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General distress and symptoms of anxiety and depression: A factor analysis in two cohorts of dialysis patients

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ABSTRACT

Objective: Depression and anxiety often coexist in patients with end-stage-kidney disease. Recently, studies showed that a composite 'general distress score' which combines depression and anxiety symptoms provides a good fit in dialysis and oncology patients. We aim to investigate if the three most frequently used self-report questionnaires to measure depression and anxiety in dialysis patients are sufficiently unidimensional to warrant the use of such a general distress score in two cohorts of dialysis patients.

Methods: This study includes two prospective observational cohorts of dialysis patients (total $n = 749$) which measured depression and anxiety using Beck Depression Inventory (BDI), Beck Anxiety Inventory (BAI) and Hospital Anxiety and Depression Scale (HADS). Confirmatory factor analyses was used to investigate both a strictly unidimensional model and a multidimensional bifactor model that includes a general distress, depression and anxiety factor. The comparative fit index (CFI) and The Root Mean Square Error of Approximation (RMSEA) were used as model fit indices.

Results: Factor analysis did not show a good fit for a strictly unidimensional general distress factor for both the BDI/BAI and HADS (CFI 0.690 and 0.699, RMSEA 0.079 and 0.125 respectively). The multidimensional model performed better with a moderate fit for the BDI/BAI and HADS (CFI 0.873 and 0.839, RMSEA 0.052 and 0.102).

Conclusions: This data shows that the BDI/BAI and HADS are insufficiently unidimensional to warrant the use of a general distress score in dialysis patients without also investigating anxiety and depression separately. Future research is needed whether the use of a general distress score might be beneficial to identify patients in need of additional (psychological) support.

1. Introduction

Chronic kidney disease is an increasingly prevalent disease, with millions of patients worldwide needing dialysis therapy when reaching its end-stage. Patients on dialysis therapy experience high levels of physical and mental distress, [1–3] with depression and anxiety symptoms as most common mental health symptoms [1,2]. Both depression and anxiety are known to be associated with an impaired quality of life (QoL), treatment non-adherence and adverse clinical outcomes, such as hospitalization and mortality [4,5]. Despite this burden, symptoms of depression and anxiety are often not screened and left untreated in dialysis patients [6]. Knowledge on the properties and performance of screening tools in this specific population could aid in the development of screening programs.

The most common self-report questionnaires to measure depressive and anxiety symptoms in dialysis patients are the Hospital Anxiety and Depression Scale (HADS) and the Beck Depression and Anxiety Inventories (BDI and BAI). These questionnaires focus on depression and anxiety as being different entities or symptom domains. However, depression and anxiety often coexist in dialysis patients, and there exists a substantial correlation and possibly overlap between symptoms of depression, anxiety and physical symptoms from the chronic renal

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Abbreviations

BDI Beck Depression Inventory
BAI Beck Anxiety Inventory
HADS-D Hospital Anxiety and Depression Scale – Depression subscale
HADS-A Hospital Anxiety and Depression Scale – Anxiety subscale
PHQ-ADS Combined questionnaire on Depression and Anxiety to indicate general distress
ERA-EDTA European Renal Association-European Dialysis and Transplant Association
CFA Confirmatory Factor Analysis
CFI Comparative Fit Index (part of the fit indices of the CFA)
RMSEA The Root Mean Square Error of Approximation (part of the fit indices of the CFA)
QoL Quality of Life

failure and the dialysis therapy itself [1,2]. Furthermore, treatment options for these mental health symptoms may also overlap. For example: cognitive behavioral therapy is advised to treat anxiety symptoms but also (subclinical) depressive symptoms, without the need for a formal diagnosis [7]. Within the field of Psychology, the concept of 'general distress' has been introduced which includes symptoms of both depression and anxiety, and may potentially be beneficial for screening purposes and to guide therapy [8,9].

The concept of general distress has been investigated by testing the unidimensionality or multidimensionality of the depression and anxiety concepts in questionnaires using factor analysis. In 1991, Clark et al. described a tripartite model including a general distress domain besides specific depression and anxiety domains, which provided a good fit for their data [8]. More recently, Kroenke et al. investigated a general distress score in three medically ill patient groups and found the 16-item PHQ-ADS 'general distress score' to be a reliable and valid composite measure of depression and anxiety. This composite score could, if validated in other populations, be useful as a single measure for jointly assessing two of the most common psychological conditions in clinical practice and research [9]. Chilcot et al. tested this unidimensional general distress model and confirmed these results with the PHQ-ADS in dialysis patients [10]. However, these authors also indicated that validation of this general distress score is warranted in a larger sample of dialysis patients. Additionally, it is unknown whether this concept of a general distress score also exists in other, more frequently used self-report questionnaires to assess depression and anxiety (i.e. HADS, BDI and BAI).

In addition to a general distress factor, studies found evidence that Somatic items can be differentiated from Cognitive items in both the BDI and BAI questionnaires [11–13]. Given the large burden of physical symptoms in these chronically ill patients, we hypothesize that there might be an overarching Somatic distress factor and Cognitive distress factor. A previous study among cardiac rehabilitation patients described a 3-factor model including Depression, Subjective Anxiety and Somatic Anxiety using a combination of the BDI and BAI [14]. So far, it is unknown how these Somatic-Cognitive models perform in dialysis patients.

This study aims to investigate a general distress score for depression and anxiety by using the BDI/BAI and HADS in two different cohorts of dialysis patients. Evidence for a general distress score will be determined based on the performance of the following three models: 1) strictly unidimensional model that includes a general distress factor, 2) multidimensional model that includes a depression factor and anxiety factor, and 3) tripartite bi-factor model that includes a general distress, depression and anxiety factor. Secondary analyses included the investigation of a Somatic-Cognitive distress model using the extensive 42-item BDI/BAI questionnaires.

2. Methods

2.1. Study design and participants

This study performs analyses in two Dutch cohorts of dialysis patients: the DIVERS-cohort (n = 687) and the Loosman-cohort (n = 73) [11,15]. All analyses were performed separately for both cohorts, both the demographic description of the cohorts and the factor analysis. By analyzing two separate cohorts we aimed to generate more results with synchronized methods to better interpret the concept of 'general distress' in dialysis patients.

The DIVERS-study is an observational, prospective cohort study among dialysis patients from 10 urban dialysis centers in The Netherlands. The cohort consists of both prevalent and incident hemodialysis and peritoneal dialysis patients, included between June 2012 and October 2016, as described in detail elsewhere [5].. Patients were offered questionnaires in Dutch, English, Arabic and Turkish. To promote generalizability, all patients on chronic dialysis therapy (> 90 days on dialysis therapy) were considered eligible. If needed, patients received assistance in filling in the questionnaires.

The Loosman-study is an observational, prospective cohort study in 1 urban dialysis center in Amsterdam, The Netherlands. All patients with chronic kidney disease who were treated with either hemodialysis or peritoneal dialysis in the St. Lucas Andreas hospital (currently OLVG) between February 2008 and June 2008 were eligible for participation in this study, as described in detail elsewhere [15]. Patients who were unable to read or understand the Dutch language were excluded.

Ethical Approval of the Medical Ethnic Committee was obtained. All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards. Informed consent was obtained from all individual participants included in the study.

2.2. Demographic, social and clinical data

At baseline, the following socio-demographic and clinical data were collected from electronic medical records in both cohorts: age, gender, dialysis modality and vintage, primary cause of kidney disease, routine laboratory measures (e.g. hemoglobin and albumin) and status on the transplantation waiting list. Incident patients on chronic dialysis therapy were defined as new patients who started renal replacement therapy (> 90 days and < 180 days). Primary cause of kidney disease was classified according to the European Renal Association-European Dialysis and Transplant Association (ERA-EDTA) coding system and divided into 3 groups: diabetic nephropathy, renal vascular disease and other cause [16].

We collected the following characteristics through self-report questionnaires: ethnicity (defined as immigrant status based on the country of birth), marital status, children, educational level, working status, current smoking, alcohol use and previous diagnosis of depression. No data was available on previous anxiety diagnoses.

2.3. Assessment of symptoms of depression and anxiety

The DIVERS-cohort used the Beck Depression Inventory-II edition (BDI) and the Beck Anxiety Inventory (BAI) [17,18]. Respondents were asked to rate how much each of the 21 symptoms had bothered them in the past week on a scale ranging from 0 (not at all) to 3 (severely). The total score ranges from 0 to 63. Both the BDI and the BAI include many items assessing physical symptoms. The BDI has been validated in dialysis patients using a depression diagnosis as reference with good

sensitivity and specificity [15]. The BAI has not been validated in dialysis patients using a formal anxiety diagnosis as reference, however, the BAI has been validated in a large variety of cohorts, including cohorts with somatically ill patients [14,19–22].

The Loosman-cohort used the Hospital Anxiety and Depression Scale (HADS) [23]. The HADS consists of seven items to assess anxiety symptoms (HADS-A) and seven items to assess depressive symptoms (HADS-D). Respondents were asked to rate how much each of the symptoms bothered them from 0 (not present) to 3 (considerable). The item scores are summed to provide subscores on the HADS-A and HADS-D, with scores ranging from 0 to 21 for either anxiety or depression. The HADS items are primarily based on psychological aspects of anxiety and depression with no items assessing physical symptoms, thus the HADS may be especially useful for screening for anxiety and depression in somatically ill patients. The anxiety items concentrate on general anxiety, with five out of 7 items that resemble the diagnostic criteria for generalized anxiety disorder. The depressive items concentrate primarily on anhedonia. The HADS has been validated in dialysis patients using the DSM diagnosis for depression as reference with good sensitivity and specificity [15,24].

2.4. Statistical analysis

Standard descriptive statistics were used to present baseline patient characteristics for both cohorts separately. The factor structure of the BDI/BAI and the HADS-D/HADS-A was analyzed using confirmatory factor analysis (CFA) with robust full information maximum likelihood (FIML) estimation as the primary method. FIML estimation is robust for missing data and non-normally distributed data [25]. Missing items on the questionnaires will be included in this estimation method.

The models were identified using the marker-item approach, which means that the loading of the first item of every subscale is fixed to 1 and its intercept is set to 0.

Model fit was interpreted by inspecting fit indices, employing the following rules of thumb: the comparative fit index (CFI) indicates acceptable fit above 0.900 and good fit above 0.950; the root mean squared error of approximation (RMSEA) indicates good fit below 0.060 [26]. These fit indices should be considered in combination, so a good fit meets all these criteria [26]. The best fitting model was obtained by means of an iterative process, starting with factor models found in the literature [9,14] and, if necessary, adapting the model until adequate model fit was obtained.

The following constructs were evaluated using CFA:

- strictly unidimensional model that includes a general distress factor
- multidimensional model that includes a depression factor and anxiety factor
- tripartite bi-factor model that includes a general distress, depression and anxiety factor.

Secondly, besides the performance indices, factor loadings were inspected to judge the amount of correlation between the items and the general factor, where an R^2 above 0.60 as a marker for a relatively high explained common variance.

In the bifactor models, the correlations between the factors were fixed on zero and the variances of the general factor and the other factors together were set to be equal.

Secondary analyses included the investigation of a construct containing a Somatic general distress factor based on the Somatic items in the BDI and BAI, and a Cognitive general distress factor based on the Cognitive items of the BDI and BAI. Furthermore, a construct by Clark et al. containing a 3-factor Depression, Subjective Anxiety and Somatic Anxiety factor model was investigated [11,19]. Constructs that were evaluated using CFA for this secondary analysis include:

- Two-factor model including Somatic distress and Cognitive distress
- A bifactor model including Somatic, Cognitive and a general distress factor
- Three-factor model including Depression, Subjective Anxiety and Somatic anxiety

2.5. Sensitivity analyses

To be able to directly compare our results with the existing literature, we have included analyses using a weighted least square mean and variance adjusted (WLSMV) estimation in the CFA, in concordance with the analyses by Kroenke and Chilcot, [9,10] This WLSMV method is specifically designed for ordinal data and uses full information data, in contrast to the main analyses in this paper using FIML estimation which may be more appropriate to use in this setting with missing data.

All analyses were performed in R (R Core Team), using the package lavaan [27]. The complete R code used for the factor analyses can be found in Supplementary file S1.

3. Results

3.1. Baseline patient characteristics

A total of 687 patients were included in the DIVERS-cohort and 73 patients in the Loosman-cohort. Table 1 describes the baseline patient characteristics of the two cohorts. The mean age was 65 years and both cohorts had relatively large proportions of immigrant patients, which is explained by the urban setting. Primary causes of kidney disease were mostly diabetic nephropathy or renal vascular disease in both cohorts. Hemodialysis and peritoneal dialysis patients were included in both cohorts, with most of the patients being prevalent dialysis patients. The median dialysis vintage was 13 months [4–47] in the DIVERS-cohort and 41 months [23–64] in the Loosman-cohort.

3.2. Factor analysis on general distress

Multiple a priori defined factor models were investigated in both cohorts. Table 2 shows the performance of these dimensional models for the BDI/BAI combination and HADS-D/HADS-A combination.

First, a unidimensional general distress model with only one factor was investigated. This model showed poor performances in the BDI/BAI and the HADS-D/HADS-A questionnaires with a CFI of 0.737 and 0.699, and a RMSEA of 0.062 and 0.125, respectively.

Second, a 2 factor model with only a depression factor and an anxiety factor was investigated. This model showed a moderate performance in the BDI/BAI questionnaires with a CFI of 0.823 and a RMSEA of 0.060. For the HADS-A/HADS-D combination, the model fit was good, with a CFI of 0.956 and a RMSEA of 0.052.

Last, a tripartite bi-factor model included a general distress factor besides the depression and anxiety factors. This model showed a better fit compared to the 2-factor or unidimensional model in the BDI/BAI (CFI 0.873, RMSEA 0.052). For the HADS-A/HADS-D combination, the inclusion of a general factor did not improve the performance (CFI 0.839, RMSEA 0.102). A visual representation of this model, including its factor loadings is shown in Fig. 1 for the BDI/BAI and in Fig. 2 for the HADS. The factor loadings on the general distress factor in the BDI/BAI cohort were low and often negative, indicating that the general factor does not seem to be appropriate for these questionnaires. Furthermore, the R^2 (explained variance) of the general and anxiety factors were low compared to the depression factor. The factor loadings on the general factor for the HADS questionnaires were better, however the model performance indicated a better fit without a general factor.

A sensitivity analysis which uses an ordinal model with weighted least squares (WLSMV) showed similar results, with all three models showing better fit indices compared to the main analyses. The bi-factor model for the BDI/BAI and HADS showed a CFI of 0.988 and 0.997, and a RMSEA of 0.022 and 0.021 respectively, as Supplementary Table S2.

Table 1
Baseline characteristics of the 2 dialysis cohorts.

Characteristic	DIVERS-cohort (n = 687)	Loosman-cohort (n = 73)
Demographic		
Mean age, years	65 ± 15	64 ± 15
Male sex	424 (62%)	39 (53%)
Ethnicity		
Native Dutch	387 (52%)	38 (52%)
Immigrant	300 (48%)	35 (48%)
Social		
Married	316 (52%)	29 (40%)
Has Children	474 (78%)	–
Low education[a]	127 (22%)	–
Not employed	534 (89%)	70 (96%)
Renal and dialysis		
Incident dialysis patient[b]	240 (36%)	3 (4%)
Median vintage of prevalent group, months	13 [4–47]	41 [23–64]
Treatment modality		
Hemodialysis	592 (88%)	51 (70%)
Peritoneal dialysis	80 (12%)	11 (30%)
Primary kidney disease		
Diabetic nephropathy	155 (24%)	15 (21%)
Renal vascular disease	163 (26%)	23 (32%)
Other cause	317 (50%)	35 (48%)
AVG or AVF[c]	435 (65%)	–
Residual diuresis > 100 ml/24 h	475 (71%)	–
On waiting list for kidney transplantation		
Yes	201 (30%)	6 (8%)
No	471 (70%)	67 (92%)
Laboratory parameters		
Mean hemoglobin (mmol/l)	7.1 ± 0.8	7.1 ± 1.0
Mean albumin (g/l)	37.0 ± 5.3	40.2 ± 4.3
Clinical		
Current smoking	108 (18%)	5 (7%)
Current alcohol use	161 (27%)	14 (19%)
Comorbidities		
Diabetes mellitus	284 (42%)	21 (29%)
Chronic heart disease	111 (17%)	23 (32%)
Peripheral vascular disease	84 (13%)	8 (11%)
Davies co-morbidity score		
Low comorbidity	183 (27%)	–
Moderate comorbidity	370 (55%)	–
Severe comorbidity	119 (18%)	–
Psychiatric and quality of life		
Depression and anxiety		
Previous diagnosis of depression	27 (4%)	8 (11%)
Mean BDI depression score	12.9 ± 9.6	8.7 ± 7.2
Mean BAI anxiety score	10.3 ± 10.1	–
Mean HADS-D depression score	–	6.5 ± 3.8
Mean HADS-A anxiety score	–	5.8 ± 4.0
Health-related quality of life (SF-12)		
Mean physical component summary	38.1 ± 11.1	–
Mean mental component summary	48.9 ± 10.8	–

Values are presented as mean ± SD, median [IQR] or frequency (percentage).
[a] Low education: highest level of education is high school or less.
[b] < 180 days on dialysis.
[c] Arteriovenous Graft (AVG) or Fistula (AVF), for HD patients only.

3.3. Somatic and cognitive distress

The performance of these models are described in Table 3. The Somatic-Cognitive model did not show a good performance with a CFI of 0.785 and a RMSEA of 0.066. When a general distress factor was added to this model, the model improved to a moderate fit with a CFI of 0.879 and a RMSEA of 0.051. A visual representation of this model, including factor loadings, is shown in Fig. 3. The factor loadings for the Somatic and Cognitive factors show a better fit compared to the relatively low factor loadings on a general factor. This is especially the case for the anxiety symptoms. The model from Clark et al. showed a similar performance with a CFI of 0.839 and a RMSEA of 0.057.

Table 2
Performance of dimension models with a general factor using confirmatory factor analysis in 2 cohorts.

Dimension model and cohort	CFI	RMSEA
DIVERS-cohort*		
1-factor: General distress	0.737	0.062
2-factor: BDI + BAI	0.823	0.060
Tripartite bi-factor: BDI + BAI + general distress	0.873	0.052
Loosman-cohort**		
1-factor: General distress	0.699	0.125
2-factor: HADS-A + HADS-D	0.956	0.048
Tripartite bi-factor: HADS-A + HADS-D + general distress	0.839	0.102

CFI > 0.900 indicates adequate (or okay) fit and CFI > 0.950 indicates good fit.
Root Mean Square Error of Approximation (RMSEA) < 0.06 is considered to demonstrate good fit.
* The chi-square P-value for the BDI/BAI factor models were: P < 0.001 for all models. The ωh and coefficients for the BAI/BDI using 3 factors: Alpha: 0.97, G.6: 0.99, Omega Hierarchical: 0.66, Omega H asymptotic: 0.67, Omega Total 0.98.
** The chi-square P-value for the HADS factor models were: P < 0.001 for the 1-factor model, P = 0.196 for the 2-factor model, and P < 0.001 for the bi-factor model. The ωh and coefficients for the HADS using 3 factors: Alpha: 0.83, G.6: 0.89, Omega Hierarchical: 0.53, Omega H asymptotic: 0.60, Omega Total 0.89.

4. Discussion

This study aimed to investigate the performance of a general distress factor model in dialysis patients using the BDI/BAI and HADS. We found no evidence to warrant the use of a unidimensional general distress score in these questionnaires. We did find evidence for a tripartite model using the BDI/BAI which includes a general distress factor in addition to the separate constructs for anxiety and depression. The HADS performed best with only a 2-factor model including only depression and anxiety. Furthermore, we found a moderate performance for overarching Somatic and Cognitive dimensions of the BDI/BAI.

A direct comparison of our results to existing literature is somewhat difficult due to the use of different questionnaires and differences in cohort characteristics. The only other study that performed a confirmatory factor analysis in dialysis patients is Chilcot et al. investigating general distress [10]. This study was based on a study by Kroenke et al. in three cohorts of oncology patients [9]. Both Kroenke and Chilcot found a good performance for both the bi-factor and unidimensional model for general distress (CFI 0.99 and 0.967 in 182 dialysis patients). The present study did not find a good performance for the unidimensional general distress model and only found a moderate performance of the bi-factor model. Several factors may play a role in the conflicting results. First, the present study investigated the 42-item BDI/BAI and 14-item HADS questionnaires, while other existing studies on general distress used the 16-item PHQ-ADS questionnaire [9,10]. Despite the fact that all questionnaires measure the same concept of core symptoms of depression and (generalized) anxiety, there are several differences, such as the absence of physical symptoms in the HADS. Second, other studies used weighted least squares (WLSMV) estimation in their factor analyses, while the present study used maximum likelihood estimation (ML) which may be more applicable to handle missing data. A sensitivity analysis using WLSMV estimation showed an overall better performance of the models, however, similar results were found regarding the performance of the unidimensional general distress model.

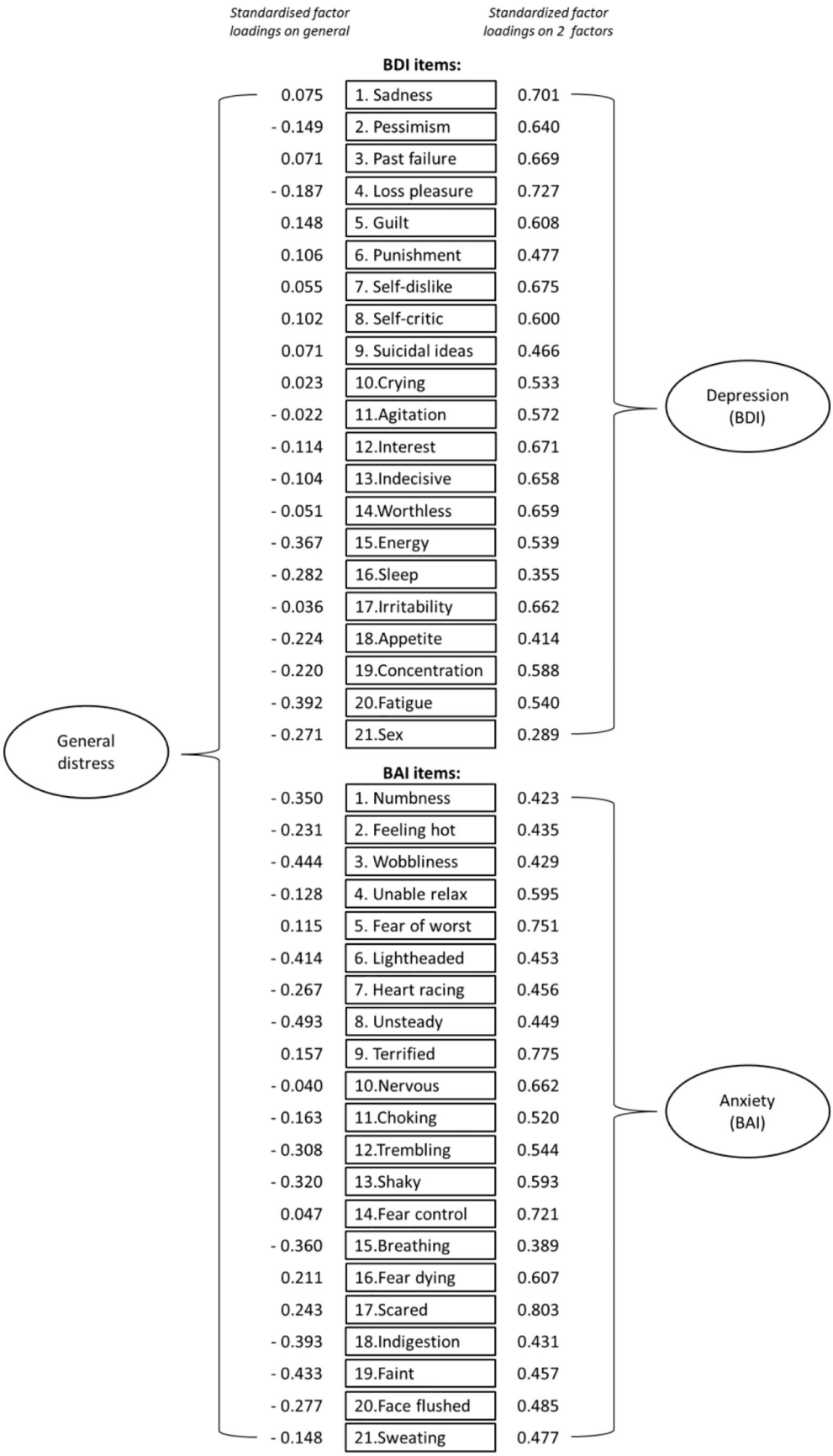

Fig. 1. Factor loadings in tripartite bifactor model including general distress, Depression and Anxiety using the BDI/BAI
Standardized factor loadings using a tripartite bifactor model. The items of the BDI and BAI load onto both the general factor and on either depression or anxiety (bi-factor model). Factor loadings > 0.5 indicate a good fit.

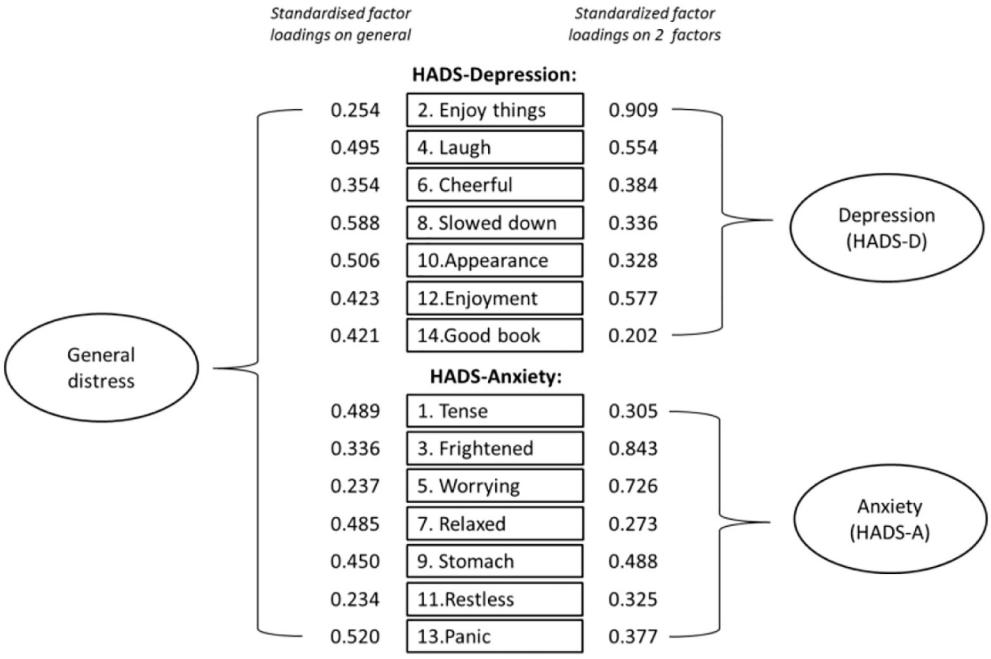

Fig. 2. Factor loadings in tripartite bifactor model including general distress, Depression and Anxiety using the HADS
Standardized factor loadings using a tripartite bifactor model. The items of the HADS load onto both the general factor and on either depression or anxiety (bi-factor model). Factor loadings > 0.5 indicate a good fit.

Table 3
Performance of dimension models with a combination of BDI and BAI in the DIVERS cohort using confirmatory factor analysis.

Dimension model and cohort	CFI	RMSEA
3-factor: Depression-somatic anxiety-subjective anxiety (Clark)	0.839	0.057
2-factor: Somatic-Cognitive BAI + BDI	0.785	0.066
Bi-factor: general-somatic-cognitive BAI + BDI	0.879	0.051

CFI > 0.900 indicates adequate (or okay) fit and CFI > 0.950 indicates good fit.
Root Mean Square Error of Approximation (RMSEA) < 0.06 is considered to demonstrate good fit.

While the present study found no evidence for a unidimensional use of the BDI/BAI or HADS, evidence was found for a tripartite general distress model, hereby confirming that such a composite 'general distress' construct may be used in dialysis patients when using other questionnaires (e.g. PHQ-ADS).

Furthermore, this study showed that an overarching Somatic-Cognitive distress model provided a moderate fit (CFI 0.879, RMSEA 0.051). Such a dimensional model has been described previously for both the BDI and the BAI separately [11,12]. This adds to the existing knowledge on factor models and possible clinically relevant symptom domains in dialysis patients. In previous research we found that somatic and cognitive symptoms of depression are differentially related to important clinical outcomes like mortality in dialysis patients, were the somatic symptoms of depression are more strongly associated with subsequent mortality. [11] Future research should investigate if somatic and cognitive distress measured with the BDI and BAI are also clinically relevant in relation to the effect of treatment of these symptoms or if the different symptom dimensions need other treatment options.

4.1. Strengths and limitations

This study has several strengths. First, this is the first study to investigate the concept of general distress in dialysis patients using the most frequently used questionnaires to assess anxiety and depressive symptoms, namely: BDI/BAI and HADS. Besides being relevant for dialysis patients, a factor analysis on general distress in the BDI/BAI and HADS questionnaires may also be relevant for other (chronically ill) patient populations. Second, in contrast to trial data often used in other studies on this topic, this study uses a prospective cohort design which may promote the generalizability of the present study [9,10]. Finally, the sample size of the DIVERS-cohort is substantially larger compared to the only other study in dialysis patients on this topic (687 versus 182 patients) [10].

While interpreting the results of this study, one should take the following limitations into account. First, while the sample size of the BDI/BAI cohort was large (n = 687), the sample size of the HADS cohort was small (n = 73), which may increase the possibility of a type II error. Second, we included both incident and prevalent dialysis patients, creating a difference in baseline characteristics. However, the combination of both incident and prevalent patients improves the generalizability of our results to the entire dialysis population in clinical practice. Finally, as a result of using self-report questionnaires, there are missing values. Although this is common across literature, there is a possible selection bias of patients who are able and willing to fill in questionnaires.

Future studies are needed to further unravel and specify the concept and hierarchal models of general distress in relation to symptom domains of anxiety and depression in specific patient groups [28].

4.2. Clinical implications

There may be several potential advantages of using a general distress score. First, patients could suffer from depressive and anxiety symptoms below the cut-off score for each disorder, while a composite general distress score may be able to identify these patients who are also in need for additional (psychological) support. Second, the use of a single composite score might be an easy to understand and practical solution to the implementation of screening for depression and anxiety, which has been advocated for years but has not yet been implemented into daily nephrological care. Literature on the barriers and facilitators of implementing screening for depression and anxiety in dialysis patients is scarce. More research is needed to better understand these

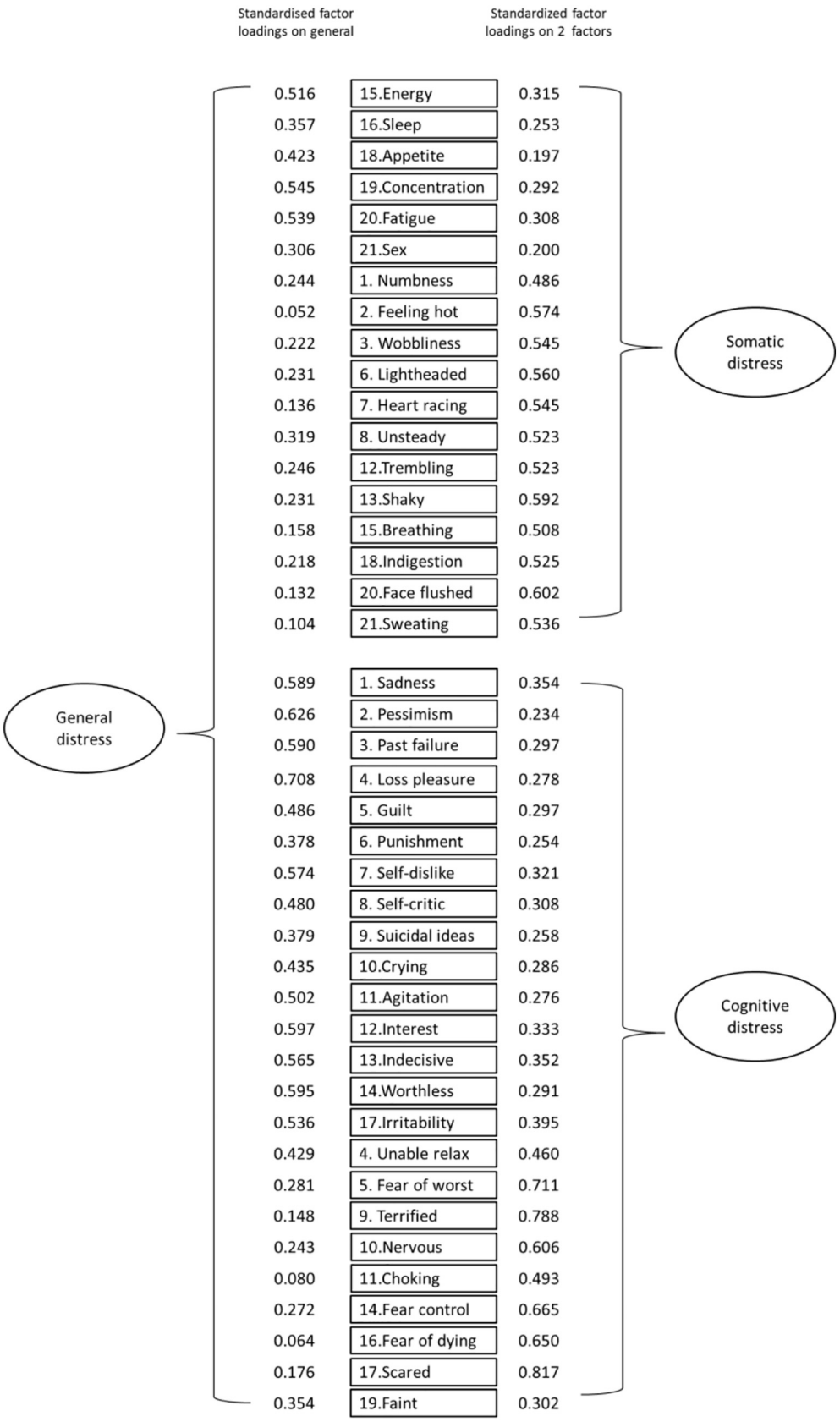

Fig. 3. Factor loadings in model including a somatic, cognitive and general factor using the BAI/BDI
Standardized factor loadings using a tripartite bifactor model. The items of the BDI and BAI load onto both the general factor and on either a somatic factor or a cognitive factor (bi-factor model). Factor loadings > 0.5 indicate a good fit.

barriers to improve screening and outcomes.

Despite the possible benefits of using a general distress score, this study did not find evidence to warrant the use of a general distress score to describe both depression and anxiety for the BDI/BAI or the HADS. The present study does provide evidence for a tripartite model when using the BDI/BAI that includes a general distress score, in addition to depression and anxiety. In practice, this could mean that a general distress score could be used as a first step to screen patients for depressive and anxiety symptoms, with the second step being the identification of depression and anxiety to identify if additional treatment options need to be considered for these particular disorders. We believe these results show that both anxiety and depressive symptoms provide a meaningful addition to only measuring a (shorter) general distress questionnaire or score. Additionally, a distinction between a Somatic distress domain and a Cognitive distress domain could be of added value in the choice of treatment options. However, it remains difficult to translate the result of factor analyses to clinical practice, since factor analysis cannot formally investigate whether a concept is clinically meaningful. More research on the association between the symptom dimensions of depression and anxiety and (adverse) clinical outcomes could aid in identifying clinically relevant dimensions.

Psychotherapy, such as cognitive behavioral therapy show promising results in reducing depressive symptoms in dialysis patients. However, there is still a lack of adequately powered randomized controlled trials for both depression and anxiety in dialysis patients. Future research is needed to gain insight in the effectiveness of screening and treatment programs for these symptoms in dialysis patients.

5. Conclusion

Results suggests that the BDI/BAI and HADS do not show a sufficiently unidimensional structure to warrant the use of such a general distress score without investigating anxiety and depression separately. The results from this study do not support the use of a general distress score to identify anxiety and depressive symptoms. Future research is needed whether the use of a general distress score might be beneficial to identify patients in need of additional (psychological) support.

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Declaration of competing interest

We have no conflict of interest to report. The OLVG hospital has full ownership of the data collected for this study.

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Author contributions

RS, EN, WB, YM, CS and BB contributed to the conceptualization of the research question and hypotheses. Data was collected by RS and WL. Analysis was conducted by RS and WB. AH, CS, BB supervised the project. RS wrote the manuscript in close cooperation with EN, YM and BB. All authors contributed to and approved the final version of the manuscript.

Compliance with ethical standards

Ethical Approval of the Medical Ethnic Committee was obtained. All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards.

Informed Consent Informed consent was obtained from all individual participants included in the study.

Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.genhosppsych.2020.04.004.

References

[1] Palmer S, Vecchio M, Craig JC, Tonelli M, Johnson DW, Nicolucci A, et al. Prevalence of depression in chronic kidney disease: systematic review and meta-analysis of observational studies. Kidney Int 2013;84(1):179–91.
[2] Cohen SD, Cukor D, Kimmel PL. Anxiety in patients treated with hemodialysis. Clin J Am Soc Nephrol 2016;11(12):2250–5.
[3] Cukor D, Coplan J, Brown C, Friedman S, Cromwell-Smith A, Peterson RA, et al. Depression and anxiety in urban hemodialysis patients. Clin J Am Soc Nephrol 2007;2(3):484–90.
[4] Farrokhi F, Abedi N, Beyene J, Kurdyak P, Jassal SV. Association between depression and mortality in patients receiving long-term dialysis: a systematic review and meta-analysis. Am J Kidney Dis 2014;63(4):623–35.
[5] Schouten RW, Haverkamp GL, Loosman WL, Chandie Shaw PK, van Ittersum FJ, Smets YFC, et al. Anxiety symptoms, mortality, and hospitalization in patients receiving maintenance dialysis: a cohort study. Am J Kidney Dis 2019;74(2):158–66. https://doi.org/10.1053/j.ajkd.2019.02.017. Published online April 23.
[6] Cukor D, Coplan J, Brown C, Peterson RA, Kimmel PL. Course of depression and anxiety diagnosis in patients treated with hemodialysis: a 16-month follow-up. Clin J Am Soc Nephrol 2008;3(6):1752–8.
[7] Copyright. In: The American Psychiatric Association Practice Guidelines for the Psychiatric Evaluation of Adults. edn.
[8] Clark LA, Watson D. Tripartite model of anxiety and depression: psychometric evidence and taxonomic implications. J Abnorm Psychol 1991;100(3):316–36.
[9] Kroenke K, Wu J, Yu Z, Bair MJ, Kean J, Stump T, et al. Patient health questionnaire anxiety and depression scale: initial validation in three clinical trials. Psychosom Med 2016;78(6):716–27.
[10] Chilcot J, Hudson JL, Moss-Morris R, Carroll A, Game D, Simpson A, et al. Screening for psychological distress using the patient health questionnaire anxiety and depression scale (PHQ-ADS): initial validation of structural validity in dialysis patients. Gen Hosp Psychiatry 2018;50:15–9.
[11] Schouten RW, Harmse VJ, Dekker FW, van Ballegooijen W, Siegert CEH, Honig A. Dimensions of depressive symptoms and their association with mortality, hospitalization, and quality of life in dialysis patients: a cohort study. Psychosom Med 2019;81(7):649–58.
[12] Steer RA, Clark DA, Beck AT, Ranieri WF. Common and specific dimensions of self-reported anxiety and depression: a replication. J Abnorm Psychol 1995;104(3):542–5.
[13] Steer RA, Clark DA, Beck AT, Ranieri WF. Common and specific dimensions of self-reported anxiety and depression: the BDI-II versus the BDI-IA. Behav Res Ther 1999;37(2):183–90.
[14] Clark JM, Marszalek JM, Bennett KK, Harry KM, Howarter AD, Eways KR, et al. Comparison of factor structure models for the Beck Anxiety Inventory among cardiac rehabilitation patients. J Psychosom Res 2016;89:91–7.
[15] Loosman WL, Siegert CE, Korzec A, Honig A. Validity of the Hospital Anxiety and Depression Scale and the Beck Depression Inventory for use in end-stage renal disease patients. Br J Clin Psychol 2010;49(Pt 4):507–16.
[16] van Dijk PC, Jager KJ, de Charro F, Collart F, Cornet R, Dekker FW, et al. Renal replacement therapy in Europe: the results of a collaborative effort by the ERA-EDTA registry and six national or regional registries. Nephrol Dial Transplant 2001;16(6):1120–9.
[17] Beck AT. SR: Beck Anxiety Inventory manual. San Antonio, TX: Psychological Corporation; 1993.
[18] Beck AT, Steer RA, Brown GK. Manual for the Beck Depression Inventory-II. San Antonio. TX: Psychological Corporation; 1996.
[19] Osman A, Kopper BA, Barrios FX, Osman JR, Wade T. The Beck Anxiety Inventory: reexamination of factor structure and psychometric properties. J Clin Psychol 1997;53(1):7–14.
[20] Beck AT, Epstein N, Brown G, Steer RA. An inventory for measuring clinical anxiety: psychometric properties. J Consult Clin Psychol 1988;56(6):893–7.
[21] Rutten S, Ghielen I, Vriend C, Hoogendoorn AW, Berendse HW, Leentjens AF, et al. Anxiety in Parkinson's disease: symptom dimensions and overlap with depression and autonomic failure. Parkinsonism Relat Disord 2015;21(3):189–93.
[22] Wetherell JL, Areán PA. Psychometric evaluation of the Beck Anxiety Inventory with older medical patients. Psychol Assess 1997;9(2):136–44.
[23] Zigmond AS, Snaith RP. The hospital anxiety and depression scale. Acta Psychiatr Scand 1983;67(6):361–70.
[24] Untas A, Aguirrezabal M, Chauveau P, Leguen E, Combe C, Rascle N. Anxiety and depression in hemodialysis: validation of the Hospital Anxiety and Depression Scale (HADS). Nephrologie & therapeutique 2009;5(3):193–200.
[25] Enders CK. The impact of nonnormality on full information maximum-likelihood

estimation for structural equation models with missing data. Psychol Methods 2001;6(4):352–70.
[26] Hu L, Bentler PM: Cuttoff criteria for fit indexes in covariances structure analysis: conventional criteria versus new alternatives. In., vol. 6; 1999: 1–55.
[27] Rosseel Y. Lavaan: an R package for structural equation modeling. 48(2). 2012. p. 36. 2012.
[28] Prenoveau JM, Zinbarg RE, Craske MG, Mineka S, Griffith JW, Epstein AM. Testing a hierarchical model of anxiety and depression in adolescents: a tri-level model. J Anxiety Disord 2010;24(3):334–44.