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The personal disturbance scale (sAD): normative data and latent structure in a large non-clinical sample

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Abstract

The Personal Disturbance Scale [sAD; Bedford & Foulds (1978) *Delusions–Symptoms–States Inventory State of Anxiety and Depression*. Windsor: NFER-Nelson] is widely used in diverse settings and yet there are unresolved issues concerning its psychometric properties and normative data for the English speaking version are limited. The sAD was administered to a large sample of the general adult population ($N = 758$). Demographic variables (gender, age, years of education and occupational status) had only very modest influences on sAD scores. Tables are presented for conversion of raw scores on the Anxiety, Depression and Total scales to percentiles. The sAD scales possessed adequate convergent and discriminant validity, as demonstrated by their pattern of correlations with two other measures of depression and anxiety (the DASS and the HADS). Ten competing models of the latent structure of the sAD were derived from theoretical and empirical sources. These models were evaluated using confirmatory factor analysis. The best fitting model (CFI = 0.96) had a tripartite structure, and consisted of a general factor of psychological distress/negative affectivity (all items loaded on this factor) plus orthogonal specific factors of anxiety and depression. Correlated errors specified according to previous empirical findings were permitted. The theoretical and practical implications of this latent structure are discussed. © 2002 Published by Elsevier Science Ltd.

Keywords: sAD; Psychometric properties; Tripartite model; Mood disorders; Validity

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1. Introduction

The Personal Disturbance Scale (sAD) is a brief (14-item) self-report measure of depression and anxiety derived from the Delusions–Symptoms States Inventory (DSSI; Bedford & Foulds, 1978). It was originally developed for use in the normal population, but has been predominantly used in the domain of general medicine (Bedford & Deary, 1997). Its popularity may be attributed to its brevity, the fact that it solely enquires about *recent* mental state, and the omission of items tapping personality or attitude. Moreover, the scale was developed according to the hierarchy of classes of personal illness model, and is thus argued to constitute an effective means of detecting 'cases' (Foulds & Bedford, 1975).

The DSSI was developed to provide a measure of personal illness which is regarded as hierarchical in nature (Foulds, 1976; Foulds & Bedford, 1975). This model posits that the high degree of comorbidity which typically exists between psychiatric disorders is systematic, and attributable to the fact that four specific levels of personal illness exist which are inclusive and non-reflexive in nature. These range from Dysthymic States (Class One), to Delusions of Disintegration (Class Four). That is, whilst individuals in Class Three are also members of Class Two and Class One, the reverse relationship does not necessarily hold. Bedford and Deary (1999) presented 36 data sets in which the percentage of subjects fitting the hierarchy of classes of personal illness model ranged from 73.3% to 97.8%. Thus, since the sAD was derived from the Dysthymic States class, the sAD should represent an effective means of detecting cases as individuals in the upper classes with more serious 'personal illness' should also score highly in this lower domain.

Despite its widespread use there have been relatively few studies of the psychometric properties of the sAD, particularly in non-clinical samples. Three studies which have been conducted suggest that the sAD Anxiety, Depression and Total scales possess adequate internal consistencies, with estimates ranging from 0.80 to 0.88 (Bedford, Grant, de Pauw, & Deary, 1999; Christensen et al., 1999; Morgan, Dallosso, Arie, Byrne, Jones, & Waite, 1987). However, *no* study has assessed the reliability of the sAD in a sample of the British general population.

At present, interpretation of the sAD is primarily based on the use of cut-off scores. Bedford and Foulds (1978) recommend that cumulative Depression and Anxiety scores in the range zero to two be interpreted as non-personally disturbed, three to six as personally disturbed, and seven or greater as personally ill. Thus, in this regard they do not dichotomise between anxiety and depression as most self-report measures do, but rather, view each as cumulatively contributing to personal illness. However, scores of four or greater are argued to represent membership of a set; that is, whether an individual should be regarded as suffering from an anxiety and/or depressive disorder. However, updated normative data is necessary, as the size of the sample was relatively modest and its generalisability to the normal population questionable; participants consisted of "non-graduate hospital personnel, and members of recreational and educational classes." (p. 6), i.e. a convenience sample composed predominantly of young participants.

Means and SDs for the sAD scales are available for a large general population sample in Australia (Christensen et al., 1999). However, these data cannot be used to estimate the rarity or abnormality of a given sAD score as it is to be expected that the distribution of scores in the general population would be highly positively skewed. This rules out the use of the reported summary statistics to express an individual's standing as a z score or percentile. Christensen et al. (1999) scored each item on the sAD 1, 2, 3 or 4 instead of the test authors' recommended 0, 1, 2

or 3. However, by deducting 7 from each scale's total score, norms directly comparable with those presented by Bedford and Foulds (1978) can be derived. This results in means of 2.26 (SD = 2.89) for sAD depression, and 2.95 (SD = 2.96) for sAD anxiety ($N = 2622$). These values are higher than the original norms presented by Bedford and Foulds (1978). Analogously, norms presented for the Greek version of the sAD (Angelopoulos & Economou, 1994; Economou & Angelopoulos, 1989; Lyketsos, Blackburn, & Mouzaki, 1979) differed, often markedly, from the original British norms (Bedford & Foulds, 1978). This highlights the need to obtain updated UK norms based on a large sample.

A number of studies have examined the influence of demographic characteristics on sAD scores. Studies investigating gender effects have produced conflicting results. Whilst three studies involving non-clinical samples found that females had higher scores on both sub-scales than males (Christensen et al., 1999; Henderson, Byrne, & Duncan-Jones, 1981; Lyketsos et al., 1979), no differences were reported for the original norms presented for the British population (Bedford & Foulds, 1978). The influence of other important demographic variables, notably age, education and occupation, also needs to be investigated. The only study to date which has assessed the influence of these demographics variables reported significant effects of each upon sAD scores in an Australian sample (Christensen et al., 1999). The relationships between demographic variables and sAD 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. Whilst Christensen et al. (1999) did present norms broken down according to each of these categories, only means and SDs, not percentiles, were presented.

If the use of the sAD 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 the existing method of scoring the scale into separate anxiety and depression scales may not adequately reflect its structure. In an influential series of papers, Clark and Watson have argued that anxiety and depression have an important shared component which they call negative affectivity (NA; Clark & Watson, 1991a, 1991b; Watson, Clark, & Tellegen, 1988). NA is conceptualised as 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 this dimension is highly related to the symptoms and diagnosis of both anxiety and depression (Brown, Chorpita, Korotitsch, & Barlow, 1997; Watson, Clark, Weber, Assenheimer, Strauss, & McCormick, 1995; Watson, Weber, Assenheimer, Clark, Strauss, & McCormick, 1995). Thus, there are strong reasons for suggesting that the anxiety and depression scales of the sAD should simply be collapsed, as both measure the same underlying dimension, NA.

However, as Bedford and Deary (1997) note, "studies of the sAD's psychometric structure are rare" (p. 493), particularly in non-clinical populations. Better information on its properties in the general adult population would place clinical interpretation of the sAD on a sounder footing, and would also have wider applicability given that the sAD is also used in non-psychiatric and non-medical settings to provide a measure of mood or general distress.

Factor analytic studies conducted thus far have yielded inconsistent results (Bedford & Deary, 1997; Bedford et al., 1999; Christensen et al., 1999; Shevlin, Brunsden, & Miles, 1998). Bedford

and Deary (1997) conducted an exploratory factor analysis (EFA) of the SAD in a psychiatric sample ($N = 480$). A single factor model, a two factor model (with specific anxiety and depression factors), and a three factor model could be delineated. This latter model consisted of specific anxiety and depression factors, with items 2 (''Recently I have been so miserable that I have had difficulty with my sleep'') and 11 (''Recently worrying has kept me awake at night'') forming the third factor. Confirmatory factor analysis (CFA) was then used to test five competing models. The optimal model permitted a general NA factor upon which all items loaded, plus two specific anxiety and depression factors. Three Anxiety items (items 1, 11 and 13) did not load significantly on the anxiety factor, so were a posteriori constrained to load only on the shared NA dimension. Bedford and Deary (1997) permitted the item-specific variances of the two 'sleep' items to correlate because, ''first, two items is small to define a latent trait; and second, the correlation of the error terms captures the possibility that the two items might represent a bloated specific, essentially having a similar item content.'' (p. 505). Indeed, Kendler, Heath, Martin, and Eaves (1987) used EFA to investigate the latent structure of a 13-item version of the sAD, and they too found that a third factor was defined by items 2 and 11. Thus, this suggests that there is a degree of item redundancy (i.e. the two items are simply rewords of the same question).

Shevlin et al. (1998), however, criticised Bedford and Deary (1997) for failing to take parsimony into consideration. Shevlin et al. (1998) conducted CFA using data derived from elderly general population participants ($N = 979$). A general factor model (Model 1), a correlated two-factor model (Model 2), and a tripartite model consisting of a shared general factor as well as specific anxiety and depression factors (Model 3) were tested. Model 3 was then re-tested, but with loadings found to be non-significant omitted (Model 4). Shevlin et al. (1998) argued that the fit of all these models was comparable (although, in fact, large differences in chi square were obtained). However, they also employed parsimony fit indices (which control for the number of free parameters), and argued that these indices indicated a one factor model represented the optimal fit.

In response to Shevlin et al. (1998), Bedford et al. (1999) conducted an EFA using data from a psychiatric sample ($N = 132$). Again, one, two and three factor solutions could be delineated, corresponding almost exactly to those identified by Bedford and Deary (1997). CFA was then employed to test the fit of each competing model. A nested three factor model which permitted correlated error between items 2 and 11 proved optimal (CFI = 0.97), and a significantly better fit than a one factor model ($P < 0.001$). However, only two of the three Anxiety items constrained to load uniquely on NA in Bedford and Deary's (1997) best-fitting model were restricted in this manner (items 13 and 11); the third item (item 1) loaded significantly on both the NA and the Anxiety factors.

Finally, Christensen et al. (1999) conducted a confirmatory factor analysis using data derived from a large Australian sample generalisable to the normal population ($N = 2622$). A correlated two factor model was originally specified, and represented a relatively poor fit (GFI = 0.91). However, the residuals of three item pairs were permitted to correlate on an a posteriori basis (items 2 and 11; 2 and 1; and 6 and 14), and resulted in substantial improvement (GFI = 0.96). This model was then compared with a one factor model permitting correlated error as specified above. The correlated two factor model represented a substantially better fit.

It should be clear that a general problem with this area of research has been that many of the researchers cited have made post-hoc adjustments in the absence of strong theoretical justifications to increase model fit (Bedford & Deary, 1997; Bedford et al., 1999; Christensen et al., 1999;

Shevlin et al., 1998). This is problematic because a very real possibility of capitalising on chance exists. That is, a particular model may prove optimal as a consequence of idiosyncracies in the study sampled, and thus not be replicated in subsequent analyses. Bedford and Deary (1997) for example, found that although item 1 failed to load significantly on the Anxiety factor in the optimal model, this was not the case in a subsequent study (Bedford et al., 1999). The use of such post-hoc adjustments may partially account for the fact that the studies described have presented different interpretations of the underlying structure of the sAD.

In addition, only two of the studies investigating the latent structure of the sAD employed samples drawn from non-clinical populations, and only one of these was representative of the general population (Christensen et al., 1999). Moreover, this study did not test the fit of a tripartite structure. There are strong theoretical grounds for believing that this structure will be optimal. As noted, it has been argued that anxiety and depression scales tap a common factor, NA. The tripartite theory of anxiety and depression (Clark & Watson, 1991b) extended this theory to posit that anxiety and depression nevertheless have specific components and can thus be differentiated, with anxiety uniquely related to physiological hyperarousal, and depression to low positive affectivity (PA). This theoretical position has been supported by empirical evidence suggesting that a tripartite structure is optimal for the sAD in independent clinical samples (Bedford & Deary, 1997; Bedford et al., 1999). It is necessary to test competing models of the sAD in a sample generalisable to the normal population because of the possibility that the factor structure of the measure may not be invariant across different populations.

The aims of the present study are (1) to investigate the influence of demographic variables on sAD scores in the general adult population, (2) to provide normative data for the sAD in the form of tables for converting raw scores to percentiles, and (3) to obtain estimates of the reliability of the sAD. In addition, (4) competing models of the latent structure of the sAD will be evaluated using confirmatory factor analysis. Details of the parameterisation of the models (and the theoretical, methodological and empirical considerations that guided their selection) are presented in the methods section. Finally, (5) the convergent and discriminant validity of the sAD will be assessed by correlating each sub-scale with two other independent measures of depression and anxiety.

2. Method

2.1. Participants

Complete sAD data were collected from 758 members of the general adult population (females = 422, males = 336). Participants were recruited from a wide variety of sources including commercial and public service organisations, community centres, and recreational clubs. The mean age of the sample was 39.9 (SD = 15.8) with a range of 16–91 years. The mean years of education was 13.8 (SD = 3.2).

2.2. Materials and procedure

Each potential participant received an introductory letter, a sAD form, and a form for recording demographic variables. In addition, the majority of participants also completed two additional

self-report measures of depression and anxiety. These were: the Hospital Anxiety and Depression Scale (HADS, $N = 746$; Zigmond & Snaith, 1983) and the Depression Anxiety Stress Scales (DASS, $N = 733$; Lovibond & Lovibond, 1995). Participants sealed the completed forms in an envelope, and these were either collected by a researcher or returned by mail. The refusal rate was approximately 17% (participants who failed to return forms or returned entirely blank forms were also treated as refusals). In addition, of the 764 completed forms, six 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 five (i.e. unskilled).

The percentage of participants in each of the occupational categories is presented in Table 1 together with the census derived percentages for the general adult UK population. It can be seen from Table 1 that there is a broad spread but that there is an over-representation of professional occupations, and an under-representation of skilled and semi-skilled occupations. The percentage of participants in each of four age bands (18–29, 30–44, 45–59, 60+) are presented in Table 2 along with the percentages for the adult UK population. Again it can be seen that although there is a broad spread, individuals in the fourth category are relatively under-represented.

2.3. The Hospital Anxiety and Depression Scales (HADS)

The HADS is a 14-item scale developed by Zigmond and Snaith (1983) to identify and measure severity of depression and anxiety in non-psychiatric clinical environments. The respondent is asked to underline the reply which most closely matches how they have felt during the past week.

Table 1
Distribution of occupational codes in the sAD sample and in the general adult population (the entries are percentages)

	Occupational code				
	1 (Professional)	2 (Intermediate)	3 (Skilled)	4 (Semi-skilled)	5 (Unskilled)
Present sample	11.5	35.2	35.2	11.5	6.5
General population	7	32	42	14	5

Table 2
Age distribution in the sAD sample and in the general adult population (the entries are percentages)

	Age bands			
	18–29	30–44	45–59	60+
Present sample	34	28.8	24.4	12.9
General population	27	25	22	26

2.4. The Depression Anxiety and Stress Scales

The DASS (Lovibond & Lovibond, 1995) consists of three 14-item self-report scales which measure depression, anxiety and stress. The measure was developed to quantify these disorders in both the normal and clinical population. A four-point severity scale measures the extent to which each state has been experienced over the past week.

2.5. 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 sAD items using EQS for Windows Version 4 (Bentler, 1989; Bentler & Wu, 1993). The fit of CFA models was assessed using the Satorra–Bentler chi square statistic (S-Bχ^2), the average off-diagonal standardised residual (AODSR), the Comparative Fit Index (CFI) and the Robust Comparative Fit Index (RCFI). The S-Bχ^2 is a statistic which better approximates χ^2 under conditions of non normality, and is derived by dividing the normal theory χ^2 by a scaling correction. Off-diagonal standardised residuals reflect the extent to which covariance between observed variables has 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).

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. When models are nested it is possible to test whether the less constrained model has a significantly better fit than its more constrained counterpart. Satorra and Bentler's (in press) recently developed method for testing for differences between the S-B χ^2 statistic for nested models was employed to make such comparisons.

2.6. Parameterisation of competing models of the sAD

The first model (Model 1a) to be evaluated was a single factor model; this model expressed the hypothesis that the variance in the sAD 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. However, in the case of the sAD there are strong theoretical and empirical grounds for considering it to be a serious candidate. That is, as stated earlier, Watson and Clark (1984) have argued that most anxiety and depression scales predominantly tap a general factor of psychological distress that they term NA. Moreover, Shevlin et al. (1998) reported that a single factor model represents the optimal fit when parsimony indices are used to assess fit. Model 1b was identical to Model 1a, but additionally permitted correlated error between items 2 and 11. Model 1b was then re-tested but was adapted to allow the residuals of items 6 and 14, and 1 and 2 to additionally correlate (Model 1c). Christensen et al. (1999) found that freeing these parameters resulted in a substantial improvement in fit.

Models 2a–2d represented variants on the hypothesis that the sAD measures two factors, anxiety and depression. Model 2a specified two orthogonal factors, with the Anxiety items loading on one dimension, and the Depression items on another. Model 2b was identical except that the factors were permitted to correlate. Model 2c was identical to Model 2b except that additionally correlated error between the 'sleep' items was permitted. The final variant, Model 2d, represented the Model which Christensen et al. (1999) found to be optimal. This Model was identical to Model 2c, but additionally permitted correlated error between the residuals of the two items pairs described in Model 1c.

Models 3a–3c represented variants on the hypothesis that the latent structure of the sAD is tripartite. As stated previously, according to tripartite theory, in addition to a shared component (NA), anxiety and depression are also argued to possess specific components and can thus be differentiated, with anxiety uniquely related to physiological hyperarousal, and depression to low positive affectivity (PA). PA is argued to be orthogonal to NA, with low PA characterised by sadness, lethargy, and particularly, loss of pleasure (Watson et al., 1988).

The basic tripartite model (Model 3a) was parameterised so that all fourteen items were indicators of a general factor (representing NA). In addition, the seven Depression items were also indicators of a factor reflecting the variance specific to depression (essentially PA), and the seven Anxiety items were indicators of a specific anxiety factor. The specific factors were constrained to be orthogonal to each other and the general factor. Model 3b was identical to Model 3a except that item-specific variances of the two 'sleep' related items were permitted to correlate. Model 3c was parameterised to test a tripartite structure with correlated error according to Christensen et al.'s (1999) empirical findings.

Finally, it was intended to test additional models specified according to earlier empirical findings that when a tripartite structure is specified, some Anxiety items do not load significantly upon the specific anxiety factor (Bedford & Deary, 1997; Bedford et al., 1999). However, variants of these models could not be tested as Models parameterised according to these specifications produced inadmissible parameter estimates.

3. Results

3.1. Reliabilities of the sAD

The reliabilities (internal consistencies) of the sAD Anxiety, Depression and Total scales were estimated using Cronbach's alpha. Alpha was 0.77 (95% CLs = 0.75–0.80) for the Anxiety scale, 0.85 (95% CLs = 0.83–0.87) for Depression, 0.88 (95% CLs = 0.87–0.90) for the Total score.

3.2. Influence of demographic variables on sAD scores

Independent samples t-tests revealed that females obtained significantly higher scores than males on the Anxiety scale ($t = -3.2$, df = 756, $P = 0.002$), and Total of the two scales ($t = -2.4$, df = 756, $P = 0.017$). However, there was no significant difference between male and female scores for the Depression scale ($t = -1.3$, df = 756, $P = 0.19$).

The influence of the remaining demographic variables (age, years of education and occupational status) on the sAD Anxiety, Depression and Total scales, was tested through correlational analyses. The point-biserial correlations between gender and the sAD scales were also derived. All correlations between demographic variables and the sAD scales were relatively trivial (all $\leqslant 0.11$).

3.3. Summary statistics and normative data for the sAD

The means, medians, SDs and ranges for each of the three sAD scales are presented in Table 3 for the total sample and broken down according to gender. Additionally, for each sub-scale the percentage of participants with a score greater than or equal to the original cut-off score of four is presented.

Kolmogorov–Smirnov tests revealed that the distributions of the Depression, Anxiety and Total scales deviated highly significantly from a normal distribution (Z ranged from 6.7 to 8.7, all P's < 0.001). Given the positive skew, use of means and SDs from a normative sample are not useful when interpreting an individual's score. Therefore Table 4 was constructed for conversion of raw scores on each of the sAD scales to percentiles.

3.4. Testing competing confirmatory factor analytic models of the sAD

The fit statistics for the CFA models are presented in Table 5. It can be seen that the general factor model (Model 1) had 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 errors between items 2 and 11 (Model 1b) led to an improvement, but was still a poor fit. Finally, allowing correlated error specified according to Christensen et al.'s (1999) empirical findings (Model 1c), was also associated with extremely poor fit.

Table 3
Summary statistics and normative data for the sAD

	Median	Mean	SD	Range	%4+
Total sample ($N = 758$)					
Depression	1	1.94	2.62	0–16	17.9
Anxiety	0	1.38	2.79	0–18	12.7
Total scale	1	3.32	5.00	0–33	
Females ($N = 422$)					
Depression	1	2.20	2.80	0–16	21.1
Anxiety	0	1.50	2.95	0–18	14.0
Total scale	2	3.70	5.32	0–33	
Males ($N = 336$)					
Depression	1	1.61	2.34	0–13	14.0
Anxiety	0	1.24	2.57	0–14	11.0
Total scale	1	2.85	4.48	0–25	

Table 4
Raw scores on the sAD converted to percentiles

Percentile	Raw scores			Percentile
	Depression	Anxiety	Total	
25	0	0	0	25
50	0	1	1	50
55	0	1	2	55
60	0	1	2	60
65	1	2	3	65
70	1	2	3	70
75	2	3	4	75
80	2	3	5	80
85	3	4	7	85
86	3	4	7	86
87	3	5	8	87
88	4	5	8	88
89	4	5	9	89
90	4	5	10	90
91	5	6	10	91
92	5	6	10	92
93	6	7	12	93
94	7	7	13	94
95	8	7	15	95
96	9	8	16	96
97	10	9	17	97
98	12	11	20	98
99	13	12	24	99

Table 5
Fit indices for CFA models of the sAD (best fitting model in italic)

Model	S-B χ^2	df	AODSR	CFI	RCFI
1a. Single factor (NA)	262.8	77	0.0529	0.831	0.790
1b. NA with correlated error (CE) for sleep items (SCE)	207.3	76	0.0499	0.874	0.852
1c. NA with Christensen et al. (1999) CE (CCE)	181.2	74	0.0467	0.894	0.879
2a. Anxiety and Depression as independent factors	404.0	77	0.1945	0.725	0.630
2b. Anxiety and Depression as correlated factors	234.9	76	0.0485	0.853	0.820
2c. Anxiety and Depression as correlated factors, with SCE	169.8	75	0.0470	0.901	0.893
2d. Anxiety and Depression as correlated factors with CCE	148.5	73	0.0426	0.917	0.915
3a. Tripartite Model (NA plus specific Anxiety and Depression factors)	149.3	63	0.0341	0.915	0.902
3b. Tripartite Model with SCE	97.4	62	0.0298	0.951	0.960
3c. Tripartite Model with CCE	*87.4*	*60*	*0.0272*	*0.958*	*0.969*

Model 2a expressed the conception that the sAD measures two independent factors of anxiety and depression. The fit of this model is also very poor; χ^2 is high and fit indices are low. Permitting correlated factors (Model 2b) resulted in a substantially better, although still inadequate fit. However, although re-testing Model 2b but allowing correlated error between the 'sleep' items 2 and 11 (Model 2c), produced a better fit, only one of the two fit indices attained adequacy and χ^2 was large. Model 2d consisted of two correlated anxiety and depression factors, with correlated error specified according to Christensen et al.'s (1999) empirical findings. This model's fit was adequate according to both fit indices, and χ^2 smaller than the preceding models.

The fit of Model 2b is markedly superior to its more constrained counterpart, Model 2a. As noted, inferential statistics can be applied to compare nested models. Therefore, the following comparisons were conducted, the results of which are presented in Table 6. Model 2a is nested in Model 2b in that they differ only by the imposition of the constraint that the factors are independent. Model 2b represented a significantly better fit than its independent factors counterpart ($P < 0.001$).

The chi square difference test that compared Model 1a with Model 2b was also highly significant ($P < 0.001$), demonstrating that it is untenable to view the sAD as measuring only a single underlying factor. Moreover, Models 1b and 2c represented significantly better fits than their more constrained counterparts (Models 1a and 2b, respectively), indicating that items 2 and 11 do share a substantial amount of unique variance. Analogously, permitting correlated error in accordance with Christensen et al.'s (1999) empirical findings resulted in a significant improvement (Models 1c and 2d were significantly better than Models 1b and 2c, respectively).

Models 3a–3c represented variants on the hypothesis that the latent factors measured by the sAD correspond to the tripartite model of depression and anxiety. Model 3a represented the basic model, with both specific depression and anxiety factors as well as a shared NA component. Model 3b was identical but permitted correlated error between items 2 and 11. Finally, Model 3c tested the basic tripartite structure, but with correlated error according to Christensen et al.'s

Table 6
Results of testing for differences between nested CFA models of the sAD

Comparison		Δ Statistics		
More constrained	Less constrained	Δ S-B χ^2	df	*P*
Model 1a	Model 1b	22.5	1	<0.001
Model 1b	Model 1c	18.0	2	<0.001
Model 2a	Model 2b	55.1	1	<0.001
Model 2b	Model 2c	27.4	1	<0.001
Model 1a	Model 2b	16.6	1	<0.001
Model 1b	Model 2c	23.1	1	<0.001
Model 1c	Model 2d	23.6	1	<0.001
Model 2c	Model 2d	15.7	2	<0.001
Model 3a	Model 3b	22.9	1	<0.001
Model 2b	Model 3a	75.7	13	<0.001
Model 3b	Model 3c	9.2	2	0.010
Model 2c	Model 3b	62.8	13	<0.001
Model 2d	Model 3c	54.7	13	<0.001

(1999) specifications permitted. Models 3b and 3c both yielded acceptable fit indices (>0.95), and had low AODSR's and χ^2's. However, all fit indices indicated that Model 3c represented the optimal fit; Satorra–Bentler's (in press) chi square difference test revealed that Model 3c had a significantly better fit than its more constrained counterpart, Model 3b.

A schematic representation of the structure for Model 3c is presented as Fig. 1. 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

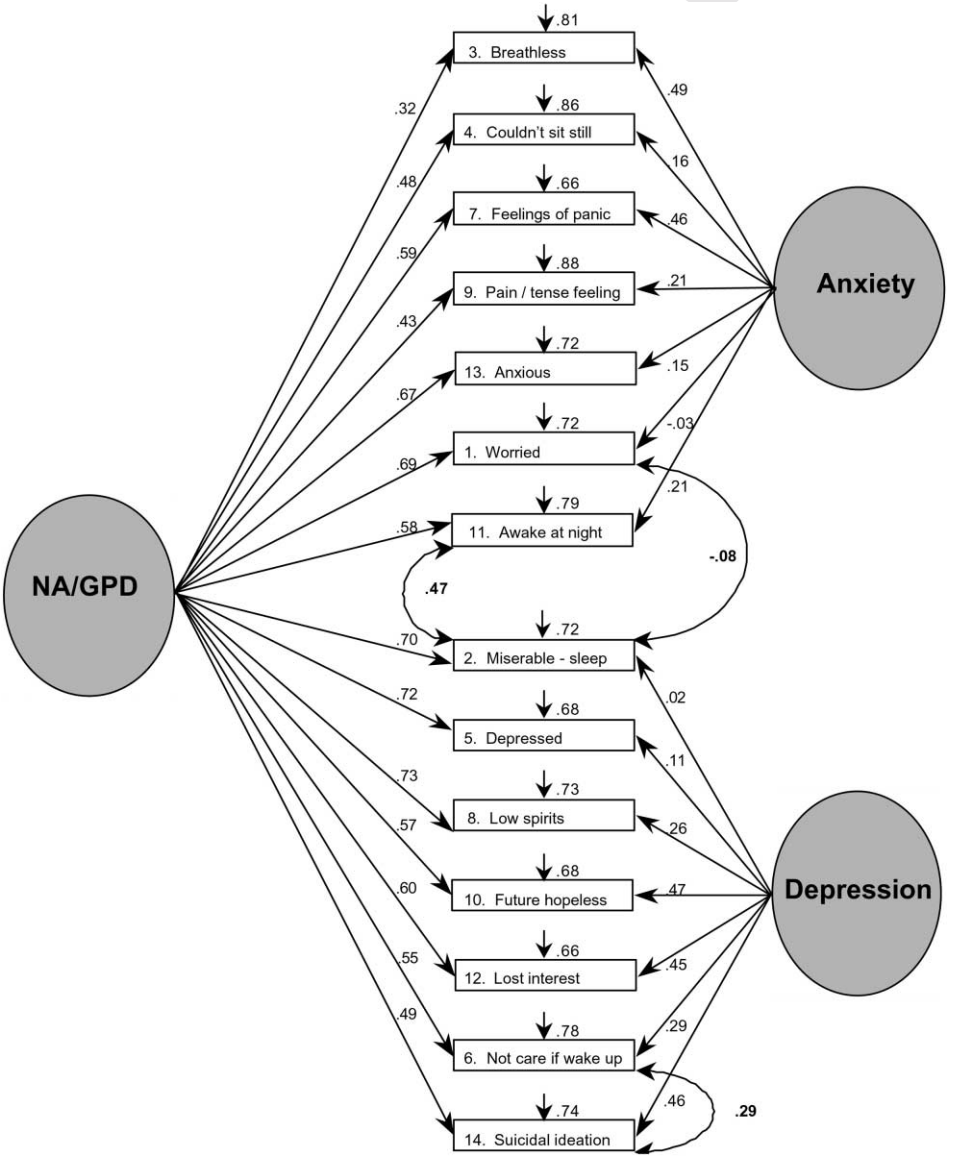

Fig. 1. Graphical representation of the tripartite model of the sAD with correlated error (Model 3c).

arrows represent covariance or correlation between variables but do not imply causality; in this model these paths represented correlated errors. NA/GPD refers to negative affectivity/general psychological distress.

3.5. Relationship with measures of anxiety and depression

The correlations of the sAD Anxiety and Depression scales are presented in Table 7. With respect to convergent validity, the sAD Depression sub-scale correlated highly with the HADS and DASS Depression sub-scales (r's = 0.58 and 0.78, respectively), comparable to the correlation between HADS and DASS Depression ($r = 0.66$). sAD Anxiety also correlated highly with the other Anxiety sub-scales (HADS and DASS r's = 0.67 and 0.72, respectively), with HADS and DASS Anxiety sub-scales related to a similar degree ($r = 0.62$). The mean within-construct correlation for all measures was $r = 0.67$.

Discriminant validity was relatively poor, but similar to that of the other clinical measures. That is, whilst sAD Depression and sAD Anxiety correlated highly ($r = 0.70$), the correlations between HADS Depression and Anxiety, and DASS Depression and Anxiety were similar ($r = 0.56$ and 0.68, respectively). sAD Depression also correlated highly with the other Anxiety sub-scales (HADS $r = 0.54$; DASS $r = 0.56$), as did sAD Anxiety with the other Depression sub-scales (HADS $r = 0.52$; DASS $r = 0.62$). The mean between-construct correlation for all measures was $r = 0.59$. Thus, the sAD, like other depression and anxiety measures, appears to possess good convergent validity, but relatively poor discriminant validity.

4. Discussion

4.1. Influence of demographic variables

One basic aim of the present study was to examine the influence of demographic variables on sAD scores. Although seven out of the 12 relationships examined proved significant, the percentage of variance explained was very small, ranging from 0.01% (years of education and anxiety) to 1.3% (gender and anxiety). Thus, for practical purposes, the influence of gender, occupation,

Table 7
Correlations between the sAD, HADS and DASS[a]

	sAD Depression	sAD Anxiety	HADS Depression	HADS Anxiety	DASS Depression	DASS Anxiety
sAD Depression	–	–	–	–	–	–
sAD Anxiety	0.70 (758)	–	–	–	–	–
HADS Depression	0.58 (746)	0.52 (746)	–	–	–	–
HADS Anxiety	0.54 (746)	0.67 (746)	0.56 (746)	–	–	–
DASS Depression	0.78 (733)	0.62 (733)	0.66 (724)	0.61 (724)	–	–
DASS Anxiety	0.56 (733)	0.72 (733)	0.48 (724)	0.62 (724)	0.68 (733)	–

[a] N for each correlation in parentheses.

education and age on sAD scores can be ignored; the significant effects result from the high statistical power conferred by a large sample size.

4.2. Normative data and reliabilities

Despite the widespread use of the sAD in the English speaking world, normative data based on a large representative sample have not been presented previously. Instead, use of the sAD has been primarily based on the use of cut-off scores. The normative data presented here usefully complements this by providing additional information on the degree of rarity of a given sAD score in the general adult population. The tabulation method in Table 4 was adopted to permit conversion of raw scores to percentiles for both sAD sub-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 a given raw score can correspond to more than one percentile (e.g. for the Anxiety scale a raw score of 1 spans the 50th to 60th percentiles). When this occurs the user should take the highest percentile.

The intention of providing normative data was not to replace the use of clinically derived cut-offs, but to provide supplementary information. However, as it transpires, the normative data raise questions concerning the existing cut-off scores. It can be seen from Table 3 that the proportion of participants obtaining scores that exceeded what Bedford and Foulds (1978) considered to be the "normal" range (i.e. scores of 4 or more) ranged from 11.0% (males as 'anxious'), to 21.1% (females as 'depressed'). For those who wish to use cut-offs on the sAD to identify "cases", it is unlikely that a cut-off that identifies such a substantial proportion of the general population would be of much utility as it would include many cases with fairly mild symptoms of each disorder. Therefore, it may be more appropriate to consider use of a cut-off of 8 for the Depression scale and 7 for the Anxiety scale; in the present study these scores fell at the 95th percentile for Depression and Anxiety respectively. However, it must be reiterated that the results of the present study indicate that percentiles, and not 'cut-off' scores should be used to express an individual's level of general distress, anxiety or depression. That is, Kolmogorov–Smirnoff tests revealed highly significant departures from normality in the distributions of the sAD scales (all exhibited a strong positive skew). Further, each of the scale scores was associated with large standard deviations relative to the mean for each scale.

It is useful to compare the present normative data with sAD data on other samples drawn from the general adult population. The mean score in the present sample for Depression was 1.4 (SD = 2.8), and for Anxiety 1.9 (SD = 2.6). These norms are substantially higher than those derived from the original standardisation sample (Bedford & Foulds, 1978), for which the mean score for Depression was 0.6 (SD = 1.5) and for Anxiety 0.9 (SD = 1.3), yet notably lower than those presented by Christensen et al. (1999) for a large sample in Australia. For Depression Christensen et al. (1999) reported a mean of 2.26, (SD = 2.89), and for Anxiety, 2.95 (SD = 2.96). This highlights the importance of obtaining updated UK norms.

The reliabilities of the sAD scales, as measured by Cronbach's alpha, were 0.77 for Anxiety, 0.85 for Depression, and 0.88 for the Total scale. The narrowness of the confidence limits associated with these coefficients indicate that they can be regarded as providing very accurate estimates of the internal consistency of the sAD 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 alpha should be at least .85 if it is intended to use an instrument to draw inferences concerning an individual. By this criterion the Depression and Total scales can be viewed as possessing adequate reliability, whilst the Anxiety scale fell below this criterion, although not substantially. In any case, given that the sAD was designed to provide brief measures of multifaceted constructs, these values of alpha are satisfactory. Were the alphas much higher than those observed, they could be taken as an indication that the scales have insufficient bandwidth (Boyle, 1985).

4.3. Competing models of the structure of the sAD

The use of CFA to test ten competing models of the latent structure of the sAD yielded clear cut results that help resolve some of the inconsistencies in the previous EFA and CFA literature. From the fit statistics in Table 5, it is clear that the hypothesis that the sAD measures a single factor (Model 1a, 1b and 1c) is untenable, as is the conception of the sAD as measuring two independent factors of anxiety and depression (Model 2a). The fit of models that posited correlated anxiety and depression factors (Models 2b, 2c and 2d) were markedly better than the four foregoing models. Aside from having moderately good fit, the magnitude of the correlations between the factors in these models provides further evidence against the notion that the sAD consists of two independent measures of anxiety and depression.

However, although the correlated anxiety and depression models had superior fit to the competing models discussed thus far, they nevertheless contained substantial misspecifications as evidenced by the large chi square values and relatively modest CFI and RCFI. By contrast, the basic tripartite Model (Model 3a) was associated with a moderate chi-square and fit indices which just failed to attain adequacy (CFI = 0.92). However, permitting correlated errors (Models 3b and 3c) yielded models with significantly lower chi square values. Further, the CFI and RCFI for these models indicated good model fit according to Hu and Bentler's (1999) criterion.

Moreover, the results of CFA modelling unambiguously support previous empirical findings indicating that substantial unique variance is indexed by items 2 and 11. In the optimal model (Model 3c), these variables were highly correlated ($r = 0.47$), and the fit of Models freeing this parameter were significantly better fits than their more constrained counterparts (Models 1b, 2c and 3b compared with Model 1a, 2b and 3a, respectively). However, although permitting correlated error in accordance with Christensen et al.'s (1999) specifications led to a significant improvement relative to more constrained Models (Model 1c, 2d and 3c compared with 1b, 2c and 3b, respectively), this was clearly attributable to only one of the two additional parameters freed. That is, in addition to items 2 and 11, two additional correlations were permitted; between items 1 and 2, and 6 and 14. Only this latter correlation was substantially correlated in the optimal model ($r = 0.29$), with items 1 and 2 weakly *negatively* correlated ($r = -0.08$). Items 6 and 14 appear to index some common variance related to suicidal ideation; item 6 consists of: "Recently I have gone to bed not caring if I never woke up", item 14 of: "Recently I have been so depressed that I have thought of doing away with myself".

The conclusion from the CFA modelling is that all the sAD anxiety and depression items index a substantial common factor of general psychological distress or negative affectivity but that, in addition, they also index orthogonal dimensions that are specific to either depression or anxiety. In the tripartite theory (Clark & Watson, 1991b) these specific components are conceptualised as

low positive affectivity and hyperarousal, respectively. In addition, there is evidence of substantial unique variance indexed by items 2 and 11, and 14 and 6, the former appearing related to sleep, the latter to suicidal ideation.

It is important to consider the practical implications of the present CFA results for use of the sAD in clinical research and practice. The present results indicate that combining the Anxiety and Depression scales for use as a measure of general psychological distress, as recommended by the test authors, has considerable validity. In common with most putative measures of anxiety and depression, a very substantial proportion of the variance in sAD's scores is attributable to a general factor of negative affectivity/general psychological distress rather than being specific to anxiety and depression. In the optimal tripartite model (Model 3c), all but one of the 14 items had higher loadings on negative affectivity/general psychological distress than on the specific factors, anxiety and depression.

The validity of using the anxiety and depression scales separately is more open to question. Although in addition to the evidence of a substantial common factor underlying the sAD, there is also evidence of additional group factors underlying the anxiety and depression items, these latter factors account for only a modest proportion of the variance. Relatedly, the correlation between the observed scores on the anxiety and depression scales was 0.70, and this rose to 0.87 when corrected for attenuation (this correlation is very similar to the estimated correlation of 0.86 between the anxiety and depression factors obtained in model 2b).

We presented the tables for conversion of raw scores on the anxiety and depression scales to percentiles for consistency with previous work on the sAD. However, in view of the above, clinicians or researchers who choose to use these scales separately must be aware that, like other commonly used measures of anxiety and depression (Clark & Watson, 1991a), the sAD scales are a blend of variance common to both anxiety and depression (i.e. negative affectivity), and a more modest proportion of the variance that is specific to these constructs.

4.4. Relationships with measures of anxiety and depression

Correlational analyses were conducted to test whether the sAD possesses adequate convergent and discriminant validity. The results indicated that all three measures (the sAD, the HADS and the DASS) were broadly comparable, each possessing good convergent validity but relatively poor discriminant validity. This concurs with the results of the CFA modelling, with the large amount of shared variance (i.e. NA), accounting for the difficulty in discriminating effectively between the disorders of depression and anxiety. However, the mean within-construct correlation ($r = 0.67$) was higher than the mean between-constructs correlation ($r = 0.59$), also supporting the viewpoint that whilst the disorders index substantial common variance, there still remains specific variance which differentiates between them.

5. Conclusion

The results from CFA modelling indicate that a very substantial proportion of sAD variance is attributable to a general factor of negative affectivity/general psychological distress. In addition however, there is also evidence of more modest group factors corresponding to the constructs of

anxiety and depression. In addition, the measure demonstrated convergent and discriminant validity comparable to other self-report measures of depression and anxiety. The reliabilities of the Depression and Total scale were highly acceptable and the reliability of the Anxiety scale fell just below Anastasi's (1990) criterion for acceptability. The normative data presented here should serve as useful supplements to the clinically derived sAD cut-offs and to the existing, more modest, norms.

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