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Factorial validity of the Spanish version of the Geriatric Anxiety Inventory (GAI): Empirical analysis of its structure and dimensions

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Abstract: The Geriatric Anxiety Inventory (GAI) is a 20-item questionnaire designed to assess anxiety in older adults. The main objective of this study was to assess the internal consistency and the psychometric properties of the Spanish version of the GAI. Its factorial structure was examined and compared with previous studies. In a sample of 652 non-clinical older adults from Castilla-La-Mancha (Spain), exploratory and confirmatory factor analyses were performed. The obtained results showed that the GAI presents adequate psychometric properties to identify geriatric anxiety (Cronbach's alpha = 0.83). The three factor-structure explaining 43.32% of variance was confirmed. These findings are consistent with previous studies that sustain the three-factor structure (cognitive, arousal, and somatic dimensions). Some implications and future lines of research are discussed.

Keywords: Geriatric Anxiety Inventory; GAI; older adult; anxiety; confirmatory factor analysis.

Validez factorial de la versión española del Inventario de Ansiedad Geriátrica (GAI): Análisis empírico de su estructura y dimensiones

Resumen: El Inventario de Ansiedad Geriátrica (GAI) es un cuestionario de 20 ítems diseñado para evaluar la ansiedad en población de edad avanzada. El objetivo principal de este estudio fue la evaluación de la consistencia interna y las propiedades psicométricas de la versión española del GAI. Se examinó su estructura factorial y se comparó con estudios anteriores. Se efectuó análisis factorial exploratorio y confirmatorio del instrumento empleando una muestra de 652 participantes de Castilla-La-Mancha (España). Los resultados obtenidos mostraron que el GAI presenta propiedades psicométricas adecuadas para identificar la ansiedad geriátrica (alfa de Cronbach = 0.83). Se confirmó la estructura de tres factores que explicaron el 43.32% de la varianza. Estos resultados son consistentes con estudios anteriores que sostienen la estructura de tres factores (dimensión cognitiva, dimensión de activación y la dimensión somática). Se presentan algunas implicaciones y futuras líneas de investigación.

Palabras clave: Inventario de Ansiedad Geriátrica; GAI; personas mayores; ansiedad; análisis factorial confirmatorio.

Introduction

Anxiety is one of the most common psychiatric problems experienced by older people, and still remains poorly studied in terms of assessment and treatment strategies (Pachana & Byrne, 2012; Nolla, Queral, & Miró, 2014; Sahranavard & Hassan, 2015). Research demonstrates that anxiety disorders are among the most prevalent psychiatric disorders in late life (Therrien & Hunsley, 2014; Wuthrich & Frei, 2015). Psychological assessment of older adults is a challenging issue due to the frequent comorbidity of mental and physical health problems, age-related sensory and cognitive deficits, and the presence of multiple medications and medication interactions (Dismuke & Egede, 2015; Gupta, Ingh, & Grawal, 2014; Sales et al, 2015; Wabnitz, Martens, & Neuner, 2016). There are a great number of instruments dedicated to detect anxiety symptoms, and one of them is the Geriatric Anxiety Inventory (GAI). This instrument was designed and developed to be easily adminis-

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tered to older adults in a variety of settings, including clinical and non clinical contexts. The original version of the GAI was developed in English and has been translated and validated in multiple languages, one of them Spanish. The Spanish version of the GAI was translated and validated by Márquez-González et al (2012).

Several researches have studied the psychometric properties of the GAI, including Márquez-González, Losada, Fernández-Fernández, & Pachana (2012), Gerolimatos, Gregg, & Edelstein (2013), Massena, Bom de Araújo, Pachana, & Camozzato de Pádua (2014), Yan, Xin, Wang, & Tang (2014), Gould, Segal, Yochim, Pachana, Byrne & Beaudreau (2014), Ball, Lipsius, & Escobar (2015), and Guan (2016). In general, they found that the GAI presents good psychometric properties such as internal consistency indexes (Cronbach's α) ranging from 0.91 to 0.93 among healthy community-dwelling older adults and in the psycho-geriatric sample, respectively. In support of its convergent validity, significant correlations with other measures assessing anxiety were also obtained in different studies (Byrne et al., 2010; Pachana et al., 2007). Regarding the GAI factorial analysis, there is no consensus on the dimensionality of this instrument. Byrne and Pachana (2011) describe the GAI as being an unidimensional scale, although they do not present any factor analysis data. Diefenbach, Bragdon, & Blank (2014) found acceptable psychometric properties of the Geriatric Anxiety Inventory in a sample of patients with cognitive impairment, and obtained a four-factor structure. In the same context, Johnco, Knight, Tadic, and Wuthrich (2015) suggested a one-factor solution for both the GAI and its short-form (GAI-SF) after using a clinical and non-clinical sample of older adults. In their work, Márquez-González et al. (2012) and Guan (2016) obtained a factorial structure of three factors with eigenvalues higher than 1.0 (cognitive symptoms, physiological activation and somatic symptoms). In the case of the study of Márquez-Gonzalez et al, (2012), those three factors explained 50.11% of the variance.

Therefore, despite of its acceptable psychometric properties, the factorial structure of the GAI is still unclear,. Some authors suggest a one-factor solution while other researchers find other factorial structures. In their study, Diefenbach et al. (2014) concluded that further exploratory and confirmatory factor analyses of the GAI are needed to clarify findings from previous studies in relation to the factor structure of this instrument. Therefore, the purposes of this study are two-hold: (a) to re-assess the internal consistency of the GAI scale; (b) to examine the factorial structure of the Spanish version of the GAI in order to analyze previous findings on the dimensional structure of the GAI in a non-clinical sample of older adults. Therefore, it is hypothesized that the three factor structure will be the structure that best fits the data.

Method

Participants

The sample of the study consisted of 652 participants: 398 female (61%) and 254 male (39%). They had a mean age of 67.64 (SD = 9.32, range = 60 to 89 years). The majority of them lived in couple or were married (48%), and 25% were widowed. At least, 17% of participants were single or never married. Most of them (65%) confirmed that they had a secondary school qualification or a professional (or technical) qualification. Only 22% of participants held some university degree. The majority of participants stated that their pension or income was appropriate for their standard of living: only 12% perceived they did not have enough income. Most of participants (88%) perceived they have good health.

Instruments

To reach the objectives of this study, we used the Spanish version of the Geriatric Anxiety Inventory (GAI; Márquez-González et al., 2012; Pachana, Byrne, Siddle, Koloski, Harley, & Arnold, 2007). The GAI is a self-report measure specifically designed to be used with older adults. This instrument was designed to measure common symptoms of anxiety in older adults. The 20-item GAI is rated as 1 ("agree") or 2 ("disagree"). Sample items included *"I often cannot enjoy things"*, *"I always anticipate the worst will happen", "I often feel like butterflies in my stomach"*, etc. The internal consistency (Cronbach's alpha) of the Spanish version of the GAI is: 0.91 (total scale), 0.89 (cognitive factor), and 0.72 (somatic factor) (Márquez-González et al., 2012).

Procedure

Participants were recruited from cultural and social centers in Castilla-La-Mancha (Spain) where they attended weekly activities related to active aging programs (focused on several activities such us painting, literature, use of technology, exercises to improve the mind and brainpower, etc.). In order to take part in this study, participants were required to be aged 60 years and over, and not to have significant cognitive impairment nor significant illness likely to cause death within the next six months. Of the 965 participants that ful-

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filled the criteria and attended weekly activities of active aging, 652 responded and completed the questionnaire (68% of response rate). Prior to completion of the questionnaire, participants were briefed on the purpose of this study. They were informed that their participation was voluntary and that their information would be keep confidential. All participants provided their consent and freely agreed to participate in the study. Two trained psychologists conducted field research protocol. First, they leaded structured interviews about socio-demographic data and clinical health status previous administration of the instrument. Second, they invited the participants to complete the GAI: it was self-administered under the supervision of psychologists. The average time for the questionnaire completion was about 15 minutes (from 10 to 25 minutes). This research was approved by the ethics committee of the first author's institution.

Results

To determine whether the GAI has adequate reliability as reported in previous studies, its internal consistency was calculated with especial focus on Cronbach's alpha coefficient. Besides, exploratory and confirmatory factor analyses were performed to assess it's factorial structure. As the first step, the internal consistency of the GAI scale was performed analyzing the statistics for each of the items in order to take an appropriate decision on items' retention or deletion.

Table 1 displays means, variance, corrected item-total correlation and Cronbach's alpha if item is deleted. In general, results denote adequate internal consistency of the GAI (global Cronbach's alpha = 0.83). The correlations between scores of each of the dimensions and the total scale ranged from 0.66 to 0.87. The correlations item-test between variables were higher than 0.20. This indicates that the items remain largely in relationship together. Therefore, it is worthy to underline that no item was eliminated from the whole scale based on the information obtained from item-total statistics.

Prior to factorial analysis, and following the recommendations of Dziuban and Shirkey (1974), the psychometric adequacy of the items was explored. The Bartlett test of sphericity indicated that the items were dependent ($p < .0001$), while the rate of sample adequacy Kaiser-Meyer-Olkin (Kaiser, 1970) was above 0.65 (value of reference $KMO = 0.90$). Therefore, the data confirmed a good sampling adequacy and appropriateness correlation between items. This means that the data is suitable for the factor analysis. To extract the number of factors, the method of principal components analysis with varimax rotation was used. The exploratory factor analysis displayed three factors with eigenvalue greater than 1. Then, our analysis focused on those factors in order to study the degree of fit taking into account the three-factor model provided by previous studies.

Table 2 shows the results of the exploratory factor analysis. The three factors together explained 43.32% of the total variance: 24.4% for Factor I (cognitive symptoms), and 11.91% and 7.01, for Factor II (arousal-related symptoms) and Factor III (somatic symptoms), respectively. The Factor I (cognitive symptoms) was composed of all items related to "cognitive symptoms". The Factor II (arousal-related symptoms) was composed by the 5 items defined as "arousal-related symptoms". However, Items 4 and 20 saturated also in factor III with 0.43 and 0.52 respectively. Factor III was composed by items of the "somatic symptoms" dimension with 4 items. Correlations among the three factors were 0.78 (between cognitive and arousal-related symptoms), 0.91 (between cognitive and somatic symptoms), and 0.86 (between somatic and arousal-related symptoms).

A confirmatory factor analysis was performed in order to test: (1) the three-factor structure obtained in this study; some items saturated in more than one factor (i.e., items 4 and 20), thus it is important to test whether the data fits an hypothesized measurement model of three factors; (2) the fit of the dimensional model suggested by previous studies (Byrne & Pachana, 2010; Ball et al., 2015).

The data was examined with confirmatory factor analyses using LISREL 9 structural equation model (Hoyle, 2012; Kline, 2015) and following the recommendations about the structural equation modeling (Weston & Gore, 2006). Model fit was evaluated starting from: (a) the one factor model (M1), which assumes that all GAI items load on one single and unique factor; (b) the two-factor orthogonal model (M2), in which the cognitive symptoms items constitute the first factor and arousal-related symptoms and somatic symptoms items cluster into one factor which is the second component; (c) a oblique two-factor (M3), in which the two factors of M2 are assumed to be correlated; (d) an orthogonal three-factor model (M4) in which the three factors are assumed to be independent; (e) an oblique three-factor model (M5), in which the three factors are assumed to be correlated. As Table 3 shows, the measures of goodness of fit for the oblique factorial solutions (M3 and M5) were superior to those obtained for the orthogonal factorial solutions (M2 and M4), and for one-factor solution (M1). The values of AGFI in the three-factor oblique model were higher and superior to 0.90 than those ob-

Table 1. Analysis of the internal consistency of the Spanish version of the GAI

Dimensions	Mean	*SD*	Corrected item-total correlation	Cronbach's alpha if item is deleted
COGNITIVE				
Item 1. I worry a lot of time *(Me paso mucho tiempo preocupado)*	1.40	.59	.39	.77
Item 2. I find difficult to make a decision *(Me resulta difícil tomar una decisión)*	1.32	.46	.41	.75
Item 3. I often feel jumpy *(A menudo me siento asustadizo)*	1.3	.58	.38	.67
Item 5. I often cannot enjoy things *(A menudo no puedo disfrutar de las cosas debido a mis preocupaciones)*	1.26	.53	.47	.70
Item 8. I think of myself as a worrier *(Me considero una persona preocupadiza)*	1.23	.42	.39	.68
Item 9. I cannot help worrying about even trivial things *(No puedo evitar preocuparme por cosas triviales)*	1.17	.37	.37	.68
Item 11. My own thoughts make me anxious *(Mis propios pensamientos me hacen sentir ansioso)*	1.23	.42	.43	.69
Item 14. I always anticipate the worst will happen *(Siempre anticipo que ocurrirá lo peor)*	1.48	.50	.57	.72
Item 16. I think my worries interfere with my life *(Creo que mis preocupaciones interfieren en mi vida)*	1.18	.48	.51	.67
Item 17. My worries often overwhelm me *(Mis preocupaciones me sobrepasan con frecuencia)*	1.32	.46	45	.68
Item 19. I miss out on things *(Me pierdo cosas porque me preocupo mucho)*	1.26	.57	.49	.72
Total Cronbach Cognitive Dimension .87				
AROUSAL				
Item 4. I find hard to relax *(Me resulta difícil relajarme)*	1.10	.30	.42	.63
Item 6. Little things bother me a lot *(Las pequeñas cosas me molestan mucho)*	1.34	.47	.39	.65
Item 10. I often feel nervous *(A menudo me siento nervioso)*	1.22	.41	.66	.64
Item 13. I think of myself as nervous person *(Me considero una persona nerviosa)*	1.23	.42	.46	.63
Item 20. I often feel upset *(A menudo me siento alterado)*	1.31	.46	.37	.66
Total Cronbach Arousal Dimension .68				
SOMATIC				
Item 7. I often feel like butterflies in my stomach *(A menudo siento hormigueo en mi estómago)*	1.45	.50	.43	.62
Item 12. I get an upset stomach due to my worrying *(Tengo molestias de estómago debido a mis preocupaciones)*	1.38	.48	.41	.62
Item 15. I often feel shaky inside *(A menudo me siento tembloroso)*	1.40	.49	.45	.64
Item 18. I sometimes feel a great knot in stomach *(Algunas veces siento un gran nudo en mi estómago)*	1.28	.45	.34	.57
Total Cronbach Somatic Dimension .67				
Total Cronbach of the Scale .83				

tained in three-factor orthogonal model. The RMR and RMSEA showed adequate fit in case of the three-factor oblique model. The chi-square value (χ^2), in this context, represents conceptually the difference between the observed covariance matrix and the predicted or model covariance matrix (Hooper, Coughlan, & Mullen, 2008). In all comparison models the difference in χ^2 was significant and the χ^2/df ratio is higher than 3; this indicates

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Table 2. Factor loading of the GAI items. Principal component analysis

	Factors		
	Factor I (Cognitive)	Factor II (Arousal)	Factor III (Somatic)
Item 1. I worry a lot of time (*Me paso mucho tiempo preocupado)*	.61		
Item 2. I find difficult to make a decision *(Me resulta difícil tomar una decisión)*	.72		
Item 3. I often feel jumpy *(A menudo me siento asustadizo)*	.54		
Item 5. I often cannot enjoy things *(A menudo no puedo disfrutar de las cosas debido a mis preocupaciones)*	.67		
Item 8. I think of myself as a worrier *(Me considero una persona preocupadiza)*	.48		
Item 9. I cannot help worrying about even trivial things *(No puedo evitar preocuparme por cosas triviales)*	.42		
Item 11. My own thoughts make me anxious *(Mis propios pensamientos me hacen sentir ansioso)*	.46		
Item 14. I always anticipate the worst will happen *(Siempre anticipo que ocurrirá lo peor)*	.63		
Item 16. I think my worries interfere with my life *(Creo que mis preocupaciones interfieren en mi vida)*	.45		
Item 17. My worries often overwhelm me *(Mis preocupaciones me sobrepasan con frecuencia)*	.58		
Item 19. I miss out on things *(Me pierdo cosas porque me preocupo mucho)*	.47		
Item 4. I find hard to relax *(Me resulta difícil relajarme)*		.61	*.43*
Item 6. Little things bother me a lot *(Las pequeñas cosas me molestan mucho)*		.67	
Item 10. I often feel nervous *(A menudo me siento nervioso)*		.68	
Item 13. I think of myself as nervous person *(Me considero una persona nerviosa)*		.59	
Item 20. I often feel upset *(A menudo me siento alterado)*		.45	*.52*
Item 7. I often feel like butterflies in my stomach *(A menudo siento hormigueo en mi estómago)*			.54
Item 12 . I get an upset stomach due to my worrying *(Tengo molestias de estómago debido a mis preocupaciones)*			.46
Item 15. I often feel shaky inside *(A menudo me siento tembloroso)*			.64
Item 18. I sometimes feel a great knot in stomach *(Algunas veces siento un gran nudo en mi estómago)*			.41
% of explained variance	24.40	11.91	7.01

Table 3. Confirmatory factor analysis of the GAI

20-item models (n = 652)	χ^2	df	χ^2/df	CFI	AGFI	RMR	RMSEA
One-factor (M1)	1614.15*	192	8.40	.59	.69	.13	.11
Two-factor orthogonal (M2)	1334.33*	187	7.13	.68	.65	.09	.10
Two-factor oblique (M3)	796.67*	185	4.31	.85	.87	.06	.05
Three-factor orthogonal (M4)	1142.61*	174	6.56	.75	.72	.11	.09
Three-factor oblique (M5)	627.18*	172	3.64	.91	.93	.04	.03

Note. AGFI = Adjusted Goodness Fit Index; CFI = Comparative Fit Index; GFI = Goodness Fit Index; RMR = Root Mean Square Residual; RMSEA = Root Mean Square Error of Approximation; *$p < .001$.

that this index of oblique solutions fitted the model significantly better than the orthogonal solutions. Therefore, the confirmatory factor analysis confirms the hypothesized 20-item model is consistent with the original GAI scale; the three-factor oblique model (M5) fits the data in this study.

Discussion

The purpose of this study was to re-examine the psychometric properties of the Spanish version of the Geriatric Anxiety Inventory (GAI) and to study it's factorial structure since there is not a consensus on the unidimensionality of this instrument. Previous studies provide contradictory results: one-factor structure (Byrne & Pachana, 2010; Johnco et al., 2015), three-factor structure (Márquez-González et al., 2012; Guan, 2016), and four-factor structure (Diefenbach et al., 2014).

First, our analyses confirm that the Spanish version of GAI presents adequate psychometric properties. Our findings are consistent with previous studies (Pachana et al., 2007; Pachana & Byrne, 2012; Gerolimatos et al., 2013; Guan, 2016). The correlations item-test ranched between 0.37 and 0.66, and Cronbach's alpha (*if the item is deleted*) of all items are superior to 0.40. Besides, the overall Cronbach's alpha of the scale was 0.83. This data suggests adequate internal consistency and leads to confirm that the GAI is a good instrument to assess anxiety symptoms. This is consistent with previous research (Diefenbach et al., 2014; Márquez-González et al., 2012; Pacheco et al., 2007; Ball et al., 2015; Guan, 2016) that demonstrated the psychometric appropriateness of the GAI for the assessment of anxiety symptoms.

Second, the findings of this study provide empirical support for the factorial structure of the GAI that consists of three factors: cognitive symptoms, arousal-related symptoms, and somatic symptoms. All the three dimensions of the GAI explained 43.32% of the total variance in which cognitive symptoms represent more than 24% of the explained variance. The percentage of variance explained by the three dimensions obtained in other studies ranges between 40% and 59% (Márquez-Gónzalez et al, 2012; Guan, 2016). This three-factor structure of the GAI was confirmed using all 20 items of the scale. The three-factor model fit well the data for our sample, suggesting that cognitive, arousal, and somatic symptoms constitute three related but separated dimensions of the GAI. The three-factor structure obtained in our findings is consistent with previous findings (Márquez-González et al., 2012). In general, the results of exploratory factor analysis showed that the first factor (Factor I) gathers items that measure cognitive symptoms; the second factor (Factor II) gets together items related to arousal-related symptoms, and the items that measure somatic symptoms are clustered around a third factor (Factor III). Nevertheless, there are two items (item 4 and item 20) that deserve comments in relation to their double saturation. One of the main psychometric weaknesses afflicting the GAI questionnaire is the factorial ambiguity of certain items. In this study, Item 4 (*"I find hard to relax"*) shows saturation in two factors: factor II (0.61) and factor III (0.43); the item 20 (*"I am often upset"*) has a factorial loading of 0.44 in factor II, but also shows higher factorial load in factor III (0.52).

Confirmatory factor analysis (CFA) indicated a good fit for the 20-item GAI; this points out that the GAI-20 is a well-fitting dimensional scale that measures three dimensions: cognitive, arousal-related and somatic symptoms. These findings are consistent with previous research in which CFA results clearly support the notion that the GAI is best defined by three distinct but inter-correlated dimensions. Consequently, our results did not confirm some previous studies that support a one single factor structure (Byrne & Pachana, 2010; Johnco et al, 2015), nor a four-factor structure (Diefenbach, Bragdon & Blank, 2014). In this context, our findings coincide with Márquez-González et al. (2012) and Guan (2016) who found a three-factor structure of the GAI.

However, our results show double saturation of Item 4 and Item 20. Despite of their double saturation, the results of our confirmatory factor analysis do not recommend to delete them. This double saturation might be attributed to the overall weakness of the GAI as an instrument to evaluate anxiety. The different factorial structures found in previous studies of the GAI scale and the double saturation of some variables could be due to the dichotomy format and to the sensibility of the scale to the sample size used. Dichotomization of item answers ease the presentation of results and produces meaningful findings that are easily understandable to a wide audience. However, one of the main inconvenient of dichotomous items is that information is lost and leads to a decrease in the measured strength of associations between variables (Farrington & Loeber, 2000). In case of the GAI, the dichotomous answer (agree and disagree) is mostly appropriate for people with some cognitive impairment and other limitations. Although the agree/disagree format of the GAI may help to increase its ease of use among older adults, it also limits the ability of users to indicate gradations of anxiety when responding to items (Yochim, et al., 2011). This might limit the GAI application in other old adults' population. A design of another version of the GAI with the Likert scale format is encouraged for certain groups of older adults (specifically, for older people without significant mental problems). Previous experiences in scales elaboration show that the change of an original yes/no or agree/disagree scale into a Likert-type scale improves the features and psychometrics properties of the scale or test (Muñiz, García-Cueto & Lozano, 2005).

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Despite of our interesting findings, certain limitations should be taken into consideration when interpreting the results of this study. First, the sample was composed of non-clinical older adults that had been recruited using a convenience sampling of participants attending active aging programs. Future researches should continue to test the properties of this instrument in clinical and non-clinical samples of older adults. Second, it seems that the GAI is an instrument sensitive to sample size. In this study, the sample included more than six hundred participants and a three-factor structure has been found. It would be interesting to replicate this study using a similar sample or increasing the number of participants in order to get more information about the features of the GAI, particularly in relation to its dimensional structure. Replication of those findings in independent studies using large numbers of clinical and non-clinical participants is needed.

Despite of above-mentioned limitations, this research has made a significant contribution to our understanding of the dimensional structure of the GAI (and its psychometric properties) as instrument that assesses anxiety in older adults.

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