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The Factor Structure and Factor Stability of the Hospital Anxiety and Depression Scale in Patients with Cancer

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An exploratory factor analysis of the HAD was carried out in 568 cancer patients. Two distinct, but correlated, factors emerged which corresponded to the questionnaire's anxiety and depression subscales. The factor structure proved stable when subsamples of the total sample were investigated. The internal consistency of the two subscales was also high. These results provide support for the use of the separate subscales of the HAD in studies of emotional disturbance in cancer patients.

With the growth of liaison psychiatry as a specialty in its own right, the need for standardised measures of emotional disturbance in patients with physical illness has become increasingly important. The most commonly encountered emotional disorders in medical patients are anxiety and depression, which frequently coexist. Scales for investigating both these symptoms are therefore particularly attractive to researchers and clinicians in this field. One such scale which is receiving attention is the Hospital Anxiety and Depression Scale (HAD). This is a brief, self-administered rating scale which has been specifically designed for patients with physical illness (Zigmond & Snaith, 1983). It consists of 14 items, seven regarding depression, seven anxiety. The depression subscale has been constructed so that somatic items are largely excluded. The subscale heavily emphasises anhedonia, which is considered by some to be the symptom of depression characteristic of the endogenous subtype and predictive of response to antidepressant medication (Klein, 1974). The items on the anxiety subscale were chosen by Snaith *et al* (1982) from anxiety items in the Present State Examination (Wing *et al*, 1974) and from Snaith's own research.

Evidence for the concurrent validity of the HAD has been reported in psychiatric patients (Bramley *et al*, 1988), in a heterogeneous group of patients with physical illness (Aylard *et al*, 1987) and in patients attending a genitourinary clinic (Batczak, 1988). Ibbotson *et al* (1989) investigated the validity of the HAD as a screening instrument for psychological distress in 514 patients with cancer. The HAD was compared with two other self-rating scales, the General Health Questionnaire (GHQ; Goldberg, 1972) and the Rotterdam Symptom Checklist (RSCL; de Haes *et al*, 1983). All three scales were also assessed by comparison with the Psychiatric Assessment Schedule (PAS; Maguire *et al*, 1978) which was used as a gold standard: the PAS is a semistructured interview that includes symptoms based on DSM-III criteria (American Psychiatric Association, 1980). Ibbotson *et al* concluded that the HAD performed best overall, but the RSCL performed better as a screening instrument for patients with stable disease.

These validation studies assume that the HAD does, as its authors suggest, function as two scales measuring two distinct mood states. Clinical experience with patients with physical illness, however, suggests that it is frequently difficult to distinguish anxiety and depression. In view of this it could be argued that the HAD would be more validly used as a single 14-item measure of mixed emotional disturbance: it might act as a global measure of psychological distress, as does the GHQ. Lewis & Wessely (1990) have used the HAD in this way with dermatology patients, while Razavi *et al* (1990) used the full 14-item scale in a study of Belgian cancer patients. On the basis of a factor analysis of the data, Razavi *et al* concluded that the HAD was a unidimensional measure of emotional distress.

It is of both theoretical and practical importance to establish whether the HAD should be used as a unidimensional or bidimensional scale. This paper describes the factor structure of the HAD in 568 cancer patients, and is the first detailed analysis of the scale to be reported with any substantial group of patients. The use of factor analysis as a method of assessing the validity of an empirical measure is well established (Nunnally, 1978). In this study it has been used to test for the existence of two underlying factors corresponding to the subscales of the HAD.

Method

The HAD is currently being used as a screening instrument in a larger study by the Psychological Medicine Group at the Royal Marsden Hospital. The plan of investigation has

been described in detail elsewhere (Moorey & Greer, 1989). In brief, a consecutive series of cancer patients attending the Royal Marsden Hospital is screened to select patients with psychological morbidity. These patients are then invited to join a randomised controlled trial comparing a brief psychological therapy with a no-treatment control. Since the HAD is one of the screening instruments, anxiety and depression scores are available from a large sample of cancer patients with a wide range of psychological distress, from none to pathological. To enter the study and receive the HAD as part of the screening procedure patients need to fulfil the following criteria:

(a) patients attend the Royal Marsden Hospital with a diagnosis of any form of cancer except cerebral tumours at initial diagnosis of cancer or first recurrence
(b) patients are aware of their diagnosis
(c) estimated duration of survival, as judged by the clinician, is more than 12 months
(d) patients are aged 18–75 years
(e) patients speak fluent English
(f) patients have no obvious intellectual impairment
(g) patients reside within the Greater London or Home Counties area.

Patients who meet the entry criteria are seen between 4 and 12 weeks after initial diagnosis or first recurrence. This time lag allows patients to recover from the initial shock of learning of their diagnosis. Patients screened earlier would be more likely to be experiencing transient disturbances of mood. Although these patients may vary in the stage and severity of their cancer, they all share the same characteristic of being within three months of learning that they have cancer, or a recurrence of cancer.

The 575 patients who had been screened during the first 18 months of the study were included in this investigation.

Factor analyses were performed on the full 14-item HAD scale, and on the two seven-item subscales separately. Using the BioMedical Data Package (BMDP, 1988), Pearson product-moment correlation coefficients were computed and a principal-components procedure used to extract the initial factors. The predetermined criterion chosen for the number of factors to be extracted was the commonly used Kaiser or eigenvalue criterion, with which factors are retained if they have an eigenvalue equal to or greater than 1.

Two methods of rotation of this factor solution were compared: orthogonal rotation using the varimax procedure, and oblique rotation using direct quartimin (the oblique rotational procedure recommended for use with BMDP). Following the initial extraction of factors, rotation is used to achieve the simplest and most meaningful factor structure. An orthogonal rotation makes the assumption that the underlying factors are not correlated. An oblique rotation, however, does not make this assumption, and so allows for the possibility that the factors might show a correlation with each other. There is considerable debate over whether anxiety and depression exist as separate entities (Stavrakaki & Vargo, 1986) and subscales of anxiety and depression on questionnaires frequently show high correlations. For this reason it was considered important to compare the two rotation procedures.

In order to test the stability of the factor structure obtained, further analyses of two subsamples were carried out. (a) The sample was split into two halves, and factor analyses were then performed on these two subsamples. (b) Separate factor analyses were performed on the data from male and female subjects to establish the factor stability across sexes.

Results

Results from the screening questionnaires were available for 575 patients. The mean age of the sample (70.8% men, 29.2% women) was 55.1 (s.d. 12.8) years. A wide range of cancer diagnoses was covered. The largest diagnostic category was breast cancer (47.1%), while 9.7% of patients had malignancies of the cervix, uterus or ovary, 8.7% non-hodgkin's lymphoma, 7.3% head and neck tumours, and 5.7% Hodgkin's disease. Other diagnoses constituted 21.5% of the sample. The sample was heavily weighted towards those experiencing a first episode of cancer: 92.5% of patients had primary disease while only 7.5% had recurrent disease. This bias was reflected in the stage of disease recorded: 62.7% had local disease, 26.9% loco-regional disease, and 10.4% metastatic disease. A further biasing factor was the exclusion of any patients from the study who had a life expectancy of less than one year. The World Health Organization's (WHO, 1979) performance status criteria were used to record the degree to which patients were disabled by the disease: 59% of the patients were able to carry out all normal activities, 33% experienced some difficulty with strenuous activity, 6% were unable to work, but able to carry out all self-care, and only 1% were limited in their self-care or restricted to bed for more than 50% of the time.

The mean scores on the HAD were 5.44 for anxiety (s.d. 4.07; range 0–19) and 3.02 for depression (s.d. 2.98; range 0–15). Zigmond & Snaith (1983) recommend that scores of 8 or more on a subscale are taken to indicate possible pathology. Using this cut-off point, 27% of patients were in the range for clinical anxiety, and 8.7% for depression. Individual HAD items (possible scores of 0, 1, 2, 3) varied between a minimum of 0.23 (item 11) and 1.23 (item 8).

Complete sets of HAD scores were available for 568 patients, and factor analyses were carried out on these. Two factors emerged which accounted for 53% of the variance. An orthogonal rotation was performed; using the criterion of loading of 0.45 as a cut-off point, the anxiety and depression items loaded onto separate factors with the exception of item 7, from the anxiety subscale – "I can sit at ease and feel relaxed."

An oblique rotation was then performed (Table 1). Again all the items except item 7 loaded on the appropriate factor. It is to be expected that levels of anxiety and depression will not be entirely independent in this population, and this is supported by the finding of a correlation of 0.50 between the two factors when an oblique rotation is performed. It was considered that oblique rotation provides the most psychologically meaningful way of analysing the data in this sample. This method of rotation was used in the rest of the study to test the stability of the factor structure.

Table 1
Factor loadings of HAD items (oblique rotation)

HAD item	Factor 1 (depression)	Factor 2 (anxiety)
Anxiety subscale		
(1) I feel tense or wound up	0.13	0.71
(3) I get a sort of frightened feeling as if something awful is about to happen	0.09	0.77
(5) Worrying thoughts go through my mind	0.17	0.72
(7) I can sit at ease and feel relaxed	0.51	0.30
(9) I get a sort of frightened feeling like 'butterflies' in the stomach	−0.10	0.86
(11) I feel restless as if I have to be on the move	−0.07	0.66
(13) I get sudden feelings of panic	−0.01	0.83
Depression subscale		
(2) I still enjoy the things I used to enjoy	0.78	−0.02
(4) I can laugh and see the funny side of things	0.74	−0.06
(6) I feel cheerful	0.76	−0.01
(8) I feel as if I am slowed down	0.51	0.14
(10) I have lost interest in my appearance	0.49	0.07
(12) I look forward with enjoyment to things	0.79	0.01
(14) I can enjoy a good book or TV programme	0.65	−0.08

Principal-components analysis was carried out on the two subscales of the HAD separately. Analysis of the HAD anxiety scale resulted in a single factor which accounted for 57% of the variance. Analysis of the HAD depression scale revealed a single factor which accounted for 47% of the variance. Two reliability estimates for the subscales were calculated. Carmine's theta for the anxiety scale was 0.87

Table 2
Factor loadings of split halves of sample (oblique rotation)

HAD item	Depression factor		Anxiety factor	
	sample 1	sample 2	sample 1	sample 2
Anxiety subscale				
1	0.15	0.13	0.71	0.70
3	0.17	0.01	0.69	0.86
5	0.19	0.15	0.72	0.72
7	0.51	0.50	0.28	0.36
9	−0.04	−0.15	0.80	0.90
11	−0.14	0.03	0.66	0.65
13	0.00	−0.02	0.82	0.83
Depression subscale				
2	0.74	0.81	0.12	−0.12
4	0.71	0.76	−0.05	−0.05
6	0.68	0.80	0.05	−0.02
8	0.51	0.47	0.16	0.16
10	0.59	0.35	−0.03	0.22
12	0.76	0.81	0.06	0.00
14	0.65	0.61	−0.16	0.04

Table 3
Factor loadings for men and women (oblique rotation)

HAD item	Depression factor		Anxiety factor	
	men	women	men	women
Anxiety subscale				
1	0.18	0.14	0.68	0.70
3	0.23	0.05	0.62	0.81
5	0.25	0.17	0.70	0.70
7	0.59	0.48	0.23	0.33
9	−0.12	−0.07	0.82	0.85
11	−0.05	−0.11	0.62	0.72
13	−0.11	0.06	0.82	0.80
Depression subscale				
2	0.82	0.75	−0.07	0.01
4	0.80	0.71	−0.12	−0.03
6	0.66	0.82	0.12	−0.09
8	0.61	0.42	0.11	0.14
10	0.61	0.42	0.02	0.11
12	0.83	0.79	0.05	−0.02
14	0.61	0.64	−0.09	−0.05

and for the depression scale 0.81. Cronbach's α was 0.93 for the anxiety scale and 0.90 for the depression scale.

To test the stability of the factor structure obtained, the sample was split into two halves by taking the first 285 cases and comparing them with the last 283 cases. There were no significant differences between these two subsamples in terms of age, sex, or performance status. There were, however, significantly more patients with locoregional disease (as opposed to local or metastatic disease) in the second sample ($\chi^2 = 12.50$, 2 d.f., $P = 0.002$). A principal-components analysis was computed on each sample and oblique rotation performed. Table 2 shows the factor loadings for the two samples. For sample 1 two factors emerged explaining 52% of the variance, while for sample 2 two factors also emerged which explained 54% of the variance. The factor structure of the two samples is the same, and identical to the factor structure of the full sample of 568 cases.

Principal-components analysis followed by oblique rotation using direct quartimin in 167 men and 401 women revealed two factors in both groups. A correlation of 0.37 was found between the two factors in men. In women this correlation was 0.55. For the majority of items the factor loadings were very similar (Table 3). In women two items from the depression subscale just failed to load on the depression factor, item 8 "I feel as if I am slowed down" and item 10 "I have lost interest in my appearance".

Discussion

These results support the view that in the group of cancer patients studied, the HAD is bidimensional, tapping the separate but related constructs of anxiety and depression. Principal-components analysis consistently extracted two factors, in both the full sample of 568 patients and in the subsamples. The HAD is a relatively new instrument, and only one previous

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study has examined its factor structure in cancer patients (Razavi *et al*, 1990).

Razavi *et al* interviewed 226 Belgian cancer in-patients using the Diagnostic Interview Schedule (DIS; Spitzer, 1983) and validated the Belgian translation of the HAD against this measure. They briefly report that a preliminary factor analysis failed to show the bidimensionality of the scale in the sample tested, and so used the total HADS score as a psychological distress scale. There is not sufficient description of the statistical tests used to make a full comparison of the two studies. If the difference is not a product of differing statistical techniques, it is likely to be due to some difference in the nature of the populations studied. This may be a reflection of cultural or translation differences, or the composition of the two samples of cancer patients might affect the way the instrument performs. Although the Belgian sample is comparable in the types of cancer represented, age, range and sex distribution, all the patients were in hospital, whereas in the present study most were out-patients. While breast cancer represented the largest group in the Belgian study as in our own, other types of cancer were represented in larger numbers. Razavi's patients had more advanced disease and were more disabled by the disease than the group reported here.

One final possible difference concerns the HAD scores in these two populations. Unfortunately, Razavi does not report the separate anxiety and depression scores in his patients. Our cancer patients displayed substantially more anxiety than depression (27% in the clinical range for anxiety and 8.7% in the clinical range for depression). Patients with more advanced disease might be expected to experience more hopelessness and depression. It is not clear to what extent and in what way the factor analysis of our sample may have been affected by this preponderance of anxiety over depression. In the light of the differences between the present study and that of Razavi *et al*, our findings of the psychometric properties of the HAD can only be applied to patients with early-stage cancer. The instrument may not display the same properties when used with those with more advanced disease.

Our results suggest that the items on the two subscales of anxiety and depression discriminate very well. This applies to both orthogonal and oblique rotations. The only item which does not perform well is item 7 ("I can sit at ease and feel relaxed"). This item is from the anxiety subscale but actually loads on both factors. This difference applies more to women than men, but there appears to be no clear explanation for why this item should not be correlated more highly with anxiety. Further studies are needed to establish whether this is an enduring finding.

Although the two factors extracted correspond well to the two subscales, these factors only contribute 53% of the variance, leaving nearly half the variance unexplained. This result, however, compares well with other factor-analytic studies of questionnaires of this kind. Gould (1982) identified five factors which explained 58.7% of the variance in the 21-item Beck Depression Inventory (BDI; Beck *et al*, 1961). O'Brien & Glaudin (1988) examined the factor structure of the Hamilton Rating Scale for Depression (HRSD; Hamilton, 1960) and found that the factors accounted for only 40% of the variance. In a recent study using the GHQ in a sample of 6000 subjects in the community (Huppert *et al*, 1989), six factors were identified which accounted for 50.6% of the variance. It is of some interest that these questionnaires were consistently found to produce five or six factors, even though the BDI and HRSD are measures of a single mood state – depression. Authors have taken these findings to be evidence for the multidimensional nature of the depressive syndrome.

Factor analysis of the HAD, by contrast, extracted two factors. Factor analysis of the separate subscales for anxiety and depression produced unidimensional solutions for both, although this is perhaps not surprising given the small number of items in each subscale. Further evidence for the homogeneity of the two subscales of the HAD are their high-coefficient α values (anxiety, 0.93; depression, 0.90). For a scale to be used for research purposes, Nunnally (1978) recommends that coefficient α is at least 0.6, while for it to be used as a screening instrument it should be at least 0.8. Using these criteria both the HAD subscales can be justifiably used as screening measures. This homogeneity is a distinct advantage for the HAD, but it may also be a weakness. Significant aspects of the syndromes of anxiety and depression are omitted. This does not just apply to somatic symptoms which have been deliberately excluded. Important components of depression, for instance, such as hopelessness, guilt and low self-esteem are not assessed, because the scale measures only features of anhedonia. This is perhaps not so important in screening studies as it is in outcome studies.

At the moment the HAD seems to be the best instrument available for simple and rapid evaluation of psychological interventions in patients with physical illness. It is well established that the component symptoms of the syndromes of anxiety and depression do not all respond at the same pace to treatment. In this case more comprehensive scales

might prove more sensitive to change. Studies of how the HAD changes in response to treatment in comparison with other scales are required.

In addition to its high internal consistency, the questionnaire has a reliable factor structure. The same two factors emerged from analyses of two halves of the sample, and from separate analyses of male and female subjects. In this large sample of cancer patients the factor structure is robust.

These results confirm that the HAD is a useful instrument for measuring anxiety and depression in cancer patients, and that for patients with early cancer the continued use of its two subscales is justified. Further studies are needed to establish whether this also applies to patients with advanced cancer and other types of physical illness.

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