A psychometric evaluation of the Hospital Anxiety and Depression Scale for the medically hospitalized elderly

ANNE-SOFIE HELVIK, KNUT ENGEDAL, RANDI H. SKANCKE, GEIR SELBÆK,


Background: Few psychometric studies of the Hospital Anxiety and Depression Scale (HADS) scale have been performed with clinical samples of elderly individuals. Methods: The participants were 484 elderly (65–101 years, 241 men) patients in an acute medical unit. The HADS, the Montgomery–Aasberg Depression Rating Scale (MADRS) and questionnaires assessing quality of life, functional impairment, and cognitive function were used. The psychometric evaluation of the HADS included the following analyses: 1) the internal construct validity by means of principal component analysis followed by an oblique rotation and corrected item–total correlation; 2) the internal consistency reliability by means of the alpha coefficient (Cronbach's) and 3) concurrent validity by means of Spearman's rho. Results: We found a two-factor solution explaining 45% of the variance. Six of seven items loaded adequately (≥0.40) on the HADS-A subscale (item 7 did not) and five of seven items loaded adequately on the HADS-D subscale (items 8 and 10 did not). Cronbach's alpha for the HADS-A and HADS-D subscale was 0.78 and 0.71, respectively. The correlation between HADS-D and the MADRS, a measure of the concurrent validity, was 0.51. Conclusion: The HADS appears to differentiate well between depression and anxiety. The internal consistency of the HADS in a sample of elderly persons was as satisfactory as it is in samples with younger persons. In contrast to younger samples, item 8 (“I feel as if I have slowed down”) did not load adequately on the HADS-D subscale. This may be attributed to the way elderly people experience and describe their symptoms.

• Factor analysis, Principal component analysis, Psychometric properties, Quality of life, Validation.

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The prevalence of depression and/or depressive symptoms in the elderly (aged 65 years or above) has been reported to be between 8% and 19% in community studies (1–4) and is most often reported to be higher in somatically hospitalized elderly people, where it varies from 6% to 73% (2, 3, 5, 6). The variation in prevalence estimates may partly be explained by sample characteristics and/or by cultural differences. However, the methodology used, including the approach and inventories involved may be important for the estimated prevalence (6–8). Over the last two decades, approximately 30 studies have reported the prevalence of depression in elderly medical inpatients, 17 of those studies used screening tools (one or more), and eight different tools were used (6). The Hospital Anxiety and Depression Scale (HADS) was one of them.

The HADS was developed by Zigmond & Snaith in 1983 to identify patients with emotional distress in terms of anxiety and depression in non-psychiatric hospital units (9). In order to avoid confounding with the symptoms of a physical illness, somatic symptoms of depression and anxiety like dizziness, insomnia, fatigue and reduced appetite were excluded (10, 11). Furthermore, in order to make the scale suitable for clinical practice, psychiatric symptoms that are less common in medical hospitals were omitted and the number of questions was reduced to a minimum (11, 12). The original study of Zigmond & Snaith found the HADS to distinguish
Validation of the HADS for elderly medical inpatients

The HADS has been extensively validated among medical inpatients and outpatients and psychiatric patients (10, 11, 13), as well as in carers and general populations of adults, students and adolescents (10, 13, 14). Two articles have reviewed the various validations of the HADS (10, 13). None of the studies in the reviews included elderly medical patients, and in no study was the mean age of participants as high as 65 years. However, in one population-based study, a separate principal component analysis of the participants who were older than 65 years was performed (15). This study showed that the dimensional structure and reliability of the HADS was quite stable across medical settings and age groups. We searched for articles describing psychometric properties published later than those included in the reviews and used the following criteria: indexed in Medline and/or PubMed (before 1 November 2009), using the terms evaluation/validation/psychometric properties and the HADS. We found 24 relevant articles, but only five of them included elderly patients; one among the elderly with major depression (16) and four among the elderly with mean age above 65 years with specific medical diagnoses (17–20). No studies have reported the psychometric properties of HADS in a general sample of elderly medical inpatients.

The correlation between the depression subscale of the HADS and the Montgomery–Aasberg Depression Rating Scale (MADRS) has been reported to vary between 0.6 and 0.8 in younger clinical samples of somatic, psychiatric and mixed character (21–23). As far as we know, the correlation between the depression subscale in the HADS and other measures of depression in elderly medically inpatients has not been described. Elderly individuals may have uncharacteristic disease symptoms, multiple diseases, a physical disability or cognitive reduction, and may exhibit atypical depressive symptoms (24–26). This warrants a study of the psychometric properties of the HADS in a sample of medically ill elderly inpatients with a variety of health problems.

Thus, the purpose of the present study was to explore the internal construct validity and consistency reliability of the HADS for elderly medical inpatients and to examine the correlation between the HADS and the MADRS in the elderly.

Method
Participants
Over a study period of 2 years (1 September 2006–30 August 2008) all elderly patients (≥65 years) acutely hospitalized and staying for at least 48 h at a medical unit at Tynset Division of the Inlandet Hospital Trust were invited to participate. The number of patients eligible for inclusion was 802. Of these 294 patients were excluded because of severe cognitive impairment (n = 116), severe communication difficulties (n = 25), terminal state or died (n = 47), poor physical functioning (n = 106). In all, 24 patients refused to participate. Thus, 484 (241 male) patients were included. The mean duration (± standard deviation, s) of the hospital stay and hospital stay before inclusion was 6.4 ± 5.2 and 4.3 ± 3.5 days, respectively. The mean age was 80.7 ± 7.4 years, with an age range of 65–101 years. Further description of the criteria for inclusion and the sample may be found elsewhere (6).

Measures
Depression and anxiety were measured by means of the self-report HADS. The scale comprises 14 items. Seven items assess depressive symptoms and seven items address anxiety symptoms (each item is scored 0–3, producing a sum score 0–21 on each subscale) (9, 10, 13). A high score indicates that the symptoms are more severe. The depression (HADS-D) subscale focuses on anhedonia: five of the seven items relate to loss of pleasure. In the anxiety (HADS-A) subscale, the emotional and cognitive aspects of anxiety are central; three items concern feelings of fear and panic and four items reflect the characteristics of generalized anxiety.

In addition to the HADS, the MADRS was used for the assessment of depressive symptoms (27). The MADRS interview can be administered by non-psychiatric professionals (28). The scale consists of 10 items. Each item gives a score from 0 to 6, producing a sum score from 0–60 with higher scores denoting more severe depression. In contrast to the HADS, the MADRS includes somatic items. Sleeping difficulties and lack of appetite are invariably included among somatic items, but in some papers, lassitude is also classified as a somatic symptom. In this paper, we have limited somatic symptoms to sleeping difficulties and lack of appetite.

Cognitive function and degree of dementia were assessed by means of the Mini-Mental-State Examination (MMSE) (29) and the Clinical Dementia Rating Scale (CDR) (30), respectively. A CDR score of 0 indicates no dementia and 3 (the maximum) indicates severe dementia (30, 31).

Procedure
All patients aged 65 years or more who were admitted to the medical service were assessed for inclusion. Patients were invited to participate during their hospital stay, when their medical condition was stabilized. The patients received written and oral information about the study, and they subsequently gave written consent. If they lacked the ability to give informed consent, their next of kin was informed and they could refuse participation on
behalf of the patient. Initially, the research assistants completed the MMSE for all the eligible patients. If the MMSE score was 18 or lower, the CDR evaluation was performed. Those \( (n = 116) \) with severe dementia (CDR = 3) were excluded. The study was approved by the Regional Committee for Medical Research Ethics in south-eastern Norway and the Norwegian Social Science Data Service.

**Statistical analysis**

Data were analysed with SPSS version 16.0 (SPSS, Chicago, IL, USA). Pearson’s chi-square and analysis of variance (ANOVA) were used to analyse categorical and continuous data, respectively. \( P \)-values below 0.05 were considered statistically significant.

The psychometric evaluation included construct validity and internal consistency. Initially, the scale was explored by means of Bartlett’s test (significance better than 0.05) and the Kaiser–Meyer–Olkin measure (higher than 0.60) to check whether the data were suitable for principal component analysis. A principal component analysis was performed. The number of factors retained for extraction and rotation was based on the Kaiser criterion (eigenvalues >1) (32) and inspection of the scree plot (33). The retained factors were explored by an oblique rotation (Direct oblimin method with delta = 0), which makes the assumption that the factors are correlated. Loadings of 0.40 or higher were considered satisfactory for interpretation of the factors (34, 35). The mean factor loadings were calculated by dividing the sum of the loadings of items included in each factor by the number of items. Furthermore, the internal construct validity of each subscale was assessed by use of corrected item–total correlation \( (r_{it}) \) (36). Thus, items with high \( r_{it} \) scores are more representative of the scale and strengthen the homogeneity of the scale. The mean \( r_{it} \) in each factor was calculated by dividing the sum of the \( r_{it} \) of items included in the factor by the number of items. Lastly, the internal consistency reliability was assessed by means of the (Cronbach) alpha coefficient (34).

The concurrent validity between the score on the HADS (HADS-D, HADS-A and HADS-Total) and the MADRS was examined using bivariate correlations with Spearman’s rho (34).

**Results**

In the total sample of 484 elderly medical inpatients, the mean scores of the HADS-A and HADS-D subscales were 2.90 ± 3.21 and 3.22 ± 3.07, respectively (Table 1). The mean HADS-A and HADS-D scores did not differ by gender. The youngest age strata (65–79 years) of females had a significantly higher mean HADS-A score (mean 4.10 ± 4.28) than the older age category (80 years and older) (mean 2.33 ± 2.56), the mean score of the HADS-D was not significantly lower according to age. In men, the youngest age category (65–79 years) had a significantly lower HADS-D score (mean 2.61 ± 2.77) than the older one (80 years and older), but the mean score of the HADS-A was not significantly higher according to age.

**The construct validity and internal consistency**

Bartlett’s test of sphericity \( (\chi^2 = 1899.52, \text{df} = 91) \) and the Kaiser–Meyer–Olkin measure of sampling adequacy (0.87) showed that the data were suitable for principal component analysis. Based on the eigenvalue criterion and a clear break in the slope in the scree plot, two factors were retained for subsequent analysis. The two factors explained 44.79% of the variance (Table 2). When using the oblique rotation, the two factors were found to be moderately correlated (−0.45).

Based on the assumption of a satisfactory loading being 0.40 or higher, the anxiety items of the HADS loaded adequately on the first factor (the HADS-A factor) except for item 7 (“I can sit at ease and feel relaxed”), which did not load satisfactorily onto either factor. Five of the depression items loaded satisfactorily onto factor 2 (the HADS-D factor). Item 8 (“I feel as if I have slowed down”) and 10 (“I have lost interest in my appearance”) did not load satisfactorily onto either factor. The mean factor loadings on the HADS-A and HADS-D subscales were 0.64 and 0.55, respectively.

The corrected item–total correlation \( (r_{it}) \) of the HADS-A factor varied from 0.34 to 0.62. Item 7 had the lowest corrected item–total correlation and contributed least of all to the scale homogeneity. The mean corrected item–total correlation of this factor was 0.51. The corrected item–total correlation of the HADS-D factor varied from 0.26 to 0.68. Items 8 and 10 had the lowest scores and

### Table 1. Mean score and standard deviation (s) on the Hospital Anxiety and Depression Scale anxiety (HADS-A) and depression (HADS-D) subscales by gender and age \( (n = 484) \).

<table>
<thead>
<tr>
<th></th>
<th>HADS-A</th>
<th>HADS-D</th>
<th>HADS-T(total)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>( n )</td>
<td>%</td>
<td>Mean ( s )</td>
</tr>
<tr>
<td>Female*</td>
<td>243</td>
<td>50.2</td>
<td>3.03(^{A})</td>
</tr>
<tr>
<td>65–79 years</td>
<td>94</td>
<td>19.4</td>
<td>4.10(^{A})</td>
</tr>
<tr>
<td>≥80 years</td>
<td>149</td>
<td>30.8</td>
<td>2.83(^{A})</td>
</tr>
<tr>
<td>Male†</td>
<td>241</td>
<td>49.8</td>
<td>2.78(^{A})</td>
</tr>
<tr>
<td>65–79 years</td>
<td>113</td>
<td>23.4</td>
<td>2.64(^{A})</td>
</tr>
<tr>
<td>≥80 years</td>
<td>128</td>
<td>26.4</td>
<td>2.91(^{B})</td>
</tr>
<tr>
<td>Total‡</td>
<td>484</td>
<td>100.0</td>
<td>2.90(^{A})</td>
</tr>
<tr>
<td>65–79 years</td>
<td>207</td>
<td>42.8</td>
<td>3.30(^{A})</td>
</tr>
<tr>
<td>≥80 years</td>
<td>277</td>
<td>57.2</td>
<td>2.60(^{B})</td>
</tr>
</tbody>
</table>

*Mean age 81.3 \( (s = 7.4) \) years.
†Mean age 80.0 \( (s = 7.4) \) years.
‡Mean age 80.7 \( (s = 7.4) \) years.

\( A \)In females, the symptom score of HADS-A is negatively associated with increasing age \( (F = 15.97, P < 0.001) \).

\( B \)In males, the symptom score of HADS-D is positively associated with increasing age \( (F = 7.039, P < 0.01) \).
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HADS-A subscale (item 7 did not) and five of seven items loaded adequately on the HADS-D subscale (items 8 and 10 did not). These items (7, 8 and 10) did not load satisfactorily onto any of the subscales and their corrected item–total correlations were low. The internal consistency coefficient (Cronbach’s alpha) for the HADS was 0.81, whereas for the anxiety and depression subscales it was 0.78 and 0.71, respectively. The correlation between the HADS-D subscale and the MADRS was moderate.

Most articles studying the internal construct validity of the HADS with principal components analysis have found a two-factor structure consistent with our results (10). The explained variance in the present study of the HADS was somewhat lower than in clinical samples of younger patients with somatic disorders and problems, varying were least representative for the HADS-D subscale in this sample of elderly medical inpatients. The mean corrected item–total correlation of the HADS-D factor was 0.45.

The internal consistency reliability assessed with the Cronbach’s alpha was 0.82 for the entire scale. Cronbach’s alphas for the HADS-A and HADS-D subscales were 0.78 and 0.71, respectively. Removing item 7 from the HADS-A subscale and items 8 and 10 from the HADS-D subscale would have increased the Cronbach’s alphas to 0.79 and 0.78, respectively.

The correlations between the HADS and the MADRS, expressing concurrent validity, are presented in Table 3. The total MADRS score correlated moderately (0.51) with the HADS-D subscale. The correlation between the score of the items with emotional content in MADRS (all items of MADRS, except for sleep and appetite) and the HADS-D subscale was also moderate (0.53), whereas the correlation between the items with somatic content in MADRS and HADS-D was negligible (0.14).

Discussion

To the best of our knowledge, this is the first study evaluating the psychometric properties of the HADS in a broad sample of medically hospitalized elderly people. The principal component analysis clearly showed a two-factor structure that explained 45% of the variance. In all, six of the seven items loaded adequately on the

Table 2. Factor loadings (oblique rotation), corrected item–total correlation and internal consistency reliability (Cronbach’s alpha) of the Norwegian version of the Hospital Anxiety and Depression Scale (HADS) in elderly medically hospitalized patients.

<table>
<thead>
<tr>
<th>HADS item</th>
<th>Factor*</th>
<th>Corrected item–total correlation</th>
<th>Cronbach’s alpha</th>
</tr>
</thead>
<tbody>
<tr>
<td>Anxiety subscale</td>
<td>1</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>1 I feel tense and wound up</td>
<td>0.81</td>
<td>0.08</td>
<td>0.62</td>
</tr>
<tr>
<td>3 I get a sort of frightened as if something awful is about to happen</td>
<td>0.68</td>
<td>−0.10</td>
<td>0.59</td>
</tr>
<tr>
<td>5 Worrying thoughts go through my mind</td>
<td>0.80</td>
<td>0.05</td>
<td>0.62</td>
</tr>
<tr>
<td>7 I can sit at ease and feel relaxed</td>
<td>0.34</td>
<td>−0.19</td>
<td>0.34</td>
</tr>
<tr>
<td>9 I get a sort of frightened feeling like “butterflies in the stomach”</td>
<td>0.59</td>
<td>−0.20</td>
<td>0.59</td>
</tr>
<tr>
<td>11 I feel restless as if I have to be on the move</td>
<td>0.63</td>
<td>0.08</td>
<td>0.43</td>
</tr>
<tr>
<td>13 I get sudden feelings of panic</td>
<td>0.61</td>
<td>0.11</td>
<td>0.40</td>
</tr>
<tr>
<td>Depression subscale</td>
<td></td>
<td></td>
<td>0.71</td>
</tr>
<tr>
<td>2 I still enjoy the things I used to enjoy</td>
<td>−0.04</td>
<td>−0.83</td>
<td>0.54</td>
</tr>
<tr>
<td>4 I can laugh and see the funny side of things</td>
<td>−0.04</td>
<td>−0.86</td>
<td>0.57</td>
</tr>
<tr>
<td>6 I feel cheerful</td>
<td>0.21</td>
<td>−0.61</td>
<td>0.50</td>
</tr>
<tr>
<td>8 I feel as if I have slowed down</td>
<td>0.34</td>
<td>−0.08</td>
<td>0.26</td>
</tr>
<tr>
<td>10 I have lost interest in my appearance</td>
<td>0.33</td>
<td>−0.07</td>
<td>0.26</td>
</tr>
<tr>
<td>12 I look forward with joy to things</td>
<td>0.00</td>
<td>−0.86</td>
<td>0.68</td>
</tr>
<tr>
<td>14 I can enjoy a good book, or radio or TV programme</td>
<td>0.01</td>
<td>−0.49</td>
<td>0.36</td>
</tr>
<tr>
<td>Total scale</td>
<td></td>
<td></td>
<td>0.82</td>
</tr>
</tbody>
</table>

Eigenvalue of factors | 4.67 | 1.62 |
Cumulative explained variance | 33.25 | 44.79 |

*Loadings ≥0.40 is satisfactory, marked bold and italic.

HADS-A subscale (item 7 did not) and five of seven items loaded adequately on the HADS-D subscale (items 8 and 10 did not). These items (7, 8 and 10) did not load satisfactorily onto any of the subscales and their corrected item–total correlations were low. The internal consistency coefficient (Cronbach’s alpha) for the HADS was 0.81, whereas for the anxiety and depression subscale it was 0.78 and 0.71, respectively. The correlation between the HADS-D subscale and the MADRS was moderate.

Most articles studying the internal construct validity of the HADS with principal components analysis have found a two-factor structure consistent with our results (10). The explained variance in the present study of the HADS was somewhat lower than in clinical samples of younger patients with somatic disorders and problems, varying

Table 3. Spearman correlations between the Hospital Anxiety and Depression Scale (HADS) and the Montgomery–Aasberg Depression Scale (MADRS).

<table>
<thead>
<tr>
<th>MADRS</th>
<th>HADS-A</th>
<th>HADS-D</th>
<th>HADS-T(total)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total</td>
<td>0.48**</td>
<td>0.51**</td>
<td>0.57**</td>
</tr>
<tr>
<td>Emotional items (items 1–3, 6–10)</td>
<td>0.50**</td>
<td>0.53**</td>
<td>0.60**</td>
</tr>
<tr>
<td>Somatic items (items 4, 5)</td>
<td>0.16**</td>
<td>0.14**</td>
<td>0.17**</td>
</tr>
</tbody>
</table>

*P < 0.05. **P < 0.01.
from 52% to 61% explained variance (37–40). However, the two studies using principal component analysis of the HADS in elderly samples (one psychiatric sample and one from the general population) found the explained variance similar to the present study (15, 16). The fact that some of the items did not load satisfactorily on any of the factors may also be an explanation to the relatively low explained variance.

The limit for satisfactory loading after rotation of the factors in HADS has varied (0.30–0.50) (13, 16, 20) and is debatable since it may be influenced by the sample size, the type of rotation, and the breadth and complexity of the scale (34, 35, 41). A loading of importance is often set to 0.40, which we did (34, 35). Consistently with our results, unexpected and low loadings on items 7 (“I can sit at ease and feel relaxed”) and 10 (“I have lost interest in my appearance”) have been reported in younger samples (13). Rewording of these items has been suggested (13), but not performed. However, the present study had an additional item, 8 (“I feel as if I have slowed down”), with an unsatisfactory loading at both subscales. Also, in mixed-aged somatic samples with a high mean age (≥65 years), item 8 had a low loading on HADS-D (17, 18, 20) and, furthermore, this item has in some studies, as in ours, loaded somewhat poorly on the HADS-A subscale (18, 20). In contrast to these results, studies of the HADS in younger individuals have consistently found the loading of item 8 to be satisfactorily high on the HADS-D subscale (37–40, 42). Seen from a somatic perspective, many older individuals may interpret this item to include age-related slowing down or slowing down because of a physical disorder or cognitive reduction rather than being a sign of depressive or anxiety symptoms in the medically hospitalized elderly. It has been suggested that item 8 needs to be reworded in order to give it higher validity as a measure of depression in elderly people, but this still remains to be determined (16).

The five items having a predominantly anhedonic content had satisfactorily high loadings on the HADS-D subscale and loaded negligibly onto the HADS-A subscale. Six of seven items in the HADS-A subscale had satisfactorily high loading on this subscale and low loadings on the HADS-D subscale. These results demonstrate the ability of the HADS to discriminate adequately between depression and anxiety in the medically hospitalized elderly. Even so, it is well known that the HADS-A and HADS-D subscale are correlated (0.37–0.63) (16, 43), and there is a tendency towards higher correlations in studies of individuals with somatic difficulties than in studies of healthy individuals (43). Thus, in the present study, we used an oblique rotation, which is appropriate when the factors are correlated. The correlation coefficient found in the oblique rotation was moderate (0.45).

The correlation between the HADS-D subscale and the MADRS was moderate (0.51). Previous studies of younger samples have reported higher correlations (0.6–0.8) (21–23). The somatic items in the MADRS (loss of appetite and sleeping difficulties) correlated negligibly (0.14) with the HADS-D subscale. This agrees with the fact that somatic symptoms have been omitted from the HADS in order to avoid confounding with physical illness, and it may indicate that the HADS is a more appropriate screening scale for depression in somatically hospitalized elderly people. However, we do not know which of the two scales work best as a screening instrument among elderly somatically ill patients because such a comparative validation study has never been carried out. As some of the symptoms assessed by the HADS-D subscale differ from those of the MADRS, the MADRS and the HADS-D subscales might assess slightly different constructs and this could explain the only moderate correlation between the scores of the two scales. Another explanation could be that the two scales are performed in different ways. HADS is a self-report scale and MADRS interview-based scale, where the interviewer interprets the patients answers about symptoms of depression.

The internal consistency coefficient (Cronbach’s alpha) for the HADS-A and HADS-D subscales were satisfactorily high (0.78 and 0.71, respectively) and quite similar to findings in other clinical samples with a high mean age (≥65 years) (16, 17) and in general populations of the elderly (15, 43). This supports the robustness of the scale for elderly people.

Some limitations of the present study need to be addressed. The psychometric evaluation was based on a cross-sectional single-site study, which recruited medically hospitalized elderly patients from rural areas. The present study did not perform test–retest reliability estimates because the patients only had a short stay in hospital. Another limitation is that we did not include a contrast group. By including such a group, the findings could have been more robust.

Thirdly, the participants should have been diagnosed according to established diagnostic criteria of depression and anxiety, allowing for a more thorough analysis of concurrent validity to be performed, including a receiver operating characteristic (ROC) analysis estimating cut-off values for depressive and anxiety disorders. Furthermore, including a diagnosis of depression might have shed light on whether the HADS or the MADRS is the most appropriate instrument in this setting. Even so, previous studies using younger and out patients have demonstrated a quite low concordance between the HADS-defined anxiety and depression and the DSM-IV defined depressions and anxiety disorders (44, 45).

Even though patients with severe dementia according to the MMSE score and the CDR staging were excluded from the study, it is possible that some of the included patients had dementia. This may have influenced the results.
Conclusion
The psychometric evaluation of the HADS in the present sample of the medically hospitalized elderly found a two-factor solution explaining somewhat less of the variance than in younger samples. In addition to unsatisfactory loading on items 7 and 10, which have also been found in earlier psychometric evaluations of younger samples (13), item 8 (“I feel as if I have slowed down”) in the HADS-D subscale loaded unsatisfactorily. It may be that older individuals interpret this item as including age-related slowing down or slowing down because of a physical disorder or cognitive reduction rather than being a depressive or anxiety symptom. Even with this limitation of the internal structure, the internal consistency validity of the HADS was satisfactorily high.

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