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Original Article

Reliability and Validity of a Short Version of the STAI Anxiety Measurement Scale in Respiratory Patients ☆

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ABSTRACT

Background: There is comorbidity between respiratory disease and anxiety. In order to measure the anxiety of hospitalized patients it is necessary to use reliable and valid, and preferably short questionnaires.
Objective: To analyze the reliability and validity of a shortened version of the state subscale of the "State-Trait Anxiety Inventory (STAI)" in respiratory patients.
Patients and methods: A total of 103 respiratory patients admitted to the respiratory ward between February of 2009 and February of 2010 were non-consecutively selected. They answered two questionnaires: the Spanish version of the STAI-state and a short version consisting of 7 items. Sociodemographic and clinical variables of the patients were also obtained. The internal consistency, and convergent and construct validity of the short scale were analyzed.
Results: The short scale did not have floor/ceiling effect, the α-Cronbach was acceptable (0.89), and correlated positively (r = 0.90; *P* = .01) and also maintained the factorial structure of the original scale (half anxiety-present items and half anxiety-absent items).
Conclusions: The short version of the state subscale of the STAI has showed good metric properties in hospitalized respiratory patients.

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Fiabilidad y validez de una versión corta de la escala de medida de la ansiedad STAI en pacientes respiratorios

RESUMEN

Antecedentes: Existe comorbilidad entre enfermedad respiratoria y ansiedad. Para medir la ansiedad en pacientes hospitalizados es necesario usar cuestionarios fiables, válidos, y preferiblemente, cortos.
Objetivo: Analizar la fiabilidad y validez de una versión corta de la escala de medida de la ansiedad STAI en pacientes respiratorios.
Pacientes y método: Se seleccionó una muestra no probabilística y no consecutiva de 103 pacientes con enfermedad respiratoria ingresados en la planta de neumología entre febrero de 2009 y febrero de 2010. Se administraron dos cuestionarios: la adaptación española de la subescala estado del Cuestionario de Ansiedad Estado-Rasgo (STAI) y una versión corta del mismo instrumento de 7 ítems. También se recogieron variables sociodemográficas y clínicas de los pacientes. Se analizó la consistencia interna y la validez convergente y de constructo de la escala corta.
Resultados: La escala corta no tiene efecto techo/suelo, el α-Cronbach es aceptable (0,89), correlaciona positivamente con la escala original (r = 0,90; p = 0,01) y mantiene la estructura factorial de esta última (mitad de ítems de ansiedad presente y la otra mitad de ansiedad ausente).
Conclusiones: La versión corta del STAI estado muestra buenas propiedades métricas en pacientes respiratorios hospitalizados.

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Introduction

Respiratory diseases have many comorbidities, including among these anxiety disorders.[1] Although there are studies developed in respiratory patients reporting anxiety levels within normal range[2] or low percentages of significant anxiety,[3] most research gives evidence of higher levels of anxiety in COPD and asthma patients than in the general population[4,5] or in patients with other chronic pathologies.[6,7] In patients with obstructive respiratory disease, associations have also been found between anxiety and the manifestation of respiratory symptoms (breathlessness, dyspnea, hyperventilation syndrome),[8-11] relapse,[12] perception if poor health,[13] rehospitalization[14] and a poor quality of life.[15,16]

Despite the evident relationship between anxiety and respiratory disease, anxiety disorders are undertreated in respiratory patients (between 6.5-31%),[17,18] which leads to poorer compliance of medical treatment , increase in the frequency of hospitalizations and length of stay and an increase in the number of Primary Attention office visits.[7] This undertreatment is related with different barriers that the health-care professional comes up against in detecting and managing anxiety, including the lack of standardized protocols for the diagnosis of this disorder, improper use of evaluation tools, the lack of confidence and skill when making psychological evaluations, and the lack of time.[7]

However, many researchers think that a systematic evaluation of possible psychological disorders like anxiety and depression should form part of the management of respiratory disease.[6,13,17,18] It has even been suggested that it would be advisable to categorize patients with a certain psychological profile as they may require more care.[6] However, there is no consensus on the most appropriate method of evaluation.

The most important characteristics of a measurement tool are reliability and validity,[19] but in the hospital setting the applicability of such tools take on special relevance. In hospitalized patients, it is recommendable to use brief questionnaires for at least two reasons. The first is that the questionnaires should not be an excessive burden for the respondents because these patients, due to the severity of the disease, may experience mental and physical limitations to understand and complete long questionnaires[20,21]; the second is related to the small amount of time available in the hospital setting for psychological evaluation.[7]

The most widely-used tools for evaluating state of anxiety in respiratory patients are: *the State Trait Anxiety Inventory* –STAI– (state sub-scale with 20 items),[2,3,6,10,11,15] *the Hospital Anxiety and Depression Scale* –HADS– (anxiety sub-scale with 7 items)[8,12-14] and, somewhat less utilized, *the Beck Anxiety Inventory* –BAI– (21 items).[18] Although all have good psychometric properties in diverse populations,[20] none of them has been adapted for application in respiratory patients. The two most often used tools in these patients are STAI and HAD; HAD, although it has already been adapted in Spain, was designed for the hospital setting, and therefore does not allow for comparisons with samples of non-hospitalized subjects. STAI, on the other hand, is a generic instrument tested in a multitude of populations and has also been adapted in Spain, but it is too long, increasing the burden for the respondent. As a result, this has led to the international development of shorter versions of STAI, which are less cumbersome and allow for comparisons of different samples. These short versions have not been adapted in our country; therefore the objective of this study is to analyze the reliability and the validity of a short version of the state sub-scale of the State-Trait Anxiety Inventory (STAI), in hospitalized respiratory patients.

Patients and Methods

Study Design and Sample

The study population was made up of the patients with respiratory disease hospitalized in the Pulmonology Ward at two hospitals in the Spanish province of Alicante: Hospital General Universitario in Alicante and Hospital General Universitario in Elche. Excluded from the study were those patients whose main medical diagnosis was not a respiratory pathology, patients with a cognitive state that did not enable them to comprehend the statements of the questionnaire and patients with neurological disorders. In order to calculate the sample size, we adhered to the recommendation followed by other instrumental studies that considered 10 patients for the number of items in the questionnaire to be evaluated.[22] *A prioi,* we hypothesized that the main medical diagnosis as well as the duration of the hospital stay at the time of the administration of the questionnaire, are variables that can influence the level of anxiety of the sample. Therefore, we selected a non-probabilistic and non-consecutive sample of patients that included patients with prevalent diseases (chronic obstructive pulmonary disease, asthma, pneumonia, acute respiratory insufficiency) as well as with less-prevalent diseases (pulmonary thromboembolism, pulmonary hypertension, fibrosis). We also tried to get similar percentages of patients with short-, medium- and long-term hospitalizations at the time of the administration of the questionnaire. Data collection started in February 2009 and 103 patients were selected who met the inclusion criteria. Authorization was obtained from the research committees of both hospitals. All subjects participated voluntarily, giving verbal consent.

Instruments

Two questionnaires were administered: the Spanish adaptation of the state subscale of the State-Trait Anxiety Inventory (STAI) by Spielberger (STAI-state)[23] and a short version of the same tool (7 items).

The STAI-state is a self-administered questionnaire that evaluates anxiety as a state. It was adapted by TEA Ediciones in 1982. It has 20 items and the possible answers vary on a Likert scale with four points, from 0 = "not at all", to 3 = "very much so". The final score can vary between 0 and 60 points.

Out of the two short versions found of the STAI-state, one by Marteau & Bekker[24] and another by Chlan et al.,[25] the latter is the only version that has been developed in patients, specifically patients undergoing invasive mechanical ventilation (IMV). A previous study,[26] carried out by the authors of this present paper, concluded that the short version developed by Chlan, showed an adequately valid content for Spanish patients subjected to IMV, although the item number 1 of the original scale ("I feel calm.") was selected by the patients was more significant in describing their emotional state than item number 17 ("I am worried."), proposed by Chlan.

The short version of the STAI-state used in this study consists of 7 items and corresponds to the 6-item short version developed by Chlan,[25] plus item number 1 of the original scale.

In addition to the two STAI versions, the data collection questionnaire included sociodemographic (age, sex, marital status, level of education) and clinical (diagnosis, history of psychological disorders and number of days hospitalized) variables. We also recorded the method of response.

Procedure

Despite the fact that the instrumental studies recommend alternating the order of administration of the questionnaires to avoid the order effect,[27] we decided that all the subjects should complete the short version first, followed by the longer version, in order to maintain their motivation. In no cases was the order of the two versions alternated. The interviewers were a nurse from each floor of the Pulmonology Wards who followed the recommendations of the STAI instruction manual, asking the patients to respond to the questions according to how they felt at that precise moment (anxiety-state). The patients were given the option to complete the questionnaire themselves or to receive help from the interviewer (who read and then wrote down the response given by the patient).

Data Analysis

We carried out a descriptive analysis of the items, finding the mean, standard deviation and the ceiling and floor effects for each item and for the scale as a whole. The internal consistency reliability was examined with Cronbach's α, corrected α and the corrected element-total correlation. The type of validity analyzed was convergent through Pearson's correlation coefficient with the original scale, and the construct validity was examined by means of a factorial analysis with varimax rotation. By means of the Kruskal-Wallis test, we analyzed the influence of the method of response on the level of anxiety. The calculations were made with version 14 of the SPSS program.

Results

Table 1 shows the demographic and clinical characteristics of the patients that participated in the study.

Regarding the performance of the items, table 2 shows the position that the items occupy within the response scale ($\bar{x}$; SD) and the floor and ceiling effects for the 7 items of the short version as well as the same items extracted from the scale of 20 items. In general, the average score of each of the items of the short scale is similar to the score the items receive when presented within the scale of 20 items. In both the short scale and the 20-item scale, all the negative items or those showing absence of anxiety (1, 5, 10, 20) show the ceiling effect (percentages > 15%, which is the reference value[28]), while the affirmative items or those showing presence of anxiety (9, 12, 17) have a floor effect (percentages > 15% or reference value[28]). Item 9 should be noted, with a floor effect greater than 60%.

The short scale as an index does not show floor and ceiling effects, as the number of respondents that obtain the highest or lowest possible scores does not exceed 6%.

Reliability

The reduced version shows de Cronbach's α of 0.83, which is somewhat less than that obtained by the 20-item scale (0.89). The correlations of each item with the total score of the questionnaire are high in all cases (table 3). There are no great differences in the correlation of items 1 and 17 with the total scale. The corrected α, if the element is eliminated, is no less than 0.79 in any of the cases.

Validity

The short scale positively correlates with the 20-item scale: Pearson's correlation coefficient r = 0.89 (p = 0.01). If we correlate the

Table 1
Description of the study sample

Sample	(n = 103)
Age, mean (SD)	64.44 (16.31); Range: 22-93
Sex, n (%)	
Men	62 (60.2)
Women	41 (39.8)
Marital status, n (%)	
Single	7 (6.8)
Married/living with partner	70 (68.0)
Separated	4 (3.9)
Widow	22 (21.4)
Level of education, n (%)	
Unable to read or write	9 (8.7)
Primary studies	70 (68.0)
High school/vocational training	16 (15.5)
University studies	8 (7.8)
Diagnosis, n (%)	
Chronic obstructive pulmonary disease	25 (24.3)
Asthma	4 (3.9)
Respiratory infection: pneumonia, tuberculosis	24 (23.3)
Acute respiratory insufficiency	30 (29.1)
Lung nodule	3 (2.9)
Other: hemoptysis, pulmonary thromboembolism, pleural effusion, pulmonary hypertension, fibrosis	17 (16.5)
Other associated pathologies, n (%)	
None	58 (56.3)
Cardiovascular pathology	14 (13.6)
Post-surgery	1 (1.0)
Renal pathology	1 (1.0)
Cancer	2 (1.9)
Diabetes	2 (1.9)
Other: dyslipidemia, obesity	10 (9.7)
Two or more of the above	15 (14.6)
History of psychological disorders, n (%)	
Yes	7 (6.8)
No	96 (93.2)
N of hospitalization days when questionnaire was administered, n (%)	
Between 1-3 days	23 (22.3)
Between 4-6 days	21 (20.4)
Between 7-9 days	24 (23.3)
Between 10-12 days	12 (11.7)
More than 12 days	20 (19.4)
Existence of previous hospitalizations, n (%)	
Yes	72 (69.9)
No	31 (30.1)
Method of response, n (%)	
Self-completion	17 (16.5)
The interviewer reads and writes patients' answers	82 (79.6)
Other	4 (3.9)
Difficulties found, n (%)	
None	63 (61.2)
In comprehending explanations	11 (10.7)
In comprehending items	28 (27.2)
Other	1 (1.0)

short scale with the subgroup of the same 7 items extracted from the 20-item scale, the Pearson's correlation coefficient is r = 0.90 (p = 0.01).

The factorial analysis with varimax rotation of the 7-item scale extracted, using the analysis of the main components, 2 factors that explain 65.8% of the variance. These factors depend on the format of the response and not on the construct. Table 4 shows the matrix of the rotated components, with the load of the 7 items on each factor. Three items saturate high in the factor 1, and 3 items saturate high in factor 2. Item 1 saturates equally in both factors.

Table 2
Descriptive analysis of the 7-item scale: means and ceiling/floor effect of the items

Scale	Item 1 Calm		Item 5 At ease		Item 9 Frightened		Item 10 Comfortable		Item 12 Nervous		Item 17 Worried		Item 20 I feel pleasant	
	Short*	Long	Short	Long	Short	Long	Short	Long	Short	Long	Short	Long	Short	Long
Mean (SD)	1.97 (0.82)	1.95 (0.86)	2.17 (0.83)	2.09 (0.81)	0.49 (0.73)	0.54 (0.82)	1.98 (0.77)	1.98 (0.77)	0.79 (0.90)	0.83 (0.86)	1.05 (0.95)	1.06 (1.0)	2.02 (0.77)	1.96 (0.86)
Not at all (%)	4.9	5.8	3.9	4.9	62.1	63.1	3.9	4.9	45.6	41.6	35.0	37.9	2.9	4.9
A little (%)	20.4	22.3	15.5	14.6	31.1	23.3	19.4	16.5	37.9	38.6	33.0	28.2	20.4	24.3
Somewhat (%)	47.6	42.7	40.8	47.6	2.9	9.7	51.5	54.4	8.7	14.9	24.3	24.3	48.5	40.8
Very much so (%)	27.2	29.1	39.8	33.0	3.9	3.9	25.2	24.3	7.8	5.0	7.8	9.7	28.2	30.1

*The short scale is the 7-item scale. The long scale refers to the same 7 items, but extracted from the original scale.

Table 3
Reliability analysis of the 7-item scale

	Item 1	Item 5	Item 9	Item 10	Item 12	Item 17	Item 20
Cronbach's alpha 0.83							
Corrected element-total correlation	0.66	0.60	0.60	0.58	0.56	0.54	0.52
α if the element is eliminated	0.79	0.80	0.80	0.81	0.81	0.81	0.81

Table 4
Analysis of the main components: matrix of rotated components

Item	Factor 1 Absence of anxiety	Factor 2 Presence of anxiety
Absence of anxiety		
1. Calm	0.57	0.53
5. At ease	**0.87**	0.15
10. Comfortable	**0.66**	0.33
20. I feel pleasant	**0.79**	0.12
Presence of anxiety		
9. Frightened	0.15	**0.86**
12. Nervous	0.13	**0.85**
17. Worried	0.35	**0.60**

No significant differences were found in the level of anxiety according to the response format used ($p = 0.65$).

Discussion

The results obtained have shown that the short version of the STAI-state has good metric properties in respiratory patients in hospital units.

Although none of the scales (original or short) has floor or ceiling effects, it is striking that the floor or ceiling effect appears in all items. Close to one-third of the patients (n = 103) choose the most extreme option (very much so) in the items that indicate absence of anxiety (I feel calm, at ease, comfortable, pleasant.). On the other hand, approximately half of the patients (n = 103) choose as a response option the other extreme of the scale (not at all) for items that indicate presence of anxiety (I feel frightened, nervous, worried.).

We believe that this tendency to answer the extreme options of the response scale may be due to three possible reasons:

1. The patient truly feels safe and protected in the hospital[29] and/or has become adapted to the setting.[30]
2. The patient responds according to what he/she thinks the interviewer expects (Rosenthal effect)[31] as the interviewer is, after all, the patient's nurse and is responsible for the patient's care.
3. The effect of certain drugs (anxiolytics, antidepressants, beta-blockers, etc.) on the nervous system of the patient, which has not been evaluated in this study.

The 20-item scale has obtained α values similar to those reported in other populations.[24,25,32] The 7-item scale has obtained high internal consistency values, although lower than those of the original scale, which could be explained by the reduction of the items. These values are similar to those obtained in students[24] and in patients with IMV.[25]

The correlations of each item with the total of the scale are high in all cases, therefore all the items can form part of the scale. The differences between the correlation values of items 1 and 17 are

irrelevant in statistical terms; therefore, both are pertinent for forming part of the scale. When one of the items was eliminated, the corrected α remained above the recommended standards (> 0.70).[33] Thus, the substitution of item 1 for 17 or vice-versa would maintain an acceptable internal consistency in the scale.

The short scale correlates positively with the original. This evidence of converging validity responds to the expected relationships between both, although similar studies have found somewhat higher correlations.[24,25] Maintaining a high correlation with an internationally-standardized scale like STAI-state[20] means the scale can be used with assurance. More evidence for validity is the high correlation found between the short scale and those same 7 items extracted from the complete scale.

The factorial analysis of the scale extracted 2 factors that explained more than 65% of the variance, in agreement with the model obtained by Chlan.[25] When interpreting the factors, and given that they are all measuring the same feature (anxiety), we observe a systematic variance due to the method: the items that indicate absence of anxiety constitute the first factor and those that indicate presence of anxiety make up the second factor.

The behaviour of item 1 (I feel calm.) should be noted, as it saturates equally in both factors when it should saturate high in factor 1 (absence of anxiety). This behavior leads one to believe that this item does not work well. Furthermore, as the final objective of the study is to create a reduced scale that is less cumbersome and is equivalent to the original 20-item tool, it is good for it to stay true to the subjacent factorial structure (same number of items of presence of anxiety as absence of anxiety). Therefore, we believe that it would be most pertinent to suppress item 1 and maintain 17; in other words, use the same items as Chlan[25] in order to continue to maintain a balanced scale with three positive and three negative items.

As in other studies,[21,34] most of the patients preferred to be helped by the interviewer in order to answer the questionnaire, but the method of response did not influence the level of anxiety of the patients.

Among the limitations of the study, we should highlight the effect of order produced in the administration of the short scale before the long, which could have increased the correlation between the scales.

The results obtained allows us to conclude that the short version of the STAI-state by Spielberger of 6 items, developed by Chlan,[25] shows good metric properties in hospitalized respiratory patients.

To complete the analysis of the metric properties of the scale, it would be recommendable to examine other quality criteria of health questionnaires[28,35]: the sensitivity to change and the interpretability, both aspects being quite relevant for the clinical use of the questionnaire, which would provide the health-care professional with the information necessary for its use and interpretation .

Another aspect of special interest would be to analyze the behavior of the short scale in different respiratory patient samples and in different contexts, examining different clinical variables that could influence the state of anxiety of the patient. This would provide more evidence of the validity of the scale.

Conflict of Interest

The authors declare having no conflict of interest.

Acknowledgements

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