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Validity and reliability of the Urdu version of the Hospital Anxiety & Depression Scale for assessing antenatal anxiety and depression in Pakistan

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ABSTRACT

This study aims to elucidate the appropriate factor structure for Hospital Anxiety & Depression Scale (HADS) for assessment of anxiety and depression symptoms during pregnancy among Pakistani women. This cross-sectional study was conducted during a 5 month period (2014) in four teaching hospitals of Lahore, Pakistan. Convenience sampling was done to recruit pregnant women availing obstetrics and gynecology services for routine prenatal or perinatal care in the respective departments of the four institutes. Trained interviewers interviewed the consenting participants using a pre-tested scale. All data were analyzed using SPSS v.20. Factor structure of the HADS was explored using Principal Axis Factoring (PAF) method. Goodness of fit of the factor structure was assessed using the Confirmatory Factor Analysis (CFA). Cronbach's alpha value for whole scale was good ($\alpha = 0.81$). Sensitivity analysis involving assessment of Cronbach's alpha value after removal of each item, did not reveal any major deviations in overall internal consistency of the HADS. Parallel analysis suggested one factor solution to be viable. When one factor was extracted as a uni-dimensional measure of anxiety and depression: item 11 (I feel restless as I have to be on the move) and 14 (I can enjoy a good book or radio or TV program) were deemed problematic for having low communalities and factor loading values.

1. Introduction

The profoundly negative influence of maternal psychiatric disorders including anxiety and depression is widely reported in literature (Stocky and Lynch, 2000; Tareen and Tandon, 2018). Research has suggested that identification and early screening of perinatal psychiatric morbidities is of imperative concern for healthcare professionals (Karimova and Martin, 2003; Phoosuwan et al., 2018; Jha et al., 2018). Notably, for those identified as having significant psychological antenatal and postnatal depression, effective evidence - based interventions are available (Hayes et al., 2001; Austin, 2003; Austin, 2004; Spinelli and Endicott, 2003; Gajaria and Ravindran, 2018). If left untreated, it may lead to poor emotional and physical health consequences for both the mother and infant (Thompson et al., 1998; Misri et al., 2000). Despite the fact that low and middle income countries have one of the highest rates of antenatal depression in the world, majority of the psychological morbidity literature during pregnancy comes from the Western countries (Fisher et al., 2012). For instance, prevalence of perinatal anxiety and depression has been reported to be around 18% in Karachi, and around 31% to 49% in Lahore (Karmaliani et al., 2009; Waqas et al., 2015). Literature suggests significant reduction in levels of depression and anxiety with psychological interventions employed early during pregnancy (Maselko et al., 2015; Rahman et al., 2013), however the integrity of psychometric instruments offering early screening potential has seldom been conducted in this population in Pakistan. A psychometrically robust, culturally unbiased screening instrument which is quick to administer, is highly desirable to screen anxiety and depression in the perinatal period (Ahmer et al., 2007).

The Hospital Anxiety and Depression Scale (HADS) is a broadly utilized scale among non-psychiatric populations. Its validity and reliability has been widely investigated in both the clinical and non-clinical populations globally (Bjelland et al., 2002; Herrmann, 1997; Martin, 2005; Cosco et al., 2012). In recent years, the use of HADS has also been extended to the assessment of depression and anxiety during the perinatal period (Waqas et al., 2015; Martin, 2005; Cosco et al.,

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2012). A few studies highlight the sensitivity of HADS to biological changes that may affect the validity and hence, the factor structure of the HADS among the pregnant women (Martin and Thompson, 1999; Razavi et al., 1990). Since pregnancy is the time of continuing biological changes, it is important to determine the factor structure and suitability of HADS for screening perinatal depression and anxiety. Despite of the recent use of HADS among the pregnant women in Pakistan (Waqas et al., 2015; Dodani and Zuberi, 2000; Ali et al., 2012), it has not been validated in this population. It's Urdu translation has previously been validated among healthcare students (Mumford et al., 1991), that utilized traditional heuristics for statistical validation. Specifically, Mumford & colleagues did not report any use of Exploratory Factor Analysis for validating factor structure of the HADS. Therefore, a study utilizing appropriate factor validation methods underpinning factor structure of HADS in the perinatal population was warranted. Thus, the present study aims to investigate the factor structure and internal reliability of the Hospital Anxiety and Depression Scale (HADS) during pregnancy in Pakistan.

2. Methods

This cross-sectional study was conducted during a 5 month period (2014) in four teaching hospitals of Lahore, Pakistan: CMH Lahore Medical College and Institute of Dentistry; Jinnah Hospital; Lady Willingdon Hospital and Services Hospital. Ethical approval was granted by the Ethical Review Committee of CMH Lahore Medical College and Institute of Dentistry, Lahore (CMH LMC). Convenience sampling was done to recruit pregnant women availing obstetrics and gynecology services for routine prenatal care in the respective departments of the four institutes. Pregnant women belonging to low or lower-middle income strata were included. The participants were interviewed by a team of interviewers who were trained in interviewing skills by a clinical psychologist. The questionnaire comprised of three sections: participants' demographics, health, obstetric history, social support networks and symptoms of anxiety and depression using the Urdu translation of the HADS. Written informed consent was taken from the participants and their anonymity was ensured. More details about the study design is available in a previously published manuscript, exploring predictive factors of antenatal depression and pregnancy (Waqas et al., 2015).

The Hospital Anxiety and Depression Scale (HADS) is a broadly utilized scale for screening of anxiety and depression among several populations, with an established validity and reliability (Bjelland et al., 2002; Herrmann, 1997; Martin, 2005; Cosco et al., 2012). It has been translated to various languages globally, including Urdu, the national language of Pakistan (Mumford et al., 1991). It is a short and easy to administer scale that comprises of 14 items equally divided into two subscales assessing frequency and severity of different symptoms of anxiety and depression. Only two of the items in this scale pertaining to appetite (item 7) and interest in things (item 10) are reverse scored (Bjelland et al., 2002; Herrmann, 1997; Martin, 2005; Cosco et al., 2012). Symptoms of anxiety are recorded in items 2, 4, 6, 8, 11, 12, 14 while items 1, 3, 5, 7, 9, 10, 13 correspond to depressive symptoms (Bjelland et al., 2002; Herrmann, 1997; Martin, 2005; Cosco et al., 2012). Scores on items pertaining to anxiety and depression are summed separately to yield total scores on these subscales, ranging from 0-21. A score of 0–7 is considered as normal, 8–10 borderline and $\geq$ 11 as either anxious or depressed (Bjelland et al., 2002; Herrmann, 1997; Martin, 2005; Cosco et al., 2012).

The divergent validity of the HADS was assessed by correlating it with perceived social support among pregnant women. The social support was assessed using the Urdu translation of the Social Provision Scale (Rizwan and Syed, 2010). This instrument comprises of 24 questions recording responses on a 4 point Likert-type scale ranging from 1 (strongly disagree) to 4 (strongly agree). The total scores on this scale provides an understanding of several dimensions of social support in the respondents' life: "guidance, reliable alliances, reassurance of worth, attachment, social integration and opportunities for nurturance" (Rizwan and Syed, 2010). While the convergent validity of the scale was measured by two methods: a) correlating responses on single items with the overall score on the HADS b) by checking associations between HADS scores and experience of domestic abuse. It was hypothesized that HADS scores would correlate negatively with social support and positively with experience of domestic abuse during pregnancy.

Statistical analysis was conducted using SPSS (v.20) and FACTOR program (v.10.3.1). Categorical variables were presented as frequency (%) and quantitative variables as mean (SD). Thereafter, a series of reliability and exploratory factor analyses were undertaken to explore appropriate validity and reliability of one and two factor structures of the HADS. Internal consistency of the HADS was checked using the Cronbach's alpha reliability analysis, with a cut-off value $\geq$ 0.7 considered acceptable (Streiner et al., 2015). Inter-item correlations were for all the statements were analyzed using Pearson's correlation coefficient, considered acceptable at $\geq$ 0.2 and $\leq$ 0.8 (Mumford et al., 1991).

Thereafter, exploratory factor analysis (EFA) with Principal Axis Factoring (PAF) and oblique (quartimax) rotation was run to explore dimensionality of the HADS. PAF was chosen for this because it is fairly robust to assumptions of multivariate normality (Fabbrigar et al., 1999). Whereas an oblique rotation methods accounts for correlation between factors in contrast to orthogonal rotation methods such as Varimax (Costello and Osborne, 2005). Prior to running the factor analysis, several checks were applied to ensure the suitability of data. Firstly, adequacy of sample size was assessed using the Kaiser-Meyer-Olkin (KMO) ($\geq$ 0.6) and a Bartlett's test of Sphericity achieving statistical significance. Adequacy of sample size for each item was further assessed using KMO values for individual items obtained in the anti-image correlation matrix. Maximum number of components to retain was assessed using several methods: a) Cattell's Scree Plot b) Horn's parallel analysis c) the Velicer MAP test, and d) the Hull method. Only those items were deemed suitable for inclusion in the scale that had a communality value $\geq$ 0.2 and a factor loading $\geq$ 0.32. Items with the lowest individual KMO statistic were considered for dropping from the HADS, with judgments additionally made on the basis of magnitudes of communalities and factor loadings for each items.

After identification of an appropriate factor structure of the HADS, it was subjected to confirmatory factor analysis. Several indices for goodness of fit were used: Root Mean Square of Residuals (RMSR), comparative fit index (CFI), normed fit index (NFI), Tucker-Lewis index (TLI), incremental fit index (IFI), goodness-of-fit index (GFI) and adjusted goodness-of-fit index (AGFI). Cut-off values for goodness of fit indices were > 0.90 for CFI and TLI. The value of RMSR was considered acceptable, if it was not significantly larger than the Kelley's criterion (Kelley, 1935).

3. Results

There were a total of 500 pregnant women included in the final analyses. Participants had a mean age of 27.41 years (5.65), with a majority of Punjabi ethnicity 369 (73.8%), followed by Urdu-speaking 110 (22%) and other 21 (4.2%). Most of the respondents were high school graduates 315 (63%), while 85 (17%) could neither read nor write. Only 59 (11.8%) of the pregnant women were employed while the rest were housewives. Socioeconomically, most of the respondents identified themselves as belonging to lower-middle (284, 56.8%), lower (148, 29.6%) or middle class (68, 13.6%). Detailed demographic characteristics have been presented in the parent publication (Waqas et al., 2015).

3.1. Descriptive

Symptoms of anxiety and depression were rated as feelings of

Table 1
Reliability and descriptive statistics.

Items	Scale Mean if Item Deleted	Mean	SD	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Squared Multiple Correlation	Cronbach's Alpha if Item Deleted
A: I feel tense or 'wound up'	16.41	1.15	.864	48.463	.526	.338	.794
D: I still enjoy the things I used to enjoy	16.56	1.00	.867	49.713	.415	.207	.801
A: I get a sort of frightened feeling as if something awful is about to happen:	15.90	1.66	1.050	45.725	.614	.448	.785
D: I can laugh and see the funny side of things:	16.92	.64	.789	50.198	.422	.209	.801
A: Worrying thoughts go through my mind:	16.10	1.46	.965	47.744	.515	.339	.794
D: I feel cheerful:	16.19	1.37	1.306	41.963	.702	.530	.774
A: I can sit at ease and feel relaxed:	16.43	1.13	.979	49.003	.407	.207	.802
D:I feel as if I am slowed down:	16.20	1.36	.890	50.684	.321	.143	.808
A: I get a sort of frightened feeling like 'butterflies' in the stomach:	16.22	1.34	.978	46.792	.583	.388	.788
D: I have lost interest in my appearance:	16.13	1.43	1.050	49.277	.350	.150	.807
A: I feel restless as I have to be on the move:	15.95	1.62	.929	53.470	.089	.040	.823
D: I look forward with enjoyment to things:	16.70	.86	1.008	48.868	.401	.240	.802
A: I get sudden feelings of panic:	16.22	1.34	1.016	47.017	.538	.350	.792
D: I can enjoy a good book or radio or TV program:	16.37	1.19	1.055	51.268	.209	.111	.818

*Values less than 0.30 have been omitted.

tension (6.8%), inability to enjoy things (3.8%), feeling as if something bad is going to happen (24.4%), inability to see funny side of things (2%), worrying thoughts (17.2%), not feeling cheerful (32.4%), inability to feel relaxed (9.2%), psychomotor retardation (11.8%), feeling of butterflies in stomach (12.2%), lost interest in appearance (18.8%), feel restless (17%), inability to look forward to enjoying things (9.2%), feelings of panic (13.8%) and inability to enjoy TV or radio program (12%). Lowest mean score was reported on the item "I can laugh and see the funny side of things" (0.64±0.79) and highest on "I get a sort of frightened feeling as if something awful is about to happen" (1.66±1.05). Table 1 lists mean scores and SD on all items of HADS scale.

Mean score on HAD scale was 17.56 (7.45); skewness -0.37 (SE = 0.11) and kurtosis -0.88 (SE = 0.02). Total score on HADs depicted significant deviation from normality; with a platykurtotic histogram (Fig. 1). Minimum score of 0 and maximum score of 36 were reported by only 2 participants (0.4%), hence, presenting no floor and ceiling effects.

3.2. Face validity

The translation of the HADS into Urdu language has been described in great detail by Mumford et al. (1991). Initially, the HADS was translated into Urdu, by six junior psychiatrists working independently from one another. These drafts were then examined by a five member committee of senior psychiatrists, four of whom were bilingual in Urdu and English. The items were examined one by one choosing appropriate expression, resulting in a consolidated draft. This was then back-translated into English language by six other bilingual and non-medical members. Both the English and Urdu versions of the scale were then administered to 120 bilingual medical students at King Edward Medical College in Lahore. A systematic two-way classification process showed that a high concordance rate (82.4 to 91.7% for anxiety and 87–98.1% for depression subscale) was achieved between Urdu and English version of the HADS.

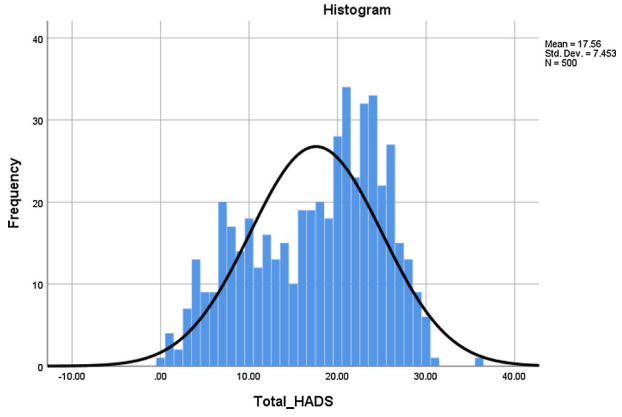

Fig. 1. Histogram exhibiting distribution of HADS scores.

3.3. Reliability analysis

All of the statements in HADS has at least one inter-item correlations > 0.2, thus, yielding an acceptable convergent validity. Highest total-item correlation was yielded by the item "I feel cheerful" (0.72). While the highest inter-item correlation of 0.54 was yielded by item 3 (something awful is going to happen) & 6 (feel cheerful). Firstly, reliability analyses were run separately for the subscales of anxiety and depression. Anxiety subscale yielded an acceptable Cronbach's alpha value of 0.74 while for depression (α = 0.65), it was lower than the acceptable value of 0.70. However, Cronbach's alpha value for whole scale was good (α = 0.81). Sensitivity analysis involving assessment of Cronbach's alpha value after removal of each item, did not reveal any major deviations in overall internal consistency of the HADS. Analysis of item-total correlations revealed one problematic statement "I feel restless as I have to be on the move", yielding a low value of 0.09. However, this item was kept in to be tested in further analysis Table 1.

3.4. Exploratory factor analysis

Dimensionality of HADS was tested using ML method with oblique rotation. Prior to running EFA, sampling adequacy of the study sample was assessed using the KMO test. It yielded a good sampling adequacy (0.89) as well as a statistically significant Bartlett's statistic (1525.7_{91}; $P < 0.001$). Sampling adequacy of each item was further found to be acceptable in the anti-image correlation matrix. Total number of factors to retain were assessed using several methods. Assessment of Eigen value as well as Cattel's scree plot suggested two factor solution to be retained (Fig. 2). Eigen value of first factor was 4.36, explaining 31.14% of variance in HADS scores while the second factor yielded an Eigen value of 1.19 and explained a variance of 8.52. A two factor solution for HADS is the most frequently reported factor structure in the literature. However, for present sample, it was found to be problematic at levels of

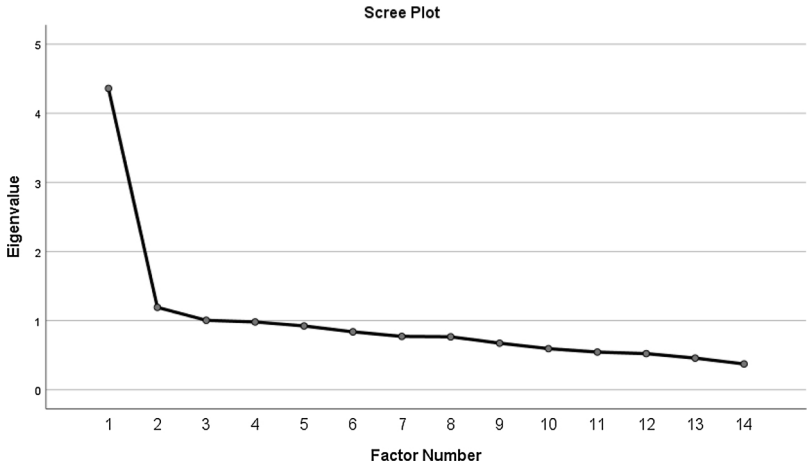

Fig. 2. Scree plot exhibiting number of factors to retain.

Table 2
Communalities and factor loadings of two factor model for HADS.

	Mean	SD	Communality	Factor 1*	Factor 2*
A: I feel tense or 'wound up'	1.15	.864	0.41	0.59	
D: I still enjoy the things I used to enjoy	1.00	.867	0.20		0.34
A: I get a sort of frightened feeling as if something awful is about to happen:	1.66	1.050	0.54	0.64	0.36
D: I can laugh and see the funny side of things:	.64	.789	0.21		0.36
A: Worrying thoughts go through my mind:	1.46	.965	0.43	0.62	
D: I feel cheerful:	1.37	1.306	0.65	0.43	0.68
A: I can sit at ease and feel relaxed:	1.13	.979	0.22		0.41
D:I feel as if I am slowed down:	1.36	.890	0.14	0.34	
A: I get a sort of frightened feeling like 'butterflies' in the stomach:	1.34	.978	0.43	0.41	0.51
D: I have lost interest in my appearance:	1.43	1.050	0.14		
A: I feel restless as I have to be on the move:	1.62	.929	0.04		
D: I look forward with enjoyment to things:	.86	1.008	0.31		0.55
A: I get sudden feelings of panic:	1.34	1.016	0.39	0.49	0.37
D: I can enjoy a good book or radio or TV program:	1.19	1.055	.015		0.38

* Values less than 0.30 have been omitted.

communalities as well factor loadings. Firstly, four items 8, 10, 11 and 14 yielded poor values of communality (< 0.20). Item 10 and 11 also yielded poor factor loadings < 0.30. Secondly, Item 3, 6 and 13 cross-loaded on both factors. Based on these reasons, we concluded that two factor structure of HADS was invalid Table 2.

In second phase, we employed Parallel analysis, Velicer's MAP test and Hulls' method to assess number of factors to retain. All of these tests suggested one factor solution to be viable. When one factor was extracted as a uni-dimensional measure of anxiety and depression: item 11 (I feel restless as I have to be on the move) and 14 (I can enjoy a good book or radio or TV program) were deemed problematic for having low communalities and factor loading values. However, both of these items were kept for further analysis based on theoretical relevance of these items underpinning ICD/DSM criteria of diagnoses and symptoms of anxiety and depression (Tables 2 and 3).

3.5. Confirmatory factor analysis

Confirmatory factor analysis revealed an appropriate goodness of fit of uni-dimensional structure of HADS. It yielded an acceptable value of RMSR (0.046) which was not significantly higher than the the Kelley's criterion (0.045). RMSEA was 0.05 which is below the cut-off value of 0.08. All of the goodness of fit indices were > 0.90; Tucker & Lewis index (0.92), CFI (0.93), GFI (0.99), AGFI (0.98), GFI without diagonal values (0.97) and AGFI without diagonal values (0.96).

Table 3
Communalities and factor loadings of one factor model for HADS.

Item	Factor loading	Communality
A: I feel tense or 'wound up'	0.59	0.35
D: I still enjoy the things I used to enjoy	0.44	0.20
A: I get a sort of frightened feeling as if something awful is about to happen:	0.70	0.50
D: I can laugh and see the funny side of things:	0.46	0.21
A: Worrying thoughts go through my mind:	0.58	0.33
D: I feel cheerful:	0.77	0.59
A: I can sit at ease and feel relaxed:	0.45	0.20
D:I feel as if I am slowed down:	0.36	0.13
A: I get a sort of frightened feeling like 'butterflies' in the stomach:	0.66	0.43
D: I have lost interest in my appearance:	0.37	0.14
A: I feel restless as I have to be on the move:	0.11	0.12
D: I look forward with enjoyment to things:	0.45	0.20
A: I get sudden feelings of panic:	0.62	0.38
D: I can enjoy a good book or radio or TV program:	0.22	0.05

3.6. Reliability and goodness of fit for unidimensional scale

The internal consistency (Cronbach's alpha) of the HADS improved to 0.81. The removal of item 11 and 14 raised the Cronbach's alpha value further to 0.83. Confirmatory factor analysis excluding items 11 and 14 suggested that this factor structure of the HADS had an appropriate goodness of fit. The RMSR was 0.043 which was lesser than the Kelley's criterion (0.045). RMSEA value was 0.05 (P > 0.05) and

Tucker & Lewis index (0.94), CFI (0.95), GFI (0.99), AGFI (0.99), GFI without diagonal values (0.98) and AGFI without diagonal values (0.97).

3.7. Convergent and divergent validity

The unidimensional structure of the HADS yielded a negative association with social support (r = -0.47, P < 0.001) and positively with experience of domestic abuse (0.45, P < 0.001). The spearman's rho between individual items and total HADS scores ranged from a minimum of 0.44 for item 8 and 0.81 for item 6.

4. Discussion

The present study is the first concerted effort to evaluate factor validity and internal consistency of the HADs among pregnant women in Pakistan. It revealed that the commonly reported two factor structure of the HADS is neither consistent nor valid to assess perinatal anxiety and depression in Pakistan. However, using several evidence based techniques, a uni-dimensional factor structure of the HADS was deemed more suitable.

The dimensional structure of the HADS has only received limited empirical assessment with equivocal results (Razavi et al., 1990; Lewis, 1991; Moorey et al., 1991). We tested and hypothesized a single psychological distress factor underpinning the HADS items. These results corroborate previous studies concerning the dimensional structure of the HADS in somatically ill patients, which compared both two-factor solution and one factor solution, finding latter to be more reliable and valid (Moorey et al., 1991). They also favored a strong single dimension of psychiatric illness represented as a global score on the HADS (Razavi et al., 1990; Lewis, 1991). Our results corroborate with those of Karimova et al's study of HADS among Uzbek women during antenatal period (Karimova and Martin, 2003). They emphasized that the HADS is not psychometrically sound and robust tool for screening perinatal anxiety and depression. They further opined that these irregularities in factor structure of the HADS is because of its sensitivity to experience of biological changes and misperception of affective state that accompany pregnancy (Karimova and Martin, 2003). These findings have also been replicated among several other populations suffering from physical pathologies harbingering biological changes. For instance, Razavi et al. (1990) found in a study of cancer patients the underlying factor structure of the HADS to be uni-dimensional, and has advocated use of the HADs scale as an index of global psychological distress, a suggestion at clinical odds with Snaith and Zigmond's (1994) position. These findings were also consistent with those reported by Ayalu Aklilu Reda who found the unifactorial model of the Ethiopian version of HADS to be reliable and valid, similar to the reports of Razavi et al. (1990, 1989) and Chaturvedi (1991).

In our opinion, methodological heterogeneity in previous studies can also account for disparities in results from the originally developed two factor structure of the HADS. Firstly, both the original study describing the development of HADS (Zigmond and Snaith, 1983) and cross-cultural validation study in Pakistan (Mumford et al., 1991) tested HADS among healthcare students and not psychiatric populations. This suggests the notion that the dimensions could differ from one patient or socio- cultural group to another. Secondly, we noted a major variations in methodologies of EFA, CFA and reliability analysis employed in different studies (Supplementary **Table 1**). Most of the studies employed either the criteria of Kaiser's Eigen's value > 1 or Cattel's Scree plot. Both of these techniques are considered as traditional heuristics and presently Parallel analysis is considered a better criteria for factor retention that almost always outperforms Kaiser's and Catell's criteria, however, it is underutilized by authors that validated the HADS (Watkins, 2000; Lorenzo-Seva and Ferrando, 2006). Thirdly, literature often explains high correlation of depressive and anxiety disorders as an artefact of symptom overlap between the two disorders when measured with separate scales (i.e., anxiety and depression) (Brady and Kendall, 1992). Even in clinical settings, both disorders are correlated and are highly comorbid (Stavrakaki and Vargo, 1986; Watson et al., 1995). Due to this, researchers contend that HADS may be measuring emotional distress or psychological disturbance in general rather than separate entities of depression and anxiety (Herrmann, 1997; Razavi et al., 1989; Chaturvedi, 1991; Stavrakaki and Vargo, 1986).

4.1. Strengths & limitations

This study has several strengths including surveying multiple sites, and an appropriate sample size of pregnant women. In addition to identifying the factor structure of the HADS and its goodness of fit, several other facets of validity including face validity, expert validation, and convergent and divergent validity were ascertained. However, this study lacks comparisons with gold standard instruments such as diagnostic interviews for diagnoses of anxiety and depression to ascertain criterion validity of the HADS.

5. Conclusion

The present study revealed that poor internal consistency and validity of the commonly employed two factor structure of the HADS for measuring antenatal anxiety and depression. A single factor structure, yielding a global score for overall psychiatric morbidity maybe more appropriate for use among this population in Pakistan.

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Declaration of Competing Interest

None of the authors have any conflict of interests to report.

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Not applicable.

Appendix A. Supplementary data

Supplementary material related to this article can be found, in the online version, at doi:https://doi.org/10.1016/j.ajp.2019.08.008.

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