

Confirmatory factor analysis of the brief Spanish Zung Self-Rating Depression Scale in patients with chronic pulmonary obstructive disease

Adalberto Campo-Arias MD, MSc  | Hillary Leticia Pinto-Vásquez |
John Carlos Pedrozo-Pupo MD, FCCP

Programa de Medicina, Facultad de Ciencias de la Salud, Universidad del Magdalena, Santa Marta, Colombia

Correspondence

Adalberto Campo-Arias, Universidad del Magdalena, Carrera 32 No. 22-08, Santa Marta 470004, Colombia.
Email: acampo@unimagdalena.edu.co

Funding information

Universidad del Magdalena,
Grant/Award Number: The Research Vice-rectory through Resolution 0516 of August 9th, 2019

Abstract

Purpose: To corroborate the factor structure of the brief Spanish Zung Self-Rating Depression Scale among patients with chronic pulmonary obstructive disease at Santa Marta, Colombia.

Design and Methods: A psychometric study was done in which 409 patients with the chronic obstructive pulmonary disease were included, aged between 40 and 102 years. Participants completed the 10 items on the brief Spanish Zung Self-Rating Depression Scale. Confirmatory factor analysis was performed.

Findings: The two-dimensional structure was confirmed. The goodness of fit indicators was acceptable.

Practical Implication: The brief Spanish Zung scale for depression has a clear two-dimensional structure for evaluating depressive symptoms in patients with chronic obstructive pulmonary disease. New studies should prove this dimensionality in patients with other clinical conditions.

KEYWORDS

assessment, depression rating scale, depressive symptoms, psychiatry, psychometrics

1 | INTRODUCTION

Chronic obstructive pulmonary disease (COPD) is characterized by dyspnea, cough, and expectoration, secondary to reduced airflow and inflammation of the airways, and a chronic course, with remissions and exacerbations.¹ Therefore, depressive symptoms and disorders are frequent in patients with COPD.²⁻⁴ Furthermore, recently, the CODEXS was introduced, a multidimensional index to predict exacerbations in chronic obstructive pulmonary disease that includes the score on depressive symptoms.⁵

CODEX is an acronym for comorbidity, airflow obstruction, dyspnea, and previous severe exacerbations.⁶ Moreover, CODEXS added the measurement with the Self-Rating Depression Scale.⁵ The Self-Rating Depression Scale was published without an extensive statistical psychometric analysis; the scale explores affective,

cognitive, and somatic symptoms of a major depressive episode during the last 15 days. The 20 items have an ordinal response pattern of four options response.⁷ However, in the last two decades, it has been observed that the scales show strong and reliable performances with a lower number of items,⁸ and the advantage that this implies a shorter completion time and qualify in health services with little personnel and limited time for a comprehensive evaluation of patients.⁹

Consequently, in Spanish, the Self-Rating Depression Scale was refined into a shorter version of 10 items, the Brief Spanish Zung Self-Rating Depression Scale. The brief version showed similar psychometric and clinimetric performance in the exploratory factor analysis, an acceptable one-dimensional structure with high internal consistency Cronbach's alpha of 0.80. Besides, it was observed that the scale compared with a structured clinical interview, for a cutoff

point of 20/40, showed a sensitivity of 95.5%, a specificity of 70.3%, a positive predictive value of 38.9%, a value negative predictive of 98.7%, positive probability ratio of 3.2, negative probability ratio of 0.07, Cohen's kappa of 0.42, and area under the curve of 0.90; similar to the original 20-item version.¹⁰ Therefore, the Brief Spanish Zung Self-Rating Depression Scale has been used to quantify depressive symptoms in other studies in Latin America.¹¹⁻¹⁵

However, few studies have performed confirmatory factor analysis for the Brief Spanish Zung Self-Rating Depression Scale. A single study in which 206 adults dedicated to recycling the urban waste in Cartagena, Colombia, participated. It was observed that the data adjusted better for a two-dimensional structure, with a high internal consistency of each dimension goodness of fit indicators of the model were unsatisfactory.¹⁶ In the present investigation, the confirmatory factor analysis for the Brief Spanish Zung Self-Rating Depression Scale is carried out in patients with COPD, given the need to corroborate the instruments' psychometric performance in different populations.^{17,18} Excellent performance would justify the inclusion of this short version in the routine evaluation proposed in the CODEXS index to predict exacerbations among COPD in- and -outpatients.⁵

The current study's objective was to test the dimensionality of the Brief Spanish Zung Self-Rating Depression Scale in COPD outpatients at Santa Marta, Colombia.

2 | METHODS

2.1 | Design and ethical considerations

A psychometric study was designed, with data from a cross-sectional study endorsed by the Research Ethics Boards of the University of Magdalena, Santa Marta, Colombia. According to the recommendations of the Colombian regulations and the Declaration of Helsinki,¹⁹ participants signed informed consent.

2.2 | Participants

Four hundred and nine patients between 40 and 102 participated in, mean 73.0 (*SD* = 10.2). More details of demographic and clinical characteristics are presented in Table 1. The sample was taken from patients who consulted consecutively, between August 1st and December 13th, 2019, at three outpatient care institutions in Santa Marta, Colombia. Pregnant women and patients with cognitive impairment that limited completion of the scale for and depression were excluded.

2.3 | Brief Zung scale for depression

The Zung Brief Depression Scale is a self-administered instrument that takes 5–15 min. This scale is made up of ten items that explore

TABLE 1 Demographic description of the participants

Variable	<i>n</i>	%
Gender		
Female	169	41.3
Male	240	58.7
Marital status		
Married and free union	363	88.8
Single, separated, and widows	46	11.2
Socioeconomic level (Colombia)		
I	114	27.9
II	80	19.6
III	107	26.2
IV	58	14.2
V	18	4.4
VI	32	7.8
Cigarette smoking history		
Yes	355	86.8
No	54	13.2
GOLD		
1	29	7.1
2	198	48.4
3	136	33.3
4	46	11.2
Combined evaluation		
A	81	19.8
B	237	57.9
C	19	4.6
D	72	17.6

depressive symptoms during the most recent 2 weeks. The scale presents ordinal responses with four response options; these are never, sometimes, often, or always scored from one to four; consequently, the total score can be between 10 and 40.⁷

2.4 | Statistical analysis

Each item's description was carried out by calculating the mean, standard deviation, and corrected correlation between the item and the total score. Cronbach's alpha was also computed for the global scale, identified dimensions, and scale with each item's omission.²⁰ Besides, the McDonald's omega was a more robust statistic of internal consistency when the assumption of tau equivalence necessary for the calculation of Cronbach's alpha is violated.²¹

TABLE 2 Mean, standard deviation, correlated correlation with the total score, and Cronbach's alpha with the item's omission

Item	Mean	SD	ITCC ^a	CAOI ^b
1. Down-hearted and blue	1.65	0.88	0.61	0.74
2. Crying	1.55	0.83	0.47	0.76
3. Heartbeats	1.52	0.77	0.46	0.76
4. Tired	1.98	1.04	0.44	0.76
5. Clear mind	1.61	0.93	0.37	0.77
6. Easy to do things	2.10	1.09	0.36	0.77
7. Restless	1.86	0.98	0.48	0.75
8. Irritable	1.60	0.83	0.49	0.75
9. Enjoy things	1.75	1.05	0.42	0.76
10. Pretty full life	1.36	0.77	0.40	0.76

^aCorrected correlation between item score and total.

^bCronbach's alpha with the omission of the item.

Confirmatory factor analysis was carried out using the maximum likelihood method. The goodness of fit indicators was computed: χ^2 , degrees of freedom, and probability (the relationship between χ^2 /degrees of freedom), root mean square error of approximation (RMSEA), and 90% confidence interval (90% CI) were calculated, Comparative Fit Index (CFI), Tucker–Lewis Index (TLI), and the standardized mean square residual (SMSR). For the χ^2 , the probability is expected to be higher than 0.05; χ^2 /degrees of freedom relationship, a value less than 3, for RMSEA and SMSR that are around 0.06; and for CFI and TLI values greater than 0.89.²² The analysis was completed in the IBM-SPSS program, version 23.0.²³

3 | RESULTS

3.1 | Description of the items

Item means were between 1.36 and 2.10; standard deviations between 0.77 and 1.09; and the corrected correlations between items; and total score were found between 0.36 and 0.61. More details are presented in Table 2. The total score for the scale showed a mean of 16.98 and a standard deviation of 5.33.

3.2 | Internal consistency

Cronbach's alpha with the omission of the item was between 0.74 and 0.77. See Table 2. The first factor showed Cronbach's alpha of 0.77 and McDonald's omega of 0.78, and the second factor showed Cronbach's alpha of 0.61 and McDonald's omega of 0.62. The global scale showed Cronbach's alpha and McDonald's omega of 0.78.

TABLE 3 Community and coefficient for the items of the brief Zung scale for depression

Item	Communality	Coefficient	
		I	II
1. Down-hearted and blue	0.698	0.834	
2. Crying	0.449	0.664	
3. Heartbeats	0.271	0.515	
4. Tired	0.260	0.506	
5. Clear mind	0.187		0.419
6. Easy to do things	0.160		0.374
7. Restless	0.301	0.541	
8. Irritable	0.308	0.550	
9. Enjoy things	0.518		0.720
10. Pretty full life	0.398		0.631

3.3 | Factor analyses

In the one-dimensional model of the brief Zung scale for depression, the factor showed an Eigenvalue of 3.45% that explained 34.5% of the variance and unsatisfactory goodness-of-fit indicators χ^2 of 160.29, degrees of freedom 35, and probability value less than 0.001, χ^2 coefficient/degrees of freedom of 4.58, RMSEA of 0.09 (90% CI 0.08–0.11), CFI of 0.85, TLI of 0.81, and SMSR of 0.06. For the two-dimensional model, the first (depressed mood and somatic symptoms) showed an Eigenvalue of 3.45% that explained 34.5% of the variance, and the second (anhedonia and cognition) presented an Eigenvalue of 1.28 and was responsible for 12.8% of the variance. The two factors accounted for 47.3% of the total variance and showed a correlation between 0.49. The commonality and loading for each item are described in Table 3. The goodness of fit indicators were χ^2 of 70.35, degrees of freedom 34, and probability value less than 0.001, χ^2 /degrees of freedom of 2.07, RMSEA of 0.05 (90% CI 0.03–0.07), CFI of 0.96, TLI of 0.94, and SMSR of 0.04.

4 | DISCUSSION

In the present study, the brief Spanish Zung Self-Rating Depression Scale shows a two-dimensional structure in COPD outpatients in Santa Marta, Colombia. There is little research to compare these findings. In the publication presenting the brief Spanish Zung Self-Rating Depression Scale, the one-dimensional structure was preferred based on an exploratory factor analysis that took the minimum Eigenvalue of 1.40. This dimension presented Cronbach's alpha of 0.80, similar to what was observed in the current analysis of the one-dimensional solution of the Brief Spanish Zung Self-Rating Depression Scale.¹⁰ Exploratory factor analysis could be vastly affected by the criteria used for retaining factors.²⁴

On the other hand, Gómez-Bustamante et al.¹⁶ computed a confirmatory factor analysis with a sample of people dedicated to recycling the urban waste in Cartagena, Colombia, and they reported a better performance for the two-dimensional structure of the brief Spanish Zung Self-Rating Depression Scale, both dimensions showed acceptable values of internal consistency; however, the goodness of fit indicators for the model was lower than the expected values: χ^2 of 126.83, degrees of freedom of 34, $\chi^2/\text{degrees of freedom}$ of 3.73, RMSEA of 0.12 90% CI 0.09–0.14, CFI of 0.85, TLI of 0.80, and SMSR of 0.08. Psychometric analysis discrepancies are frequent due to differences in population characteristics and response patterns.^{17,25}

It is necessary to repeatedly test the performance of the screening instruments in different contexts and populations. Often, significant psychometric performance variations are observed that undermine the validity and reliability of the measurement.²⁶ In particular, for a measurement scale such as the Self-Rating Depression Scale that was designed more than 50 years ago based on criteria Diagnostic and Statistical Manual of mental disorders. This first edition has changed over time and did not follow a rigorous process of psychometric evaluation.⁷ Current psychometrics invites the repeated review of measurement instruments to the extent that clinical concepts are modified or redefined over time.²⁶ The brief Spanish Zung Self-Rating Depression Scale keeps its usefulness as a screening instrument since it retains the core symptoms of a major depressive episode present in the most recent version of the Diagnostic and Statistical Manual of the American Psychiatric Association.²⁷

4.1 | Practical issues

Routine screening for depressive disorders in COPD patients is necessary given the high prevalence of these disorders²⁻⁴ and the negative implications on the course of patients' disease and quality of life.²⁸ Chronically ill patients frequently hide depressive symptoms for various reasons, including stigma-discrimination.²⁹ Non-psychiatrist clinicians should bear in mind that depression is present in most COPD patients who engage in self-injurious behaviors.³⁰

4.2 | Strengths and limitations

This analysis is a contribution to the knowledge of the psychometric performance of the brief Spanish Zung Self-Rating Depression Scale in patients with chronic diseases. This finding is important because the 20-item version Zung Self-Rating Depression Scale has shown problems in other samples' dimensional structure.³¹ Furthermore, the routine use of evaluating depressive symptoms was proposed to estimate the risk of exacerbations in patients with COPD.⁵ However, it presents the limitation of psychometric studies that do not allow generalizations to populations with similar characteristics.¹⁷ Furthermore, the performance was not evaluated against a structured interview, which is the most valid strategy for assessing a scale's

usefulness in screening for possible episodes of mental disorders, such as major depressive disorder.³²

5 | CONCLUSION

In conclusion, the brief Spanish Zung Self-Rating Depression Scale has a two-dimensional structure for evaluating depressive symptoms among COPD outpatients. Future research should test this dimensionality in patients with other clinical conditions and test performance against a structured clinical interview.

ACKNOWLEDGMENT

The Research Vice-rectory of the Universidad del Magdalena, which financed the entire project through Resolution 0516 of August 9th, 2019.

CONFLICT OF INTERESTS

The authors declare that there are no conflict of interests.

DATA AVAILABILITY STATEMENT

The data that support the findings of this study are available from the corresponding author upon reasonable request.

ORCID

Adalberto Campo-Arias  <http://orcid.org/0000-0003-2201-7404>

REFERENCES

1. Nici L, Donner C, Wouters E, et al. American thoracic society/European respiratory society statement on pulmonary rehabilitation. *Am J Respir Crit Care Med*. 2006;173(12):1390-1413. <https://doi.org/10.1164/rccm.200508-1211ST>
2. DeJean D, Giacomini M, Vanstone M, Brundisini F. Patient experiences of depression and anxiety with chronic disease: a systematic review and qualitative meta-synthesis. *Ontario Health Tech Assess Ser*. 2013;13(16):1-33.
3. Matte DL, Pizzichini MM, Hoepers AT, et al. Prevalence of depression in COPD: a systematic review and meta-analysis of controlled studies. *Respir Med*. 2016;117:154-161. <https://doi.org/10.1016/j.rmed.2016.06.006>
4. Van Ede L, Yzermans CJ, Brouwer HJ. Prevalence of depression in patients with chronic obstructive pulmonary disease: a systematic review. *Thorax*. 1999;54(8):688-692. <https://doi.org/10.1136/thx.54.8.688>
5. Deng D, Zhou A, Chen P, Shuang Q. CODEXS: a new multi-dimensional index to better predict frequent COPD exacerbators with inclusion of depression score. *Int J Chronic Obstruct Pulm Dis*. 2020;15:249-259. <https://doi.org/10.2147/COPD.S237545>
6. Almagro P, Soriano JB, Cabrera FJ, et al. Short- and medium-term prognosis in patients hospitalized for COPD exacerbation: the CODEX index. *Chest*. 2014;145(5):972-980. <https://doi.org/10.1378/chest.13-1328>
7. Zung WW. A self-rating depression scale. *Arch Gen Psychiatry*. 1965;12(1):63-70. <https://doi.org/10.1001/archpsyc.1965.01720310065008>
8. Stanton JM, Sinar EF, Balzer WK, Smith PC. Issues and strategies for reducing the length of self-report scales. *Pers Psychol*. 2002;55(1):167-194. <https://doi.org/10.1111/j.1744-6570.2002.tb00108.x>

9. Jaju A, Crask MR. The perfect design: optimization between reliability, validity, redundancy in scale items, and response rates. *Am Mark Assoc.* 1999;10:127-131.
10. Campo A, Díaz LA, Rueda GE. Validity of the brief Zung's scale for screening major depressive episode among the general population from Bucaramanga, Colombia. *Biomédica.* 2006;26(3):415-423.
11. Barrientos NU, Salles PG, Milán AS, Meza PC, Juliet RP, Rapoport A. Medication overuse headache and its specific clinical markers. *Headache.* 2016;7(3):64-69.
12. Mejía C, Agudelo S, Perea E. Association between depression and poor academic achievement in university students. *Psicogente.* 2015; 14(25):67-75.
13. Petkova-Gueorguieva M, Paredes-Coz G, Alvarado-Menacho S, Jara-Castro M, Barra-Hinostrza M. Prevalence of depressive symptoms and associated factors in dental students of a Peruvian public university. *Odontol Sanmarquina.* 2015;18(1):7-11. <https://doi.org/10.15381/os.v18i1.11333>
14. Villalobos-Otayza A, Vela-Alfaro FM, Wiegeling-Gianoli D, Robles-Alfaro RA. Level of resilience and depressive symptoms in medical interns in Peru. *Educ Méd.* 2021;22(1):14-19. <https://doi.org/10.1016/j.edumed.2018.12.006>
15. Cassiani CA, Scoppetta O. Factorial structure of the Patient Health Questionnaire-9 as a depression screening instrument for university students in Cartagena, Colombia. *Psychiatry Res.* 2018;269:425-429. <https://doi.org/10.1016/j.psychres.2018.08.071>
16. Gómez-Bustamante E, Cogollo-Milanés Z, Herazo E, Caballero-Domínguez C, Campo-Arias A. Dimensional and internal structure of the Zung' self-rating depression scale in urban recyclable waste pickers. *Duazary.* 2019;16(Suppl 2):1-9. <https://doi.org/10.21676/2389783X.3149>
17. Keszei AP, Novak M, Streiner DL. Introduction to health measurement scales. *J Psychosom Res.* 2010;68(4):319-323. <https://doi.org/10.1016/j.jpsychores.2010.01.006>
18. Smith GT, McCarthy DM, Anderson KG. On the sins of short-form development. *Psychol Assess.* 2000;12(1):102-111. <https://doi.org/10.1037/1040-3590.12.1.102>
19. World Medical Association. *WMA Declaration of Helsinki - Ethical Principles for Medical Research Involving Human Subjects.* The World Medical Association; 2018. <https://www.wma.net/policies-post/wma-declaration-of-helsinki-ethical-principles-for-medical-research-involving-human-subjects/>
20. Cronbach J. Coefficient alpha and the internal structure of tests. *Psychometrika.* 1951;16(3):297-334. <https://doi.org/10.1007/BF02310555>
21. McDonald RP. The theoretical foundations of principal factor analysis, canonical factor analysis, and alpha factor analysis. *Br J Math Stat Psychol.* 1970;23(1):1-21. <https://doi.org/10.1111/j.2044-8317.1970.tb00432.x>
22. Hu LT, Bentler PM. Cutoff criteria for fit indexes in covariance structure analysis: conventional criteria versus new alternatives. *Struct Equ Model.* 1999;6(1):1-55. <https://doi.org/10.1080/10705519909540118>
23. IBM Corp. *IBM SPSS Statistics for Windows, Version 23.0.* Armonk, NY: IBM Corp; 2015.
24. Gorsuch RL. Exploratory factor analysis: Its role in item analysis. *J Pers Assess.* 1997;68(3):532-560. https://doi.org/10.1207/s15327752jpa6803_5
25. Streiner D, Norman G. *Health Measurement Scales: A Practical Guide to Their Development and Use.* 4th edition. Oxford: Oxford University Press; 2008.
26. Reise SP, Waller NG, Comrey AL. Factor analysis and scale revision. *Psychol Assess.* 2000;12(3):287-297. <https://doi.org/10.1037/1040-3590.12.3.287>
27. Fried EI. The 52 symptoms of major depression: lack of content overlap among seven common depression scales. *J Affect Disord.* 2017;208:191-197. <https://doi.org/10.1016/j.jad.2016.10.019>
28. Blakemore A, Dickens C, Guthrie E, et al. Depression and anxiety predict health-related quality of life in chronic obstructive pulmonary disease: systematic review and meta-analysis. *Int J Chronic Obstruct Pulm Dis.* 2014;9:501-512. <https://doi.org/10.2147/COPD.S58136>
29. Coventry PA, Hays R, Dickens C, et al. Talking about depression: a qualitative study of barriers to managing depression in people with long term conditions in primary care. *BMC Fam Pract.* 2011;12(1):10. <https://doi.org/10.1186/1471-2296-12-10>
30. Goodwin RD. Is COPD associated with suicide behavior? *J Psychiatry Res.* 2011;45(9):1269-1271. <https://doi.org/10.1016/j.jpsychires.2011.01.014>
31. Chen, X, Hu W, Hu Y, Xia X, Li X. Discrimination and structural validity evaluation of Zung self-rating depression scale for pregnant women in China. *J Psychosom Obstet Gynecol.* 2020: 2020-2029. <https://doi.org/10.1080/0167482X.2020.1770221>
32. De Vet HC, Terwee CB, Bouter LM. Current challenges in clinimetrics. *J Clin Epidemiol.* 2003;56(12):1137-1141. <https://doi.org/10.1016/j.jclinepi.2003.08.012>

How to cite this article: Campo-Arias A, Pinto-Vásquez HL, Pedrozo-Pupo JC. Confirmatory factor analysis of the brief Spanish Zung Self-Rating Depression Scale in patients with chronic pulmonary obstructive disease. *Perspect Psychiatr Care.* 2021;1-5. <https://doi.org/10.1111/ppc.12868>