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## Primary Care Screening Questionnaire for Depression (PQS4D)'s Dimensionality, Internal Consistency, Nomological Network, and Gender Differential Item Functioning

*Dimensionalidad, consistencia interna, red nomológica y funcionamiento diferencial de ítems según género del Cuestionario de Detección de Depresión en Atención Primaria (CDDAP)*

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## ABSTRACT

**Objective:** To test the dimensionality, internal consistency, nomological network, and gender differential item functioning (Gender-DIF) of the Primary Care Screening Questionnaire for Depression (PSQ4D) among elderly Colombian patients with COPD.

**Material and methods:** A psychometric study was conducted involving 349 COPD outpatients. They were aged between 60 and 98 years ( $M=75.56$ ,  $SD=8.41$ ); 61.9% were male, and 80.2% presented low severity (A or B COPD combined evaluation). The PSQ4D (Spanish version), the Brief Zung's Self-rating Depression Scale (BSDS), the Brief Zung Self-Rating Anxiety Scale (BSAS), the COPD Assessment Test (CAT), and the Frail Non-Disabled [FiND] Screening Tool were completed. Dimensionality (using exploratory and confirmatory factor analysis), internal consistency (Kuder-Richardson coefficient and McDonald's omega), nomological network (Student's t-test and Spearman correlation [ $r_s$ ]), and Gender-DIF (Kendall's tau b correlation [(t)] were evaluated.

**Results:** The PSQ4D presented a one-dimensional structure that accounted for 55.78% of the total variance with adequate goodness-of-fit indicators (normalized chi-square of 2.84, RMSEA of 0.07 [90%CI 0.00-0.15], CFI of 0.99, TLI of 0.96, and SRMR of 0.02), acceptable internal consistency (Kuder-Richardson coefficient of 0.73 and McDonald's omega of 0.74), adequate nomological validity ( $r_s \geq 0.30$  with SDS, SAS, CAT and FiND), and non-Gender-DIF ( $t \leq 0.20$ ).

**Conclusions:** The PSQ4D's one-dimensional structure shows acceptable dimensionality, good reliability, an acceptable nomological network, and no Gender-DIF among Colombian COPD patients. Consequently, establishing the cutoff point with the best sensitivity and specificity using a clinical gold standard in this population is necessary.

**Keywords:** PSQ4D, factor analysis, internal consistency, nomological network, differential item functioning, id, elderly, validation studies.

## RESUMEN

**Objetivo:** Demostrar la dimensionalidad, la consistencia interna, la red nomológica y la relación FDI-género del Cuestionario de Detección de Depresión en Atención Primaria (CDDAP, en inglés, PQS4D) en pacientes adultos mayores colombianos con enfermedad pulmonar obstructiva crónica (EPOC).

**Materiales y métodos:** Se diseñó un estudio psicométrico en el que se incluyeron 349 pacientes ambulatorios con EPOC, con edades entre 60 y 98 años ( $M = 75,56$ ;  $DE = 8,41$ ); el 61,9 % eran hombres y el 80,2 % presentó un deterioro leve (evaluación combinada de EPOC A o B). Se completaron la PSQ4D, la Escala Breve de Zung para Autoevaluación de Depresión (EBZAD), la Escala Breve de

Zung para Autoevaluación de Ansiedad (EBZAA), la Prueba de Evaluación de la EPOC (CAT, en inglés) y la Herramienta de Detección de Fragilidad sin Discapacidad [FiND, del inglés]. Se realizaron la dimensionalidad (análisis factorial exploratorio y confirmatorio), la consistencia interna (coeficiente de Kuder-Richardson y omega de McDonald), la red nomológica (test de Student y correlación de Spearman [rs]) y la FDI-género (correlación tau b de Kendall [t]).

**Resultados:** El PSQ4D presentó una estructura unidimensional que explicó el 55,78 % de la varianza total con un indicador de ajuste de bondad adecuado [chi-cuadrado normalizado de 2,84, RMSEA de 0,07 (IC90 % 0,00-0,15), CFI de 0,99, TLI de 0,96 y SRMR de 0,02], consistencia interna aceptable (coeficiente de Kuder-Richardson de 0,73 y omega de McDonald de 0,74), aceptable validez nomológica ( $r_s \geq 0,30$  con EBZAD, EBZAA, CAT y FiND)], sin FDI-género ( $t \leq 0,20$ ).

Conclusiones: El PSQ4D muestra una estructura dimensional aceptable, buena confiabilidad y una red nomológica aceptable, sin diferencias FDI-género entre pacientes con EPOC colombianos. Es necesario establecer el punto de corte con la mayor sensibilidad y especificidad posible frente a un criterio de referencia clínico.

**Palabras clave:** PQS4D, análisis factorial, consistencia interna, red nomológica, funcionamiento diferencial de ítems, enfermedad pulmonar obstructiva crónica, adultos mayores, estudios de validación.

## INTRODUCTION

Depression is the most common mental disorder in the older population, leading to a negative impact on people's quality of life and the economies of countries due to the lost years of healthy life (1). The prevalence of depression is usually significantly higher in people who face acute and chronic stressors (2). Therefore, the number of cases of depression is high in people with chronic diseases such as chronic obstructive pulmonary disease [COPD] (3, 4). Nonetheless, examination for depressive symptoms is often omitted, and subsequently, the diagnosis of depression among older adults with COPD (5). However, there are instruments for screening cases of depression with acceptable clinimetric performance (6, 7).

About this aspect, Indu et al. (8) recently introduced the Primary Care Screening Questionnaire for Depression (PSQ4D). The PSQ4D is a four-item instrument with a dichotomous response option (yes or no); the doctor can administer it, and it includes the key symptoms for the diagnosis of depression—depressed mood and anhedonia—and two psychosomatic symptoms of the

disorder, such as feelings of fatigue and insomnia. There are associated symptoms included for the diagnosis of a major depressive episode in the International Classification of Diseases (9) and the Diagnostic and Statistical Manual (10). The PSQ4D can be considered an advantageous instrument compared to both shorter instruments for depression with fewer items, because it provides better exploration of the construct, and to longer ones with nine or fifteen items that require more time to administer (11).

In India, the PSQ4D administered by primary care physicians to 827 primary care patients showed a sensitivity of 96%, specificity of 87%, positive predictive value of 74%, negative predictive value of 98%, and Cohen's kappa of 0.72 at a score  $\geq 2$  compared to an interview conducted by a psychiatrist based on ICD-10 criteria. Moreover, the PSQ4D showed a Cronbach's alpha of 0.80 in the entire sample, with similar values across age and gender (7). However, its dimensionality, internal consistency, nomological network, and gender differential item functioning are unknown. It is essential to know these properties of a brief instrument for depression screening because they are indirect indicators of its possible practical usefulness (11). This is particularly relevant in low- and middle-income countries, where there is little financial investment in validation studies using a clinical interview as a reference standard (12). Furthermore, it must be remembered that validating health measurement and screening instruments is a continuous and ongoing process, given that widely divergent findings can emerge across populations and over time (11).

The study aimed to test the dimensionality, internal consistency, nomological network, and gender differential item functioning of the PSQ4D among elderly Colombian COPD patients.

## METHOD

### Design and Participants

A psychometric study was conducted with adult COPD patients aged 60 and older who did not exhibit evident neurocognitive impairment or limitations in completing self-administered questionnaires. Specifically, cognitive impairment was evaluated through an unstructured clinical interview for episodic memory issues and a family member's report of frequent forgetfulness.

The study involved a non-probabilistic sample of 349 patients aged between 60 and 98 ( $M=75.56$ ,  $SD=8.41$ ). Regarding demographics, 61.89% were male participants, 79.37% had high school or

less formal education, 88.57% were married or in a common-law union, 73.92% lived in a low-income neighborhood, and 80.23% had low deterioration (A or B COPD combined evaluation).

## Measurements

**PSQ4D.** The PSQ4D was applied as a self-report rating scale. It includes four items with a dichotomous response pattern that explore mood during the two most recent weeks (using the following Spanish translation):

1. Have you been experiencing sadness or a depressed mood during the last two weeks or longer? (*¿Has estado triste o deprimido durante las dos últimas semanas o durante más tiempo?*).
2. Have you been experiencing loss of interest or loss of pleasure in doing things, during the last two weeks or longer? (*¿Has perdido el interés o el gusto por hacer cosas durante las dos últimas semanas o durante más tiempo?*).
3. Have you been feeling excessively tired or without energy, during the last two weeks or longer? (*¿Te has sentido cansado y sin energía durante las dos últimas semanas o durante más tiempo?*).
4. Have you been suffering from sleeplessness during the last two weeks or longer? (*¿Has tenido insomnio durante las dos últimas semanas o durante más tiempo?*).

In this context, two or more affirmative answers suggest depression risk. Furthermore, the PSQ4D has shown acceptable clinimetric indicators, including a specificity of 0.96 and a sensitivity of 0.87 (7).

**Brief Zung's Self-rating Depression Scale (BSDS).** The BSDS is a ten-item tool that measures depressive symptoms during the most recent month. It offers four options, from “never” to “always,” that are rated from zero to three, depending on whether they suggest a major depressive episode. Possible scores range between zero and thirty; consequently, the higher the score, the greater the risk of depression (13). In the current sample, the scale showed acceptable internal consistency (Cronbach's alpha of 0.72).

**Brief Zung's Self-rating Anxiety Scale (BSAS).** The BSAS is a ten-item instrument that explores symptoms of anxiety over the past month. The scale presents four options from “never” to

“always” that are rated zero to three, depending on whether they suggest an anxiety disorder. Total scores can range from 0 to 30; hence, the higher the score, the greater the risk of anxiety (14). Anxiety was included as an indicator of the nomological network for the PSQ4D because anxiety scores are usually highly correlated with depression scores (15). This scale showed high internal consistency (Cronbach's alpha of 0.82) in the present patient sample.

**COPD Assessment Test (CAT).** The CAT is an eight-item instrument to assess the impact of COPD on quality of life. Six response options are rated from 0 to 5, with 0 as the lowest severity and 5 as the highest. The total scores range from 0 to 40; thus, the higher the score, the greater the deterioration in quality of life (16). This measurement was included for the nomological network because depression scores are usually related to quality-of-life scores, with depressive symptoms explaining a significant variance in the CAT score (17). Moreover, the CAT showed acceptable internal consistency (Cronbach's alpha of 0.73) in the current sample.

**Frail Non-Disabled [FiND] Screening Tool.** The FiND is a questionnaire to measure frailty. It includes five items. The first two assess for 'disability,' and the remaining three evaluate for 'frailty.' Each item has two scoring options: zero or one. The possible scores range from 0 to 5; accordingly, the higher the score, the greater the risk of disability/fragility (18). Frailty was included as an indicator of the nomological network for PSQ4D because the scores on this construct correlate statistically significantly with scores from different instruments that quantify depression risk (19). In the present study, the FiND presented a Kuder-Richardson coefficient (equivalent to Cronbach's alpha) of 0.65.

## Procedure

The adaptation was conducted using a standard translation-back-translation process (20). Two bilingual psychiatry professionals independently translated the PSQ4D from English to Spanish, and a high agreement was observed. Minor discrepancies were resolved by consensus. Later, a professional translator translated the Spanish version back into English. The comparison of the original English version and the back-translation product was highly concordant. Due to the scale's straightforward language, additional semantic validation was skipped.

The patients were contacted in the specialized outpatient clinics of two institutions in Santa Marta, Colombia. The city has approximately 500,000 inhabitants and is located in the Colombian

Caribbean, in the country's north. Between July 1, 2021, and June 30, 2022, patients completed the PSQ4D in the office's waiting room. With minimal instruction, this instrument can be completed in less than 2 minutes by people with 5 years of basic primary education.

## Data Analysis

**Dimensionality.** The Kaiser-Meyer-Olkin's measure of sampling adequacy [KMO] (21), Bartlett's test of sphericity (22), factor loadings, eigenvalues, and the variance explained by the factors were calculated in the exploratory factor analysis. In the confirmatory factor analysis, goodness-of-fit indicators were calculated: chi-square, normalized chi-square, root mean square error of approximation (RMSEA), 90% confidence interval (90% CI), Comparative Fit Index (CFI), Tucker-Lewis Index (TLI), and standardized root mean square residual (SRMR). The chi-square probability was expected to be greater than 0.05, the normalized chi-square less than three (23), RMSEA less than 0.08 (24), SRMR less than 0.05, and CFI and TLI greater than 0.90 (25).

**Internal Consistency.** Internal consistency was estimated using the Kuder-Richardson coefficient [K-RC] (26) and McDonald's omega (27). When a scale has a dichotomous response pattern, the K-RC is used instead of Cronbach's alpha (28). In addition, McDonald's omega is a more reliable coefficient than Cronbach's alpha if the tau equivalence principle is violated, which is necessary to estimate Cronbach's alpha (29) accurately.

**Nomological Network.** The PSQ4D total score was correlated with the total scores of the BSDS, BSAS, CAT, and FiND using Pearson's correlation coefficient (30) or Spearman's rank correlation (31), depending on the distribution's symmetry. Furthermore, the mean and standard deviation of the PSQ4D scores were compared by gender and grade in the combined COPD evaluation using the Student's t-test (32), after checking for homogeneity of variance with Levene's F test. It was hypothesized that scores in women and patients with more severe COPD (C or D combined evaluation) would be higher than in men and less severely ill patients (A or B combined evaluation).

**Gender Differential Item Functioning (Gender-DIF).** The Gender-DIF was estimated using the tau-b correlation coefficient, which is reported when one of the variables involved is dichotomous (33). Correlations greater than 0.20 were considered the differential functioning acceptance criterion (34). The analysis was performed using STATA (35).

## Ethical Issues

The Institutional Ethics Committee of the Universidad del Magdalena, Santa Marta, Colombia, approved the project according to Minute 003 of the ordinary virtual session of March 4, 2021. In accordance with ethical standards, all patients signed informed consent.

## RESULTS

The PSQ4D scores ranged between zero and four ( $M=1.07$ ;  $SD=1.32$ ), and 109 patients (31.23%) were at risk for depression. Table 1 presents the item performance descriptions, while Table 2 summarizes the corrected item-total correlations and the KR-20 if the item was omitted.

**Table 1.** Item description of the PSQ4D

Item	M	SD	Kurtosis	Skewness	Communality	Loading
Sadness	0.32	0.47	0.76	-1.44	0.62	0.79
Loss of interest	0.24	0.43	1.22	-0.52	0.62	0.79
Tired	0.26	0.44	1.13	-0.73	0.31	0.55
Sleeplessness	0.25	0.43	1.18	-0.61	0.18	0.42

**Source:** own elaboration.

**Table 2.** Corrected the item-total correlation and KR-20 if the item was omitted

Item	Corrected item-total score			KR-20 if the item was omitted		
Sadness	0.60			0.62		
Loss of interest	0.61			0.62		
Tired	0.50			0.69		
Sleeplessness	0.39			0.74		
Sleeplessness	0.25	0.43	1.18	-0.61	0.18	0.42

**Source:** own elaboration.

The exploratory factor analysis showed a single salient dimension, with a KMO value of 0.73 and a Bartlett's test with a chi-square of 317.17 (degrees of freedom 6, p-value 0.001). The retained factor had an eigenvalue of 2.23, explaining 55.85% of the total variance. Confirmatory factor

analysis confirmed the one-dimensionality of the PSQ4D with acceptable goodness-of-fit indicators (Chi-square of 5.78 [degrees of freedom of 6 and p-value of 0.001], normalized chi-square of 2.84, RMSEA of 0.07 [90% CI 0.00 -0.15], CFI of 0.99, TLI of 0.96, and SRMR of 0.03).

Regarding reliability, the PQS4D showed acceptable internal consistency with a Cronbach's alpha of 0.73 and a McDonald's omega of 0.74. In addition, the nomological network was adequate. The PSQ4D reported appropriate correlations with the SDS ( $r_s=0.41$ ), SAS ( $r_s=0.43$ ), the CAT ( $r_s=0.35$ ), and the FiND ( $r_s=0.34$ ).

Additionally, patients with more severe disease (C or D combined assessment) showed higher scores than patients with less severe disease (A or B combined assessment) [M=1.43 (SD=1.43) versus 0.98 (SD=1.27), Levene's F test=5.61, p-value =0.03, t=2.44, df=96.16, p-value=0.02]. However, the scores were similar between women and men [M=1.20 (SD=1.34) versus 0.98 (SD=1.30); Levene's F test=2.01, p-value=0.16; t=1.53, df=347, p-value=0.13].

Finally, the Gender-DIF analysis was not significant: item 1 (sadness) showed t=0.10, item 2 (loss of interest) t=0.10, item 3 (tired) t=0.02, and item 4 (sleeplessness) t=0.03.

## DISCUSSION

The current report demonstrates that the PSQ4D is a one-dimensional structure tool showing adequate dimensionality, good reliability, an acceptable nomological network, and no Gender-DIF among Colombian COPD patients.

Specifically, this report is the first study to show that the PSQ4D items converge on a single dimension. This finding is desirable for an instrument with only four items, given that a two-dimensional structure with only two items per dimension could be irreproducible in future factor analyses (11).

Likewise, the present study observed internal consistency above 0.70, as measured by the Kuder-Richardson coefficient (0.73) and McDonald's omega (0.74). Indu et al. (8) documented a higher value for Cronbach's alpha (0.80); however, Cronbach's alpha is not the most appropriate coefficient to measure the internal consistency of a scale with a dichotomous response pattern (29).

Furthermore, the nomological network and the lack of Gender-DIF found in this study provide information on the construct validity and possible practical usefulness of the PSQ4D for patients with chronic diseases, such as COPD, in low- and middle-income countries like Colombia. These findings suggest that the instrument sufficiently approximates the diagnosis of a major depressive episode without gender bias. Indeed, biased symptom measurements are a critical problem in screening for mental health problems (11).

Depression screening should be implemented in care services for patients with chronic conditions, such as COPD, who are at high risk of meeting the criteria for a major depressive episode (3, 4). In this regard, all screening must guarantee a timely and accurate diagnosis, effective treatment, and adequate follow-up (36). These actions improve patients' quality of life, reduce exacerbations and hospitalizations, and optimize the use of scarce mental health resources in most low- and middle-income countries (37).

This research provides several indicators of the PSQ4D's validity and reliability in a sample of medically ill individuals. Likewise, the study shows the instrument's performance in a version quickly adapted to Spanish, given the shortness of the questionnaire and the simplicity of the item responses. Notably, brevity and simplicity are relevant in contexts involving individuals with limited reading and writing skills who can quickly become fatigued (38). Furthermore, the findings suggest that the instrument is equally valid and useful as a self-administered scale.

However, it has the limitation that the patients did not undergo a clinical interview with a psychiatrist to determine the best cut-off point in this population. The clinical interview is the validity criterion par excellence for clinical constructs such as depression (11). Similarly, it is necessary to include measurements that enable convergent validation with other instruments for measuring depression, such as the Patient Health Questionnaire (PHQ-9), and a more robust measure of Gender-DIF (11). Another limitation is that similar scores were observed in men and women. However, readers should consider that the gender gap is narrowing in the prevalence of depressive symptoms in people over 60 years of age (39). This observation needs corroboration, given that scores on depression screening instruments usually are more suggestive of depression in women than in men (2, 40).

In conclusion, the PSQ4D is a brief rating scale for screening depression with an acceptable one-dimensional structure, adequate internal consistency, a satisfactory nomological network, and no Gender-DIF among Colombian COPD patients. Further studies should establish the best cut-off point in this population.

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