PERGAMON

Personality and Individual Differences 25 (1998) 569–574

PERSONALITY AND INDIVIDUAL DIFFERENCES

Alternative factor models of the Personal Disturbance Scale (DSSI/sAD)

M. Shevlin[a]*, V. Brunsden[a], J. N. V. Miles[b]

[a]*Quantitative Research Group, Division of Psychology, Department of Social Sciences, Nottingham Trent University, Burton Street, Nottingham NG1 4BU, U.K.*

[b]*Applied Research Vision Unit, Derby University, Mickleover, Derby DE3 5GX, U.K.*

Received 30 August 1997

Abstract

This study examined the factor structure of the Personal Disturbance Scale (DSSI/sAD) [Bedford, A. & Foulds, G. A. (1978). *Manual of the Personal Disturbance Scale (DSSI/sAD)*. Windsor: NFER-Nelson] on data from a sample of 979 elderly respondents. A series of four alternative factor models were specified and estimated using weighted least squares in LISREL8 [Jöreskog, K. G. & Sörbom, D. (1993a). *New features in LISREL8*. Chicago: Scientific Software]. Contrary to previous findings, and to the theoretical underpinning of the scale, a one factor model was judged to provide an adequate and parsimonious explanation of the data. The criteria on which this judgement was based were levels of overall fit, levels of component fit and model parsimony. The issue of parsimony has not been addressed in the previous examinations of the scale's structure. The findings of this study suggest that the DSSI/sAD is measuring a single factor, previously labelled general psychological distress [Bedford, A. & Deary, I. J. (1997). The Personal Disturbance Scale (DDSI/sAD): development use and structure. *Personality and Individual Differences, 22*(4), 493–510], rather than two distinct constructs of anxiety and depression.

1. Introduction

There are several widely used self-report measures of depression (Beck et al., 1961; Zung, 1965) and anxiety (Spielberger et al., 1970; Zung, 1971). Tanaka-Matsumi and Kameoka (1986) examined the correlations among widely used self-report measures of depression and anxiety. They found that three measures of depression were moderately correlated as were six anxiety measures. The mean correlation within the depression measures was 0.61 and within the anxiety measures 0.55.

*Corresponding author.

S0191-8869/98/$19.00
PII: S0191-8869(98)00109-3

However, the mean correlation between the depression and anxiety measures was 0.56. The similarity of the mean correlations within and between the measures suggest a substantial degree of shared variation.

The apparent difficulty in differentiating depression and anxiety by using self report measures was further suggested by the factor analytic study of Bedford and Deary (1997) using the Personal Disturbance Scale (DSSI/sAD: Bedford and Foulds, 1978), a 12 item self report measure of depression and anxiety. Exploratory factor analysis by Bedford and Deary (1997, p. 507) suggested a number of alternative factor structures which were subsequently specified in terms of three general competing confirmatory factor models: (1) a unidimensional structure representing general psychological distress; (2) a two-factor structure, the factors representing anxiety and depression and (3) a three-factor structure which specifies a general psychological distress factor loading on all the items and anxiety and depression factors loading on their respective items. It was concluded that scores for the DSSI/sAD could be interpreted in terms of a single "general psychological distress" factor, two correlated components of clinical anxiety and depression, or basic uncorrelated mood factors. However, no account was taken of parsimony for each of the alternative factor models. According to Mulaik et al. (1989, p. 437) "...in assessing the quality of a model, especially when comparing different models formulated for a given set of data, the goodness of fit of the model should never be taken into account without also taking into account the parsimony of the model".

This study, like that of Bedford and Deary, used the alternative models approach (Jöreskog, 1993) by specifying competing factor models for the DSSI/sAD but included considerations of parsimony in the evaluation of the alternative models. The criteria for model selection was based on both overall and component fit (Bollen, 1989). In terms of overall fit the χ^2 and incremental fit indices (NFI and CFI) were used along with indices that include a penalty for model complexity. The PGFI and PNFI were used as parsimony adjusted fit indices. Component fit was assessed by examination of the magnitude and direction of the parameter estimates in light of previous research findings.

2. Method

Data were derived from the Nottingham Longitudinal Study of Activity and Ageing (NLSAA). The NLSAA was an 8-year survey of activity, health and well-being conducted within a representative stratified sample of people originally aged 65 and over. The data used in this study was from the first wave during 1985. Age, sex and social class structure of this sample closely resembled that for England and Wales as a whole. Listwise deletion reduced the effective sample size from 1,299 to 979 respondents (377 males, 602 female) with a mean age of 75 years (S.D. = 6.28). The dataset was archived at the University of Sheffield, U.K., in 1996. These analyses were conducted using the archived data.

As the DSSI/sAD scale uses a 4-point response format, the responses represent only a crude measurement of what is hypothesised to be a continuous latent variable. According to Jöreskog (1990) and Jöreskog and Sörbom (1993a) the most appropriate method of fitting a confirmatory factor model with such data is to use a matrix of polychoric correlations analysed with weighted least squares with an appropriate weight matrix. These matrices were computed using PRELIS2

Table 1
Fit indices for alternative confirmatory factor specifications of the DSSI/sAD

	Model 1	Model 2	Model 3	Model 4
χ^2	185.29	184.98	131.69	135.65
df	77	76	63	71
p	0.00	0.00	0.00	0.00
NFI	0.94	0.94	0.95	0.95
CFI	0.96	0.96	0.98	0.98
PGFI	0.72	0.71	0.59	0.67
PNFI	0.79	0.78	0.66	0.74

(Jöreskog and Sörbom, 1993b) and the models were specified and estimated using LISREL8 (Jöreskog and Sörbom, 1993a).

A series of four alternative confirmatory factor models was specified and estimated. Model 1: a one-factor model representing general psychological distress. Model 2: a two-factor model, the correlated factors representing anxiety and depression loading on their respective items only. Model 3: a three-factor model, as suggested by Bedford and Deary (1997) specifying a general psychological distress factor loading on all the items, in addition to the factors of anxiety and depression loading on their respective items. All the factors were specified to be uncorrelated. Model 4: the general structure as model 3, but including only those factor loadings for the anxiety and depression factors that were statistically significant in model 3. As opposed to the specification of Bedford and Deary no correlated errors were included in the model. Independent unique variances represent a more parsimonious and interpretable solution.

3. Results

Table 1 shows that in terms of the χ^2 none of the models were found to be an acceptable description of the data. However, this may be due to the large sample size rather than poor model specification. The χ^2 has been found to be positively related to sample size (Bollen, 1989) meaning that the probability of rejecting the model increases with sample size. A more useful application of the χ^2 is to calculate the χ^2 difference (χ^2_{diff}) and differences in the degrees of freedom between alternative models, to test if one model represents a significantly better description of the data. When this difference was calculated using model 1 as a baseline, both model 3 ($\chi^2_{diff}=53.6$; $df=14$; $p<0.01$) and model 4 ($\chi^2_{diff}=49.64$; $df=6$; $p<0.01$) were found to provide a significantly better fit to the data.

With the incremental fit indices there was little difference between the four models (see Table 1), although models 3 and 4 had slightly higher values. The NFI and CFI suggest that all the models are an acceptable description of the data. However, the parsimony adjusted fit indices do not suggest that model 3 and 4 provide a better description of the data than models 1 and 2. Indeed, the PGFI and PNFI indicate that models 1 and 2 are better models when the number of free

Table 2
The parameter estimations for the one factor model (model 1)

	Item 1	Item 2	Item 3	Item 4	Item 5	Item 6	Item 7	Item 8	Item 9	Item 10	Item 11	Item 12	Item 13	Item 14
Factor loading	0.68	0.91	0.60	0.79	0.74	0.91	0.66	0.85	0.53	0.86	0.84	0.87	0.80	0.92
Unique variance	0.54	0.17	0.64	0.37	0.45	0.18	0.57	0.27	0.72	0.27	0.30	0.24	0.36	0.16

parameters has been controlled for. It can, therefore, be seen that although models 3 and 4 appear to provide the best overall fit, when parsimony is taken into account models 1 and 2 provide the better model fit.

The overall fit indices have shown that there is no single model that clearly represents a superior explanation of the data. Overall fit should be evaluated along with information concerning component fit (Bollen, 1989). Parameter estimates of a model should be within bounds and in the expected direction. For model 1 all the factor loadings were high and within bounds, ranging from 0.53 for item 9 to 0.92 for item 14. The factor loadings and unique variances for model 1 are reported in Table 2.

Model 2 had a similar pattern of factor loadings, however, the correlation between the two factors was out of bounds ($r = 1.01$). For model 3, the factor loadings for the general psychological distress factor were all positive and reasonably high, ranging from 0.44 to 0.95. However, the first factor loading of the depression factor (item 2) was negative (-0.34) and had an associated negative error variance (-0.01). Furthermore, four of the seven factor loadings for both the anxiety and depression factors were not statistically significant. When the non-significant factor loadings were removed and the model re-estimated (model 4) item 2 still had a negative loading on the depression factor. The three factor loadings for the depression factor were low (0.33, 0.37 and 0.51) as were those for the anxiety factor (-0.30, 0.17 and 0.53). Factor loadings on the general psychological distress factor ranged from 0.45 to 0.93.

4. Discussion

The findings from this study indicate the importance of considering parsimony when evaluating alternative factor models. Although the inclusion of a general psychological distress factor in addition to the anxiety and depression factors did provide an acceptable level of overall fit, the component fit was unsatisfactory. Further, this solution is less parsimonious than the other models tested. This lack of parsimony, or over-fitting, necessarily leads to improvement in levels of overall model fit, as the freeing of any additional parameter for estimation removes a constraint on the final solution (Mulaik et al., 1989).

Three arguments have appeared in the literature for preferring a parsimonious, over a less parsimonious model. The first argument is that the models with fewer degrees of freedom may be capitalising on chance (Bollen, 1989). As the χ^2 differences between the models were significant, this is not a problem. The second argument, proposed by James et al. (1982) and discussed in

Mulaik et al. (1989), is that a model should be evaluated not just in terms of its fit, but also in terms of the number of parameters required to be estimated to reach that fit. They suggest that, in accordance with the principles of parsimony long established in the philosophy of science, that models with fewer unknown parameters stand a better chance of being scientifically replicable and explainable. Mulaik et al. (1989) introduced the notion of parsimony adjusted fit indices, to choose a model which combines good fit with high degrees of freedom. The final argument for parsimony was proposed by Bentler and Mooijart (1989). They showed that in large samples, the more parsimonious of two competing models provided the most accurate parameter estimates.

It can be seen therefore that parsimony is an important consideration. However, it should not be favoured over goodness of fit when making judgements about competing models. In this research there was little difference between the incremental fit indices of the alternative models, suggesting that all the models provided an acceptable description of the data. When differing models have equally high fit indices for the same data, preference judgements should then be made on the basis of which has the highest parsimony ratio (Mulaik et al., 1989). Findings therefore suggest that model 1, the single factor model, provides an adequate and parsimonious explanation of the structure of the DSSI/sAD.

The DSSI/sAD was formulated to measure the state of anxiety and the state of depression, which permits the separate scoring of these constructs. Although these constructs would be expected to correlate somewhat, that the two factor model had a correlation between the two factors of $r = 1.01$ provides further support for the notion that the scale is only measuring one latent construct. In conclusion it is proposed that the DSSI/sAD does not measure the distinct constructs of anxiety and depression. Instead it seems to measure a single construct, labelled by Bedford and Deary (1997) as "general psychological distress". For this reason the utility of calculating two separate sub-scale scores should be questioned.

References

Beck, A. T., Ward, C. H., Mendelson, M., Mock, J. E., & Erbaugh, J. K. (1961). An inventory for measuring depression. *Archives of General Psychiatry, 4*, 561–571.

Bedford, A., & Deary, I. J. (1997). The Personal Disturbance Scale (DSSI/sAD): development, use and structure. *Personality and Individual Differences, 22*(4), 493–510.

Bedford, A. & Foulds, G. A. (1978). *Manual of the Personal Disturbance Scale (DSSI/sAD)*. Windsor: NFER-Nelson.

Bentler, P. M., & Mooijart, A. (1989). Choice of structural model via parsimony: a rational based on precision. *Psychological Bulletin, 106*, 315–317.

Bollen, K. A. (1989). *Structural equations with latent variables*. New York: Wiley.

James, L. R., Mulaik, S. A. & Brett, J. M. (1982). *Causal analysis: assumptions, models and data*. Beverly Hills, CA: Sage.

Jöreskog, K. G. (1990). New developments in LISREL: analysis of ordinal variables using polychoric correlations and weighted least squares. *Quality and Quantity, 24*, 387–404.

Jöreskog, K. G. (1993). Testing structural equation models. In K. A. Bollen & J. S. Long (Eds.), *Testing structural equation models*. Newbury Park, CA: Sage.

Jöreskog, K. G. & Sörbom, D. (1993a). *New features in LISREL8*. Chicago: Scientific Software.

Jöreskog, K. G. & Sörbom, D. (1993b). *New features in PRELIS2*. Chicago: Scientific Software.

Mulaik, S. A., James, L. R., Van Alstine, J., Bennett, N., Lind, S., & Stilwell, C. D. (1989). Evaluation of goodness-of-fit indices for structural equation models. *Psychological Bulletin, 105*(3), 430–445.

Spielberger, C. D., Gorsuch, R. C. & Lushene, R. E. (1970). *Manual for the State-Trait Anxiety Inventory*. Palo Alto, CA: Consulting Psychologists Press.

Tanaka-Matsumi, J., & Kameoka, V. A. (1986). Relaibilities and concurrent validities of popular measures of depression, anxiety and social desirability. *Journal of Consulting and Clinical Psychology*, *54*, 328–333.

Zung, W. W. K. (1965). A self-rating depression scale. *Archives of General Psychiatry*, *12*, 63–70.

Zung, W. W. K. (1971). A rating instrument for anxiety disorders. *Psychosomatics*, *12*, 371–379.