2013). The authors attributed this increased sensitivity to the inclusion of items in the DASS relating to devaluation of life, self-deprecation, and hopelessness, which are absent from the HADS.

Despite our bifactor analysis results, it should be acknowledged that the fit of the unidimensional DASS models was poor according to traditional model fit indices. Although our findings suggest it is more justifiable to use the DASS total score over the conventional three-factor scoring, it may also still be possible in the future to identify a factor pattern of the DASS with improved specific factors—in particular a specific depression factor. This is likely not a straightforward task, potentially requiring the addition, removal, or customization of items and exploration of further factor analytic techniques (e.g., exploratory structural equation modeling, bifactor (*S* – 1) modeling), which was outside the scope of the current study. The item-level results from our study could guide the development of an enhanced depression scale in TBI by selecting those items that were meaningfully associated with the specific depression factor beyond general distress. In lieu of such revisions to the DASS, clinicians may also consider the individual items which are most strongly endorsed by their clients with TBI, as well as the potential value of some depression scale items to add meaningful information beyond the total score.

**A Transdiagnostic Reconceptualization of the DASS**

Our findings can be interpreted in relation to transdiagnostic conceptualizations of depression and anxiety (Clark & Watson, 1991; Kotov et al., 2017, 2021; Shields et al., 2016). According to the Tripartite Model (Clark & Watson, 1991), depression and anxiety are thought to share a higher-order factor of negative affectivity (other times referred to as general distress, internalizing psychopathology, or negative emotional symptoms), helping to explain the high comorbidity between these syndromes. The DASS total score after TBI could therefore be conceptualized as a transdiagnostic measure of negative affectivity common to depression, anxiety, and other emotional disorders characterized by pervasive negative emotionality. In addition, the Tripartite Model proposes the existence of symptom components *unique* only to anxiety or depression, which allow these syndromes to be distinguished (Watson et al., 1988). Unidimensional model fit and analysis of individual items within the DASS bifactor models suggested some items were less tied up in general distress than others. Consistent with other studies (Mihic et al., 2021; Moore et al., 2017; Naumova, 2022), this was mostly confined to items of the depression scales (e.g., hopelessness, lack of interest) addressing symptoms which align with the unique component of depression articulated within the Tripartite Model – ‘low positive affectivity’ or anhedonia (Clark & Watson, 1991).

## Implications

Our findings provide new insights into the appropriateness and clinical utility of the DASS for individuals with TBI, offering practical implications. Consistent with prior work (Wong et al., 2013), caution should be exercised in using the conventional three-factor scoring of the DASS21 and DASS42 when completed by individuals with TBI. The specific factors, especially anxiety and stress, had limited reliability, were conceptually ambiguous, and added little meaningful information after accounting for the general factor’s influence; the specific factors were also poorly differentiated from one another and from the general factor. Conversely, bifactor analysis and associated statistical indices indicated that the general factor of the DASS represented a reliable and coherent construct, capturing most of the systematic variance in the scale scores. Therefore, the DASS remains valuable as a screening tool in TBI. However, we recommend considering the total score as a more psychometrically justified, transdiagnostic approach to measuring general emotional distress in this population.

The DASS manual already documents the use of the total score as a measure of “negative emotional symptoms” (see <https://www2.psy.unsw.edu.au/dass/DASSFAQ.htm>). The authors of the DASS recommend utilizing the normative data provided in the manual, obtaining a separate *z*-score for each scale, averaging the three *z*-scores, and comparing to severity in the same way as for individual scales. Normative data for the total score have also been published from the general adult population in both the United Kingdom (Crawford et al., 2009) and Australia (Crawford et al., 2011), providing additional means to describe the level of general emotional distress.

The DASS total score could serve as a useful initial screen for individuals with TBI who may require a more detailed psychiatric evaluation. This transdiagnostic, dimensional characterization of emotional distress may be more inclusive for many individuals with TBI who do not fit neatly into traditional diagnostic criteria after their injury but might nevertheless benefit from treatment (Alway et al., 2016; Gould et al., 2011b; Ouellet et al., 2018). Additionally, this approach could be beneficial in identifying individuals currently below the threshold for diagnosis of a psychiatric disorder but at risk of developing one later (Hart et al., 2012). Future research is needed to assess the clinical utility of the DASS total score, including the derivation of cut-offs validated against important clinical outcomes such as functional disability, quality of life, or the need for psychiatric treatment. Moreover, given the DASS42 did not yield improved reliability of the individual scales or greater multidimensionality in this study, the use of the DASS42 for the purpose of more thorough screening may be trivial in practice and unduly increase burden on individuals with TBI.

Since the DASS seems more justifiable as a measure of ‘general distress’ in TBI compared to the conventional three factor-scoring, an important direction for future research is determining how we can reliably parse more specific symptom dimensions in this population. Differentiating narrower forms of psychopathology (e.g., anhedonia, panic) may support more comprehensive case formulation and tailored/targeted treatment (Ruggero et al., 2019). It can also aid in identifying domain-specific pathways between psychopathology and its external correlates (e.g., etiologic factors specific to post-TBI depression; Conway et al., 2022). It should be noted that the difficulties faced by the DASS in disentangling specific psychopathological symptom dimensions are not unique to this instrument; rather, similar issues have been identified in TBI for the HADS (Carmichael et al., 2023) as well as the Patient Health Questionnaire–9 and Generalized Anxiety Disorder–7 scales when combined (Teymoori et al., 2020). These scales were designed to be general measures of depression, anxiety, and other heterogeneously defined and overlapping constructs (Watson et al., 2007, 2022).

In response to the limited discriminant validity of these brief/general measures of psychopathology, alternative measures optimized for transdiagnostic research have been developed, such as the 99-item Inventory of Depression and Anxiety Symptoms (IDAS; Watson et al., 2007; see Kotov et al., 2017 for a list). In contrast to the DASS, these alternative measures are more comprehensive, purposely incorporating multiple, non-redundant items tapping the same narrow symptom or trait domain, thereby enabling meaningful, more homogeneous subscales to be reliably parsed from a more general psychopathology factor (Stanton et al., 2020). For example, the IDAS includes six items all addressing insomnia, facilitating the identification of a corresponding specific insomnia factor within internalizing psychopathology (Simms et al., 2008; Watson et al., 2007). Further research is required to determine the applicability of these transdiagnostic, symptom-oriented measures to TBI. While these alternative measures may prove beneficial for differentiating narrower forms of psychopathology, the DASS offers an efficient assessment of higher-order general emotional distress. Measures like the DASS may therefore be advantageous in situations with time constraints (e.g., acute settings, limited insurance-funded treatment) or where mental health is just one factor among many to be considered.

We recognize that TBI clinicians will already be focused on documenting and treating the specific symptoms of their individual clients, and we do not anticipate them using the DASS as a diagnostic tool for discriminating depressive and anxiety disorders. Nevertheless, TBI clinical scientists should be aware that scores on each conventional DASS scale are mostly a function of a shared, non-specific component of general distress. Using these scores separately may not provide the full picture of one’s symptom profile. From a technical perspective, the findings show that the residual variances accounted for by the conventional DASS scales (after accounting for the general factor) are unreliable in TBI, precluding scale-specific inferences from being made (i.e., drawing separate conclusions regarding depression, anxiety, and stress). Instead, the DASS may be more suitably applied to answer questions about characteristics shared across these syndromes, rather than characteristics unique to each. More broadly, our study also contributes to the discussion about the conceptualization and measurement of psychopathology in the TBI population, highlighting the existence of a strong general factor of emotional distress, aligning with clinical efforts in the broader population to implement transdiagnostic approaches in assessment and treatment (e.g., Insel et al., 2010; Kotov et al., 2017). Based on our findings, we advocate for developing and validating more broadband, symptom-oriented procedures to provide more fine-grained assessment of psychopathology after TBI, where that is desired.

## Limitations

Our study has several limitations, notably the relatively small sample size—a challenge when recruiting from a clinical population such as moderate-severe TBI. To address this statistical power concern, we conducted RMSEA-based power analyses, which indicated that we had satisfactory power for detecting differences between a close (RMSEA = .05) and very close fitting factor model (RMSEA = .01). As our main analyses focused on bifactor statistical indices, we also computed bootstrapped 95% CIs for the factor loadings. Although mostly reasonable, estimates of specific factor loadings in the bifactor model were less precise, and some CIs for the bifactor model were exceptionally wide (see Supplemental Table S1). This may be partly due to the residual variances captured by the specific factors (i.e., after accounting for the general factor) being unreliable. Future research should seek to independently validate our findings in larger samples of individuals with TBI, particularly those reporting more severe or frequent emotional symptoms than in our study (e.g., a treatment-seeking sample) to reduce the positive skewness in some items. This will provide more precise estimates of the extent to which DASS items are markers of general distress versus more narrowband symptom dimensions after TBI. Nevertheless, it should be noted that our findings align with studies of the DASS conducted in much larger samples (e.g., Naumova, 2022, *n* = 4,202), including a meta-analysis involving over 20,000 participants (Yeung et al., 2020), instilling confidence in our findings.

Our sample consisted of predominately White patients with TBI recruited from one center’s system of care. Therefore, our results may lack generalizability to individuals with diverse racial or ethnic identities or different rehabilitation experiences. Furthermore, most participants sustained their injury within the past two years. The frequency of anxiety disorders has been found to decrease across the first five years after TBI, whereas depressive disorders are more persistent (Alway et al., 2016). This raises the possibility that the DASS’ ability to discriminate between depression and anxiety may vary in a more chronic TBI sample. Unfortunately, we could not explore this possibility due to the limited number of participants who were in the later stages of recovery.

Lastly, the specific composition of symptoms experienced by our TBI sample may have influenced the study findings. Some symptoms were not commonly endorsed, with a lower prominence of physiological hyperarousal symptoms as measured by the DASS anxiety scale (see Table 2). As before, it would be beneficial to replicate our findings in other samples, such as a sample of treatment-seeking individuals with TBI. Additionally, some DASS items overlap with direct physiological and cognitive consequences of TBI itself (e.g., shakiness, difficulty initiating). Notwithstanding, our findings are consistent with previous bifactor analyses of the DASS conducted in non-medical populations. Thus, we consider our conclusions were not highly influenced by these overlapping symptoms. Future research should further assess whether there is measurement invariance of the DASS between TBI and non-TBI populations, identifying any items less indicative of emotional distress after TBI.

## Conclusion

We used factor analytic procedures, with an emphasis on novel bifactor statistical indices, to assess the ability of the DASS to differentiate depression, anxiety, and stress in individuals with TBI. Across a range of indices, our results consistently indicated that scores on the DASS21 and DASS42 after TBI predominantly reflect a single, underlying latent variable of general distress. The specific factors, particularly anxiety and stress, added little meaningful information beyond that provided by the total score. Of the conventional DASS scales, the depression scale performed best in TBI after accounting for the general factor’s influence, but ultimately, this scale did not reliably differentiate depression from general distress. In conclusion, our results support using the DASS total score as a transdiagnostic measure of general emotional distress for individuals with TBI, as opposed to using the conventional three-factor scoring.

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