

A validation study of the Hospital Anxiety and Depression Scale (HADS) in different groups of Dutch subjects

PH. SPINHOVEN,¹ J. ORMEL, P. P. A. SLOEKERS, G. I. J. M. KEMPEN,
A. E. M. SPECKENS AND A. M. VAN HEMERT

From the Department of Psychiatry, Leiden University and the Department of Psychiatry and Department of Health Sciences, University of Groningen, The Netherlands

ABSTRACT

Background. Research on the dimensional structure and reliability of the Hospital Anxiety and Depression Scale (HADS) and its relationship with age is scarce. Moreover, its efficacy in determining the presence of depression in different patient groups has been questioned.

Methods. Psychometric properties of the HADS were assessed in six different groups of Dutch subjects ($N = 6165$): (1) a random sample of younger adults (age 18–65 years) ($N = 199$); (2) a random sample of elderly subjects of 57 to 65 years of age ($N = 1901$); (3) a random sample of elderly subjects of 66 years or older ($N = 3293$); (4) a sample of consecutive general practice patients ($N = 112$); (5) a sample of consecutive general medical out-patients with unexplained somatic symptoms ($N = 169$); and (6) a sample of consecutive psychiatric out-patients ($N = 491$).

Results. Evidence for a two-factor solution corresponding to the original two subscales of the HADS was found, although anxiety and depression subscales were strongly correlated. Homogeneity and test–retest reliability of the total scale and the subscales were good. The dimensional structure and reliability of the HADS was stable across medical settings and age groups. The correlations between HADS scores and age were small. The total HADS scale showed a better balance between sensitivity and positive predictive value (PPV) in identifying cases of psychiatric disorder as defined by the Present State Examination than the depression subscale in identifying cases of unipolar depression as defined by ICD-8.

Conclusions. The moderate PPV suggests that the HADS is best used as a screening questionnaire and not as a ‘case-identifier’ for psychiatric disorder or depression.

INTRODUCTION

The Hospital Anxiety and Depression Scale (HADS) is a 14-item self-report screening scale that was originally developed to indicate the possible presence of anxiety and depressive states in the setting of a medical out-patient clinic (Zigmond & Snaith, 1983). It contains two 7-item scales: one for anxiety and one for depression both with a score range of 0–21.

Items referring to symptoms that may have a physical cause (e.g. insomnia and weight loss) are not included in the scale. Therefore, the HADS is considered to be unbiased by coexisting general medical conditions (Snaith, 1987).

Although the HADS was developed in order to provide a screening measure for the presence of anxiety and depression specifically and not for a global psychiatric disorder in general, the HADS has been ‘misused’ (Snaith, 1991) in this way in several studies (Lewis & Wessely, 1990; Razavi *et al.* 1990). Up till now, the dimensional structure of the HADS has only received limited

¹ Address for correspondence: Dr Philip Spinhoven, PO Box 1251, 2340 BG Oegstgeest, The Netherlands.

empirical assessment with equivocal results (Razavi *et al.* 1990; Lewis, 1991; Moorey *et al.* 1991) and is in need of further clarification. Also, the homogeneity and test-retest reliability of the HADS subscales have not been studied extensively (Zigmond & Snaith, 1983; El-Rufaie & Absood, 1987; Jack *et al.* 1987; Malasi *et al.* 1991; Moorey *et al.* 1991).

In addition, the relationship of HADS anxiety and depression scores with age awaits empirical study. The HADS was originally developed for hospital out-patients with ages between 16- and 65-years-old and the authors did recommend additional research to validate its use in elderly patients (Zigmond & Snaith, 1983). Only two studies have been published on HADS data in elderly patients: one focusing on anxiety and depression in patients with early dementia in comparison to controls (Wands *et al.* 1990) and the other on the concurrent validity and sensitivity to change of the HADS in depressive psychiatric patients (Kenn *et al.* 1987). No study has directly compared the dimensional structure and reliability of the HADS obtained for elderly subjects with the age groups in which the HADS was originally developed.

Finally, although initially developed to indicate the possible presence of an anxiety or depressive state, more recently the HADS has been used as an instrument to determine the prevalence of depression in both general medical (Channer *et al.* 1985; Lepine *et al.* 1985; Chandarana *et al.* 1987; Razavi *et al.* 1990; Silverstone, 1990, 1994; Hopwood *et al.* 1991) and psychiatric patients (Bramley *et al.* 1988; Nayani, 1989; Silverstone, 1990, 1994; Malasi *et al.* 1991). Results from three studies (Razavi *et al.* 1990; Malasi *et al.* 1991; Silverstone, 1994), which validated the HADS against standardized criteria for depressive disorder, suggest that the depression subscale of the HADS may not be accurate in determining the prevalence of depression.

The primary objective of the present study was threefold: (a) to assess the dimensional structure, internal consistency and test-retest reliability of the HADS across medical settings and age groups; (b) to establish the association between HADS scores and age; and (c) to evaluate the performance of the total scale and depression subscale of the HADS in identifying

cases of psychiatric disorder and depression respectively.

METHOD

Selection of subjects

Six different groups of primarily Dutch speaking subjects were asked to participate in this study. As practically all Dutch inhabitants are registered by general practitioners, three random samples of the general population were formed by addressing patients of general practitioners. Data on two general population samples of elderly patients were obtained from the Nestor-Glas research programme from the Northern Centre for Health Studies. All registered patients, of age 57 years or beyond, of 12 selected general practitioners in the three northern provinces of Holland were asked to participate. In the present study subjects with ages ranging from 57 to 65 formed one group and all subjects of 66 years and beyond formed the second group. The third group, also, constituted a sample of the general population: subjects aged 18-65 years were randomly selected from the register of a general practitioner in a small village in an urbanized country side in the west of Holland. Only this group answered the HADS by mail. The fourth group was formed by contracting consecutive patients aged 18-65 years attending their general practitioner. The fifth group comprised consecutive patients aged 18-65 years of the general medical out-patient clinic of the Leiden University Hospital, who presented with unexplained medical symptoms as determined by their attending physician (Speckens *et al.* 1995). The sixth group was composed of consecutive referrals aged 18-65 years to a psychiatric out-patient clinic at Leiden. In addition, test-retest data were collected from the first 100 subjects of the general population sample of younger adults.

Psychiatric examination

In all six groups an authorized Dutch translation of the HADS was used. In the group of general medical out-patients psychiatric status was assessed by means of a limited version of the Present State Examination (PSE), excluding items referring to psychotic symptoms (Wing *et al.* 1974; Slooff *et al.* 1983; Van Hemert *et al.*

1993). The symptoms of the PSE were processed by the CATEGO computer program, which generates an Index of Definition from 1 to 8. As is customary, psychiatric disorders were defined with an Index of Definition of 5 or more (PSE-ID 5+). In addition, the CATEGO programme provides a single psychiatric diagnosis according to the revision of the International Classification of Diseases (ICD-8). In general medical patients, psychiatric diagnoses mainly concern depressive and anxiety disorders. In the CATEGO hierarchy a depressive disorder does not permit the diagnosis of an anxiety disorder although the anxiety symptom complex may be present and an anxiety disorder will only be diagnosed in the absence of a full depressive disorder. In the other five groups standardized psychiatric assessment was not performed.

Statistical analysis

Factor analysis was executed by an exploratory principal-components analysis (PCA) on the correlation matrix of the 14 HADS items with orthogonal rotation using the varimax procedure. Number of constituting factors was determined on the basis of the scree-test (Cattell, 1966). The percentage of explained variance was subsequently compared to the amount of variance accounted for by the two 'multiple group' components of Zigmond & Snaith (1983) by means of a Multiple Group Method Analysis (MGM) (Nunnally, 1978), i.e. a matrix with binary elements only, such that each variable has a weight of one on the component of whose group it is supposed to be a member of (e.g. anxiety), and zero on the other group (e.g. depression). Homogeneity of the factor solution was determined by calculating mean inter-item correlations, item-rest correlations and internal consistencies by Cronbach's coefficient alpha. Interrelationships of the HADS scales with continuous variables were analyzed with Pearson product-moment correlation coefficients (two-tailed). Differences in HADS scores between nominal variables were assessed with analyses of (co)variance. Strength of association and size of between group differences were expressed in terms of effect size units (Cohen, 1977). The relation between the HADS scores and psychiatric 'caseness' was evaluated with Receiver Operating Characteristics (ROC) analyses, using

the 'area under the curve' (AUC) as a summary measure of the overall discriminative ability of the questionnaire (Metz *et al.* 1984). In addition to ROC analysis, the sensitivity, specificity and positive predictive value were calculated at various cut-off scores.

RESULTS

Subject characteristics

Table 1 displays for each sample the response rate, the number of patients who completed the HADS scale, age, sex distribution and scores on the HADS. In the two elderly samples the response rate is low. Of the eligible elderly subjects 22.2% did not give their general practitioner permission to provide the researchers their name and address, while an additional 17.3% was not willing or unable (a score of 16 or lower on the Mini-Mental State Examination (MMSE) (Folstein *et al.* 1975)) to participate when contacted by the researcher. Moreover, in all samples, 102 subjects failed to answer all items of the HADS and were subsequently excluded from further analyses.

Factor structure and reliability of the HADS

On the basis of an exploratory principal-components analysis (PCA) in the six samples, the scree-test showed for the plots of all groups a distinct break between the steep slope of the first two factors and the gradual trailing off of the remaining factors, except for the sample of younger adults and general medical out-patients where the break occurred after the first factor. A one-factor model accounted for 32.9% of the total variance in the general practice population up to 44.9% in the general medical population. In all analyses of a two-factor model, the first factor of the unrotated results accounted for most of the variance (32.9 to 44.9%) with the second factor accounting for an additional 7.6 to 13.1% of the variance. The two-factor model accounted for 45.4% of the total variance in the general population of subjects older than 65 years up to 52.6% in the general medical population.

Subsequent multiple group method analyses revealed that the *a priori* matrix with two components resulted in a loss of only 0.55 to 1.47% in accounting for the total variance in

Table 1. Group characteristics

Group	Response rate (%)	N	Age mean (S.D.) (years)	Age range (years)	Percentage females	Anxiety scores Mean (S.D.)	Depression scores Mean (S.D.)	Total scores Mean (S.D.)
General population 18–65 years	82	199	39.9 (12.4)	18–63	53.8	5.1 (3.6)	3.4 (3.3)	8.4 (6.3)
General population 57–65 years	66	1901	61.3 (2.3)	57–65	51.2	3.9 (3.5)	3.7 (3.3)	7.6 (6.0)
General population > 65 years	58	3293	74.3 (6.0)	66–99	59.0	3.9 (3.6)	4.6 (3.6)	8.5 (6.4)
General practice patients	97	112	42.5 (13.3)	18–64	66.1	6.2 (3.8)	3.7 (3.4)	9.9 (6.1)
General medical patients	76	169	37.9 (13.7)	18–65	54.5	6.5 (4.2)	5.0 (4.2)	11.5 (7.8)
Psychiatric out-patients	90	491	35.6 (11.2)	18–64	61.9	11.1 (4.7)	9.3 (5.2)	20.4 (8.9)

each of the groups in comparison to the exploratory 2-factor PCAs.

Pearson correlations between the components (subscales) in the different groups ranged from 0.43 to 0.73 (all significant at $P < 0.001$), indicating that the subscales do not measure independent constructs.

Data on the homogeneity of the total scale and two subscales are shown in Table 2. In all six samples, mean inter-item correlations for HADS scales lie inside the range of 0.10 to 0.50 for an acceptable level of homogeneity (Nunnally, 1978). Moreover, all 14 items manifest a significant and positive correlation with the other items of the total HADS scale (range 0.20 to 0.74). Item-remainder correlations of anxiety and depression items with the other items of the anxiety and depression subscale respectively also proved to be significant and positive (range 0.21 to 0.75). Cronbach's alpha's for the total scale and both subscales (range 0.71 to 0.90) are satisfactory to good (Nunnally, 1978).

Finally, of the first 100 subjects of the general population sample of younger adults who completed the HADS scale, 89 returned their second questionnaire, of which 86 were complete. The mean test-retest interval comprised 22 days (range 9 to 43 days). A Pearson product-moment correlation coefficient of 0.89, 0.86 and 0.91 ($P < 0.001$) between test and retest subscale scores for anxiety, depression and total scale scores respectively attested of a high test-retest stability over a mean 3 weeks period.

Relationships with age

The association of HADS scores with age was assessed in the combined three general population samples. The Pearson correlations of age with anxiety ($r = -0.04$, $P < 0.001$), depression

($r = 0.15$, $P < 0.001$) and the total HADS scores ($r = 0.06$, $P < 0.001$) were relatively small. Pearson correlations of the individual HADS items with age were also small (range -0.07 to 0.19). Correlation coefficients of 0.10 are regarded as small, 0.30 as medium and 0.50 as large (Cohen, 1977). Spearman rank correlation coefficients were of the same magnitude. Consequently, no evidence for a clinically relevant linear relationship of age with HADS total or subscales scores was found.

Ability of the HADS in identifying psychiatric disorder and depression

First, HADS scores of psychiatric and general medical out-patients were compared to those of younger adults from the general population with a similar age range as inclusion criterion. No significant differences in sex ratio between groups were observed. However, between group differences in age proved to be significant ($F(2, 854) = 9.620$, $P < 0.001$). A one-way analysis of covariance with group (three levels) being the independent variable and age as covariate revealed a significant main effect of group on anxiety ($F(2, 853) = 160.88$, $P < 0.001$), depression ($F(2, 853) = 140.14$, $P < 0.001$) and HADS total scores ($F(2, 853) = 186.46$, $P < 0.001$). In comparison to general medical out-patients and normal controls, psychiatric patients had significantly higher scores on all scales. The effect sizes for the differences on the scales ranged from 0.86 to 1.45. General medical out-patients manifested significantly higher anxiety ($d = 0.36$), depression scores ($d = 0.43$) and total HADS scores ($d = 0.44$) than normal controls. So, not surprisingly differences in HADS scores were moderate between general medical out-patients and normal controls and large between psychiatric patients and both other groups.

Table 2. Reliability of total and subscale scores on the HADS

Group	Scales								
	Anxiety subscale			Depression subscale			Total score		
	α	Mean r_{ii}	Range r_{ir}	α	Mean r_{ii}	Range r_{ir}	α	Mean r_{ii}	Range r_{ir}
General population 18–65 years	0.84	0.42	0.46–0.67	0.79	0.36	0.29–0.69	0.88	0.35	0.24–0.69
General population 57–65 years	0.83	0.41	0.41–0.67	0.71	0.26	0.21–0.56	0.85	0.29	0.21–0.66
General population > 65 years	0.82	0.40	0.37–0.68	0.71	0.26	0.24–0.56	0.84	0.28	0.20–0.66
General practice patients	0.80	0.36	0.39–0.65	0.77	0.33	0.30–0.60	0.82	0.26	0.23–0.66
General medical patients	0.84	0.43	0.39–0.70	0.84	0.42	0.39–0.75	0.90	0.39	0.41–0.74
Psychiatric out-patients	0.81	0.38	0.46–0.61	0.86	0.48	0.48–0.74	0.88	0.36	0.43–0.67

α = Cronbach's coefficient alpha; r_{ii} = mean inter-item correlation; r_{ir} = item-remainder correlation.

Table 3. Sensitivity, specificity and positive predictive value (PPV) of the depression subscale and total HADS scale in detecting general medical out-patients with depression and psychiatric disorder

Cut-off point for depression using depression subscale	Sensitivity (%)	Specificity (%)	PPV (%)	Cut-off point for psychiatric disorder using total scale	Sensitivity (%)	Specificity (%)	PPV (%)
3	91	43	27	5	98	30	39
4	84	50	28	7	94	48	45
5	84	62	34	9	92	56	49
6	75	68	35	11	89	66	55
7	66	77	40	13	79	77	61
8	56	82	43	15	74	84	67
9	56	88	51	17	58	87	67
10	56	92	62	19	49	96	84
11	50	96	75	21	38	98	91
12	31	98	77	23	32	99	94

Of the 169 general medical out-patients, 53 (31%) were classified as having a psychiatric disorder as defined by an Index of Definition of 5 or more. All psychiatric cases manifested a depressive or anxiety disorder. Thirty-two patients (19%) obtained a ICD-8 diagnosis of unipolar depression (i.e. depressive neurosis ($N = 27$) or manic depressive psychosis: depressed type ($N = 5$)). In an additional 21 patients (12%) an anxiety disorder was diagnosed (i.e. anxiety neurosis ($N = 13$) or phobic neurosis ($N = 8$)).

The sensitivity, specificity, and positive predictive value (PPV) of the depression subscale of the HADS in detecting cases of unipolar depression (ICD-8) in general medical out-patients using a range of cut-off points is shown in Table 3. It can be seen that although the sensitivity of the HADS is good with a low cut-off point, the PPV is rather poor, and, while increasing the cut-off point improved the PPV it also led to a marked fall in sensitivity. No cut-off point on the depression subscale can be found at

which a satisfactory PPV is combined with a reasonable degree of sensitivity. The AUC was 0.82 (95% CI: 0.74 to 0.90). Table 3, also, displays the sensitivity, specificity and PPV of the total HADS scale in detecting cases of psychiatric disorder (PSE-ID 5+) using a range of cut-off points. As can be inferred from this Table, the total HADS scale yields a slightly better balance between a sufficient degree of sensitivity and satisfactory PPV in detecting cases of psychiatric disorder. The AUC was 0.88 (95% CI: 0.82 to 0.93).

DISCUSSION

The first aim of the present study was to investigate the psychometric properties of the HADS. With respect to the dimensional structure of the HADS, according to the scree-test in four of the six groups evidence for a two-factor solution was found. In the group of younger adults and general medical out-patients, the scree test suggested a one-factor solution. A

one-factor solution accounted for 32.9 to 44.9% of the variance. In all analyses of the two-factor solution, the first factor of the unrotated results accounted for most of the variance (32.9 to 44.9%) with the second factor accounting for an additional 7.6 to 13.1% of the variance. A confirmatory factor analysis revealed that the original anxiety and depression subscales resulted in a negligible loss in accounting for the total variance in comparison to two-factor explorative PCAs. The correlations between the anxiety and depression subscales, however, were rather high (0.43 to 0.73).

These results corroborate previous studies concerning the dimensional structure of the HADS in somatically ill patients, which reported evidence both for a two-factor solution that corresponded almost exactly with the anxiety and depression subscale of the HADS (Moorey *et al.* 1991), as well as for a strong single dimension of psychiatric illness (Razavi *et al.* 1990; Lewis, 1991). Moreover, with the exception of one study (Aylard *et al.* 1987) most studies (Channer *et al.* 1985; Bass *et al.* 1988; Bramley *et al.* 1988; Lewis, 1991; Moorey *et al.* 1991) found high correlations with a range of 0.37 to 0.69 between the HADS anxiety and depression subscales.

Taken together, our results indicate that even with the HADS (originally developed to distinguish the constructs of anxiety and depression in a hospital medical out-patient sample), it remains difficult to distinguish between the constructs of anxiety and depression. Although, a two-factor solution may be defended on psychometric and theoretical grounds, self-reported anxiety and depression symptoms covary to a considerable extent. This confirms the findings of Clark & Watson (1991*a*) that self-ratings of syndromal anxiety and depression are highly interrelated with correlation values ranging between 0.60 and 0.70 suggesting the presence of a large non-specific component that is shared by both syndromes (Ormel *et al.* 1995). Even though the depression subscale of the HADS primarily focuses on anhedonia or the absence of positive affect, a factor deemed unique to depression (Clark & Watson, 1991*b*), HADS scores still seem to be influenced by a strong common non-specific distress factor. This may be partly due to the predominance of subjective anxiety symptoms in the anxiety subscale of the

HADS. According to the tripartite model of anxiety and depression these symptoms are considered central characteristics of general distress or negative affectivity (Watson & Tellegen, 1985). It has been suggested that especially physiological arousal symptoms can distinguish anxiety from depression, but these symptoms are less prominent in the anxiety subscale of the HADS.

The homogeneity of the total scale and two HADS subscales as determined by mean inter-item correlations, item-rest correlations and Cronbach's coefficient alpha was satisfactory to good. Apart from the two samples of elderly subjects, the (corrected) item-total correlations in terms of level of significance or absolute values are comparable to those reported in previous studies (Zigmond & Snaith, 1983; El-Rufai & Absood, 1987; Jack *et al.* 1987; Malasi *et al.* 1991). The same holds true for the internal consistency of the two subscales as measured with Cronbach's coefficient alpha (Jack *et al.* 1987; Moorey *et al.* 1991) with on average values of at least 0.80. The test-retest reliability of the HADS scales proved to be very high and warrants further research on the sensitivity to change of the HADS.

The second aim of the present study was to validate the HADS in elderly patients, since the HADS was originally developed for somatic out-patients between 18 and 65 years of age. As mentioned above, in comparison to the four samples of 18 to 65 years of age, the dimensional structure of the HADS in the general population samples of 57 to 65 years and 66 years and beyond proved to be similar. In the absence of comparative data in elderly subjects, the somewhat lower alpha values, mean inter-item correlations and corrected item-total correlations for the depression subscale in the two samples of elderly subjects suggest more random error. This needs further study.

Overall, our results suggest that the psychometric properties of the HADS are invariant for age. Moreover, in the combined general population samples no evidence for a linear relationship between age and anxiety scores was found, while age and depressive symptoms showed a small and positive relationship. Elevated levels of depressive symptoms on self-ratings in subjects of 65 years of age or older have been reported in previous studies, although

prevalence rates of well-defined depressive disorder in these subjects are relatively low (0.5–2.5%) (Beekman *et al.* 1993). A substantial group of elderly subjects with high levels of self-rated depressive symptoms does not fulfil diagnostic criteria for a depressive disorder, dysthymic disorder or depression NOS (Blazer & Williams, 1980; Gurland, 1983; O'Hara *et al.* 1985). Various diagnostic labels to describe this group of subjects have been proposed, such as 'pervasive depression' (Gurland, 1983) or 'significant depression' (Blazer & Williams, 1980). Possibly, the slightly elevated HADS depression scores in elderly subjects reflect the higher prevalence of these milder forms of depression in elderly subjects. Moreover, most of the depression items of the HADS relate to anhedonia and these depressive symptoms may be more frequent in elderly subjects than in younger adults (Newman *et al.* 1990, 1991).

The third aim of the present study was to evaluate the capacity of the total scale and depression subscale of the HADS in identifying cases of psychiatric disorder and unipolar depression respectively. Although direct comparisons between the results of the present study with those of previous studies (Razavi *et al.* 1990; Malasi *et al.* 1991; Silverstone, 1994) are difficult because of differences in prevalence rates, use of different diagnostic criteria, and differences between samples, our results essentially agree with those of Silverstone (1994), who also reported for medical patients that on the depression subscale no cut-off point could be found with a reasonable positive predictive value (PPV) combined with a satisfactory degree of sensitivity. However, as in the study of Lewis & Wessely (1990) a slightly better balance between sensitivity and PPV was found in identifying cases of minor psychiatric disorder with the total HADS scale.

In the present study differences in HADS total and subscale scores between general medical out-patients and normal controls were moderate, while large differences between psychiatric out-patients and both general medical out-patients and normal controls were found. This is consistent with the finding that especially in general medical samples many depressive patients manifest a less severe mixed anxious-depressed symptom pattern that cannot easily be characterized as one type of disorder or the

other (Klerman, 1989; Katon & Roy-Byrne, 1991). The somewhat better sensitivity and PPV of the total HADS scale in detecting cases of psychiatric disorder in general medical out-patients can be interpreted in this light. In other words, patients with minor psychiatric disorders as generally found in a medical setting manifest somewhat elevated levels of both anxiety and depressive symptoms and consequently the total HADS scale yields the highest PPV in detecting cases of minor psychiatric disorder (Lewis, 1991). These results are also consistent with the tripartite model of anxiety and depression (Watson & Tellegen, 1985), in which it is assumed that the association between anxiety and depression reflects a large non-specific distress factor called negative affectivity.

In conclusion, the dimensional structure and reliability of the HADS seems stable across medical settings and age groups. Sensitivity, specificity and PPV of the HADS scales may critically depend on the nature and severity of psychiatric disorder. Suggested cut-off points on the total scale (Ravazi *et al.* 1990) and subscales (Zigmond & Snaith, 1983) cannot be indiscriminately used in different samples. In samples with minor psychiatric disorders the total scale may be more useful than just one of the subscales. Furthermore, given the rather low PPV of the HADS scales it seems advisable to use the HADS primarily as a screening instrument and not as a 'case-identifier'. Further research on sensitivity, specificity and PPV of the HADS especially in somatically ill and elderly subjects seems warranted. Also, in a general population sample of elderly subjects the total HADS scale may prove to be more effective for the screening of less severe mixed anxious-depressed symptom configurations than just the score on one of the subscales.

REFERENCES

- Aylard, P. R., Gooding, J. H., McKenna, P. J. & Snaith, R. P. (1987). A validation study of three anxiety and depression self-assessment scales. *Journal of Psychosomatic Research* **31**, 261–268.
- Bass, C., Chambers, J. B., Kiff, P., Cooper, D. & Gardner, W. N. (1988). Panic anxiety and hyperventilation in patients with chest pain: a controlled study. *Quarterly Journal of Medicine* **69**, 949–959.
- Beekman, A. T. F., Tilburg, W. van & Deeg, D. (1993). Depressie bij ouderen in de bevolking. *Tijdschrift voor Psychiatrie* **35**, 154–168.
- Blazer, D. & Williams, C. D. (1980). Epidemiology of dysphoria and depression in an elderly population. *American Journal of Psychiatry* **137**, 439–444.

- Bramley, P. N., Easton, A. M. E., Morley, S. & Snaith, R. P. (1988). The differentiation of anxiety and depression by rating scales. *Acta Psychiatrica Scandinavica* **77**, 133–138.
- Cattell, R. B. (1966). The scree test for the number of factors. *Multivariate Behavioral Research* **1**, 245–276.
- Chandarana, P. C., Eals, M., Steingart, A. B., Bellamy, N. & Allen, S. (1987). The detection of psychiatric morbidity and associated factors in patients with rheumatoid arthritis. *Canadian Journal of Psychiatry* **32**, 356–361.
- Channer, K. S., Papouchado, M., James, M. A. & Rees, J. R. (1985). Anxiety and depression in patients with chest pain referred for exercise testing. *Lancet* *ii*, 820–822.
- Clark, L. A. & Watson, D. (1991a). Tripartite model of anxiety and depression: psychometric evidence and taxonomic implications. *Journal of Abnormal Psychology* **100**, 316–336.
- Clark, L. A. & Watson, D. (1991b). General affective dispositions in physical and psychological health. In *Handbook of Social and Clinical Psychology* (ed. C. R. Snyder and D. R. Donaldson), pp. 221–245. Pergamon Press: New York.
- Cohen, J. (1977). *Statistical Power Analysis for the Behavioral Sciences*. Academic Press: New York.
- El-Rufaie, O. E. F. A. & Absood, G. (1987). Validity study of the Hospital Anxiety and Depression Scale among a group of Saudi patients. *British Journal of Psychiatry* **151**, 687–688.
- Folstein, M. F., Folstein, S. E. & McHugh, P. R. (1975). 'Mini-Mental State': a practical method for grading the cognitive state of patients for the clinician. *Journal of Psychiatric Research* **12**, 189–198.
- Gurland, B. J. (1983). *The Mind and Mood of Aging*. Haworth Press: New York.
- Hopwood, P., Howell, A. & Maguire, P. (1991). Screening for psychiatric morbidity in patients with advanced breast cancer: validation of two self-report questionnaires. *British Journal of Cancer* **64**, 353–356.
- Jack, T. M., Walker, V. A., Morley, S. J., Hanks, G. W. & Finlay-Mills, B. M. (1987). Depression, anxiety and chronic pain. *Anaesthesia* **42**, 1235–1236.
- Katon, W. & Roy-Byrne, P. P. (1991). Mixed anxiety and depression. *Journal of Abnormal Psychology* **100**, 337–345.
- Kenn, C., Wood, H., Kucyj, M., Wattis, J. & Cunane, J. (1987). Validation of the Hospital Anxiety and Depression rating Scale (HADS) in an elderly psychiatric population. *International Journal of Geriatric Psychiatry* **2**, 189–193.
- Klerman, G. L. (1989). Depressive disorders: further evidence for increased medical morbidity and impairment of social functioning. *Archives of General Psychiatry* **46**, 856–858.
- Lepine, J. P., Godchau, M. & Brun, P. (1985). Anxiety and depression in inpatients. *Lancet* *ii*, 1425–1426.
- Lewis, G. (1991). Observer bias in the assessment of anxiety and depression. *Social Psychiatry and Psychiatric Epidemiology* **26**, 265–272.
- Lewis, G. & Wessely, S. (1990). Comparison of the General Health Questionnaire and the Hospital Anxiety and Depression Scale. *British Journal of Psychiatry* **157**, 860–864.
- Malasi, T. H., Mirza, I. A. & El-Islam, M. F. (1991). Validation of the Hospital Anxiety and Depression Scale in Arab patients. *Acta Psychiatrica Scandinavica* **84**, 323–326.
- Metz, C. E., Wang, P. L. & Heineman, H. B. (1984). *ROCFIT*. Department of Radiology & the Franklin McLean Memorial Research Institute. University of Chicago: Chicago.
- Moorey, S., Greer, S., Watson, M., Gorman, C., Rowden, L., Tunmore, R., Robertson, B. & Bliss, J. (1991). The factor structure and factor stability of the Hospital Anxiety and Depression Scale in patients with cancer. *British Journal of Psychiatry* **158**, 255–259.
- Nayani, S. (1989). The evaluation of psychiatric illness in Asian patients by the Hospital Anxiety and Depression Scale. *British Journal of Psychiatry* **155**, 545–547.
- Newmann, J. P., Engel, R. J. & Jensen, J. E. (1990). Depressive symptom patterns among older women. *Psychology and Aging* **5**, 101–118.
- Newmann, J. P., Engel, R. J. & Jensen, J. E. (1991). Age differences in depressive symptom experiences. *Journal of Gerontology* **46**, 224–235.
- Nunnally, J. (1978). *Psychometric Theory*. McGraw-Hill: New York.
- O'Hara, M. W., Kohout, F. J. & Wallace, R. B. (1985). Depression among the rural elderly. A study of prevalence and correlates. *Journal of Nervous and Mental Disease* **173**, 582–589.
- Ormel, J., Oldehinkel, A. J., Goldberg, D. P., Hodiament, P. P. G., Wilimink, F. W. & Bridges, K. (1995). The structure of common psychiatric symptoms: how many dimensions of neurosis? *Psychological Medicine* **25**, 521–530.
- Razavi, D., Delvaux, N. & Farvacques, C. (1990). Screening for adjustment disorders and major depressive disorders in cancer inpatients. *British Journal of Psychiatry* **156**, 79–83.
- Silverstone, P. H. (1990). Low self-esteem in eating disordered patients in the absence of depression. *Psychological Reports* **67**, 276–278.
- Silverstone, P. H. (1994). Poor efficacy of the Hospital Anxiety and Depression Scale in the diagnosis of major depressive disorder in both medical and psychiatric patients. *Journal of Psychosomatic Research* **38**, 441–450.
- Slooff, C. J., Mulder-Hajonides van der Meulen, W. R. E. H. & Van den Hoofdakker, R. H. (1983). De nederlandse vertaling van de Present State Examination 9e editie. I. Betrouwbaarheidsaspecten. *Tijdschrift voor Psychiatrie* **25**, 151–163.
- Snaith, R. P. (1987). The concepts of mild depression. *British Journal of Psychiatry* **150**, 387–393.
- Snaith, R. P. (1991). The GHQ and HAD. *British Journal of Psychiatry* **158**, 433.
- Speckens, A. E. M., Van Hemert, A. M., Spinhoven, Ph., Hawton, K. E., Bolk, J. H. & Rooijmans, H. G. M. (1995). Cognitive behavioural therapy for medically unexplained physical symptoms: a randomized controlled trial. *British Medical Journal* **311**, 1328–1332.
- Van Hemert, A. M., Hengeveld, M. W., Bolk, J. H., Rooijmans, H. G. M. & Vandenbroucke, J. P. (1993). Psychiatric disorders in relation to medical illness among patients of a general medical out-patient clinic. *Psychological Medicine* **23**, 167–174.
- Wands, K., Merskey, H., Hachinski, V. C., Fisman, M., Fox, H. & Boniferno, M. (1990). A questionnaire investigation of anxiety and depression in early dementia. *Journal of the American Geriatric Society* **38**, 535–538.
- Watson, D. & Tellegen, A. (1985). Toward a consensual structure of mood. *Psychological Bulletin* **98**, 219–235.
- Wing, J. K., Cooper, J. & Sartorius, N. (1974). *The Measurement and Classification of Psychiatric Symptoms*. Cambridge University Press: Cambridge.
- Zigmond, A. S. & Snaith, R. P. (1983). The Hospital Anxiety and Depression Scale. *Acta Psychiatrica Scandinavica* **67**, 361–370.