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The Depression Anxiety Stress Scales (DASS): Normative data and latent structure in a large non-clinical sample

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Objectives. To provide UK normative data for the Depression Anxiety and Stress Scale (DASS) and test its convergent, discriminant and construct validity.

Design. Cross-sectional, correlational and confirmatory factor analysis (CFA).

Methods. The DASS was administered to a non-clinical sample, broadly representative of the general adult UK population ($N = 1{,}771$) in terms of demographic variables. Competing models of the latent structure of the DASS were derived from theoretical and empirical sources and evaluated using confirmatory factor analysis. Correlational analysis was used to determine the influence of demographic variables on DASS scores. The convergent and discriminant validity of the measure was examined through correlating the measure with two other measures of depression and anxiety (the HADS and the sAD), and a measure of positive and negative affectivity (the PANAS).

Results. The best fitting model (CFI = .93) of the latent structure of the DASS consisted of three correlated factors corresponding to the depression, anxiety and stress scales with correlated error permitted between items comprising the DASS subscales. Demographic variables had only very modest influences on DASS scores. The reliability of the DASS was excellent, and the measure possessed adequate convergent and discriminant validity

Conclusions. The DASS is a reliable and valid measure of the constructs it was intended to assess. The utility of this measure for UK clinicians is enhanced by the provision of large sample normative data.

The Depression Anxiety Stress Scale (DASS) is a 42-item self-report measure of anxiety, depression and stress developed by Lovibond and Lovibond (1995) which is increasingly used in diverse settings. Its popularity is partly attributable to the fact

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that, unlike many other self-report scales, the DASS is in the public domain (i.e. the measure can be used without incurring any charge). The DASS was originally intended to consist of only two subscales—one measuring anxiety, the other depression—each composed of items that were purportedly unique to either construct. Ambiguous items (i.e. items non-specifically related to depression and anxiety) were not included in the measure but were regarded as controls. This strategy was adopted because the authors' original intention was to develop measures that would maximally discriminate between depression and anxiety. However, during scale development it was revealed that the control items tended to form a third group, of items characterized by chronic non-specific arousal. More items were added to this group and the third scale, the stress scale, emerged. Lovibond and Lovibond maintain that, although this scale is related to the constructs of depression and anxiety, it nevertheless represents a coherent measure in its own right.

Whilst Lovibond and Lovibond's (1995) attempt to develop a measure that maximally discriminates between the constructs of depression and anxiety is not unique (Beck, Epstein, Brown, & Steer, 1988; Costello & Comrey, 1967), the strategy adopted for scale construction is. Conventionally, items are derived from pre-existing anxiety and depression scales, with factor analyses of clinical data used to identify those which measure different constructs. By contrast, Lovibond and Lovibond employed predominantly non-clinical samples for scale development on the basis that depression and anxiety represent dimensional, not categorical, constructs. Moreover, core symptoms of anxiety and depression which were unique to one but not both of the disorders were identified from the outset, and not on an a posteriori basis. Thus, unconventionally, the initial items selected were retained, with new items compatible with the emerging factor definitions successively added.

Preliminary evidence has been presented, which suggests that the DASS does possess adequate convergent and discriminant validity (Lovibond & Lovibond, 1995). A large student sample ($N = 717$) was administered the Beck Depression Inventory (BDI; Beck, Ward, Mendelsohn, Mock, & Erbaugh, 1961), the Beck Anxiety Inventory (BAI; Beck *et al.*, 1988) and the DASS. The BAI and DASS anxiety scale were highly correlated ($r = .81$), as were the BDI and DASS depression scale ($r = .74$). However, between-construct correlations were substantially lower ($r = .54$ for DASS depression and BAI; $r = .58$ for DASS anxiety and BDI). Moreover, Antony, Bieling, Cox, Enns, and Swinson (1998) found a similar pattern of correlations in a clinical sample.

To assess the DASS's psychometric properties, Lovibond and Lovibond (1995) administered the measure to a large non-clinical sample ($N = 2{,}914$). It was found that reliability, assessed using Cronbach's alpha, was acceptable for the depression, anxiety and stress scales (.91, .84 and .90, respectively). These values are similar to those obtained from clinical populations (Antony *et al.*, 1998; Brown, Chorpita, Korotitsch, & Barlow, 1997).

At present, interpretation of the DASS is based primarily on the use of cut-off scores. Lovibond and Lovibond (1995) presented severity ratings from 'normal' to 'extremely severe' on the basis of percentile scores, with 0–78 classified as 'normal', 78–87 as 'mild', 87–95 as 'moderate', 95–98 as 'severe', and 98–100 as 'extremely severe'. However, these original norms were based predominantly on students. This means that the generalizability of their results to the normal population is uncertain. Moreover, although 1,307 of the participants in this study were non-students, no information was presented regarding whether they were broadly representative of the general population; all that was stated was that they were 'white and blue collar workers' (Lovibond & Lovibond, 1995, p. 9).

Relatedly, the influence of demographic characteristics on DASS scores has gone largely uninvestigated. In development of the DASS, this analysis was restricted to gender and age. Although the test authors did not state explicitly whether age and/or gender yielded a significant effect, '. . . there was a trend towards higher scores in the youngest and oldest age brackets' (Lovibond & Lovibond, 1995, p. 28). However, Andrew, Baker, Kneebone, and Knight (2000) found that in a sample of elderly community volunteers ($N = 53$), scores on all three DASS subscales were almost half those reported by Lovibond and Lovibond. It is possible that this discrepancy is attributable to idiosyncrasies in one or both of these samples or the influence of potential mediating factors such as years of education or occupation. Yet no study to date has assessed the influence of either of these latter variables. The relationships between demographic variables and DASS scores in the general population are of interest in their own right, but investigation of these relationships would also serve the very practical purpose of identifying whether normative data should be stratified.

If the use of the DASS in research and clinical practice is to be optimal, then it is also necessary to delineate the underlying structure of the instrument. This is particularly important given that Lovibond and Lovibond (1995) found through empirical analyses that, in both clinical and non-clinical samples, symptoms conventionally regarded as core to the syndrome of depression (American Psychiatric Association, 1994) were actually extremely weak markers of this construct. Specifically, items pertaining to changes in appetite, sleep disturbance, guilt, tiredness, concentration loss, indecision, agitation, loss of libido, diurnal variation in mood, restlessness, irritability and crying were excluded from the measure.

Moreover, the legitimacy of the stress scale as an independent measure must be assessed. In an influential series of papers, Clark and Watson (Clark & Watson, 1991a, 1991b; Watson, Clark, & Tellegen, 1988) have argued that anxiety and depression have an important shared component which they call 'negative affectivity' (NA). NA is a dispositional dimension, with high NA reflecting the experience of subjective distress and unpleasurable engagement, manifested in a variety of emotional states such as guilt, anger and nervousness, and low NA represented by an absence of these feelings (Watson & Clark, 1984). Studies have supported the existence of a dominant NA dimension (Watson & Clark, 1984; Watson & Tellegen, 1985) and provide evidence that it is highly related to the symptoms of both anxiety and depression (Brown *et al.*, 1997; Watson, Clark, Weber *et al.*, 1995; Watson, Weber *et al.*, 1995). Thus, there are strong theoretical grounds for suggesting that the stress scale is simply a measure of NA, particularly given that this scale actually originated from items believed to relate to *both* dimensions.

To date, four studies have directly tested the construct validity of the DASS (Antony *et al.*, 1998; Brown *et al.*, 1997; Clara, Cox, & Enns, 2001; Lovibond & Lovibond, 1995). Lovibond and Lovibond (1995) conducted a principal-components analysis in a student sample ($N = 717$) which revealed that the first three factors accounted for a high proportion of the variance. Furthermore, all items loaded on their designated factor except for anxiety item 30 ('I feared that I would be "thrown" by some trivial but unfamiliar task') which loaded on the stress factor. In the same sample, a confirmatory factor analysis (CFA) was then used to quantitatively compare the fit of a single-factor model, a two-factor model (in which depression was one factor, and anxiety and stress were collapsed into another) and a three-factor model corresponding to the three DASS scales. The three-factor model was found to represent the optimal fit, and a significantly better fit than the two-factor model.

Analogous findings have been reported in two independent clinical samples. Brown *et al.* (1997) conducted an exploratory factor analysis (EFA) with varimax rotation using data derived from a sample ($N = 437$) of patients suffering from a range of affective disorders. A three-factor solution emerged, reproducing Lovibond and Lovibond's (1995) hypothesized structure. The only discrepancies were that anxiety item 9 ('I found myself in situations which made me so anxious that I was most relieved when they ended') and stress item 33 ('I was in a state of nervous tension')[1] double loaded, and anxiety item 30 failed to load strongly on any factor. Brown *et al.* then administered the instrument to an independent clinical sample ($N = 241$) and employed CFA to test the fit of four models. The first three models corresponded exactly to those tested by Lovibond and Lovibond. In addition, a model revised according to the results of the EFA conducted with Brown *et al.*'s first sample was also tested. The results revealed that the revised model represented the optimal fit, and a significantly better fit than the model corresponding to Lovibond and Lovibond's original specifications.

Finally, both Clara *et al.* (2001) and Antony *et al.* (1998) identified three factor solutions in clinical samples ($N = 258$ and $N = 439$, using CFA and EFA respectively). Antony *et al.* (1998), however, again noted discrepancies; stress items 22 ('I found it hard to wind down') and 33 double loaded on anxiety, and anxiety items 9 and 30 double loaded on stress. Thus, whilst these studies suggest that there is a slight degree of misspecification, they have consistently supported the validity of a three-factor structure corresponding to the dimensions of anxiety, depression and stress. To date, though, no study has tested the construct validity of the DASS in a sample drawn from the general adult population.

The aims of the present study were:

(1) to investigate the influence of demographic variables on DASS scores in the general adult UK population;
(2) to provide UK normative data for the DASS in the form of tables for converting raw scores to percentiles;
(3) to evaluate competing models of the latent structure of the DASS using CFA (details of the parameterization of the models, and the theoretical, methodological and empirical considerations that guided their selection, are presented in the methods section);
(4) to obtain estimates of the reliability of the DASS; and
(5) to test the convergent and discriminant validity of the DASS.

Method

Participants

Complete DASS data were collected from 1,771 members of the general adult population (females = 965, males = 806). Participants were recruited from a wide variety of sources including commercial and public service organizations, community centres and recreational clubs. The mean age of the sample was 40.9 ($SD = 15.9$) with a range of 15–91 years. The mean years of education was 13.8 ($SD = 3.1$).

[1] *Brown et al. (1997) refer to item 33 as item 34.*

Materials and procedure

Each potential participant received an introductory letter, a DASS form, and a form for recording demographic variables. A subset of participants also received and completed two additional self-report measures of depression and anxiety, as well as a measure of positive and negative affect. These were the Hospital Anxiety and Depression Scale (HADS, $N = 1512$; Zigmond & Snaith, 1983), the Personal Disturbance scale (sAD, $N = 733$; Bedford & Foulds, 1978), and the Positive and Negative Affect Schedule (PANAS, $N = 740$; Watson *et al.*, 1988). Participants sealed the completed forms in an envelope, and these were either collected by the researcher or returned by mail. The refusal rate was approximately 18% (participants who failed to return forms or returned entirely blank forms were also treated as refusals). In addition, of the 1,786 completed forms, 15 contained either some missing data or contained equivocal responses; these forms were discarded.

Each participant's occupation was coded using the Office of Population Censuses and Surveys (1990) *Classification of occupations*. Retired participants, and those describing themselves as househusbands/housewives, were coded by their previous occupations, as were those currently unemployed. Those who had never worked were coded as 5 (i.e. unskilled).

The percentage of participants in the occupational codes of professional (1), intermediate (2), skilled (3), semi-skilled (4) and unskilled (5) was 11, 38, 34, 9 and 8, respectively. The corresponding percentage for each code in the general adult population census is 7, 32, 42, 14 and 5, respectively. Thus, whilst there was a broad spread, there was a slight overrepresentation of professional occupations, and a slight underrepresentation of skilled and semi-skilled occupations. The percentage of participants in each of four age bands (18–29, 30–44, 45–59, 60+) was 30, 31, 26 and 14. The corresponding percentage for each age band in the general adult population census is 27, 25, 22 and 26, respectively. Again it can be seen that there was a broad spread, although there was a relative underrepresentation of individuals in the oldest age group.

The Hospital Anxiety and Depression Scale (HADS)

The HADS was developed by Zigmond and Snaith (1983) to provide a brief means of identifying and measuring severity of depression and anxiety in non-psychiatric clinical environments. It consists of 14 items, seven of which measure depression, the other seven anxiety. The respondent is asked to underline the reply which most closely matches how they have felt during the past week.

The Personal Disturbance Scale (sAD)

The sAD is a brief (14-item) self-report measure derived from the Delusions-Symptoms States Inventory (DSSI; Bedford & Foulds, 1978), and consists of seven anxiety and seven depression items.

The Positive and Negative Affect Schedule (PANAS)

The PANAS is a brief (20-item) self-report measure of positive affect and negative affect developed by Watson *et al.* (1988). It is claimed that the PANAS provides independent (i.e. orthogonal) measures of these constructs. The 'past week' time format was adopted.

Statistical analysis

Basic statistical analysis was conducted using SPSS Version 8. Confidence limits on Cronbach's alpha were derived from Feldt's (1965) formulae.

CFA (robust maximum likelihood) was performed on the variance-covariance matrix of the DASS items using EQS for Windows Version 5 (Bentler, 1995). The fit of CFA models was assessed using the Satorra–Bentler scaled chi square statistic (S-B χ^2), the average off-diagonal standardized residual (AODSR), the Comparative Fit Index (CFI), the Robust Comparative Fit Index (RCFI) and the Root Mean Squared Error of Approximation (RMSEA). Off-diagonal standardized residuals reflect the extent to which covariances between observed variables have not been accounted for by the models under consideration. Values for the CFI and RCFI can range from zero to unity; these indices express the fit of a model relative to what is termed the 'null model' (the null model posits no relationship between any of the manifest variables). There is general agreement that a model with a CFI of less than 0.95 should not be viewed as providing a satisfactory fit to the data (Hu & Bentler, 1999). The RMSEA has been included as this fit index explicitly penalizes models which are not parsimonious.

A model is considered to be nested within another model if it differs only in imposing additional constraints on the relationships between variables specified in the initial model. The difference between chi square for nested models is itself distributed as chi square with k degrees of freedom where k equals the degrees of freedom for the more constrained model minus the degrees of freedom for the less constrained model. This means that it is possible to test directly whether more constrained models have a significantly poorer fit than less constrained models; this feature of CFA is one of its major advantages over EFA. In the present case there is a slight complication because the S-B χ^2 is used as an index of fit rather than the standard chi-square statistic (the Satorra–Bentler statistic is recommended when the raw data are skewed). The *difference* between S-B χ^2 for nested models is typically not distributed as chi square. However, Satorra and Bentler (2001) have recently developed a scaled difference chi-square test statistic that can be used to compare S-B χ^2 from nested models. This statistic is used in the present study.[2]

Parameterization of competing models of the DASS

The first model (Model 1a) to be evaluated was a single-factor model; this model expressed the hypothesis that the variance in the DASS can be partitioned into one general factor plus error variance associated with each individual item. It is standard practice to test the fit of a one-factor model because it is the most parsimonious of all possible models. A further model was tested (Model 1b) in which again all items were presumed to load upon only one general factor. However, as can be seen in Table 6, items in each of the DASS scales are grouped into categories hypothesized to measure the same subcomponents of the relevant construct. In Model 1b, items from the same content categories were permitted to covary. No study to date has tested a model parameterized to allow for such correlated error.

Models 2a–2c expressed variants on the hypothesis that the DASS measures two factors, anxiety and depression. For all three models the items in the stress and anxiety scale were collapsed into one factor to test the hypothesis that the stress scale does not represent an independent construct but, rather, simply measures anxiety. In Model 2a

[2] *In the course of analysing the present data we wrote a computer program (for PCs) that carries out this test. The program can be downloaded from www.psyc.abdn.ac.uk/homedir/jcrawford/sbdiff.htm*

these two factors were constrained to be orthogonal and in Model 2b, permitted to correlate. Model 2b was then retested, but additionally permitted correlated error between items from the same content categories (Model 2c).

Models 3a–3d tested Lovibond and Lovibond's (1995) three-factor structure, specifying the dimensions of anxiety, depression and stress. In Model 3a, the three factors were constrained to be orthogonal, with Model 3b permitting the factors to correlate in accordance with Lovibond and Lovibond's original specifications. Model 3c represented a test of the model which Brown *et al.* (1997) derived through an EFA in a clinical sample, and which represented the optimal fit of four CFA models tested in an independent clinical sample. The model was parameterized according to Lovibond and Lovibond's original specifications, except that some items were permitted to load on more than one factor. Specifically, stress item 33 also loaded on anxiety, anxiety item 9 on stress, and anxiety item 30 on all three factors. Finally, Model 3c was retested, but additionally permitted correlated error (Model 3d).

Results

Influence of demographic variables on DASS scores

As the DASS scales had a high positive skew, analysis of their relationships with demographic variables (i.e. *t*-tests and correlations) was performed on the logarithm of their scores. Independent samples *t*-tests revealed that females obtained significantly higher scores than males on the anxiety scale ($M = 4.0$, $SD = 6.17$ [females]; $M = 3.0$, $SD = 4.23$ [males]; $t = -2.29$, $p < .05$), depression scale ($M = 6.1$, $SD = 8.14$ [females]; $M = 4.9$, $SD = 6.55$ [males]; $t = -2.68$, $p < .01$), and total of the three scales ($M = 19.9$, $SD = 20.82$ [females]; $M = 16.6$, $SD = 15.95$ [males]; $t = -2.20$, $p < .05$). The difference between males and females on the stress scale did not achieve statistical significance ($M = 9.8$, $SD = 8.56$ [males]; $M = 8.7$, $SD = 7.35$ [females]; $t = -1.802$, $p > .05$).

Table 1. Correlations between demographic variables and DASS scores

	DASS			
Demographic variable	Anxiety	Depression	Stress	Total
Age	–.036	–.109**	–.183**	–.147**
Occupational code	.066**	.018	–.039	.005
Years of education	–.033	–.008	.086**	–.054*
Gender	.054*	.064**	.043	.052*

* Correlation significant at .05 level (two-tailed); ** correlation significant at .01 level (two-tailed).

The influence of the remaining demographic variables (age, years of education and occupational code) on the DASS anxiety, depression, stress and total scales was tested through correlational analyses, the results of which are presented in Table 1. The point-biserial correlations between gender and the DASS scale scores are also presented in this table as an index of effect size (males were coded as 0, females as 1, so a positive correlation represents a higher score in females). It can be seen from Table 1 that the influence of all demographic variables on DASS scores is very modest.

Summary statistics and normative data for the DASS

The means, medians, *SD*s and ranges for each of the three DASS scales are presented in Table 2 for the total sample. Additionally, for each subscale the percentage of participants falling into each of the five categories (normal, mild, moderate, severe and extremely severe) created by the use of Lovibond and Lovibond's (1995) cut-off scores is presented. However, these cut-offs have been presented purely for comparative purposes, and it is important to reiterate that DASS scores should be regarded as providing an individual's score on an underlying dimension.

Table 2. Summary statistics for DASS

					Percentage in each DASS category				
	Median	*M*	*SD*	Range	Normal (0–78[a])	Mild (78–87)	Moderate (87–95)	Severe (95–98)	Extremely severe (98–100)
Total sample (*N* = 1771)									
Anxiety	2	3.56	5.39	0–40	94.4	2.0	3.8	2.0	3.2
Depression	3	5.55	7.48	0–42	81.7	6.2	6.3	2.9	2.9
Stress	8	9.27	8.04	0–42	80.2	8.4	5.9	3.5	2.0
Total	13	18.38	18.82	0–121					

[a] Lovibond and Lovibond's (1995) percentile cut-offs corresponding to each DASS category.

Visual inspection of the distribution of raw scores on the four scales revealed that, as is to be expected in a sample drawn from the general adult population, they were positively skewed, particularly the anxiety scale. Kolmogorov–Smirnov tests confirmed that the distributions deviated highly significantly from a normal distribution (Z ranged from 5.24 to 10.70, all ps $< .001$).

Given the positive skew, use of the means and *SD*s from a normative sample is not useful when interpreting an individual's score. Therefore, Table 3 was constructed for conversion of raw scores on each of the DASS scales to percentiles.

Testing competing confirmatory factor analytic models of the DASS

The fit statistics for the CFA models are presented in Table 4. It can be seen that the general factor model (Model 1a) had a very poor fit; the χ^2 is large, and the fit indices are low. However, all items loaded highly on this factor, evidence that there is substantial common variance among the items. Permitting correlated error (Model 1b) led to an improved, but still badly fitting, model. The two-factor models also had a poor fit, although the correlated factors models (Models 2b and 2c) were better than their more constrained counterpart (Model 2a). Again, correlated error led to an improvement in fit (Model 2c having higher fit indices and a lower χ^2 than Model 2b).

Model 3a tested Lovibond and Lovibond's (1995) three-factor structure but specified orthogonal constructs. This was associated with low fit indices and a very high χ^2. Although permitting correlated factors in Model 3b improved the model's fit, it was still

Table 3. Raw scores on the DASS converted to percentiles

	Raw scores				
Percentile	Depression	Anxiety	Stress	Total	**Percentile**
5	0	0	0	1	**5**
10	0	0	1	2	**10**
15	0	0	2	3	**15**
20	0	0	3	5	**20**
25	1	0	3	6	**25**
30	1	0	4	7	**30**
35	1	1	5	8	**35**
40	2	1	6	10	**40**
45	2	1	7	12	**45**
50	3	2	8	13	**50**
55	3	2	8	15	**55**
60	4	3	9	17	**60**
65	5	3	10	19	**65**
70	6	4	12	22	**70**
75	7	4	13	24	**75**
76	8	5	13	24	**76**
77	8	5	13	25	**77**
78	8	5	14	26	**78**
79	9	5	14	27	**79**
80	9	6	14	28	**80**
81	9	6	15	28	**81**
82	10	6	15	29	**82**
83	10	6	16	30	**83**
84	11	7	16	31	**84**
85	11	7	17	32	**85**
86	12	7	17	34	**86**
87	13	8	18	35	**87**
88	14	8	18	36	**88**
89	14	8	19	39	**89**
90	15	9	20	40	**90**
91	16	10	21	42	**91**
92	17	11	22	46	**92**
93	18	12	23	48	**93**
94	20	13	25	54	**94**
95	22	15	26	60	**95**
96	24	17	28	64	**96**
97	27	20	30	72	**97**
98	31	22	34	79	**98**
99	36	26	37	91	**99**

poor. However, for both models, all items loaded highly on the appropriate construct. Model 3c represented a revised version of Lovibond and Lovibond's model based on the empirical findings of Brown *et al.* (1997) and represented a superior fit. As with Brown *et al.*'s study, items 9 and 33 loaded equivalently on the anxiety and stress factors (.36 vs. .36; .41 vs. .40, respectively), and item 30 loaded weakly on all three factors (ranging from .12 to .35). Again, none of the fit indices was acceptable. Model 3d was identical to

Table 4. Fit indices for CFA models of DASS

Model	S-Bχ^2	χ^{2a}	*df*	AODSR	CFI	RCFI	RMSEA
Single factor							
1a. Single factor	7,259.3	14,144.5	819	.0560	.726	.542	.096
1b. Single factor with correlated error	3,986.4	7,616.1	779	.0475	.860	.772	.070
Anxiety and depression as . . .							
2a. independent factors	6,172.2	11,902.2	819	.2063	.773	.619	.087
2b. correlated factors	5,421.9	10,341.7	818	.0459	.805	.673	.081
2c. correlated factors with correlated error	2,965.0	5,607.6	778	.0385	.901	.844	.059
Lovibond & Lovibond's model with . . .							
3a. independent factors	5,661.8	10,945.0	819	.2662	.792	.656	.084
3b. correlated factors	4,298.2	8,148.0	816	.0422	.850	.752	.071
3c. correlated factors, revised	4,059.5	7,656.9	812	.0377	.860	.769	.069
3d. correlated factors, revised, and correlated error	2,347.8	4,403.2	772	.0322	.925	.888	.052

[a] The Satorra–Bentler scaled chi square statistic (S-B χ^2) was used to evaluate model fit. However, the normal chi square is also required when testing for a difference between the S-B χ^2 statistic obtained from nested models; hence we present both statistics in this table.

Table 5. Results of testing for differences between nested CFA models of DASS

Comparison		Δ statistics		
More constrained	Less constrained	Δ S-B χ^2	df	p
Model 1a	Model 1b	3,272.9	40	<.001
Model 2a	Model 2b	750.3	1	<.001
Model 1a	Model 2b	1,837.4	1	<.001
Model 2b	Model 2c	2,457.0	40	<.001
Model 1b	Model 2c	1,021.4	1	<.001
Model 3a	Model 3b	1,363.6	3	<.001
Model 1a	Model 3b	2,961.1	3	<.001
Model 2b	Model 3b	1,123.7	2	<.001
Model 3b	Model 3c	238.7	4	<.001
Model 3c	Model 3d	1,711.7	40	<.001
Model 1b	Model 3d	1,638.6	7	<.001
Model 2c	Model 3d	617.2	6	<.001

Model 3c but additionally permitted correlated error. This model was associated with the optimal fit according to all criteria, with high fit indices and a χ^2 value that, although statistically significant,[3] was substantially lower than that for the other models tested.

The fit of the correlated factors models is markedly superior to their independent factors counterparts. As noted, inferential statistics can be applied to compare nested models. Models 2a and 3a are nested within Models 2b and 3b respectively in that they differ only by the imposition of the constraint that the factors are independent. The results from chi square difference tests used to compare these nested models are presented in Table 5. It can be seen that the correlated factors models had a significantly better fit ($p < .001$) than their independent factors counterparts, demonstrating that the conception of independence between the scales is untenable. This is underlined by the correlations between the three *factors* in Models 3b–3d. For the optimal Model, 3d, the correlations were depression–anxiety ($r = .75$), stress–depression ($r = .77$) and stress–anxiety ($r = .74$). These correlations are higher than the respective correlations between the *scales*: depression–anxiety ($r = .70$), stress–depression ($r = .72$) and stress–anxiety ($r = .70$)—although these latter correlations are themselves substantial. This is because the factors in the CFA models are measured without error, whereas the correlation between the scales is attenuated by measurement error and the unique variance associated with each item.

Although it may appear initially that the general factor model is very different from the correlated factors models, it is also nested within these models. Models 2b and 3b can be rendered equivalent to a single factor simply by constraining the correlation between factors to unity (i.e. $r = 1.0$). The chi square difference tests comparing Model 1 with Models 2b and 3b were both highly significant, demonstrating that it is also untenable to view the DASS as measuring only a single factor of negative affectivity or general psychological distress.

Allowing for correlated error between the items also resulted in a significant

[3] *When dealing with large sample sizes and a large number of items it is unusual to obtain non-significant χ^2 values for CFA models of self-report data (Byrne, 1994).*

improvement in the fit of Models 1b, 2c and 3d compared with their more constrained counterparts, Models 1a, 2b and 3c, respectively. Moreover, the addition of the double loadings identified by Brown *et al.* (1997) led to improvement, with Model 3c a significantly better fit than Model 3b ($p < .001$).

Evaluation of the optimal model

As shown in Table 6, all items in Model 3d loaded $\geq .47$ on the specific factor they were intended to represent, with the exception of the three 'weak' items identified in earlier factor analyses (items 9, 30 and 33). Cross-validating Brown *et al.*'s (1997) clinical study, anxiety item 9 and stress item 33 loaded identically on the anxiety and stress factors (item 9 loaded .36 on both factors; and item 33 loaded .40 on each construct). Item 30 loaded only weakly on all three factors (.13, .36 and .23 on depression, anxiety and stress, respectively). Although allowing correlated error between items of related subscales led to a significant improvement in fit, the item-specific correlations revealed that not all of the subsets appeared to be related in the manner hypothesized. That is, although the majority were positively related, some correlations were negative, albeit modestly so.

A schematic representation of the structure for the optimal Model (3d) is presented as Figure 1 (the associated factor loadings are presented in Table 6). By convention, latent factors are represented by large ovals or circles, the error variances as smaller ovals or circles (as they are also latent variables) and manifest (i.e. observed) variables as rectangles or squares. Single-headed arrows connecting variables represent a causal path. Double-headed arrows represent covariance or correlation between variables but do not imply causality.

Reliabilities of the DASS

The reliabilities (internal consistencies) of the DASS anxiety, depression, stress and total score were estimated using Cronbach's alpha. Alpha was .897 (95% CI = .890–.904) for the anxiety scale, .947 (95% CI = .943–.951) for the depression scale, .933 (95% CI = .928–.937) for the stress scale, and .966 (95% CI = .964–.968) for the total score.

Convergent and discriminant validity of the DASS

To examine the convergent and discriminant validity of the DASS, Pearson product–moment correlations were calculated between each of the DASS scales and the sAD, HADS and PANAS scales. These correlations are presented in Table 7. With respect to convergent validity, the DASS depression scale correlated highly with sAD depression (.78). William's (1959) test revealed that this correlation was higher than that between sAD depression and HADS depression (.58; $t = 9.10$, $p < .001$). Similarly, the correlation between DASS depression and HADS depression (.66) was significantly higher than the HADS–sAD correlation ($t = 4.19$, $p < .001$). DASS anxiety scores also exhibited a high convergent validity. The correlation between DASS anxiety and sAD anxiety (.72) was significantly higher than that between the sAD and HADS anxiety scales (.67; $t = 2.40$, $p < .05$). However, although the correlation between DASS anxiety and HADS anxiety was substantial and highly significant (.62, $p < .001$), it was lower than the aforementioned correlation between HADS anxiety and sAD anxiety ($t = 2.41$, $p < .05$).

Table 6. DASS items with factor loadings from confirmatory factor analysis (Model 3d)

Scale/item summary	Subscale	Factor: Depression	Factor: Anxiety	Factor: Stress
Depression				
26 Downhearted & blue	DYS	.77		
13 Sad & depressed	DYS	.78		
37 Nothing future hopeful	HLNS	.82		
10 Nothing to look forward to	HLNS	.81		
38 Life meaningless	DoL	.78		
21 Life not worthwhile	DoL	.79		
34 Felt worthless	S-Dep	.80		
17 Not worth much as person	S-Dep	.77		
16 Lost interest in everything	LoI/I	.81		
31 Unable to become enthusiastic	LoI/I	.78		
3 Couldn't experience positive	ANH	.71		
24 Couldn't get enjoyment	ANH	.75		
5 Couldn't get going	INRT	.53		
42 Difficult to work up initiative	INRT	.64		
Anxiety				
25 Aware of action of heart	AutAr		.62	
19 Perspired noticeably	AutAr		.60	
2 Dryness of mouth	AutAr		.47	
4 Breathing difficulty	AutAr		.50	
23 Difficulty swallowing	AutAr		.57	
7 Shakiness	SkME		.63	
41 Trembling	SkME		.62	
40 Worried about situations/panic	SitAnx		.62	
9 Situations made anxious	SitAnx		.36	.36
30 Feared would be 'thrown'	SitAnx	.13	.36	.23
28 Felt close to panic	SubAA		.80	
36 Terrified	SubAA		.70	
20 Scared for no good reason	SubAA		.74	
15 Feeling faint	SubAA		.58	
Stress				
22 Hard to wind down	DRel			.69
29 Hard to calm down	DRel			.79
8 Difficult to relax	DRel			.68
12 Using nervous energy	NerAr			.67
33 State of nervous tension	NerAr		.40	.40
11 Upset easily	EU/A			.79
1 Upset by trivial things	EU/A			.69
39 Agitated	EU/A			.78
6 Overreact to situations	I/OR			.72
27 Irritable	I/OR			.77
18 Touchy	I/OR			.76
35 Intolerant kept from getting on	IMPT			.62
14 Impatient when delayed	IMPT			.53
32 Difficulty tolerating interruptns	IMPT			.63

Note. DYS = dysphoria; HLNS = hopelessness; DoL = devaluation of life; S-Dep = self-deprecation; LoI/I = lack of interest/involvement; ANH = anhedonia; INRT – inertia; AutAr = autonomic arousal; SkME = skeletal musculature effects; SitAnx = situational anxiety; SubAA = subjective anxious affect; DRel = difficulty relaxing; NerAr = nervous arousal; EU/A = easily upset/agitated; I/OR = irritable/ over-reactive; IMPT = impatient.

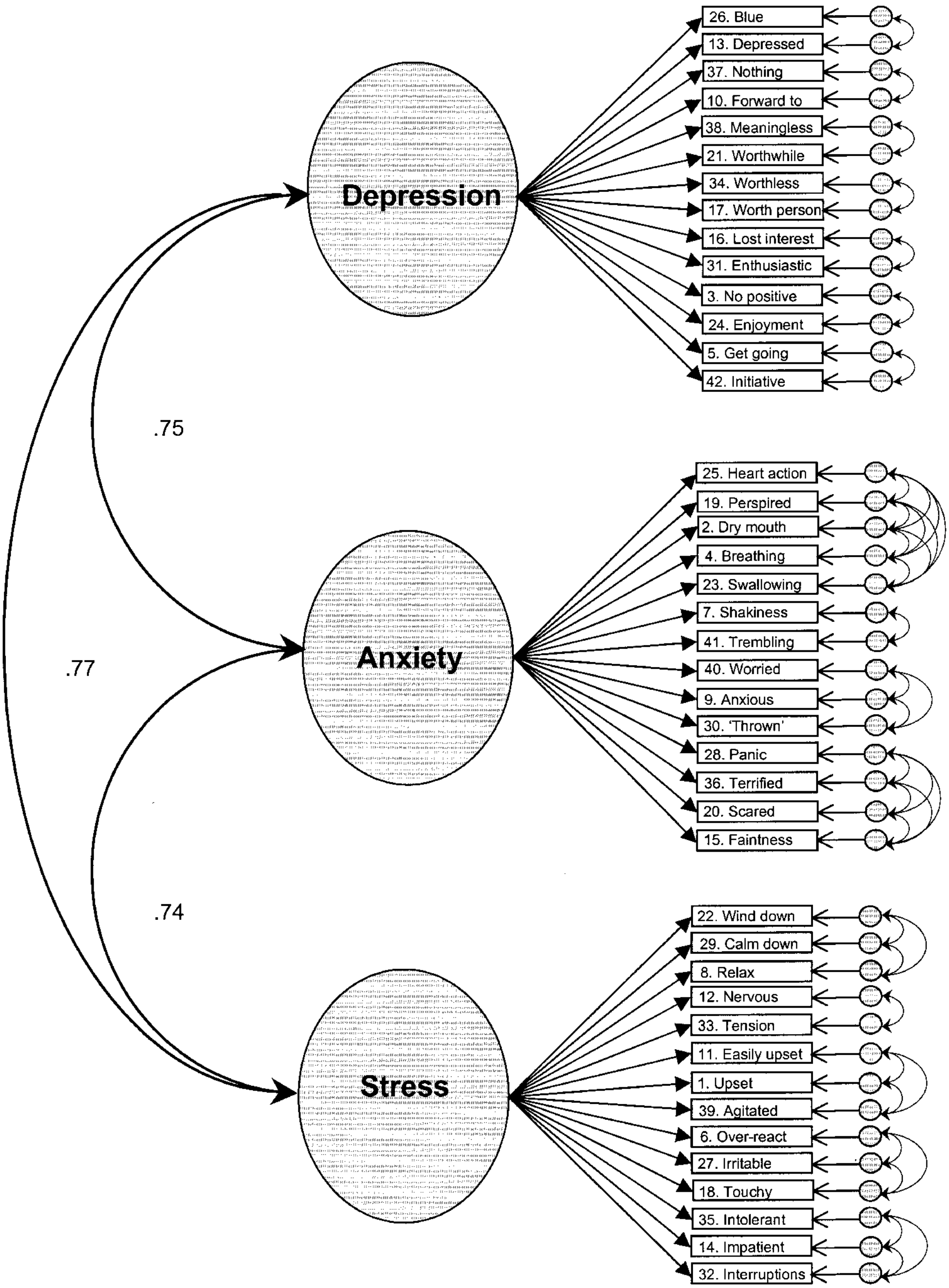

Figure 1. Graphical representation of a correlated three-factor model of the DASS (Model 3d); cross-loadings have been omitted in the interests of clarity.

Table 7. Correlations between the DASS, sAD, HADS and PANAS

	DASS depression	DASS anxiety	DASS stress	sAD depression	sAD anxiety	HADS depression	HADS anxiety	PANAS PA	PANAS NA
DASS depression	–	–	–	–	–	–	–		
DASS anxiety	.70 (1771)	–	–	–	–	–	–		
DASS stress	.72 (1771)	.71 (1771)	–	–	–	–	–		
sAD depression	.78 (733)	.56 (733)	.56 (733)	–	–	–	–		
sAD anxiety	.62 (733)	.72 (733)	.67 (733)	.70 (758)	–	–	–		
HADS depression	.66 (1512)	.49 (1512)	.54 (1512)	.58 (746)	.52 (746)	–	–		
HADS anxiety	.59 (1512)	.62 (1512)	.71 (1512)	.54 (746)	.67 (746)	.53 (1792)	–		
PANAS PA	–.48 (740)	–.29 (740)	–.31 (740)	– (0)	– (0)	–.52 (989)	–.31 (989)	–	
PANAS NA	.60 (740)	.60 (740)	.67 (740)	– (0)	– (0)	.44 (989)	.65 (989)	–.24 (1003)	–

Note. *N* for each correlation in parentheses.

In common with all other self-report scales of anxiety and depression, the discriminant validity of the DASS was less impressive: the between-construct correlations (i.e. DASS anxiety with HADS depression, etc.) were all highly significant (see Table 7). However, Williams' tests revealed that when the DASS scales were paired with their opposites from the other scales, all these latter (between-construct) correlations were significantly lower ($p < .05$ or beyond) than the corresponding within-construct correlations referred to above.

The correlations between PA and NA with the DASS scales are of particular interest, especially the correlations between PA and the depression scale, and NA and the stress scale. The depression scale's correlation with PA was highly significant and negative in sign (−.48); thus scoring high on depression was associated with low levels of PA. Using Meng, Rosenthal, and Rubin's (1992) method of comparing sets of non-independent correlations, this correlation was significantly higher than the correlations between PA and the other two DASS scales (−.29 for anxiety and −.31 for stress; $z = 8.36$, $p < .001$). The correlation between the stress scale and NA (.67) was significantly higher than the correlation of NA with the other two DASS scales (.60 for both anxiety and depression; $z = 3.64$, $p < .001$).

Discussion

Influence of demographic variables

One basic aim of the present study was to examine the influence of demographic variables on DASS scores. Although nine out of the 16 relationships examined proved significant, the size of the effects was very modest. The percentage of variance explained ranged from a low of 0.003% (occupational code and total score) to 3.35% (age and stress). Thus, for practical purposes, the influence of gender, occupation, education and age on DASS scores can be ignored; the significant effects result from the high statistical power conferred by a large sample size. This simplifies interpretation of DASS scores, as these variables do not need to be taken into consideration.

The effects of gender on DASS scores were very modest; the largest effect was on the depression scale, but even here gender only accounted for 0.41% of the variance in scores. This result is surprising given that epidemiological studies generally report a higher incidence of anxiety and depression in females (Horwath & Weissman, 1995; Meltzer, Gill, Petticrew, & Hinds, 1995). It is not clear why substantial gender effects did not emerge in the present study, but this finding is consistent with Lovibond and Lovibond's (1995) study in which gender effects were also very modest. The explanation may lie in the combination of two factors. First, epidemiological studies are concerned with caseness, in other words only with the number of individuals that meet clinical criteria, rather than measuring milder manifestations of psychological distress. Second, the DASS intentionally omits many of the symptoms that form part of traditional psychiatric criteria (Lovibond & Lovibond, 1995).

Normative data

Despite the widespread use of the DASS in the English-speaking world, adequate normative data for the English language version do not appear to have been presented previously. Instead, interpretation of the DASS has been based primarily on norms derived from a sample predominantly composed of students (Lovibond & Lovibond, 1995). The current study usefully complements this by providing normative data derived from a sample known to be broadly representative of the general adult population.

The tabulation method in Table 3 was adopted to permit conversion of raw scores to percentiles for all three scales and the total scale using the same table. Because of this, and because of the granularity of raw scores, it can be seen that, in a few cases, a given raw score can correspond to more than one percentile (e.g. for the stress scale a raw score of 8 spans the 50th to 55th percentiles). When this occurs the user should take the highest percentile. Should clinicians or researchers prefer to express an individual's standing on the DASS as a normalized z score or T score, it would be a relatively simple task to derive these from the percentile tables. For example, a raw score of 22 on the DASS depression scale would convert to a T score of 66 or a z score of 1.64, given that this raw score corresponds to the 95th percentile.

The only previous normative data for the DASS comes from Lovibond and Lovibond's (1995) Australian sample. The mean score in the present sample for depression was 5.55 (SD = 7.48), for anxiety 3.56 (SD = 5.39) and for stress 9.27 (SD = 8.04). These means are slightly lower than the norms presented by Lovibond and Lovibond: depression = 6.34 (SD = 6.97); anxiety = 4.70 (SD = 4.91) and stress = 10.11 (SD = 7.91). The minor differences may be because Lovibond and Lovibond's data were derived from a sample predominantly composed of students; there is evidence of elevated rates of psychological disturbance in student populations (Boyle, 1985; Gotlib, 1984).

Competing models of the structure of the DASS

CFA was used to test competing models of the latent structure of the DASS. From the fit statistics in Table 4, it is clear that the hypothesis that the DASS measures a single factor (Models 1a and 1b) is untenable. Analogously, all the two-factor models (Models 2a–2c) were associated with poor fits, although permitting correlated factors (Models 2b and 2c) and correlated error (Model 2c) each led to an improvement.

Model 3a represented a test of Lovibond and Lovibond's (1995) three-factor structure, but specified orthogonal factors. This model, as well as a model in which correlated factors were permitted (Model 3b), represented poor fits, with large χ^2 and low fit indices. However, both had a significantly better fit than their more constrained one-factor counterparts (Models 1a and 1b, respectively) and Model 3b's two-factor counterpart (Model 2b). This indicates that it is untenable to view the DASS as measuring only one or two dimensions; the stress scale represents a legitimate construct in its own right. Model 3c, identical to Model 3b except for Brown *et al.*'s (1997) empirically derived revisions, represented a significantly better fit than Model 3b. However, additionally permitting correlated error between related subscales resulted in the optimal fitting model, as reflected by all criteria, even though some of the subscales appear to consist of items that are heterogeneous in content.

The conclusion from the CFA modelling, therefore, is that, consistent with previous empirical findings, the depression, anxiety and stress scales do represent legitimate constructs in their own right. Moreover, the current study supports Brown *et al.*'s (1997) findings that minor adjustments are required to optimize fit.

Reliabilities

The reliabilities of the DASS scales, as measured by Cronbach's alpha, were .90 for anxiety, .95 for depression, .93 for stress and .97 for the total scale. The narrowness of the confidence limits associated with these coefficients indicates that they can be regarded as providing very accurate estimates of the internal consistency of the DASS in the general adult population. There is no absolute criterion for the reliability of an instrument. However, as a rule of thumb, Anastasi (1990) has suggested that α should be at least .85 if the intention is to use an instrument to draw inferences concerning an individual. By this criterion all three DASS subscales and the total scale can be viewed as possessing adequate reliability.

Convergent and discriminant validity of the DASS

The correlations between the anxiety and depression scales presented in Table 7, and the inferential statistical methods used to analyse them, suggest that the convergent validity of the DASS is superior to the other scales examined (e.g. the DASS scales' correlations with the other scales were significantly higher than the correlation between the other scales in three out of the four comparisons). The discriminant validity of scales is generally assessed by examining the magnitude of their correlations with measures of other constructs; a high correlation is taken as evidence of poor discriminant validity. However, in the present case there are strong theoretical grounds and empirical evidence that anxiety and depression are far from independent constructs; it is an invariant finding that such scales are highly correlated. Therefore it would have been very surprising if the DASS had bucked this trend. Moreover, the DASS scales were developed to maximize the breadth of each construct, in addition to differentiating between them. However, there was nevertheless some evidence for discriminant validity in that the within-construct correlations involving the DASS and the other self-report scales were all significantly higher than the corresponding between-construct correlations.

There is some overlap between Lovibond and Lovibond's (1995) conception of stress as measured by their stress scale, and the construct of negative affectivity. The question therefore arises whether stress is in fact equivalent to NA. The correlation between the NA and stress scales was significantly higher than NA's correlation with the other DASS scales. This is consistent with the overlap referred to above. However, the magnitude of the difference between these correlations was relatively modest (the significant effect is more a reflection of the higher statistical power conferred by the large sample size). Furthermore, it is clear from the absolute magnitude of the correlation between NA and stress (.67) that, although the constructs are associated, they cannot be viewed as interchangeable. This correlation is attenuated by measurement error in the NA and stress scales but, as both instruments are very reliable, the degree of attenuation is modest. When a correction for attenuation[4] was applied to the correlation (Nunnally & Bernstein, 1994), it rose to .75. Therefore, the present results indicate that, even if the constructs could be measured without error, only 56% of the variance would be shared variance.

Independent evidence that stress, as measured by the DASS, should not be regarded as synonymous with NA comes from Lovibond's (1998) study of the long-term temporal

[4]The reliability coefficients (Cronbach's alpha) used in this formula were calculated in the present sample: α for the stress scale is reported in the text; α for the NA scale was .85.

stability of the DASS. If the stress scale is simply an index of non-specific vulnerability to distress (i.e. NA), then stress scores at Time 1 should have been a more powerful predictor of anxiety at Time 2 than was depression, and a more powerful predictor of depression scores at Time 2 than was anxiety. Neither of these two patterns was observed, yet stress scores at Time 1 were relatively good predictors of stress scores at Time 2.

Conclusions and future research

To conclude, the DASS has been shown to possess impressive psychometric properties in a large sample drawn from the general adult population. The results from CFA modelling strongly support the construct validity of the DASS scales, and the reliabilities of all three scales and the total scale were excellent. The normative data presented here should serve as useful supplements to existing normative data as they are based on a sample that was broadly representative of the general adult population in terms of age, gender and social class. The present norms are also, to our knowledge, the only UK norms currently available.

Although beyond the scope of the present investigation, it would be valuable formally to examine whether the DASS is factorially invariant. In the present study, for example, it was shown that the demographic variables (e.g. age and gender) exerted only a negligible effect on DASS scores. However, simultaneous multi-group CFA could also be employed to test whether the latent structure is invariant across age groups and gender (see Byrne, 1989, 1994). More importantly, this method could be used to examine whether the DASS is factorially invariant across cultures and across healthy and clinical populations. Examination of this latter issue would not only provide important information for those using the DASS in research or practice, but would also constitute a stringent test on the broader theoretical question of whether the constructs of anxiety, depression and stress should be viewed as continua rather than syndromes.

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