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State Trait Anxiety Inventory factorial structure for patients diagnosed with depression

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Original article

ABSTRACT

Background
Despite being one of the questionnaires most widely used by mental health professionals to assess anxiety, the State Trait Anxiety Inventory (STAI) has been criticized. The main criticism is that the possible existence of a set of items to assess depression would form an independent factor.

Objective
The aim of this work is to evaluate the STAI's factorization in a sample of patients diagnosed with depression.

Method
We applied the Spanish adaptation of the STAI to 266 Spanish patients diagnosed with various depressive disorders.

Results
Three underlying factors were identified in the exploratory factor analysis: state anxiety, positive trait anxiety and negative trait anxiety.

Discussion and conclusion
The factorization did not confirm the presence of specific item sets for depression, pointed out above as the main criticism of this questionnaire. Furthermore, the high values of the categorical alpha, both in the factor structure obtained and the theoretical subscales, are highly reliable indications for the use of the STAI in patients diagnosed with depression.

Key words: Anxiety, depression, psychometrics.

RESUMEN

Antecedentes
Pese a ser uno de los instrumentos para evaluar ansiedad más empleados por profesionales de la salud mental, el Cuestionario de Ansiedad Estado-Riesgo (STAI, por sus siglas en inglés) ha sido objeto de críticas, entre las que destaca la posible existencia de un conjunto de reactivos que, por evaluar depresión, conformarían un factor independiente.

Objetivo
El objetivo de este trabajo es evaluar la factorización del STAI en una muestra de pacientes con diagnóstico de depresión.

Método
Se aplicó la adaptación española del STAI a 266 pacientes españoles diagnosticados con diferentes trastornos depresivos.

Resultados
Mediante un análisis factorial exploratorio, se determinaron tres factores subyacentes: ansiedad estado, ansiedad rasgo positiva y ansiedad rasgo negativa.

Discusión y conclusión
La factorización realizada no permite confirmar la presencia de conjuntos de reactivos específicos para la depresión, señalada anteriormente como la principal crítica a este cuestionario. Además, los elevados valores del alfa categórico, tanto en la estructura factorial obtenida como en las subescalas teóricas, son indicios de una elevada fiabilidad para el empleo del STAI en pacientes con diagnóstico de depresión.

Palabras clave: Ansiedad, depresión, depresivos, psicométrico.

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BACKGROUND

The first commercial version of the State Trait Anxiety Inventory (STAI) was developed in 1970.[1] This questionnaire has been cited in more than 14000 documents and adapted into more than 60 languages,[2] the Spanish language version among them.[3] Different investigations have demonstrated that the STAI has adequate reliability and validity. These characteristics are maintained in the Spanish version, which has high reliability, a correct discriminatory validity[3] and an absence of differential functioning in its items.[4] All of the above has led this questionnaire to be one of the most widely used by clinical psychologists in Spain[5] and recently, a brief version of it has been developed in various samples.[6]

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However, despite these qualities, the factorization presents a double-problem: 1. the separation into different factors of items which have been inverted for correction of the direct questions; 2. saturations of some questions in a loose factor with confusion between state and trait.

Various well-known investigations with the STAI in non-Spanish samples have obtained different factorizations, both in the number of factors to extract and in the items that make up each factor. In fact, some authors defend very robust factorial reductions with four factors: trait anxiety and state anxiety, with positive and negative, respectively.[7] Other more complex attempts indicate that some of the inverse items cause confusion when it comes to assessing positive or negative anxiety. The most representative example of this line of research is in the work of Vautier,[8] who concludes that despite being negative, various items in the STAI assess both the presence and the absence of anxiety (both state and trait) and cause problems in the factorial analysis observed in other works.

Other authors highlight the fact that the STAI notably correlates with measures of depression. One of the methods to test this correlation consisted of unifying the anxiety trait items with those of Beck's Depression Inventory, to apply an exploratory factorial analysis on the final bank of items. As such, Endler et al.[9] used the complete STAI and obtained a factor in which the Beck items saturated, another with the STAI items and other anxiety items, which indicates that this set of items would be assessed in the same theoretical dimension. Later, Andrade et al.[10] replicated this methodology, but only used the subscale of trait anxiety. In this case, it was observed that items 1, 10, 15, and 16 of the subscale of trait anxiety predominantly saturated in the factor formed of depression items. Finally, the direct correlation between the STAI and depression questionnaire has been studied, and correlations of 0.45 and above have been obtained.[11] It can also be defended that the content of some of the questions would not assess anxiety itself, which constitutes the first step in establishing content validity.[12]

To study problems with the STAI's content validity, confirmatory factor analysis was also used with the aim of establishing whether the content of any group of items was more related with various different factors different to anxiety. Bieling et al.[13] determined that in the subscale of trait anxiety, the bifactorial model obtained the best fit and that, based on the content analysis of the items, one of the factors would measure anxiety and the other, depression. Another alternative proposal was that a group of items would allow negative mood to be assessed. Following a similar procedure, other authors defended the existence of a subscale of depression[14,15] or general negative mood,[16] understanding this as a characteristic component both of depressive as well as anxiety disorders.[17] Despite obtaining a unifactorial structure, other authors argue that the trait STAI would assess general negative emotion.[18]

Despite the criticisms, it should be noted that the majority of works only use the subscale of trait anxiety and use non-clinical samples. It is therefore difficult to establish a clear conclusion with the diversity of models, number of factors, and combinations of items defended. As such, the aim of this present investigation is to analyze the factorization of the STAI in a sample of Spanish patients with depression. In this way, it will be possible to verify whether the same factorizations are found as in the general population, or conversely, if there are groups of items which may be assessing depression or general psychological discomfort instead of anxiety. It is hoped that in spite of being about depressed patients, the factorizations will be equal to those observed in the general population; in other words, two factors for state and trait and anxiety, or four: one model for state and trait anxiety, and positive and negative, respectively.

METHOD

Participants

Some 266 patients diagnosed with a depressive disorder participated in this study. They came from ten Spanish cities: Alicante, Barcelona, Bilbao, Córdoba, Granada, Jaén, Madrid, Ourense, Santiago de Compostela, and Valencia. A minimum of 5% and a maximum of 15% of the sample were taken from each one of these cities. A summary of the main characteristics of the sample can be found in table 1.

Instrument

To meet the aims of the study, the Spanish adaptation of the State-Trait Anxiety Inventory was applied.[1,3] This questionnaire assesses state and trait anxiety through 20 items on each one, with a Likert-type response scale of four options. In the case of state anxiety, the scale goes from 0 (None) to 3 (A lot), while for trait anxiety it goes from 0 (Almost never) to 3 (Almost always). In both state and trait anxiety, a percentage of the items is inverted and assesses wellbeing or the absence of anxiety, while the rest of the items refer to the presence of anxiety. The total score is obtained from the sum of the items after the inversion of those which are drafted positively.

As well as the STAI, the clinicians also responded to three aspects: primary diagnosis, assessment criteria, and treatment time. These items were presented separately from each patient's booklet.

Procedure

To carry out this *expost facto* investigation with a single group,[19] first the response sheet was drafted about the diagnosis as described above. Secondly, contact was made with

Table 1. Descriptions of the total sample, and by sex

Variable	Women	Men	Total
Frequency (%)	182.0 (68.4)	84.0 (31.6)	266.0 (100.0)
Age			
Range	18-62	18-63	18-63
Mean (DT)	31.90 (10.63)	36.99 (11.66)	33.51 (11.2)
Disorder:			
Frequency (% of the total)			
Major Depressive Disorder	122.0 (70.3)	63.0 (75.0)	191.0 (71.8)
Dysthymia	47.0 (25.8)	17.0 (20.2)	64.0 (24.0)
Mixed Disorder	6.0 (3.3)	3.0 (3.6)	9.0 (3.4)
Major Depressive Disorder with mixed characteristics	1.0 (0.5)	1.0 (1.2)	2.0 (0.8)

various clinicians (all psychological) in ten Spanish cities to present the study and they were provided with the STAI response sheets. The clinicians worked in private centers, hospitals, and public healthcare services. The clinicians selected patients previously diagnosed with a depressive disorder to fill out the booklet. The exclusion criteria were not having a depressive disorder as a primary diagnosis and being an underage minor. The questionnaires were accompanied by some written instructions to guarantee uniformity of application. Firstly, the clinician explained the informed consent to the patients so that they would understand the guarantees of participation. The patient could fill out the booklet, together with their sociodemographic data, either in the doctor's office or elsewhere, in which case they would bring it to their next appointment. The diagnostic information and the booklet with the STAI and sociodemographic data were filled out in separate documents to avoid the patient being able to access diagnostic information, should the therapist wish. To avoid patient confusion between the documents, a code was duplicated in a) the booklet and b) the diagnosis sheet. This code, managed by the healthcare staff, guaranteed the anonymity of the patient in terms of the examiner, and impeded voluntary switching of sheets between patients. Finally, the clinicians sent the documents to the researcher to start correcting and entering onto the database. To draft the manuscript, the recommendations proposed by Hartley were used.[20]

After the booklets were received, responses were transferred to a database. None of the cases provided were excluded from this process, as all of them met the diagnostic criteria specified for selection by the clinicians. In the analysis, subjects who had omitted more than 10% of the responses were discarded for analysis of the total score comparisons.

Data analysis

The first step was to carry out an exploratory factorial analysis. The retention of the number of factors was carried out through a parallel analysis. This consisted of determining some eigenvalues, calculated from a randomly-generated matrix. These values were compared to those resulting from the factorial analysis. Factors whose eigenvalue (over one according to Kayser's criteria) was also above the eigenvalue obtained with the randomly-generated matrix were kept in the factorial analysis.[21,22] The procedure for extraction was primary axes and the method of rotation was Varimax, as both subscales are theoretically independent, just as carried out in the original Spanish adaptation of the inventory.[3] It was decided to employ an exploratory method given that in Spain there is no previous data of the STAI's functioning in samples of patients with primary diagnoses of depression. As such, before confirming whether the groupings of questions which theoretically do not purely assess anxiety, it was necessary to assess whether these groupings were observed in an exploratory manner. Categorical alpha was used for reliability analysis, calculated from the matrix of polychoric correlations.[23]

RESULTS

First, the mean score was calculated for both subscales, and we compared whether it was statistically higher than the mean value established in the manual of the Spanish adaptation for the general population. In the case of state anxiety, the mean was 32.26 (*DT*=14.4). When calculating the means by sex, the group of men had 32.85 (*DT*=14.3; in comparison with the mean in the Spanish adaptation: $t_{(83)}$ 10.64; p<0.001) and the women had 31.98 (*DT*=1448; in comparison with the mean in the Spanish adaptation: $t_{(181)}$=12.73; p<0.001). In the case of trait anxiety, the mean was 36.41 (*DT*=11.96). When calculating the means of the group of men, this was had 36.39 (*DT*=13.89; in comparison with the mean in the Spanish adaptation: $t_{(83)}$ 10.64; p<0.001) and the women had 36.42 (*DT*=12.2; in comparison with the mean in the Spanish adaptation: $t_{(181)}$=14.43; p<0.001).

Secondly, we analyzed the mean for each of the depressive disorders (excluding Major Depressive Disorder with mixed characteristics, as there were only two subjects with this condition). In the case of people diagnosed with depression, the mean of state anxiety was 31.92 (*DT*=14.40)

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and that of trait anxiety was 35.84 (*DT*=11.98). In the case of people diagnosed with dysthymia, the mean of state anxiety was 32.7 (*DT*=15.13) and that of trait anxiety was 38.77 (*DT*=12.11). In the group diagnosed with mixed anxiety and depression disorder, the mean for state anxiety was 35.78 (*DT*=15.43) and for trait anxiety it was 36.67 (*DT*=9.53). After confirming the assumption, an ANOVA was carried out to compare whether the mean scores differed according to type of disorder. No statistically significant differences were found in state anxiety ($F_{(2,254)}$=0.34; p=0.713) or trait anxiety ($F_{(2,254)}$=1.42; p=0.244).

A factorial analysis was then carried out. Firstly, we confirmed the suitability of the matrix for analysis, and adequate indices were obtained (χ^2[780;266]=6.236,99; *KMO*=0.936). We determined that three factors should be extracted through parallel analysis. When carrying out the factorial analysis, it was observed that the three factors explained 52.26% of the total variance. When observing commonalities, all items reached values over 0.25, except in the case of item 7 of the trait anxiety subscale. After this, we analyzed the saturations of the items in each one of the factors. Table 2 shows a summary of the saturations.

Finally, we carried out a reliability analysis. In the case of the 40 items, the joint alpha was 0.936. In this case, only item 7 on the trait anxiety subscale improved this value if it was eliminated. In the case of state anxiety, the alpha was equal to 0.964. In the case of trait anxiety, reliability was 0.927. Here, it was again observed that eliminating item 7 improved the value (by three thousands). Through this analysis, the reliability of the factorization obtained through factorial analysis was calculated. As such, in the first factor, the alpha was 0.96 (item 7 of the state subscale improved the alpha by one thousandth). In the second factor, the alpha was 0.889 (the elimination of item 19 improved this value by a thousandth) and in the third, the alpha was 0.902. It should be noted that there were no question whose elimination improved internal consistency.

Table 2. Matrix of saturations of STAI items in each of the factors of the factorial analysis

	Factor		
Item	1	2	3
State3	**0.805**		
State12	**0.791**		
State6	**0.776**		
State4	**0.766**		
State18	**0.719**		
State14	**0.661**	0.317	
State1	**0.654**	0.365	
State15	**0.637**	0.488	
State9	**0.629**		
State13	**0.564**		
State17	**0.559**		0.370
State5	**0.539**	0.505	
State8	**0.534**	0.470	
State10	**0.511**	0.510	
Trait16		**0.740**	
Trait10		**0.734**	
Trait1		**0.709**	
State19	0.378	0.678	
State16	0.403	0.671	
State11		0.651	
Trait13		**0.645**	
State2	**0.455**	0.615	
State20	**0.539**	0.589	
Trait6		**0.512**	
Trait15		0.488	**0.427**
Trait19		**0.442**	
Trait4		0.434	**0.423**
Trait7			
Trait9			**0.667**
Trait20			**0.627**
Trait17			**0.567**
Trait8		0.398	**0.558**
Trait11			**0.540**
Trait18			**0.475**
State7	**0.414**		**0.442**
Trait12		0.421	**0.434**
Trait14			**0.432**
Trait3		0.372	**0.387**
Trait2		0.317	**0.356**
Trait5			**0.335**

Note. Saturations lower than 0.3 were eliminated.

DISCUSSION AND CONCLUSION

Through this data, it has been established that depressive people get high scores in terms of anxiety levels assessed through the STAI. These are mean scores significantly different to the values obtained in the Spanish adaptation of the questionnaire.[3] The differences are between 15 and 20 points, which coincides with other studies which compare the mean scores of patients with depressive disorders (Major Depression and mixed anxiety and depression disorders), with mean scores being observed within this range.[24] This may be due to two causes: anxiety and depression disorders have a high comorbidity between them,[25,26] because of which it is common to see correlations between the scores of instruments assessing anxiety and depression.[27] The second cause of these 15-20 points of difference would be that some of the STAI items assess depression or general discomfort.[13,14,16]

By means of the procedure employed in this article, it is not possible to categorically specify if the mean scores of patients with depression are due to also suffering from anxiety or that the STAI assesses depression or general discomfort. Because of this, it was decided to analyze the factorial structure underlying the data to verify the similarity between the factors extracted from said analysis and those defended by people who consider that the STAI contains subscales of de-

pression, general discomfort, etc. Based on the results, the existence of three underlying factors was determined. On these, despite there being four out of 40 items that did not fit into their theoretical factor, the structure obtained is a tri-factorial model, where the first of the factors corresponds with the subscale of trait anxiety. The subscale of state anxiety is divided into two factors: one which brings together items which have been inverted (factor 2 in table 2) and the other which includes positive items (factor 3 in table 2). As such, when using a sample of depressive patients, there was no statistical grouping observed of the items that predominantly measured depression or other factors different to trait anxiety. In other words, in the exploratory factorial structure, no grouping was observed of the questions criticized for assessing general psychological discomfort or depression. This fact is a guarantee that the STAI assesses anxiety, even in depressed patients, where its factorial structure is very similar to that obtained in the general population.[3] Furthermore, just as in the original Spanish adaptation,[3] various items saturated in both factors. Although this fact goes against the theoretical basis of the STAI, which affirms that that the scales are independent of one another, it is common in some factorizations.

In summary, on observing the factorization obtained in the sample of depressed patients, no grouping was detected of the items that theoretically measure depression[13,14] or negative mood.[16,28] However, in both the saturations and the case of analysis of reliability, there are five items in which problems in analysis were observed, of which item 7 of the trait anxiety subscale was the most conflictive. In this case, the item did not saturate above 0.3 in any of the theoretical factors and its elimination improved the Cronbach's alpha in all factors it formed part of. The content of item 7 ("I am a calm, serene, and peaceful person") makes reference to the person normally being calm, which is primarily linked with an absence of anxiety, but which could also be related to psychological wellbeing. The other problem with this item is that because it has three adjectives, these may confuse the subject being assessed, causing them to only take one of them into account, or even give a random response with no connection to the content of the item. In fact, in psychometrics, it is considered that "One item should express one single idea".[29]

In terms of reliability, it can be seen that the values of the categorical alpha are excellent in all cases. This is very relevant, given that it implies that the STAI is a reliable instrument for detecting high levels of anxiety comorbid with the disorder in depressed patients. This makes sense, given that the STAI shows measures of adequate internal consistency in both the original version[1,30] and the Spanish adaptation for the general population.[3,4] Furthermore, in other works with Spanish samples which assess the reliability of the brief version of the instrument in Spanish patients with respiratory intubation, the reliability is excellent,[31] as is also the case with adolescents and university students.[6]

This article has provided new evidence of the correct functioning of the STAI in depressed patients, even when, in this population, the scores are usually higher than in people without disorders. The above requires extreme prudence in being used with other patients, given that these scores could lead to thinking that there is a comorbid disorder of depression and anxiety which in reality is not the case. In terms of whether this is due to the STAI measuring depression or general discomfort, the factorization carried out fits with the theoretical structure of the original version,[1] the Spanish adaptation,[3] and similar studies.[8] As such, the present document provides evidence that its use in patients with a diagnosis of depression is adequate and offers new evidence of its factorial structure. Therefore, the work still has various limitations, of which the most relevant is the decompensation between the groups of patients in terms of the type of disorder, which impedes comparison of the functioning of the STAI for each of them. Future investigations should analyze the factorial structure (through a confirmatory factor analysis) independently for each one of the depressive disorders, and with wide samples of each of them. In this way, new evidence will be gathered to determine whether or not the Spanish adaptation of the STAI has items that assess different constructs of anxiety. Furthermore, it would be interesting to analyze through confirmatory factorial procedures, whether the theoretical groupings of depression and general discomfort have better fits than the structure obtained in the present study, through exploratory factorial analysis. Finally, the construct validity should be confirmed through correlations of the STAI and other instruments for anxiety in samples of depressed patients. Due to the limitations described, the structure underlying the Spanish adaptation of the STAI obtained in the present investigation does not imply the existence of groupings of items whose content leads to assumption that it assesses depression, general negative mood, etc. This fact will assist clinicians when it comes to applying the questionnaire, and carrying out their professional practice.

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Conflict of interest

The authors do not declare any conflict of interest.

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