

The factorial structure and validity of the Hospital Anxiety and Depression Scale (HADS) in Polish adolescents

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Summary

Aim. The present study aimed to explore the factorial structure, validity and stability of the Hospital Anxiety and Depression Scale (HADS) in chronically ill and healthy Polish adolescents.

Methods. 146 chronically ill (girls: 57.6%) and 309 healthy (girls: 45.9%) adolescents aged between 12 and 16 years ($M = 14.03$; $SD = 1.3$) filled in an adapted version of HADS (HADS-Teen) in hospital or school settings. The one-week test-retest reliability and construct validity was analysed in two sub-samples of healthy adolescents.

Results. HADS-Teen showed a two-factor structure in the chronically ill sample and a three-factor structure in the healthy sample. The Anxiety scale had high internal reliability and stability and adequate correlation with another measure for generalised anxiety. Still, the Depression scale had good stability, but poor internal reliability in both samples. In the healthy sample, the Depression items split into two factors: depressed mood together with psychomotor retardation/agitation and anhedonia.

Conclusions. The issues concerned with the factorial structure of HADS are replicated in Polish adolescents as well. HADS-Teen shows different structures in chronically ill versus healthy adolescents. Results indicate that a special attention must be paid when assessing depression symptoms in healthy adolescents using this instrument

Key words: adolescents, HADS, psychometrics

Introduction

The occurrence of emotional problems in patients with somatic diseases created a need for screening instruments able to identify patients at risk for affective or anxious disorders [1]. One such instrument is the Hospital Anxiety and Depression Scale (HADS), a self-assessment tool developed for non-psychiatric medical patients aged

between 16 and 65 years [2]. HADS was found to measure mood disorders and not traits [3]. The non-inclusion of items referring to somatic complaints made HADS one of the most frequently used screening tools in the medical settings [4]. Following the good sensitivity and specificity in detecting cases of major depression and generalised anxiety disorders [4], the use of HADS was extended to healthy adults. Consequently, HADS was used in more than 700 studies worldwide, showing good psychometric properties for both Anxiety (HADS-A) and Depression (HADS-D) subscales [5].

These promising results led authors to consider the usefulness and validity of HADS with adolescents younger than 16 years [6, 7]. In Poland, a validation study performed on 142 adolescents aged between 14 and 18 years [8] showed that HADS had acceptable internal reliability in both healthy (Cronbach's α was 0.75 for HADS-A and 0.77 for HADS-D) and chronically ill (Cronbach's α was 0.70 for HADS-A and 0.76 for HADS-D) samples, good 10–14 days test-retest reliability (Spearman's ρ was 0.67 for HADS-A and 0.75 for HADS-D), and good validity in relation with other measures of anxiety and depression symptoms. These results were obtained assuming the original two-factor structure proposed by the scale's authors [2], without testing if the structure replicates. Still, a factorial analysis is required before examining the adequacy of HADS in Polish adolescents, considering that the structure of HADS is age invariant [9]. Moreover, the original structure [2] was not confirmed in Polish adults [10]. In the current study, we aimed to address this issue by analysing for the first time the factorial structure of HADS in Polish adolescents. This was done separately for healthy and chronically ill adolescents, considering that HADS-D scale showed some issues in non-medical samples [11, 12].

The factorial analysis of HADS is important due to the failure of many studies to replicate [13] the original proposed structure of seven items per scale [2]. The most consistent problem concerns item 7 (sit at ease and feel relaxed) which was developed to assess anxiety, but has higher loading on HADS-D than on HADS-A in both adult [13] and adolescent studies [6–8]. This cross loading was explained by the reference of the item to lack of energy, which is rather a sign of depression than of anxiety [13]. In the medical patients, low loadings, not exceeding the value of 0.40 for acceptable correlation [14], were also found concerning item 11 (being restless) and item 14 (enjoying watching TV or performing stationary activities). The answer to these items may be influenced by the functional limitations linked to somatic diseases rather than by the presence of anxiety or depression symptoms [15]. Also, the low loading of item 10 (interest in one's own appearance), found in both adults [12] and adolescents [7], led authors to consider the lack of interest in one's own appearance as an inadequate indicator of depression. The problems with item loadings may result from the fact that HADS was not based on a well-established theory of emotional disorders [16].

Consequently, various authors proposed different structures over time, ranging from one to four factors [9, 11, 12, 17–19]. The one-factor model, hypothesised to as-

sess generalised distress [17], was often not confirmed. Instead, the two-factor model proposed by Moorey et al. [19] and the three-factor model proposed by Dunbar et al. [9] were mostly agreed upon [13], also in studies on adolescents [6, 7, 9]. Moorey et al.'s [19] model is similar to the one proposed by the scale authors, except that item 7 was moved from HADS-A into HADS-D. Dunbar et al.'s [9] model is based on the tripartite theory of anxiety and depression [20], which assumes that these disorders have both distinct and common characteristics. General distress is common to both anxiety and depression, thus explaining the co-occurrence of these symptoms, while fear or panic is specific for anxiety, and anhedonia is specific for depression [20]. Accordingly, Dunbar et al. [9] proposed the clustering of those HADS-A items which cross-loaded on HADS-D (items 1, 5, 7, 11) into a third factor reflecting general distress. The remaining HADS-A items and the complete HADS-D scale were kept to reflect autonomic anxiety and anhedonic depression, respectively. This three-factor model provided a better fit in community adolescents aged 15 years [9]. Still, in adolescents the loadings of items into the HADS-D scale are relatively low [7–9], indicating some inadequacy. Consequently, we consider that further exploratory analysis of HADS is needed for this age group.

Aim

The aim of the current study was to extend the research on HADS adequacy in adolescents by analysing the factorial structure and validity in medical versus healthy adolescent samples. We extend the results of the previous Polish validation study on adolescents [8] by analysing the factorial structure of HADS and by including participants as young as 12 years old. Studies from the UK [6] and Hong Kong [7] showed that HADS was valid for this young group.

Method

The sample consisted in 146 chronically ill (57.6% girls; age $M = 14.0$; $SD = 1.3$) and 309 healthy (45.9% girls; age $M = 14.1$; $SD = 1.36$) adolescents aged between 12 and 16 years. The chronically ill sample was recruited from hospitals while the healthy sample was recruited from secondary schools located in Małopolskie and Świętokrzyskie Voivodeships. The adolescents recruited from school who reported having a chronic disease were analysed with the medical sample, leading to the inclusion of the following diseases: type 1 diabetes ($N = 54$), cancer ($N = 31$), asthma ($N = 31$), and chronic renal failure ($N = 30$). Prior to adolescent's recruitment, a parent signed an informed consent. The research was approved by the Research Ethics Committee of the Institute of Psychology, Jagiellonian University in Krakow.

The test-retest reliability and validity of HADS were analysed only in the healthy sample to avoid overloading the chronically ill patients. As such, 61 adolescents (50.8%

girls; age $M = 14.5$; $SD = 1.1$) filled in HADS again after one week, corresponding to the reference period indicated in the instructions. Other 86 adolescents (55.8% girls; age $M = 13.4$; $SD = 1.3$) filled in two additional scales measuring general anxiety and depression symptoms in children.

All participants filled in the HADS-Teen, a simplified version of the Hospital Anxiety and Depression Scale (HADS) [2]. HADS-Teen was created with the kind permission of HADS' publisher, GL Assessment Limited (UK), by simplifying the complex vocabulary used in the Polish adult translation created, validated and distributed by Mapi Research Institute on behalf of HADS' publisher. For example, item 13 ("I get sudden feelings of panic") translated by Mapi Research Institute as "Nagle nachodzi mnie uczucie paniki" was adapted into "Nagle odczuwam silny strach". This simplification was done to ensure the understanding of the items by the younger adolescents. Except for simplifying the language, HADS-Teen is identical with the original HADS version. As such, HADS-Teen is a 14-item self-assessment measure of anxiety and depression symptoms (7 items/scale). For each item the participants choose one of four possible answers which best described how they felt in the past week. The answers are coded from 0 to 3; higher scores representing higher presence or severity of the symptom.

The Spence Children's Anxiety Scale – Generalised Anxiety subscale (SCAS-GA) [21] was used as an alternative measure for generalised anxiety. SCAS-GA contains six items rated on a four point Likert scale (0 = never; 3 = always) measuring the frequency of experiencing generalised anxiety symptoms. The scale was translated for this study according to the forward-backward translation design [22]. In accordance with previous results [21], SCAS-GA had good internal reliability ($\alpha = 0.83$) in the present sample.

The Center for Epidemiological Studies Depression Scale for Children (CES-DC) [23] was used as an alternative measure for depression symptoms. CES-DC contains 20 items rated on a four point Likert scale (0 = never; 3 = always) measuring the frequency of depression symptoms in the past week. CES-DC is based on an adult version [24], adapted and validated previously in Poland [25]. For the current study, CES-DC was translated from the original English child form [23]. Similar to the results obtained for the Polish adult version [25], the translation used in this study showed good internal consistency for the total scale ($\alpha = 0.87$) and poor to good consistencies for Somatic Complaints (7 items; $\alpha = 0.69$), Depression Affects (7 items; $\alpha = 0.86$), Positive Affect (4 items; $\alpha = 0.50$), and Interpersonal Problems (2 items; $\alpha = 0.54$) subscales.

Results

The factorial structure of HADS-Teen was examined separately for the healthy and the chronically ill samples. Confirmatory factor analyses (CFA) were performed in R 2.15.2 software [26] using the lavaan package [27] to test whether the factorial

models previously identified in adult samples replicate in Polish adolescents. Due to violation of the multivariate normality assumption, the models' goodness of fit was assessed based on the Satorra-Bentler scaled chi-squared statistic ($S-B\chi^2$) and on indices computed based on this correction of χ^2 , namely the robust Comparative Fit Index (R-CFI) and the robust Root Mean Square Error of Approximation (R-RMSEA) [28]. None of the seven tested models provided an acceptable fit (Table 1) according to the cut-off points of $CFI-R \geq 0.90$ and $RMSEA-R \leq 0.08$ [29]. Moreover, in the healthy sample, the loadings of items on depression factors were non-significant in all the tested models. The Satorra-Bentler chi-square difference test ($\Delta S-B\chi^2$) indicated that the alternative one and two-factor models provided worse fit, while the three-factor models provided better fit than the structure proposed by scale's authors.

Table 1. Fit indices for possible structures of the HADS-Teen in Polish adolescents

| Model | Number of factors | S-B χ^2 | df | R-CFI | R-RMSEA (90% CI) | $\Delta S-B\chi^2$ |
|------------------------|-------------------|---|----|-------|---------------------|--------------------|
| Chronically ill sample | | | | | | |
| Zigmond & Snaith [2] | 2 | 154.72* | 76 | 0.791 | 0.085 (0.066–0.103) | – |
| Razavi et al. [17] | 1 | 173.47* | 77 | 0.744 | 0.093 (0.076–0.110) | 12.85* |
| Moorey et al. [19] | 2 | 177.11* | 77 | 0.735 | 0.095 (0.077–0.112) | 14.14* |
| Dunbar et al. [9] | 3 | 146.43* | 74 | 0.808 | 0.082 (0.063–0.101) | 8.68* |
| Caci et al. [12] | 3 | 122.89* | 74 | 0.870 | 0.068 (0.047–0.087) | 24.18* |
| Friedman et al. [18] | 3 | 110.01* | 62 | 0.870 | 0.073 (0.051–0.094) | 41.63* |
| Andersson [11] | 4 | Residual covariance matrix not positively defined | | | | |
| Healthy sample | | | | | | |
| Zigmond & Snaith [2] | 2 | 228.19* | 76 | 0.842 | 0.081(0.070–0.092) | – |
| Razavi et al. [17] | 1 | 284.04* | 77 | 0.785 | 0.093 (0.083–0.104) | 36.56* |
| Moorey et al. [19] | 2 | 340.57* | 77 | 0.727 | 0.105 (0.095–0.116) | 7.64* |
| Dunbar et al. [9] | 3 | 218.34* | 74 | 0.850 | 0.080 (0.069–0.091) | 11.71* |
| Caci et al. [12] | 3 | 174.12* | 74 | 0.896 | 0.066 (0.055–0.078) | 61.23* |
| Friedman et al. [18] | 3 | 166.57* | 62 | 0.889 | 0.074 (0.062–0.087) | 61.82* |
| Andersson [11] | 4 | Residual covariance matrix not positively defined | | | | |

Note. Zigmond & Snaith's model = Anxiety (items 1, 3, 5, 7, 9, 11, 13, 15) and Depression (items 2, 4, 6, 8, 10, 12, 14); Razavi et al.'s model = Generalized distress (all items included). Moorey et al.'s model = Anxiety (items 1, 3, 5, 9, 11, 13, 15) and Depression (items 2, 4, 6, 7, 8, 10, 12, 14); Dunbar et al.'s model = Negative affectivity (items 1, 5, 7, 11), Autonomic anxiety (items 3, 9, 13), and Anhedonic depression (items 2, 4, 6, 7, 8, 10, 12, 14); Caci et al.'s model = Restlessness (items 7, 11, 14), Anxiety (items 1, 3, 5, 9, 13), and Depression (items 2, 4, 6, 8, 10, 12); Friedman et al.'s model = Psychomotor agitation (items 1, 7, 11), Psychic anxiety (items 3, 5, 9, 13), and Depression (items 2, 4, 6, 8, 10, 12); Andersson's model = Momentary anxiety (items 3, 5, 7, 8, 9, 13), Power to relax (items 1, 6, 14), Well-being (items 4, 10, 12), and Non-interpretable (items 2 and 11).

S-B χ^2 = Satorra-Bentler robust statistic; df = Degree of freedom; R-CFI = Robust Comparative Fit Index; R-RMSEA = Robust Root Mean Square Error of Approximation; Δ S-B χ^2 = Satorra-Bentler chi-square difference test between Zigmond & Snaith's model and the nested models within each sample group; *p < 0.001.

Table 2. **Measurement invariance of the three-factor structure of HADS-Teen in healthy Polish adolescents**

| Model | S-B χ^2 | df | R-CFI | R-RMSEA (90% CI) | Δ S-B χ^2 |
|--|--------------|-----|-------|---------------------|-----------------------|
| Unconstrained | 219.52* | 148 | 0.927 | 0.040 (0.029–0.050) | – |
| Constrained equal loadings | 230.84* | 159 | 0.926 | 0.039 (0.028–0.048) | 11.23 |
| Constrained equal loadings and intercepts | 258.12* | 170 | 0.910 | 0.041 (0.031–0.051) | 39.68* |
| Constrained equal loadings and intercepts, except for the intercept of item 9. | 250.78* | 169 | 0.916 | 0.040 (0.030–0.049) | 31.28 |

Note. The three-factor model = Anxiety (items 1, 3, 5, 7, 9, 13), Anhedonia (items 2, 4, 12, 14) and Depressive mood & Psychomotor retardation/agitation (items 6, 8, 10, 11). S-B χ^2 = Satorra-Bentler robust statistic; df = Degree of freedom; R-CFI = Robust Comparative Fit Index; R-RMSEA = Robust Root Mean Square Error of Approximation; Δ S-B χ^2 = Satorra-Bentler chi-square difference test between the unconstrained model and the constrained ones; *p < 0.05.

Among the three-factor structures, Caci et al.'s [12] model provided the best fit indices, and thus was further modified with the aim of identifying a good fitting model. First, the Restless and Depression factors were combined due to the high covariance observed in both samples (Figure 1 and 3). Then, in the chronically ill sample, item 10 was removed due to non-significant loading on the Depression factor. The resulting two-factor model (Figure 2) provided an acceptable goodness-of-fit based on all indices, S-B χ^2 = 93.77; df = 62; p = 0.006; R-CFI = 0.912; R-RMSEA = 0.059 (0.034–0.082). In the healthy sample, HADS-D items were split into two factors (Figure 4), as indicated by the modification indices (MI), considered in accordance with the DSM-IV-TR diagnostic criteria. This new three-factor model provided an acceptable goodness-of-fit based on all indices used, S-B χ^2 = 126.04; df = 74; p < 0.001; R-CFI = 0.946; R-RMSEA = 0.048 (0.034–0.061). This model is gender invariant, except for the intercept of item 9 (Table 2).

Because models based on MI are rather specific to the tested samples [30], we further performed exploratory factor analyses (EFA) whose results have higher generalizability. The principal component analyses were performed in the IBM SPSS 21.0 software. In both samples, the inter-item correlation matrix fit the criteria for factor analysis. The number of factors to be extracted was established based on the Kaiser-Guttman criterion of eigenvalue greater than one, the Cattell's scree plot test, the Velicer's minimum average partial (MAP) test, the parallel analysis based on 1,000 random samples, and the coherence of the resulting factors [31]. Then, factors were rotated using Oblimin rotation, considering that anxiety and depression may co-occur [19, 20].

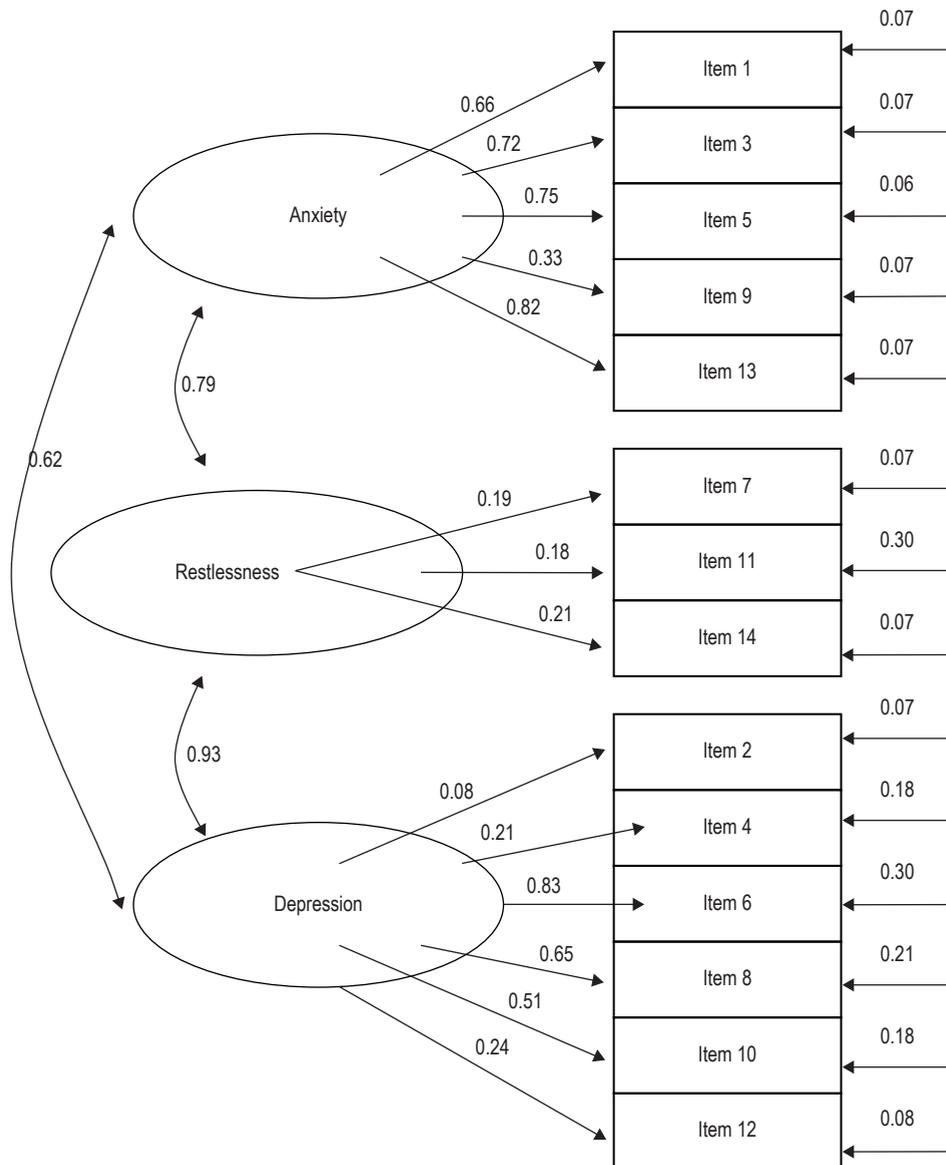


Figure 1. Caci et al.'s [12] model of HADS-Teen in Polish chronically ill adolescents

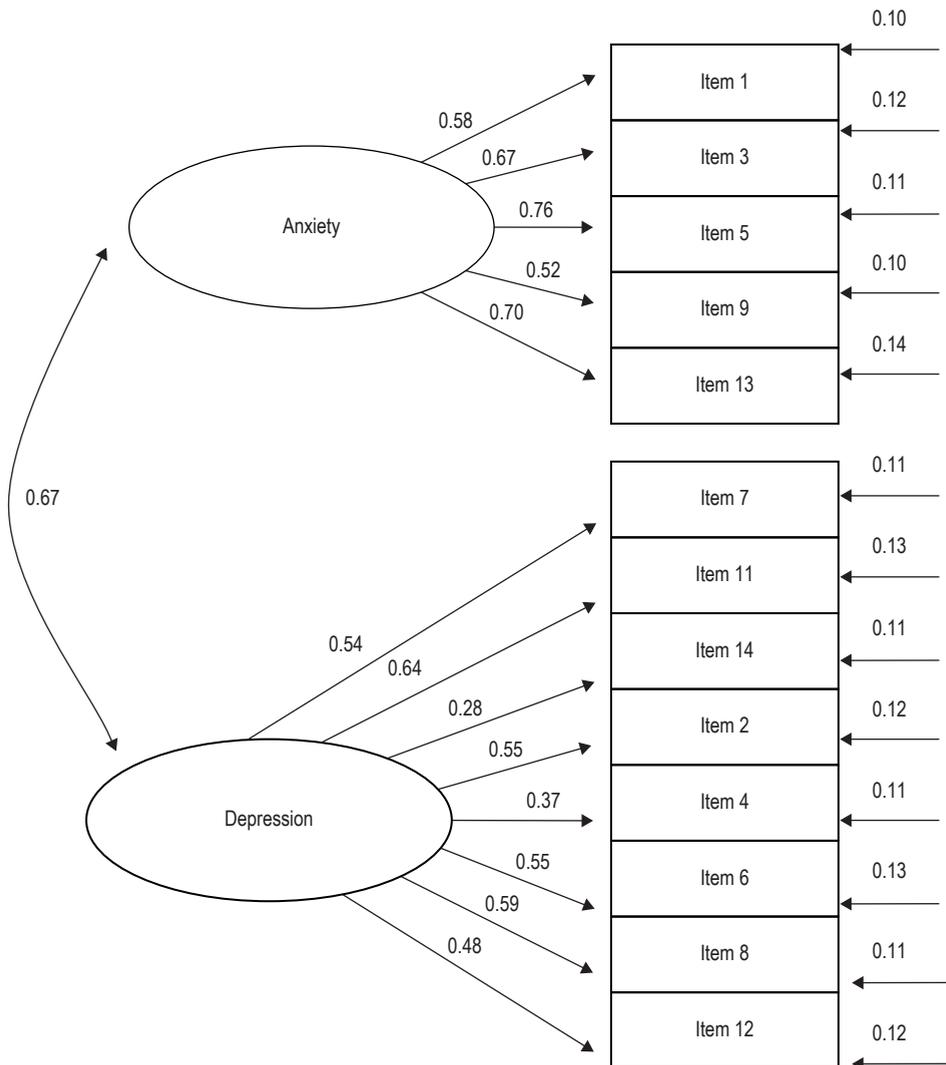


Figure 2. Modified Caci et al.'s [12] model of HADS-Teen in Polish chronically ill adolescents

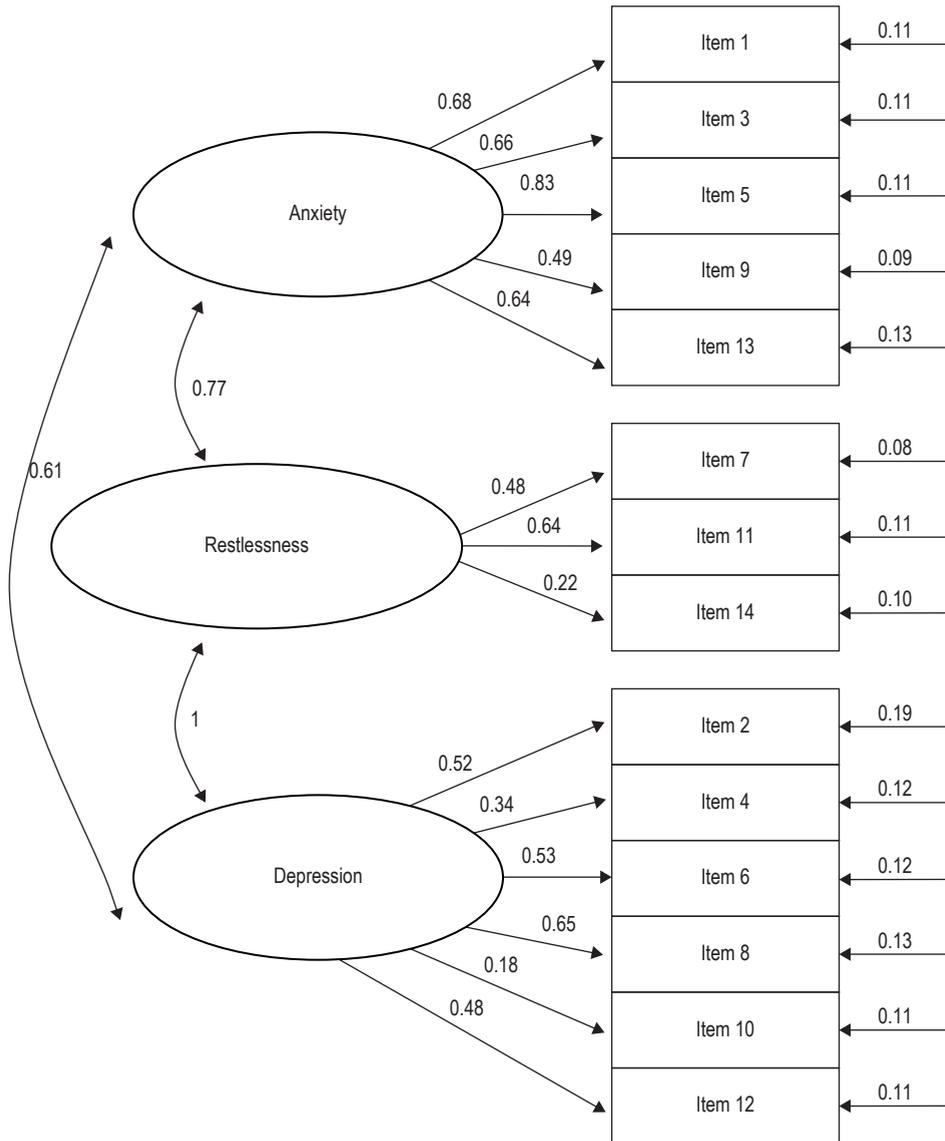


Figure 3. Caci et al.'s [12] model of HADS-Teen in Polish healthy adolescents

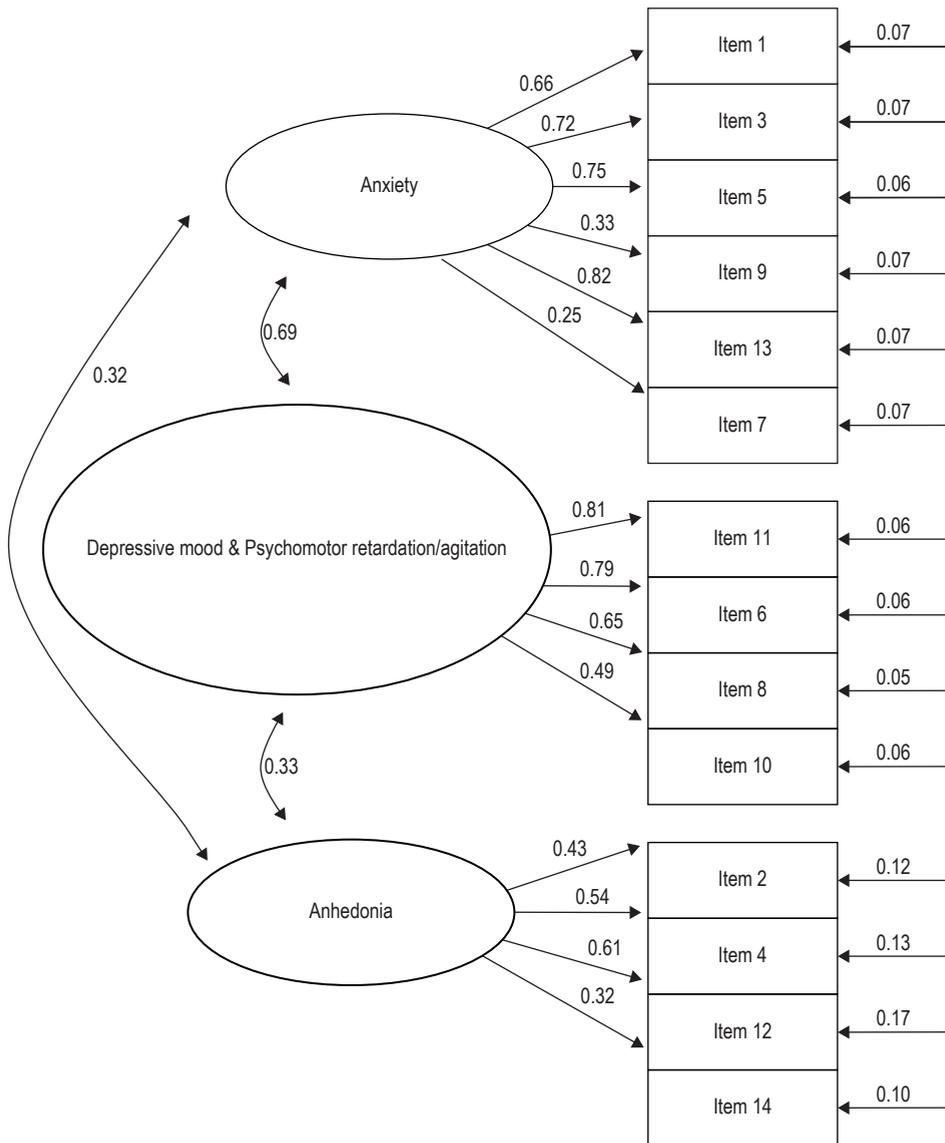


Figure 4. Modified Caci et al.'s [12] model of HADS-Teen in Polish healthy adolescents

In the chronically ill sample, each of the used criteria suggested a different one-to-four factor solution. Still, only the two-factor model resulted into a coherent structure, and thus was considered optimal for this sample. This structure (Table 3) replicated Moorey et al.'s [19] model, and thus was slightly different than the one obtained through CFA. The two-factor model suggested by the CFA had moderate inter-scale correlation ($\rho = 0.42$) and good internal consistency for both Anxiety ($\alpha = 0.79$) and Depression ($\alpha = 0.74$) scales. Similar results were obtained for the two-factor structure identified through the EFA (Table 3). The original two-factor structure proposed by the scale authors [2] would have produced an internal consistency of 0.79 for HADS-A and 0.60 for HADS-D, and an inter-scale Spearman's ρ correlation of 0.43. Thus, the modifications suggested in the structure of HADS-Teen following the EFA and CFA resulted into a more reliable HADS-D scale, without affecting the reliability of HADS-A or the inter-scale correlation.

In the healthy sample, all the used criteria suggested the extraction of three factors, except for the MAP test which indicated a one-factor solution. Therefore, three factors were extracted, resulting into an identical structure with the one obtained following the CFA (Table 4). The two-factor structure was also explored for comparison purposes. Still, this led to a not-interpretable first factor. Consequently, the three factor structure was considered optimal for this sample.

Table 3. **Properties of the structure of HADS-Teen in chronically ill adolescents following the EFA**

| Item (original scale) | Two-factor structure | | |
|-----------------------|------------------------|--------|------|
| | Item-scale correlation | F1 | F2 |
| Item 1 (HADS-A) | 0.54 | 0.66 | |
| Item 3 (HADS-A) | 0.57 | 0.77 | |
| Item 5 (HADS-A) | 0.68 | 0.82 | |
| Item 7 (HADS-A) | 0.44 | | 0.51 |
| Item 9 (HADS-A) | 0.48 | 0.68 | |
| Item 11 (HADS-A) | 0.50 | 0.53 | |
| Item 13 (HADS-A) | 0.61 | 0.66 | |
| Item 2 (HADS-D) | 0.44 | | 0.45 |
| Item 4 (HADS-D) | 0.34 | | 0.49 |
| Item 6 (HADS-D) | 0.39 | | 0.45 |
| Item 8 (HADS-D) | 0.41 | (0.37) | 0.41 |
| Item 10 (HADS-D) | 0.18 | | 0.49 |
| Item 12 (HADS-D) | 0.43 | | 0.62 |
| Item 14 (HADS-D) | 0.33 | | 0.66 |

table continued on the next page

| | | | |
|---|--|--------|--------|
| % of variance explained | | 30.51% | 11.66% |
| Cronbach's α | | 0.80 | 0.66 |
| Spearman's ρ inter-scale correlation = 0.395 | | | |

Note. Only loadings higher than 0.30 are presented. Items are arranged based on their order in the original HADS subscales. Item-scale correlation presents correlations between the items and the associated subscale score. HADS-A = Anxiety scale; HADS-D = Depression scale. F1 = Anxiety, F2 = Depression

Table 4. Properties of the structure of HADS-Teen in healthy adolescents following the EFA

| Item (original scale) | Two-factor structure | | | Three-factor structure | | | |
|-------------------------|------------------------|--------|---------|------------------------|--------|--------|--------|
| | Item-scale correlation | F1 | F2 | Item-scale correlation | F1 | F2 | F3 |
| Item 1 (HADS-A) | 0.49 | 0.55 | | 0.59 | 0.80 | | |
| Item 3 (HADS-A) | 0.56 | 0.66 | | 0.59 | 0.75 | | |
| Item 5 (HADS-A) | 0.59 | 0.63 | | 0.65 | 0.74 | | |
| Item 7 (HADS-A) | | | (0.36) | | (0.36) | | |
| Item 9 (HADS-A) | | | (0.36) | 0.30 | 0.47 | | |
| Item 11 (HADS-A) | 0.70 | 0.80 | | 0.62 | (0.37) | | 0.65 |
| Item 13 (HADS-A) | 0.69 | 0.74 | | 0.67 | 0.70 | | |
| Item 2 (HADS-D) | 0.30 | | 0.64 | 0.33 | | 0.65 | |
| Item 4 (HADS-D) | 0.35 | | 0.63 | 0.36 | | 0.67 | |
| Item 6 (HADS-D) | 0.65 | 0.76 | | 0.67 | | | 0.70 |
| Item 8 (HADS-D) | 0.56 | 0.70 | | 0.58 | | | 0.69 |
| Item 10 (HADS-D) | 0.35 | 0.59 | (-0.38) | 0.49 | | | 0.83 |
| Item 12 (HADS-D) | 0.35 | | 0.62 | 0.35 | | 0.65 | |
| Item 14 (HADS-D) | 0.22 | | 0.34 | 0.23 | | 0.54 | |
| % of variance explained | | 30.03% | 11.55% | | 30.03% | 11.55% | 10.46% |

Note. Only loadings higher than 0.30 are presented. Items are arranged based on their order in the original HADS subscales. Item-scale correlation presents correlations between the items and the associated subscale score. HADS-A = Anxiety scale; HADS-D = Depression scale. In the two-factor structure, F1 = not interpretable, F2 = Positive affect. In the three-factor structure: F1 = Anxiety; F2 = Anhedonia; F3 = Depressive mood & Psychomotor retardation/agitation

The internal consistency, one-week test-retest reliability, inter-scale correlation and validity in relation with SCAS-GA and CES-DC scales for the healthy sample are presented in Table 5 comparatively for the original proposed structure of HADS [2] and for the three-factor model obtained in this sample. As can be seen, both HADS-A and the Anxiety factor (excluding items 7 and 11) showed good internal reliability, very good one-week test-retest reliability, and high correlation with SCAS-GA, while having

fair correlation with CES-DC. Still, the split of HADS-D into two factors led to a better performing Depressive mood and psychomotor retardation/agitation factor, while the Anhedonia factor kept the poor performance of HADS-D scale. Specifically, the Depressive mood and psychomotor retardation/agitation factor had good internal consistency, while the Anhedonia factor had poor internal consistency. Also, Depressive mood and psychomotor retardation/agitation had fair correlation with the CES-DC, while Anhedonia had a poor correlation. Moreover, despite being developed to assess the same mood disorder, there was a low inter-factor correlation between these two depression factors.

Table 5. **Inter-correlations, internal consistencies (Cronbach's α), test-retest reliabilities (Spearman's ρ), and validity (Spearman's ρ) of the HADS-Teen in healthy sample**

| | Original two-factor structure | | Three-factor structure | | |
|--|-------------------------------|---------|------------------------|---------|---------|
| | HADS-A | HADS-D | F1 | F2 | F3 |
| HADS-Teen original structure | | | | | |
| HADS-A | - | 0.49*** | - | | |
| HADS-D | 0.49*** | - | | | |
| HADS-Teen three-factor structure | | | | | |
| F1 (Anxiety) | | | - | 0.23*** | 0.49*** |
| F2 (Anhedonia) | | | 0.23*** | - | 0.26*** |
| F3 (Depressive mood & Psychomotor retardation/agitation) | | | 0.49*** | 0.26*** | - |
| α | 0.80 | 0.61 | 0.79 | 0.52 | 0.78 |
| ρ_T (one-week) | 0.74*** | 0.77*** | 0.75*** | 0.77*** | 0.73*** |
| SCAS-GA | 0.77*** | 0.21* | 0.78*** | 0.21** | 0.26* |
| CES-DC | 0.58*** | 0.52*** | 0.54*** | 0.40*** | 0.53*** |

Note. Test-retest reliabilities (ρ_T) were based on $n = 61$. The validity of HADS-Teen was based on $n = 86$. HADS-Teen = adapted version of Hospital Anxiety and Depression scale for adolescents; HADS-A = Anxiety scale; HADS-D = Depression scale; SCAS-GA = Spence Children's Anxiety Scale – Generalised Anxiety subscale; CES-DC = Center for Epidemiological Studies Depression Scale for Children. * $p < 0.05$; ** $p < 0.01$; *** $p < 0.001$.

Discussion

The present study explored the factorial structure and validity of HADS in Polish adolescents. To ensure the adequate understanding of the items by younger adolescents, the language used in the copyrighted Polish translation provided by Mapi Research Institute was simplified, creating the HADS-Teen version. The copyrighted translation differs from the one proposed by Karakula et al. [1], which is most often used in Polish studies. Nevertheless, the results obtained with the HADS-Teen are consistent with the ones reported using HADS in previous Polish and worldwide studies [6, 7, 9, 10, 13]

by finding that the original proposed structure of seven items per subscale [2] is not replicated. Moreover, the results of both CFA and EFA indicated that the structure of HADS-Teen varies by health status, a different two and three-factor structures being identified in chronically ill and healthy adolescents.

The two-factor structure identified in chronically ill adolescents following the EFA replicates Moorey et al.'s [19] model in which item 7 (sit at ease and feel relaxed) is moved from HADS-A into HADS-D. This model was also identified in all the previous studies on adolescents [6, 7, 9], suggesting that six items measure anxiety and eight items measure depression symptoms. The CFA suggested the additional transference of item 11 (feel restless) from HADS-A into HADS-D and the removal of item 10 (lost interest in one's own appearance) from HADS-D. A similar transference of items between scales was observed in the healthy sample. The consistency, stability and validity of HADS-A was not influenced in neither samples by the removal of problematic items, indicating that this scale can be used also in the original seven items format. Still, the two-factor structure was adequate only for chronically ill adolescents, while a three-factor solution, resulting from the split of HADS-D items, was more suitable for the healthy sample. This split is not surprising considering the low internal consistency (Cronbach's $\alpha < 0.70$) and the low loadings of depression items, hardly exceeding the value of 0.40 for acceptable correlation [14], observed in both current and previous studies on adolescents [7, 9].

The new obtained three-factor model was found to be gender invariant. An exception is the variance in the intercept of item 9; boys and girls giving different meanings to stomach sensations associated to fear. The clustering of items 8 (feel slowed down), 10 and 11 into a separate Depressive mood and psychomotor retardation/agitation factor was observed also in a Polish adult sample [10]. This factor performed better in the healthy adolescents sample than the original HADS-D scale, having good internal consistency and fair correlation with another measure of depression. The Anhedonia factor, composed by the remaining four depression items, kept the poor performance of HADS-D. Still, the low reliability of Anhedonia is expected considering its low variance in healthy samples [12]. Also, the poor validity in relation with CES-DC is expected considering that HADS-D is among the few screening instruments which measure anhedonia. Therefore, the low performance of anhedonia items should not stop authors from using this tool. Still, attention should be paid when using it with healthy samples. The scale may be more adequate for clinical samples, where anhedonia is an important marker of depression [2].

Conclusions

The present study confirms the issues related with HADS structure and indicate that different two and three-factor models perform better in chronically ill versus healthy adolescents. HADS-A performs well in both samples regardless of the inclusion or

exclusion of problematic items. Still, HADS-D is problematic particularly in healthy adolescents where anhedonia and depressive mood and psychomotor retardation/agitation appear as two distinct constructs, the latter being more reliable. The better performance of HADS-D in the medical sample may be due to a uniform influence of somatic conditions on depression symptoms.

Consequent to the issues related with the factorial structure, we consider that the existing cut-off points proposed to assess the severity of anxiety or depression symptoms [6, 8] are not adequate for Polish adolescents and recommend against their use. Instead, we join the recommendation of Watrowski and Rohde [10] and consider that a normative study of HADS in Poland is required to establish the adequate cut-off points for screening purposes. Until such study is performed, HADS can be used as an aid in clinical practice considering the good internal reliability of the obtained factors, the stable one-week test-retest reliability of all structures, and the adequate validity of the constructs in relation with other measures for anxiety and depression symptoms. As proposed by other authors [9, 10, 13], HADS could be used as a total score reflecting general distress. Despite the poor fit of a one-factor model, HADS total score was previously found to perform better than the separate subscales scores in identifying clinical cases [4].

Note. The HADS-Teen was created with kind permission of HADS' publisher, GL Assessment Limited (UK), for the purposes of authors' own academic research project and is not available commercially. Copyright remains strictly with HADS' publisher.

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Annex

Table 6. Summary of hierarchical multiple regression analyses on CES-DC and SCAS-GA scores based on HADS scores (original two-factor structure)

| Variables | CES-DC | | | | SCAS-GA | | | |
|-------------------|--|------|---------|--------------|--|------|---------|--------------|
| | B | SE B | β | ΔR^2 | B | SE B | β | ΔR^2 |
| Step 1 | adjR2 = 0.01; F(2.83) = 1.22; p = 0.300 | | | | adjR2 = 0.03; F(2.83) = 2.20; p = 0.118 | | | |
| Gender (0 = girl) | -3.03 | 2.45 | -0.14 | | -1.87 | 0.94 | -0.22* | |
| Age | 0.75 | 0.97 | 0.09 | 0.03 | 0.14 | 0.37 | 0.04 | 0.05 |
| Step 2 | adjR2 = 0.42; F(2.81) = 31.07. p < 0.001 | | | | adjR2 = 0.60; F(2.81) = 59.99. p < 0.001 | | | |
| HADS-A | 1.17 | 0.25 | 0.45*** | | 0.85 | 0.08 | 0.84*** | |
| HADS-D | 1.17 | 0.30 | 0.35*** | 0.42*** | -0.17 | 0.10 | -0.13† | 0.57*** |

Note. N = 86; CES-DC = Center for Epidemiological Studies Depression Scale for Children; SCAS-GA = Spence Children’s Anxiety Scale – Generalized Anxiety subscale; HADS-A = Anxiety scale; HADS-D = Depression scale. * p < 0.05; *** p < 0.001; †p < 0.10.

Table 7. Summary of hierarchical multiple regression analyses on CES-DC and SCAS-GA scores based on HADS scores (three-factor structure)

| Variables | CES-DC | | | | SCAS-GA | | | |
|-------------------|---|------|---------|--------------|---|------|---------|--------------|
| | B | SE B | β | ΔR^2 | B | SE B | β | ΔR^2 |
| Step 1 | adjR2 = 0.01; F(2.83) = 1.22; p = 0.300 | | | | adjR2 = 0.03; F(2.83) = 1.20; p = 0.118 | | | |
| Gender (0 = girl) | -3.03 | 2.45 | -0.14 | | -1.87 | 0.94 | -0.22* | |
| Age | 0.75 | 0.97 | 0.09 | 0.03 | 0.14 | 0.37 | 0.04 | 0.05 |

table continued on the next page

| Step 2 | adjR2 = 0.45; F(3.80) = 20.30; p < 0.001 | | | | adjR2 = 0.59; F(3.80) = 38.34; p < 0.001 | | | |
|---|--|------|---------|---------|--|------|---------|---------|
| Anxiety | 1.23 | 0.33 | 0.37*** | | 1.06 | 0.11 | 0.82*** | |
| Anhedonia | 1.02 | 0.52 | 0.19† | | -0.03 | 0.17 | -0.01 | |
| Depressive mood & Psychomotor retardation/ agitation | 1.35 | 0.41 | 0.32*** | 0.42*** | -0.09 | 0.13 | -0.06 | 0.56*** |

Note. N = 86; CES-DC = Center for Epidemiological Studies Depression Scale for Children; SCAS-GA = Spence Children's Anxiety Scale – Generalized Anxiety subscale; HADS = Anxiety, Anhedonia and Depressive mood & Psychomotor retardation/ agitation. * p < 0.05; *** p < 0.001; †p < 0.10.

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