

What does the Hospital Anxiety and Depression Scale (HADS) Really Measure in Liaison Psychiatry Settings?

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Abstract: The hospital anxiety and depression scale (HADS) is a widely used and popular self-report measure that has been extensively translated and utilized in a broad variety of clinical populations. This 14-item measure has been subject to two previous reviews exploring a number of psychometric aspects of this tool. A relatively consistent finding of previous reviews of this instrument is that it is a reliable and valid measure of two independent and separable dimensions of anxiety and depression; indeed, this aspect of the HADS is crucial to the validity of the measure in clinical practice. The current review examines contemporary research reports that use factor analytic techniques, which suggest that the assumed bi-dimensionality of the HADS is, in fact, erroneous. The findings from the current review suggest that the HADS is underpinned by a tri-dimensional factor structure comprising dimensions of anhedonia, negative affectivity and autonomic arousal. Implications for the use of the HADS in light of these observations are discussed and recommendations made within the context of screening practice for the referral to liaison psychiatry services.

Keywords: Hospital anxiety and depression scale, factor structure, psychometrics.

INTRODUCTION

Liaison psychiatry represents an important and innovative contribution to psychiatric practice, the goal of which should undoubtedly be to target psychiatric services to those in need, irrespective of patient setting, or presenting co-morbidity. However, for liaison psychiatry to fully realize its clinical potential, effective referral pathways are required and the fundamentally most important aspect of this process is effective screening for those presenting with significant psychological distress, in order to identify a probable 'case' for referral. The focus of this paper will be on one of the most popular screening measures used for screening for non-psychotic affective disturbance; the Hospital Anxiety and Depression Scale (HADS) [1], which was principally developed to identify cases of significant anxiety and depression in medical and surgical settings. This mini-review will focus on one of the less explored, but nether the less, crucially important areas of validity of this particular instrument, specifically the underlying factor structure of the tool.

THE HOSPITAL ANXIETY AND DEPRESSION SCALE (HADS)

The HADS is an easily administered, 14-item self-report measure comprising 7 anxiety items and 7 depression items from which separate anxiety and depression sub-scale scores are calculated. A fundamental innovation accompanying the development of the HADS was the exclusion of symptoms that might arise from the somatic aspects of illness such as insomnia, anergia, and fatigue. This approach to instrument

formulation was explicit from the outset of the development of the tool, the goal of which was to make available a screening tool that could be used in any general medicine setting, since it would not be confounded by psychical symptoms of illness or disease. This is both a laudable and noble goal in terms of identification of psychiatric cases in medical settings and facilitation of referral to specialist liaison psychiatry services.

USE OF THE HADS IN LIAISON PSYCHIATRY SETTINGS

The HADS has been used for screening purposes in an extensive, diverse and broad range of clinical groups [2-9]. There have been two previous full reviews of the HADS [10-11]. Both of these reviews were highly supportive of the HADS for the purposes of clinical screening of both symptom severity and case detection of anxiety disorders and depression. Further, it has been recommended that the instrument is reliable and valid in key groups, including those with somatic symptoms, psychiatric history, primary care patients and for case detection in general population samples [11-12]. There would therefore appear to be a clear and compelling clinical rationale for the use of the HADS as an instrument of choice for screening for anxiety disorders and depressive illness in virtually all clinical groups, bar those with psychotic illness. However, there are tantalizing clues in the burgeoning evidence base regarding the HADS that suggests that acceptance and reliance on this measure as a bona-fide and valid index of anxiety and depression may be misplaced. These areas of concern are centered on the underlying factor structure of this instrument.

ASSUMPTIONS OF BI-DIMENSIONALITY

An underpinning central tenet essential to the validity of the HADS is that it measures two dimensions of anxiety and

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depression reliably and consistently [1, 10-12]. Irrespective of the sensitivity and specificity characteristics, internal consistency and test-retest reliability of the HADS in clinical groups, if the assumption of bi-dimensionality within the instrument is not supported, or found to be compromised in specific clinical groups, then the HADS cannot be concluded to be measuring reliably and accurately two domains of anxiety and depression [13]. This ascorbic psychometric specter which threatens the validity and utility of this instrument has been hinted at, even in reviews of the HADS which suggested that the instrument should be used with confidence [1, 10-12]. The most recent review of the HADS published in 2002 [11] emphasized the utility of the HADS, however, though the authors claimed the HADS performed as a bi-dimensional instrument, their summary table of the factor analytic studies conducted on the HADS revealed that only 11 out of the 20 factor analyses reported supported a bi-dimensional factor structure to the HADS. Moreover, even among those studies which did report a bi-dimensional structure, there were a number of incidences where the items loaded on the 'wrong' factor, most notably HADS anxiety item 'I can sit at ease and feel relaxed' was found to load onto the depression factor in a number of studies. A number of studies reported in the review [7, 14-17] demonstrated that the HADS appeared to have an underlying three-factor structure. Since this review was published [11], there has been a number of factor analytic investigations conducted on the HADS, with increasing degrees of methodological and statistical rigor and these appear to demonstrate that the assumption of bi-dimensionality is in fact, erroneous.

CONTEMPORARY FACTOR ANALYSIS INVESTIGATIONS OF THE HADS

Recent psychometric evaluations of the HADS in a range of clinical populations have suggested that the underlying factor structure of the instrument may indeed be compromised by the physiological aspects of disease or changes in health status [6, 18-19]. There is also accumulating evidence that the fundamental factor structure of the HADS comprises not two, but three factors [13, 15, 19-22] and indeed, that the three-factor structure offers a superior fit to clinical data than the two-factor (anxiety and depression) model formulated as part of the original instrument development [1]. A summary of the more noteworthy factor analytic investigations conducted over recent years is shown in Table 1.

It is worthy of note that there has been a fundamental shift in the number of studies finding a three-factor superior fit to HADS data over recent years. This is undoubtedly due to advances in the techniques of factor analysis. Traditionally, exploratory factor analysis (EFA) reduces the data to a smaller number of summary variables or factors. Interestingly, and contrary to popular myth, the selection of the appropriate number of factors is based on largely arbitrary criteria [23], usually eigenvalues greater or equal to 1. An alternative method of selecting the number of correct factors is the scree plot, however, even with this method arbitrary inferences are made as to the most appropriate number of factors to extract, further there is currently considerable debate as to which point of inflection to use to determine the optimal number of factors. In contrast,

confirmatory factor analysis (CFA) represents a methodological advance in factor analysis and structural equation modeling (SEM) approaches to data because it allows a factor model to be apriori specified and then tested against data. In this way, theoretically and research derived factor models can be evaluated to determine how well the model fits the data. CFA therefore specifies the predicted relationship between variables and latent structures and allows contrasting models to be compared. This is an important point because it allows more sophisticated psychological models to be evaluated against data compared to EFA. It can be seen in Table 1. that the majority of published papers in recent years which have identified a three-factor superior model fit to the HADS have used CFA. Reflecting on previous publications that have used EFA and reported two-factor model fit optimality with the HADS, it is pertinent to raise some critical issues which also highlight some of the limitations of EFA. Dagnan *et al.* [24] and Mykletun *et al.* [25] identified three-factor initial solutions within the HADS using EFA but chose to dismiss the third-factor, without a sound psychometric rationale. It is likely that an expectation of a presumed two-factor model makes it difficult to reconcile an unexpected three-factor model emerging from the data, therefore it is explainable why these researchers might choose to dismiss a third factor.

The contrast of both methodology, and contrasting two and three-factor models, can be focused into sharp relief by examination of the findings from the small number of studies which have reported both EFA and CFA of HADS data in order to attempt to reconcile some of these methodological issues. A noteworthy study is the recent investigation by Martin and Newell [23] examining the factor structure of the HADS in individuals with severe facial disfigurement. Martin and Newell [23] found that with EFA, a two-factor structure was extracted matching that of the predicted two-factor anxiety and depression taxonomy proposed by the instrument developers [1]. However, when Martin and Newell [23] conducted their CFA comparing competing two and three-factor models, they found that the best fit to the data was offered by three-factor models. Only one CFA study has found supportive evidence for a two-factor (anxiety and depression) structure to the HADS [26] however, it is noteworthy that that particular study only evaluated the two-factor model against data. The balance of evidence increasingly appears to support the finding that the HADS is fundamentally a tri-dimensional instrument.

WHAT DOES THE HADS MEASURE?

The pressing question then is what does the HADS measure if it is fundamentally and implicitly comprised of three rather than two sub-scales? The three-factor structure identified by Dunbar *et al.* [15] in a non-clinical population was underpinned by conceptual advances in defining anxiety and depression, notably, the influential 'tripartite' model proposed by Clark and Watson [27]. Dunbar *et al.*'s observation has been replicated in a number of clinical populations ranging from clinically depressed [21], to those patients experiencing life threatening coronary heart disease [13, 22]. Further, an approximation of the tripartite model has been identified in non-clinical groups appearing to support the universality of the HADS tri-dimensional

Table 1. Characteristics of Contemporary Studies Reporting Factor Analysis Findings of the HADS

Model	Number of factors	Clinical population	n	Factor extraction method [#]
Allan & Martin (2004) [33]	3	Schizophrenia	100	CFA
Barth & Martin (2004) [31]	3	Coronary heart disease	1, 320	CFA
Caci <i>et al.</i> (2003) [20]	3	Non-clinical	195	CFA
Dagnan <i>et al.</i> (2000) [24]	2	Depressed	341	PCA
Dunbar <i>et al.</i> (2000) [15]	3	Non-clinical	2, 547	CFA
Friedman <i>et al.</i> (2001) [21]	3	Depressed	2, 669	PCA
Herrero <i>et al.</i> (2003) [28]	2	Medical out-patients	385	PCA
Jomeen & Martin (in press) [32]	3	Early pregnancy	101	PCA & CFA
Karimova & Martin (2003) [28]	4-5	Pregnancy	100	MLA
Martin <i>et al.</i> (2003) [13]	3	Myocardial infarction	335	CFA
Martin <i>et al.</i> (2004) [19]	3	End-stage renal disease	160	PCA, MLA & CFA
Martin <i>et al.</i> (in press) [22]	3	Acute coronary syndrome	138	CFA
Martin & Newell (2004) [23]	3	Facial disfigurement	376	PCA & CFA
McCue <i>et al.</i> (2003) [18]	3	Chronic fatigue syndrome (CFS)	117	MLA & CFA
McCue <i>et al.</i> (2004) [39]	3	CFS and Non-clinical	494 ^a & 1362 ^b	CFA
Marinus <i>et al.</i> (2002) [36]	2	Parkinson's disease	205	PCA
Mykletun <i>et al.</i> (2001) [25]	2	Non-clinical	51, 930	PCA
Plunkett <i>et al.</i> (in press) [40]	3	Myocardial infarction	191	PCA & CFA
Quintana <i>et al.</i> (2003) [37]	2	Five clinical groups and controls	685	PCA
Roberts <i>et al.</i> (2001) [26]	2	Coronary heart disease	167	CFA
Rodgers <i>et al.</i> (2004) [35]	3	Breast cancer	110	MLA & CFA
Smith <i>et al.</i> (2002) [34]	2	Cancer	1474	PCA

Note: PCA: Principal Components Analysis; MLA: Maximum likelihood Analysis; CFA: Confirmatory Factor Analysis. Both PCA and MLA are exploratory factor analysis (EFA) techniques in the above studies. CFS^a, non-clinical^b

structure beyond that of clinical cohorts [20]. Taken together, these observations suggest that the HADS assesses a relatively coherent dimension of depression or anhedonia, essentially the HADS depression sub-scale; however the HADS anxiety sub-scale is 'split' between negative affectivity and autonomic arousal. Under this rubric, it would be anticipated that the autonomic arousal component would indeed be sensitive to the somatic aspects of experience which accompany most illness and disease manifestation. This may therefore be a considerable source of contamination in the instrument due to physical symptoms which will undoubtedly impact on case detection accuracy. These recent insights into the factor structure of the HADS have a number of significant implications in terms of the validity of the HADS as a screening instrument, however, the most important of these clinically, is that referral to liaison psychiatry services could be undermined based on a two dimensional (anxiety and depression) interpretation of HADS scores.

FUTURE DEVELOPMENTS

The three-factor underlying structure represents, with few exceptions [28] a generic rather than pathology-specific account of the instrument, an account that is readily explainable within contemporary accounts of affective presentation [27]. The suggestion has been made that the HADS could be scored as a measure comprising three, rather than two, sub-scales [15, 18-23]. However, it has been highlighted that scoring the instrument in this way would require a sophisticated scoring algorithm [23] thus complicating, and indeed confounding, the use of the measure as an easily scored and interpreted screening measure administered by busy clinical staff. It would be unlikely that staff working within a busy medical setting where the HADS is usually used for routine screening would be able to spend additional valuable time calculating regressed score values.

The possibility of developing a new measure to assess three dimensions of affect based on a tacit theoretical

framework would be clinically useful and highly desirable, particularly within the realms of screening, and intervention and outcome monitoring. It might be anticipated that such a tool would have better predictive potential than those currently widely used. Two possible alternative routes are readily apparent. Firstly, a new measure could be developed from scratch taking into account lessons learned from the wealth of clinical experience with the HADS and developing theoretical accounts of the etiology and manifestation of anxiety and depressive disorders. Secondly, an existing measure could be evaluated that has been developed from a credible theoretical account of affectivity [27]. Though both of these approaches offer promising clinical benefits in terms of screening practice, it is worthy of note that there already exists a measure that may satisfy the above criteria. The Depression Anxiety Stress Scales (DASS) [29] comprise a 42-item self-report instrument that assesses three related negative emotional states of depression, anxiety and tension/stress within three sub-scales. Conceptually cogent and consistent with the theoretical assertions of Clark and Watson [27], the DASS has been established to have excellent psychometric properties [30]. The DASS has been used in relatively few clinical studies; however the conceptual and theoretical merits of this instrument would certainly justify further exploration of its clinical utility in a screening role. A general conclusion thus far is that the three-factor structure is likely to induce error and reduce the screening accuracy of the HADS. However, until improved screening measures are available it has been suggested that the HADS can be continued to be recommended for use, but with strong emphasis that clinicians should be aware that the instrument is not fundamentally measuring anxiety and depression [23,31] as proposed by the instrument developers [1].

ATYPICAL FACTOR STRUCTURE ACCOUNTS OF THE HADS

The above mini-review has summarized recent factor analytic studies of the HADS. Interestingly, though the three-factor structure appears to be remarkably consistent across a diverse variety of clinical groups, there does appear to be a small number of clinical groups where the characteristics of clinical presentation appear to have a clearly atypical impact on the factor structure of the HADS. It has been observed that the factor structure of the HADS appears to be unstable during pregnancy [28]. It has also been observed during pregnancy that even when a three-factor fit offers the best fit to the data, it is not necessarily a good or acceptable fit [32]. In view of these observations, it is suggested that the HADS is an unsuitable instrument for screening use during pregnancy [28, 32]. A further clinical group where the HADS has received recent factor analytic attention is in screening for affective disturbance in patients with a primary diagnosis of schizophrenia [33]. The HADS was developed for use in non-psychotic illness however the use of the instrument to screen schizophrenic patients for mood disorder has been found to be common practice in regions of the United Kingdom [33], hence the rationale for Allan and Martin's [33] investigation. They found a three-factor structure to the HADS in schizophrenic patients; however, this particular three-factor structure was completely

unlike that seen in other clinical groups. Allan and Martin [33] reported that the *anxiety* items of the HADS emerged as a complete factor, however, the *depression* items were splintered between two factors. Allan and Martin [33] suggested that the HADS anxiety sub-scale *may* be acceptable for use in this group with further evaluative work; however, it was recommended by these researchers that the HADS depression sub-scale is unsuitable for use in this patient group.

CONCLUSION

The HADS has a rich psychiatric ancestry spanning more than 20 years and its longevity has been largely a product of its ease of administration, patient acceptability and simple scoring. A continuing source of psychometric ambiguity concerning this instrument relates to its underlying factor structure [34-38]. However, the recent psychometric evidence suggests that the HADS is not a bi-dimensional instrument and in fact, it is fundamentally a tri-dimensional measure. This has a number of significant ramifications for its continued use as a screening instrument for referral to liaison psychiatry services as outlined earlier. There is clearly the need for a more theoretically grounded and more accurate screening tool and there are clear indications in the psychometric literature that the time has come for the HADS to be superseded. Factor analytic techniques have contributed to raising awareness of the limitations of the HADS; such techniques are also perfectly placed to facilitate evaluation of improved screening tools that, it is hoped, will allow more patients to gain access through more effective screening to appropriate psychiatric services, particularly those of liaison psychiatry.

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